Social Impacts of Industrial Silica Sand (Frac Sand) Mining: Land Use and Value

By Mark Krumenacher and Isaac Orr*

Fourth in a series

#137 (May 2015): Environmental Impacts of Industrial Silica Sand (Frac Sand) Mining
#138 (June 2015): Economic Impacts of Industrial Silica Sand (Frac Sand) Mining
#139 (September 2015): Roadway Impacts of Industrial Silica Sand (Frac Sand) Mining
#140 (February 2016): Social Impacts of Industrial Silica Sand (Frac Sand) Mining: Land Use and Value

Introduction

As many as 9,000 non-metallic mines operate in Illinois, Iowa, Minnesota, and Wisconsin, approximately one mine per 3,000 residents. They include limestone and granite quarries in addition to sand and gravel mines, providing aggregate for construction, stones for monuments, and sand for glassmaking, foundries, livestock bedding, and oil and natural gas development. These mines represent an enormous amount of economic activity operating without widespread regional impacts on human health or the environment. Industrial silica sand has been mined in the upper Midwest for more than one hundred years.

Until recently these mines operated without widespread public recognition or opposition. But the rapid growth in the number of industrial sand facilities and the sand’s end use for oil and natural gas development have generated new public awareness about this old industry, making this once below-the-radar industry a subject of controversy in certain areas.

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Among the primary concerns voiced by residents in areas where industrial sand mining has expanded are worries about the potential impacts of sand mining on the environment, including the potential impact on air and water quality; the economy, and whether sand mining will be a net benefit to the communities and states in which it occurs; on local roads and highways; and on the quality of life in host communities.¹

Previous installments in this series of studies presented policymakers and the general public with the latest scientific data on the general environmental² and economic³ aspects of industrial sand mining. The third study in the series focused specifically on roadway impacts of mining.⁴

This Policy Study is intended to help local policymakers and the general public better understand the potential impacts of industrial sand operations on property values in the vicinity of sand-mining operations.

The “social” impact of sand-mining operations, including their impact on land use and property values, can be a sensitive topic. Personal preference and opinion tend to dominate the discussion, in contrast to the technical facts and scientific data used to describe mining’s impacts on the environment, economy, and roads. We take the sensitive nature of this topic seriously and, we believe, address it thoughtfully in this Policy Study. We welcome comments on this work and previous installments in this series.

Part One of this Policy Study briefly discusses the importance of mining and raw materials in our lives. Part Two explores concerns commonly expressed about mining as an industry and examines the similarities between farming and mining. Part Three addresses the potential impact of industrial sand-mining operations on the general quality of life, tourism, and scenic beauty in communities that host those operations. Part Four addresses property rights and the potential

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impact of industrial sand-mining operations on local and regional property. Part Five offers concluding remarks.

Although opponents of mining often cite the potential impacts of sand mining on property values as a reason to restrict or ban mining operations, this Policy Study concludes many mining companies are already addressing these concerns with local officials, who have adequate tools at their disposal to manage the impact of sand mining on their communities.

Part One
The Importance of Mining

The Necessity of Raw Materials

Modern life has resulted in an ever-increasing need for raw materials. Even in the rural Midwest, where agriculture is king and industrial sand mines operate, families tend to live consumer lifestyles, in single-generation, wi-fi-enabled, electrically powered, petroleum-heated homes on mono-cultured chemical-controlled lawns. They drive petroleum-powered vehicles on quality, ice-free roads. And they purchase inexpensive toilet paper at the local discount outlet.

We have a tendency to overlook the fact that most of our residential properties were previously forest or agricultural land. Our roadways, also former agricultural land, were constructed in part with petroleum taxes and built from materials extracted from nearby nonmetallic mines. Most importantly, essentially every material thing in our lives that was not grown is a product of mining.

Individuals and groups who oppose mining, advocate the preservation of agricultural land, and demand a transition to so-called “greener” technology hold a self-contradictory position: The modern lifestyle they enjoy is predicated on both farming and mining.

It is easy for the general public to understand and accept that agricultural land must be preserved. It appears to be more difficult to recognize, but it is no less true, that mining land must also be preserved.

It is easy for the general public to understand and accept that agricultural land must be preserved. It appears to be more difficult to recognize, but it is no less true, that mining land must also be preserved. Farming and mining are similar in almost every respect. Their potential for environmental impacts is comparable, and the need to preserve both must be equally understood. Neither enterprise can exist without the other, and our civilization cannot exist without them both.

Farming and mining, like all other business pursuits, are done to make money for the business operator. Products are planted or mined in response to demand for a given commodity, and as demand changes, corresponding adjustments to production are made. It is important to note the
Every material thing in our lives must either be farmed or mined; there are no exceptions.

The Minerals Education Coalition (MEC) reports the average American citizen born in 2015 will require an average of 3.11 million pounds of minerals, metals, and fuels in their lifetime (78.7 years).\(^5\) (See Figure 1.) Our mineral use increases annually, indicating our dependence on mining is growing and there is no indication our need for raw materials will decrease with time.

**Figure 1.**
The average American will consume ...

3.11 million pounds of minerals, metals, and fuels in their lifetime

Similarly, there would be virtually no employment as we know it without mining. Our ability to travel; tools in every industry, be they pencils, computers, staplers, or welders; our information technology, including our smartphones and streaming media players; our clothing and our shelter – all depend on mining.

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\(^5\) The Minerals Education Coalition (MEC) is a program of the Society for Mining, Metallurgy, and Exploration Foundation. MEC’s mission is to develop and deliver accurate and timely K–12 education materials and activities and conduct public awareness outreach about mining and minerals. Mineral use data are from the National Mining Association, U.S. Geological Survey, and Energy Information Administration.
While our earliest ancestors may have used a simple one-pound stone tool in a cave shelter 200,000 years ago, today we use hundreds of pounds of minerals and raw materials per person per year. Figure 2 illustrates the average quantity of minerals used by each person in the United States in 2015. Each person in the United States will require about 616 pounds of cement to make the roads, sidewalks, bridges, schools, and houses he or she will use in 2015. Although it is often not readily apparent, each material object in our lives must be either grown or mined. Even so-called “renewable” energy sources require large quantities of raw materials.

Figure 2.
We Requires Thousands of Pounds of Minerals, Metals, and Fuels Each Year

It is easy to understand why someone might oppose a mining operation near his or her home, as the proximity of these operations to one’s backyard may affect one’s quality of life. But opposition to mining as a general principle makes no sense, because we all rely on materials produced from mining. That a mining operation may open near our home does not change the crucial importance of mining in sustaining our standard of living.
Opposition to mining as a general principle can drive individuals to actions and statements inconsistent with their training, education, and even knowledge for the sake of notoriety, career, or position within a community. The most disturbing examples of this in the Midwestern industrial sand-mining debate include Ph.D. economists and chemists, medical doctors, and other well-educated individuals who use their high esteem in the community as a platform for persuasion on topics unrelated to their expertise.

**Mining for a Green Economy**

An often unrecognized reality of the transition to a greener economy is increased demand for metals and industrial minerals such as silica sand.

Since at least the early 1990s, “sustainable development” – sometimes called a “green economy” – has attracted the attention of international political organizations and institutions of higher education in the United States and around the world. An often unrecognized reality of the transition to a greener economy is increased demand for metals and industrial minerals such as silica sand.

Demand for strategic minerals is rising, with much of the demand driven by the same individuals and groups who express opposition to local mining operations. So-called green technologies, such as smart glass windows, solar panels, wind turbines, batteries, and energy-efficient consumer electronics, use increasing amounts of rare and strategic resources. The glass for smart windows and solar panels is derived from several mined minerals, most notably the same silica sand deposits used for hydraulic fracturing.

Increased demand for greener energy has driven increased demand for rare earth minerals, which are costly to produce and come with their own environmental impacts. For example, the magnets of wind turbines use neodymium, terbium, and dysprosium, and electric and hybrid cars

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contain about 10 to 15 pounds more rare earth minerals than a standard car.\textsuperscript{11}

China produced 95 percent of the world output of rare earth elements in 2011, largely because lax environmental standards and lower labor costs allowed the nation to produce these materials at costs 66 percent lower than in the United States.\textsuperscript{12} It is often better for the global environment for natural resources to be produced in developed nations with more stringent environmental standards, such as the United States, than in developing nations with less-protective regulations.\textsuperscript{13}

In addition to rare earth metals, the supply chain for green technologies requires vast quantities of traditional metals, minerals, and fossil fuels that must be mined somewhere. For example, on average a one megawatt industrial wind turbine requires 103 tons of stainless steel, 402 tons of concrete, 6.8 tons of fiberglass, three tons of copper, and 20 tons of cast iron.\textsuperscript{14}

Obtaining these raw materials requires the use of high-density fuels such as coal, oil, and natural gas. Steel, for example, unless it is recycled, is made by mining iron ore using large mining equipment that is also made of steel and runs on diesel fuel. After it is mined, the iron ore must be transported to a steel mill, typically by water or rail, and ships, barges, and trains are also powered by diesel engines.

Iron must then be converted into steel by grinding the ore with specialty metal grinders, separating the ore using industrial-sized magnets containing rare earth elements, and adding industrial minerals such as limestone and dolomite and metals such as manganese, aluminum, and nickel. The process requires either blast furnaces or direct reduction routes, both of which require large amounts of coal or natural gas. In most steelmaking operations around the world, blast furnaces are the primary means of converting iron ore into steel, and this process requires coke produced from coal. After the iron is converted to steel, the finished product is shipped to manufacturers where it is cut, rolled, pressed, and formed by equipment powered by fossil fuels.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{wind_turbine}
\caption{On average a one megawatt industrial wind turbine requires 103 tons of stainless steel, 402 tons of concrete, 6.8 tons of fiberglass, three tons of copper, and 20 tons of cast iron.}
\end{figure}

\begin{enumerate}
\item Kharunya Paramaguru, “Rethinking our Risky Reliance on Rare Earth Metals,” \textit{Time}, December 20, 2013, http://science.time.com/2013/12/20/rare-earths-are-too-rare/.
\item \textit{Supra} note 11.
\end{enumerate}
Simple physical realities mean shipping requires high-energy, dense fuels – almost universally, diesel fuel. Because of the intrinsic low power density of wind and solar, putting solar panels or a sail on a large ship will not come close to providing the energy needed to transport these materials, and diesel engines will likely remain important for transportation for generations to come.\textsuperscript{15}

\begin{figure}[h]
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\begin{minipage}{0.45\textwidth}
\textbf{Our lives and lifestyles, and our desires for a better planet, are intimately intertwined with mining as much as with agriculture.}
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It is impossible to make steel without fossil fuels, and it is impossible to make concrete without mined aggregate. Fiberglass used to insulate our homes to conserve energy is made from silica sand, limestone, soda ash, epoxy resins, and a variety of other mined minerals. Copper, rare earth elements, and other metals used in wind turbine production also depend on fossil fuels to mine, process, and transport raw materials. All of these materials are indispensable to “renewable” energy sources and products for conserving energy.
\end{minipage}
\end{figure}

The point of this discussion is to demonstrate that our lives and lifestyles, and our desires for a better planet, are intimately intertwined with mining as much as with agriculture. Environmental and human health protections are stronger in the United States than in the developing world. If our conversations about environmental policy are to be serious and intellectually honest, those who wish to increase the amount of energy generated from renewable energy sources must recognize the necessity of mining.

\section*{Part Two}
\textbf{Why Development – That Is, Change – Raises Concerns}

Once a routine aspect of life in the Midwest, industrial sand mining has become a controversial topic, not only in communities where mining operations have been recently proposed, but also in communities where industrial sand facilities have operated for decades.

Not only mining, but nearly every proposed development or land use change in a community, whether residential, commercial, institutional, governmental, or industrial, generates local opposition. While each proposal generates specific concerns, those concerns are most often simply a variation on “not in my backyard” – a response to a proposed use in the immediate vicinity that changes the existing land use in any way.\textsuperscript{16}

\textsuperscript{15} \textit{Ibid.}

The proposed change often first becomes the focus of just one or a few outspoken opponents, but organized opposition can form and spread quickly. Their message is that the proposed change is a burden, rather than a benefit, to the local community. That overall “burden, not benefit” message is the same for a mine as it may be for something more socially acceptable, say a new church, cell phone tower, waste treatment plant, or affordable housing project.\(^\text{17}\) Ironically, and perhaps out of convenience, the reasons cited for opposition are generally the same regardless of the proposed development.

Most residents do not become engaged in the debate at all. The issue takes on the appearance of a major controversy because the vocal minority is generally the only side in the debate that attracts the attention of the press (“the squeaky wheel gets the grease”), takes advantage of social media, writes letters and emails to local government officials, holds rallies, and fills the rooms at local public hearings, monopolizing the public discussion.

A township supervisor in west central Wisconsin noted at a public hearing that the most vocal opposition to any development in the town generally comes from residents who have recently relocated and built new houses in the area. Those residents want to close the door on further migration and development that might “change” the community ... after they’ve moved in.

### Four Ways to Understand a Community’s Concerns

Local government officials and supporters of development are most effective in communicating with a concerned community if they understand the nature of those concerns. While some concerns can be addressed with facts and technical information, other concerns are more emotional, sometimes expressed as accusations, sometimes based on rumors. Such concerns can be addressed, but first they must be understood.

Experts in risk communication identify four ways to understand the more emotional concerns a community might raise about development.\(^\text{18}\) They are:

\[\text{Local government officials will be most effective in communicating with a concerned community if they take the time to understand the nature of those concerns.}\]

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Mental noise is experienced when people become highly concerned or stressed about something they value. Mental noise makes it difficult, and sometimes impossible, to receive, process, and retain information. The New Jersey Department of Health reports 80 percent of the information communicated to people is lost when they are experiencing stress and mental noise.¹⁹

Mental noise is difficult to address at emotionally charged meetings. By contrast, providing concerned individuals with information in writing frees them from the intensity of a public meeting, gives them the benefit of time to process information, and allows them to re-read material as often as they need. People are more likely to understand and retain information when it is presented in writing.

Perceptions of potential threats are amplified when people are worried. Under these circumstances, the gap between the perceived threat and the actual risk of harm widens, and it is these perceptions, not the actual risk of harm, that people act on.

Four factors influence how individuals perceive threats: whether the individual trusts the person or organization presenting the potential threat; how much control the individual has over the perceived threat; whether the individual stands to benefit from the potential threat; and whether the benefits (or risks) are perceived to be fairly distributed.

These factors are readily apparent in the concerns cited by opponents of industrial sand mining. Some critics have no trust in the regulatory authorities who issue environmental permits and approvals. Others seek to control development themselves; they express concern over increasing volumes of traffic related to mining but claim to desire increased tourism. Others take issue with mining company profits while promoting their own right to profit from a business or employment in the community.

Elements of trust are undermined when people feel threatened. High levels of concern cause people to have low levels of trust. This phenomenon is frequently on display in discussions of industrial sand mining. Many comments pertaining to the potential environmental impact of a proposed mine, for example, suggest the need for an independent, third-party analysis versus the “mine’s employed experts.” The assumption is that everyone is “on the take,” inherently corrupt if employed or retained by a mining company, or cannot be trusted and is part of a conspiracy. Since mining affects everyone, this mindset implies no one in any profession can be trusted, regardless of their profession, education, and personal ethical standards.

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Dominance of negatives describes the tendency of people to view situations from the most-negative perspective possible, regardless of whether the worst is likely to happen. Negative perceptions are powerful; they trigger strong emotions and are difficult to overcome or balance with positive information.

Concerns Can Be Genuine ... or Not

Like any development or proposed land-use change, industrial sand-mining operations attract concerns that are both genuine and disingenuous. It is important for local elected officials, industry leaders, and the general public to understand the distinction.

Genuine concerns are sincere. They are based on common, justified, and fact-based problems that can be resolved. We discussed several such concerns in the previous installments in this Policy Study series.20 Genuine concerns tend to be specific in nature – what impact will the proposal have on the community’s roadways, for example – and they can be addressed with careful explanations of the mining process, technological safeguards, and mitigation efforts.

Disingenuous concerns are insincere, commonly used as smokescreens, generally broad-brush, and raised with the understanding that no response, no matter how sound, will satisfy the accuser. Individuals or groups who know safeguards are in place to address genuine concerns may raise disingenuous ones in the hope others will believe they are legitimate. Disingenuous concerns are raised merely to stir up fears and build opposition to a proposal. When presented with facts that address that particular concern, the accuser responds with a “yeah but” and shifts to another concern.

Examples of disingenuous concerns can be found in Iowa, Minnesota, and Wisconsin along the Mississippi River, where mining opponents have lined up to speak and experts have written reports against proposed and existing industrial sand-mining operations. They warn of impending damage to tourism and other businesses – failing to acknowledge tourism and mining have coexisted and indeed flourished along this Mississippi River corridor for almost 100 years.

For example, the 25-mile segment of the Great River Road along the Mississippi River from Diamond Bluff to Stockholm, Wisconsin includes decades-old sand and gravel mining operations, an asphalt plant, three industrial sand operations (two of which have operated for decades), and other industrial facilities. As industrial sand-mining operations expanded in the area, each of the communities21 along that stretch of highway experienced an increase in the

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20 Supra notes 2, 3, and 4.

21 Hager City, Bay City, Maiden Rock, and Stockholm, Wisconsin.
development of tourist-based businesses such as campgrounds, bars, restaurants, bed and breakfast operations, rental halls/suites, and art shops. Many of those tourist businesses were developed in the past 10 years.

One way to recognize a disingenuous concern is to notice it is applied not just to mining but to all kinds of proposed development – even tourist businesses.

The complaints used to impede development of tourist businesses are the same as those raised in opposition to mining: increased traffic, falling property values, noise, putting a commercial business in a rural setting, groundwater and wastewater concerns, hours of operation, and the safety of pedestrians. In 2014, nearly 100 people signed a petition and retained an attorney to represent them in an ultimately unsuccessful effort to stop development of a small winery in the town of Clifton in Pierce County, Wisconsin. The complaints used to impede development of tourist businesses are the same as those raised in opposition to mining: increased traffic, falling property values, noise, putting a commercial business in a rural setting, groundwater and wastewater concerns, hours of operation, and the safety of pedestrians. In 2014, nearly 100 people signed a petition and retained an attorney to represent them in an ultimately unsuccessful effort to stop development of a small winery in the town of Clifton in Pierce County, Wisconsin.

Professional activist groups also raise disingenuous concerns to generate financial support for their cause. These groups often use dramatic, emotionally charged but false and unscientific comments to stir fear and draw attention to themselves. A typical example is from the Sierra Club–John Muir Chapter, which solicits financial support for its anti-mining position by falsely claiming “mining companies are using open pit, hilltop removal mining in Wisconsin that is destroying landscapes, quality of life, and poisoning our air and water.”

Accusing industrial sand mining of poisoning air and water is a serious allegation, and claims of this nature provoke emotional responses that can lead to high levels of stress, anxiety, and distrust among residents. The Sierra Club offers no technical research to support its claims, instead citing controversial and widely discredited documentaries, posts on social media platforms such as anti-mining Facebook pages, and materials from nonscientific activists groups such as the Minnesota-based Land Stewardship Project.


25 Save The Hills Alliance: wisair.wordpress.com; Save Our Knapp Hills Alliance; Fracsandfrisbee.com; Dunn County Sand, http://dunncountysand.org/; Township Rights: landstewardshipproject.org; Mississippivalleyconservancy.org; Wisconsin Network for Peace and Justice Informational Pamphlet.
Similarly, a Chippewa Falls, Wisconsin-based website claims local industrial sand mining will result in the “destruction of productive agricultural land, risks of water contamination and depletion, degraded property values, loss of traditional rural communities, noise and traffic increases, and threats to health and safety,” and “many thousands of acres of Wisconsin hills, farmland and woods will be converted to open pit mines.”26 Raising human health worries, the website also claims, “Large scale mining operations will increase the amounts of both Particulate Matter (PM) and Respirable Crystalline Silica in the air. These pollutants at certain levels can cause respiratory illnesses, including silicosis, and do pose a public health threat.”

These activist groups make no attempt to cite scientific evidence to support their claims that sand mining poses a threat to public health. Their websites make only unsupported statements intended to stoke fear about concerns scientific studies have already proven to be unjustified.

The Land Stewardship Project (LSP) was founded to foster an ethic of stewardship for farmland, promote sustainable agriculture, and develop sustainable communities.27 Translating that mission statement into an attack on the sand mining industry is unfortunate and counterintuitive. Because farming and mining are so intertwined, these industries should be defended together, not pitted against each other. It is unfortunate that a misguided, tiny but vocal faction of LSP would make a claim such as, “The corporate-driven frac sand industry exploits rural communities and threatens the health and well-being of people and the land. Oil and gas corporations and their allies want to strip mine the land for frac sand, destroying bluffs and hills.” Such statements seem calculated only to scare LSP members who do not reside or travel in areas where industrial sand mines operate and thus do not know the truth of the situation.

LSP cites this as its reference: “We know from direct experience that the frac sand industry puts corporate profit above the stewardship of our land, air, water, health, safety, quality of life and local economy.” The only proof LSP offers is, “We know.” LSP also claims “the frac sand mining industry is ‘inherently destructive and exploitative.’” Here, too, its evidence is simply, “we know.”

With 3,400 members as of 2014,28 LSP represents a tiny minority (less than 0.06 percent) of the population of Minnesota (population 5.3 million in 2010). It is likely even many of its members


don’t support such fear-mongering statements. LSP certainly does not represent the majority, but the fear it creates is real and can cause governments to take counterproductive regulatory actions.

Activists in Wisconsin make similar claims. The Wisconsin League of Conservation Voters (WLCV) claims industrial sand mining is “wreaking havoc on air and water quality and public health” and alleges the industrial sand mining industry in Wisconsin, which is more than a century old, is “operating with very little oversight in Wisconsin and is significantly degrading our environment, public health, and quality of life.”

WLCV says Wisconsin laws are inadequate or insufficiently enforced, claiming, “the few Wisconsin state laws that are applicable to frac sand mining are rarely enforced.” These claims are never – and cannot ever be – supported by credible sources, because they are false.

How to Address Genuine Concerns

Any residential, commercial, or industrial development will affect the communities that host or are near the development. Newton’s third law of physics, “for every action, there is an equal and opposite reaction,” is applicable and relevant. However, most if not all impacts of industrial sand mining can be managed, contained, and minimized with safeguards developed to prevent unnecessary hardship and protect the public health, safety, and welfare. The current operation of about 10,000 nonmetallic mines in a four-state area is testament to this fact.

In Parts Three and Four of this study, we recognize and address some genuine social concerns regarding industrial sand mining, including quality of life and tourism, property rights and land use, property values, and public health. We describe the concern, present an analysis of the risks, and evaluate the adequacy of protections in place or explain what additional safeguards are needed.

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30 The fifth Policy Study in this series will address this issue.
A commonly cited concern is that a new mine or mine expansion will reduce the quality of life of local and regional residents. The claim seems plausible, especially to those without the benefit of experience from living near a mine. The concern may be driven by a fear of the unknown, fueled by the predominance of negative information spread by websites and social media platforms.

Groups opposed to mining often portray the activity as incompatible with tourism and recreation. Among the primary concerns cited are traffic congestion and noise from increasing numbers of trucks hauling sand, the potential loss of scenic beauty from hills and farm fields being converted to mining, and the potential degradation of local air and water quality.

Prior to the release in 2015 of our *Heartland Policy Studies* No. 137, 138, and 139, an Internet search for “impacts of industrial sand mining” yielded page after page of anti-mining misinformation and negative Facebook pages. Until recently that was almost the only publicly available source of information cited on issues associated with industrial sand mining. A search today provides a much different result.

**Tourism**

Industrial sand is mined in 20 Wisconsin counties, representing nearly a third of the 72 counties in the state. Each of these sand-producing counties relies on tourism to some extent for its economic activity, and whether industrial sand operations harm the tourism industry is a question meriting a serious, data-driven discussion. Tourism is discussed extensively in *Heartland Policy Study* No. 138, “Economic Impacts of Industrial Sand (Frac Sand) Mining.” A brief recap of that study is presented below.

To evaluate the impact of industrial silica sand mining on tourism in sand-mining counties, we obtained tourism data from the Wisconsin Department of Tourism for the years 2010 through 2014 to analyze trends in Wisconsin’s 20 silica sand-producing counties, the period of expansion of industrial sand activity. These data show a majority of sand-producing counties experienced growth in all tourism metrics between 2010 and 2014. The analysis below “unpacks” each of the six metrics reported by the Wisconsin Department of Tourism, as shown in Figure 3.

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31 *Supra* notes 2, 3, and 4.

32 *Supra* note 3.
Data from the Wisconsin Department of Tourism show the majority of sand-producing counties experienced growth in all major tourism metrics between 2010 and 2014.

Notes
* Jackson County data were not available for 2010, so 2011 data were used.
* Total labor income data were not available for 2010, so 2011 data were used.
* Per-capita income was calculated from 2011 total employment data because total labor income data were not available for the year 2010.
Direct visitor spending increased in all of the state’s 20 silica-sand producing counties between 2010 and 2014, with 95 percent (19 of 20 counties) registering double-digit growth as a percentage of total visitor spending. These data suggest industrial sand mining and related activities have not been a deterrent to travelers visiting sand-producing counties and generating income for tourism-related industries. Total tourism-related employment increased in 75 percent of the sand-producing counties. The Wisconsin Department of Tourism data include direct, indirect, and induced jobs.

Figure 3 shows total labor income increased in all sand-producing counties between 2011 and 2014. Figures from 2011 are used in this metric because the Wisconsin Department of Tourism did not report total labor income in 2010. Tourism-related employment increased in only 75 percent of the sand-producing counties, but all sand-producing counties experienced gains in per-capita income earned by the people holding tourism-related jobs.

State and local tax revenues generated by tourism-supported industries increased in 95 percent of industrial sand-producing counties, with a very modest decline of 0.09 percent in Burnett County. Monroe County experienced the largest increase in tourism-related revenue, as state and local taxes increased by more than 17 percent, from $8.1 million in 2010 to $9.8 million in 2014.

Per-capita income for tourism-supported jobs increased in 95 percent of sand-producing counties, with Crawford County the only one experiencing a decline. The per-capita income data begin in 2011 because that is the first year for which total labor income data were available.

Service-oriented businesses experienced an increase in revenues because the presence of nearby mining operations can support these local business where there would otherwise be fewer customers to serve. The Federal Gazette reported on one such small business, Park Service & Convenience, the only gasoline, convenience, and grocery store in Maiden Rock, Wisconsin, population approximately 120. The store provides the only fuel stop and convenience store for nearby residents and travelers on a 20-mile stretch of the Great River Road between Bay City and Pepin. The story noted the store derives more than 40 percent of its annual revenue from the nearby mine.

Wisconsin Department of Tourism data indicate Wisconsin’s tourism industry appears to have little to fear from the expanding industrial sand business.

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living-wage jobs mining creates in these communities, along with activities such as trout stream habitat restoration projects in which mining companies have participated.

**Scenic Beauty**

Opponents of industrial sand mining say mining activities will alter the landscape in rural areas, resulting in a loss of scenery, including bluffs, hills, and wildlife habitat. Of course, almost every use of land will alter the landscape; that concern is not unique to mining.

Nevertheless, changes that appear to be permanent generate more resistance than those considered to be temporary or reversible. While some anti-mining groups claim industrial sand mining will permanently alter or detract from the landscape, that concern is largely exaggerated.

| Although most mines are reclaimed for recreational or wildlife habitat, studies measuring agricultural productivity from reclaimed sand mines show productivity returns in two to five years. |
| States and municipalities in Illinois, Minnesota, and Wisconsin, for example, require mining sites to be remediated, or reclaimed. Moreover, although industrial sand mine operators may be permitted to develop hundreds or even thousands of acres of silica sand deposits, the entire permitted area is not mined simultaneously. Typically, these deposits are mined in smaller, 10- to 40-acre parcels, with reclamation of the land performed as soon as possible after mining. Topsoil removed during the initial excavation is replaced, and vegetation and plant cover are generally restored within a few years. |

Much of the discussion of reclamation in sand mining communities centers on whether reclaimed sand mines will be suitable for agricultural uses after mining is completed. Although most mines are reclaimed for recreational or wildlife habitat, studies measuring agricultural productivity from reclaimed sand mines show productivity returns in two to five years. (This topic is discussed in greater detail in *Heartland Policy Study* No. 137, “Environmental Impacts of Industrial Sand (Frac Sand) Mining.”)

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38 *Supra* note 2.
In addition to agriculture, reclamation scientists can engineer industrial sand mines to serve as native prairie grasslands, providing excellent habitat for wildlife. (See Figure 4.) Native prairie is often the preferred post-reclamation use of industrial sand mines because these ecosystems provide benefits to the soil and water, including soil stabilization, improving soil fertility, reducing soil compaction, increasing water infiltration rates, and reducing soil runoff during stormwater events.\textsuperscript{39}

Figure 4
Industrial Sand Mine Reclaimed to Prairie

Native prairie plant species are often desired by ecologists and soil scientists for the favorable ecosystem they create and because the long taproot of many of these plants helps to prevent or reverse soil compaction.\textsuperscript{40} This reclaimed industrial sand mine in Wisconsin has become a biologically diverse ecosystem supporting a wide variety of plants and animals.

Expressions of concern about the potential impact of industrial sand mining on the bluffs of northeastern Iowa, southeastern Minnesota, and western Wisconsin are common at local government meetings and in online forums. In fact, industrial sand mining has not historically affected these bluffs and it is unlikely to do so in the future, because the bluffs are capped with 200 or more feet of limestone, removal of which is impractical to access the underlying sandstone. In most areas where limestone is present on top of these sandstone deposits, it would be far too costly to access the limestone to access the deposits of silica sand.

Figure 5 shows a stratigraphic section of western Wisconsin and southeastern Minnesota. The primary sandstone deposits mined for industrial sand are, from youngest to oldest, the Jordan (J), Wonewoc (W), and Mount Simon (MS) Formations. These sandstone formations are the primary sources of industrial sand because of the physical properties of the sand and their ability to easily


\textsuperscript{40} Ibid.
disaggregate, or break apart. In many areas, these sandstone formations lie deep beneath the Oneota limestone formation and thus are not easily accessed. In some counties, the Wonewoc Formation is accessible in areas where much of the limestone bedrock has been eroded away, leaving behind sandstone hills.

**Figure 5**

Deep Sandstone Deposits Are Not Targeted for Frac Sand Mining

Red arrows indicate the Jordan and Wonewoc Sandstone formations, the primary source of industrial silica sand that is mined in Minnesota and Wisconsin and used for hydraulic fracturing. These sandstone units are near the surface in many parts of Wisconsin, but they are present deep beneath the Oneota Formation, a thick layer of dolomite, in much of Iowa, Minnesota, and Wisconsin, making the sandstone less accessible for surface mining. Modified from Mahoney *et al.* 1997.41

Thick, unconsolidated soil and dolomite deposits are the primary reason industrial sand mining opportunities are limited in Minnesota. These thick deposits limit industrial sand mining primarily to the Minnesota River Valley of southeastern Minnesota, where a prehistoric flood removed most of the soil and limestone, leaving only about 40 feet of limestone near the ground surface. Industrial sand mining is conducted primarily in existing and former limestone quarries where the Jordan Formation sandstone is accessible. Such sites are not “scenic landscapes” hurt by industrial sand mining.

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Underground mines are also used to extract silica sand beneath the limestone bluffs of the Mississippi River Valley. Such mining has occurred for about 100 years. These operations enter the sandstone through horizontal tunnels and do not alter the overlying limestone formations, leaving them, and the bluffs they form, intact.

In addition to concerns about mining on scenic limestone bluffs, some citizen groups oppose the mining of sandstone hills. There is little cause for concern. The Driftless Area, where most of the industrial sand mines in Iowa, Minnesota, and Wisconsin are located, spans an area covering more than 10 million acres – an area twice the size of the state of Massachusetts. Because this area is so large, it is able to provide industrial sand to meet demand while leaving the vast majority of the Driftless Area unmined.

Although industrial sand mining requires the removal of trees, topsoil, and other overburden to gain access to silica sand deposits, these operations do not leave the mines as permanent eyesores or barren wastelands. Reclamation begins when mining in one section of the mine has concluded, and substantial diversity in plant and animal species can be observed within a few years. This type of mining is far less long-lasting than many other forms of development, such as closed industrial or commercial developments that can remain vacant for years.

Somewhat remarkably, another subject of debate and often unnecessary regulation is the visual appearance of industrial sand mines. Exposed bedrock is common along the major river valleys in silica sand mining regions such as the Illinois, Mississippi, Minnesota, and Wisconsin Rivers and along bluffs and local roads cut throughout the upper Midwest. These bluffs and views are themselves tourist attractions, yet a charge commonly leveled against many proposed industrial sand mines is the visual appearance of exposed bedrock walls and the need to block that view forever. Such a concern is clearly not genuine and is obviously raised for other reasons.

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Part Four

Property Rights, Land Use, and Property Values

The Right to Operate a Business and the Right to Mine

In most countries of the world, all mineral resources belong to the government. This includes all valuable rocks, minerals, oil, or gas found on or within the Earth. Individuals or organizations in those countries cannot legally extract and sell any mineral commodity without first obtaining authorization from the government. The United States is one of the few nations in the world where individuals or organizations can own mineral rights. Mineral rights holders can explore, develop, extract, and market various resources under the surface of the applicable parcel of land. They also have the legal right to transfer or lease their mineral rights to another party.

The zoning process should not become a forum in which the industry must defend the importance of jobs, capitalism, the need for raw materials, U.S. industrial activity in a global marketplace, or local tax law.

Individuals and companies have the legal right to purchase property and mineral rights, make financial investments in capital and labor, operate businesses, and make a profit. This is especially true if the current or proposed use of the land is consistent with the goals, objectives, and policies of any local comprehensive land use plan, county smart growth plan, or other comprehensive plan adopted by the host community. Local zoning became common in the early years of the twentieth century, and it is the foundation of the modern local system of land-use control. Generally, local zoning regulates land use to ensure a use is not offensive and does not harm neighbors, the general public, public infrastructure, or the environment. Most of these standards are measurable, but some are subjective and all can be hotly debated.

Local governments play an important role in regulating nonmetallic mining and have a variety of tools at their disposal, including comprehensive plans, zoning ordinances, nonmetallic mining ordinances, moratoria, development agreements, and local road use agreements. The purpose of land use and zoning processes, as it pertains to industrial sand mining, is to address specific concerns such as road access, traffic routes, hours of operation, visual barriers, lighting, noise, and other potential land use conflicts that can be reasonably resolved through ordinances.

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The zoning process, while important for its specific purpose, should not become a forum in which the industry must defend the importance of jobs, capitalism, the need for raw materials, U.S. industrial activity in a global marketplace, or local tax law. Examples of industries that strive to keep a business viable for only a limited period of time are rare. Every industry has a right to plan for the benefit of current and future employees and stakeholders, including local residents.

Mining is a legal and responsible land use. Although individuals have the right to control their property, use must sometimes be regulated for the common good; property rights are not absolute. Local land use controls are normally the primary mechanism for regulating the siting and operation of industrial sand and other nonmetallic mines in the United States.

Recently, pressures have been mounting for more state-level control of land-use policy in Wisconsin. Although recently driven by the increase in silica sand mining, this is not a new issue in Wisconsin, and it is applicable to all industries that propose changes in land use. Whether Wisconsin opts for a greater state role in land-use policy will depend on whether the existing laws, which emphasize local control, can meet the challenges facing local property owners, municipal governments, and the state.

Effects on Property Values and Land Use

Concerns about the potential impact on property value are present for almost every land-use change proposed in a neighborhood or near residential property. There are few if any exceptions. Equally strong local opposition will occur if the proposed development is a residential subdivision, church, or playground if that development is planned for an area where individuals have a different perspective on the best use of the property proposed for development. The same is true even of wind farms, supposedly prized for their eco-friendly nature.

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The potential negative impact of industrial sand operations on property value is one of the top concerns raised in response to almost every proposed new mine or mine expansion. Opponents to mining often claim the construction or expansion of a mine will reduce property values in the surrounding community. Although individuals and organizations issue statements and use social media networks in an attempt to validate these concerns, they simply make claims without citing research. It is a common tactic of anti-mining activists, but repeating an unsupported statement often and loudly does not make it true.49

There are no credible studies supporting claims of widespread and predictable property value declines associated with industrial sand mining or any other similar nonmetallic mining activity. This lack of credible evidence assures the concern is unfounded.

Every sand mine is unique, and circumstances where the value of adjacent properties may be affected can be addressed only on an individual basis.

Between 1981 and 2011, several studies, using technically sound methods, examined the relationship between nonmetallic mining and property values. Each of the studies concluded there was no consistent relationship between mines and property values. Although there were specific instances where mines or quarries may have reduced nearby property values, other homeowners realized an increase in property value because of the setbacks, open space, and wooded areas used to buffer mining operations. While it can be difficult to explain this seemingly counterintuitive finding during an emotionally charged public meeting, it is a demonstrable fact and logical when calmly considered or, better yet, witnessed.

Some studies report property values near quarries were higher than similar properties farther from the quarry. This does not necessarily imply the mine itself increased the property value, but it does demonstrate a mine does not necessarily reduce the value of nearby properties. Many mines actually suffer from so much post-development encroachment by residential development they end up operating in a residential rather than rural environment, without complaint from, and more importantly without harm to, the neighbors or their properties.

Residential encroachment on existing nonmetallic mining operations has become a serious land-use issue that is gaining recognition from local officials who see a growing need for future

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49 For more on this propaganda tactic, see Dr. L. Kip Wheeler, “Logical Fallacies Handlist,” Carson-Newman University, no date, https://web.cn.edu/kwheeler/fallacies_list.html.
This planning is needed not specifically or only to protect residential land uses, but to protect the future availability of nonmetallic minerals as well. Without proper planning, for example, the most ideally situated local nonmetallic mineral resources may be buried by a subdivision, with the next-available source of minerals needed to build the local development and infrastructure significantly farther away. This unnecessarily increases costs to consumers and municipalities.

**Historical Property Value Studies**

The earliest study we have identified that addressed property values was completed in 1981 by the U.S. Bureau of Mines, which evaluated bedrock quarries in Illinois, Kentucky, Missouri, and Pennsylvania. The analysis found no consistent relationship between quarries and property values.

In 1987, the Department of Real Estate at Georgia State University conducted a study to measure adverse impacts on the value of existing homes or homes to be built near a proposed quarry in Bolingbroke, Georgia. The analysis considered quarries in DeKalb, Newton, and Monroe Counties in Georgia, utilizing two comparative analyses. The study concluded the following:

1. Properly developed quarries had no effects on the value of housing adjacent to the operation.
2. In one of three counties, property values in the non-quarry area increased more slowly than values in the quarry-influenced area.
3. Some homeowners said they benefited from being near a quarry because of the open space and wooded areas used to buffer operations.
4. The overall study of changes in the value of homes located both nearby and away from properly operated rock quarries indicates quarries have no significant adverse impact on the value of homes.

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52 Joseph Rabianski and Neil Carn, “Impact of Rock Quarry Operations on Value of Nearby Housing,” Department of Real Estate, Georgia State University, August 1987.
A 1995 analysis of a proposed sand and gravel quarry in Granite Falls, Washington conducted by Schueler, McKown & Keenan, Inc., a real estate appraisal firm, considered four case studies in Washington. The analysis concluded properties adjacent to quarry operations buffered by 100 or more feet showed no difference in value compared to properties removed from the operation, and in some instances the values near a quarry were found to be higher.

A study by the Department of Economics at Ohio Wesleyan University in 1996 evaluated previous studies by the U.S. Bureau of Mines (1981) and Rabianski and Carn (1987), who focused on residential appreciation rates near a Delaware County, Ohio quarry and a quarry located in Franklin County, Ohio. The Ohio Wesleyan researchers also used the repeat sales method to study values near the Marble Cliff Quarry and Shawnee Quarry. They found values of properties located adjacent to an existing quarry were not reduced. The researchers concluded an expansion of the Shawnee Quarry would not reduce the values of adjacent and nearby residential properties.

The land-use consulting company Banks and Gesso, LLC, conducted a study in 1998 examining property values near three quarries in Jefferson County, Colorado that sold before and after quarry development. The analysts found no basis for suggesting quarries devalue residential properties.

In 2002, Banks and Gesso evaluated 10 subdivisions in the vicinity of three sand and gravel operations in the Fort Collins, Colorado area. The analysts found no significant statistical difference in the data suggesting locations near sand and gravel mines suffered lower property values. For two of the mines, the subdivisions nearest the operations had higher rates of appreciation for home values than subdivisions farther away.

Two studies addressed expansion of existing industrial sand mines. A 2005 study by William A. McCann & Associates, Inc., a real estate appraisal company, evaluated real estate values near two quarries in Naperville and Bolingbrook, Illinois and compared them to properties near a

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54 Anne Dorrian and Clifford Cook, "Do Rock Quarry Operations Affect Appreciation Rates of Residential Real Estate," Department of Economics, Ohio Wesleyan University, April 1996.


The empirical data indicated the proposed mining expansion would not have any measurable adverse effect on nearby property values. In 2011, two Wisconsin certified appraisers, William Richardson and Brian Ducklow, analyzed sales in the Town and Village of Maiden Rock and comparable markets along the Great River Road in Pierce County, Wisconsin to determine the effect on the local real estate market of an underground industrial sand mine. They found no historical data to suggest the mine had affected the real estate market in Maiden Rock and the area.

Also in 2011, the Winona County, Minnesota, Planning Department prepared a memo to address questions submitted by the county board, planning commission, and the public regarding three proposed silica sand mines in Saratoga Township. The Planning Department concluded property values around existing quarries and sand pits in the county (54 mine sites identified) were not noticeably reduced due to proximity to existing mining operations.

**Misinformation on Property Values**

Property values depend upon a variety of local factors, with each property having specific characteristics, making it difficult to draw broad generalizations about how a particular property will be affected by development of any form. Because property values are affected by such specific factors, modeling exercises that try to isolate the influence of a specific factor, such as proximity to an industrial sand facility, rarely succeed in accurately assessing property values.

Below, we discuss the strengths and limitations of several studies commonly cited by opponents of industrial sand mining as allegedly demonstrating nonmetallic mines decrease nearby property values.

**Erickcek and Hite**

The most widely cited information claiming nonmetallic mining operations have a consistent, negative effect on property values is based on a report by George Erickcek of the W.E. Upjohn

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Institute for Economic Research, “An Assessment of the Economic Impact of the Proposed Stoneco Gravel Mine Operation on Richland Township.” Commonly but erroneously referred to as the “Erickcek study” or “Hite study,” this information is in fact not a study but a theoretical model based on an unpublished, non-peer-reviewed working paper by Diane Hite, an associate professor at Auburn University.

Although Erickcek presented Hite’s model as credible evidence for decreased property values, and he calls Hite’s analysis “the only rigorous study to date of gravel mine impacts on property values,” research by GZA GeoEnvironmental, Inc., which included a personal conversation with Hite and others, concluded Hite’s work was never more than a working paper that was neither peer-reviewed nor published and was grossly misrepresented by Erickcek and others.

The environmental impacts of landfills and industrial sand operations are vastly different, rendering these comparisons invalid and inappropriate.

Others analysts have drawn similar conclusions about Erickcek’s work. The Great Lakes Appraisal Company (GLAC) exposed Erickcek’s misuse of Hite’s information as “unprofessional at best and likely misleading and reckless.” GLAC stated, “If the author(s) of the Upjohn report were subject to the same rules and regulations governing our profession, they would be in violation of a number of basic tenets, particularly those regarding unsubstantiated conclusion and the requirement to produce credible results.”

The major shortcomings of Erickcek’s paper include:

- his use of studies that investigated the impact of trash landfills on property values as a proxy for industrial sand mines;
- his refusal to acknowledge his own findings that appreciation rates for property values near sand and gravel mines are the same as for properties distant from these operations; and
- his demonstrated lack of understanding of the inputs of the conceptual model used by Hite, which severely limit the usefulness of Erickcek’s modeling.

Most of the studies presented by Erickcek as evidence that environmental disamenities (environmental features some parties may consider undesirable) can reduce property values actually assessed the potential impact of landfills on property values. The environmental impacts


61 Disclosure: Mark Krumenacher, an author of this Heartland Policy Study, is senior principal and senior vice president of GZA Environmental, Inc.

of landfills and industrial sand operations are vastly different, rendering these comparisons invalid and inappropriate. For example, among the primary concerns regarding landfills are objectionable odors and fears of an influx of undesirable animals such as rats and seagulls. Industrial sand facilities do not emit objectionable odors or attract vermin.

Erickcek found appreciation rates (the rates at which property increases in value) to be similar for property located next to a mining operation and property located farther away. These findings suggest proximity to sand and gravel mines does not substantially influence the value of a given property.

Without data to support his claim, Erickcek developed an unsubstantiated theory suggesting sand and gravel mines create a one-time, immediate loss of property value that is then priced into the value from that point forward, essentially lowering the value all at once and hitting a “reset button” allowing the property to appreciate at the same rate as other properties. Research conducted by GLAC to assess the validity of this theory found it to be unsupported by the data. Looking back in time to before the mining operations opened, GLAC determined there was no evidence to support the hypothesis of an immediate, one-time decline in property value.

Finally, research conducted by GLAC found the supposed sand and gravel mine that was the basis of Hite’s work and the Erickcek report was in fact not a gravel mine at all, but a limestone mine in Ohio. Hite did not collect the data she used in her working paper. Neither Hite nor Erickcek visited the subject site, and they did not collect sufficient information to construct a model capable of accurately predicting the impact of industrial sand mines on property value.

Despite the documented inaccuracy of Erickcek’s representation of Hite’s working paper, others have repackaged Erickcek’s work as fact in subsequent reports, blogs, and articles relaying his manipulation of Hite’s initial working paper. Erickcek’s deeply flawed work is still being used to oppose mines in Canada and the United States, with the initial concept getting twisted a little more with every subsequent report. This is especially true of a seemingly simple curve initially created by Erickcek showing a reduction in property value plotted against distance from a mine. This now convenient curve is cited frequently as fact and even “irrefutable” without an understanding of its genesis. Inconceivably, even Diane Hite now cites Erickcek’s 2006 report

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and his use of “the Hite (2006) study” in a recent report prepared in opposition to an aggregate operation in Colorado.\(^6\)

Hite’s model – a hedonic pricing model that assumes the price of property is determined both by its own characteristics and external factors – requires credible inputs into the model. But property value is influenced by a complex mixture of variables that are difficult to control for and separate from one another for analysis. Erickcek’s work fails to take the complexity of property value into account and lacks credible inputs, rendering the outputs of the model useless for predicting the impact of industrial sand mines on property values.

It is vitally important that local decision makers and residents understand the limitations of such reports alleging to be scientific studies. Public opinion is too often influenced by unsubstantiated claims or modeling exercises that appear to be sophisticated but produce results that do not match real-world observations.

### Midwest Environmental Advocates and University of Wisconsin Extension

Several economic reports claim to address the negative impact of mining on property values, yet not one of the reports provides data to support that position. Instead, the approach many of these self-proclaimed researchers take is to incorporate repeated statements as if they were forgone conclusions of fact without doing original research or verifying sources.

That approach was used by Midwest Environmental Advocates (MEA) in its petition to compel the Wisconsin Department of Natural Resources to conduct a strategic analysis of the industrial sand mining industry.\(^6\) The success of MEA’s petition is an unfortunate testament to the fact that truth and technical facts often do not matter to activists so long as the end justifies the means.

MEA repeats others’ conjectures in statements such as this: “Further, negative impacts of frac sand mining may hurt neighboring property values and businesses that benefit from Wisconsin’s scenic beauty and natural resources” [emphasis added], providing no appraisal data or facts to support these claims. MEA also reports, “While frac sand mining may temporarily increase

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property values of land used for mining, it may also decrease the value of neighboring residential properties that are not sold for industrial uses.” This second statement cites a paper from the Department of Agricultural and Applied Economics of the University of Wisconsin, “The Potential Impacts of Frac Sand Transport and Mining on Tourism and Property Values in Lake Pepin Communities.”  

Although providing a convenient reference, the authors of the cited report provide no facts or studies, instead relying solely on speculation that mining “may” or “has the potential” to affect property values. As such, the paper referenced by MEA is not a study but merely another opinion piece similar to a number of Facebook pages. In this case, however, the opinion piece was prepared by University of Wisconsin Ph.D. researchers to provide a few local anti-mining activists with a credible-sounding report, which persuaded Pepin County to pass an ordinance prohibiting industrial sand mining under the guise of concern the activity would reduce property values and tourism.  

The most disturbing element of the report prepared for Lake Pepin communities is the authors’ complete disregard for the three industrial sand mining operations already located along the east shore of Lake Pepin. These operations are located on the border of Pepin County or seven to 15 miles from Pepin County along the lake, yet the authors neither acknowledged them nor apparently knew them to exist. Even more damning of the authors’ credibility, two of the industrial sand mines have been there for nearly 100 years. Nevertheless, the authors claim the current high property values and flourishing tourism along the lake will be forever reduced if an industrial sand operation were to be allowed there.

It is amazing their report should have garnered any amount of credibility. But the paper served its intended purpose for a small number of individuals in Pepin County set on banning mining for their own personal reasons: another unfortunate testament to the fact that evidence, truth, and technical facts often do not matter so long as the means justifies the end.


Property Values and Perceptions of Harm

Property values can be affected by the mere perception of possible harm from a given source, such as a cell phone tower, water treatment plant, industrial wind turbine, or industrial sand mine. The ways in which people perceive risks can influence how they view themselves, their surroundings, properties, and society at large. As noted earlier, people exposed to new ideas tend to give more weight to negative information, even if their initial fears are not based on a rational view of the available evidence.

Unscientific, anecdotal studies that inaccurately quantify potential risks – such as those conducted by Dr. Crispin Pierce of the University of Wisconsin-Eau Claire and those erroneously reported as fact by influential groups such as Midwest Environmental Advocates – feed the irrational perception of harm. Such studies do nothing to quantify the potential environmental impacts of industrial sand mining, instead causing unnecessary consternation among local residents. Such studies may very well have a greater negative impact on property values near industrial sand mines than the mining operations themselves.

Perceptions of harm that have no basis in fact are likely to be temporary, and so too is any property value decrease based on those perceptions. Research shows the irrational perception of harm can be addressed by scientific, evidence-based information. An important example is the concern over air quality and its impact on human health and property values near industrial sand mines.

Air quality monitoring studies conducted at or near industrial sand mining operations find levels of particulate matter and respirable crystalline silica well below concentrations that could cause harm to human health. For example, a study conducted by the University of Iowa found daily mean concentrations of particulate matter at residences near sand facilities were substantially lower than National Ambient Air Quality Standards (NAAQS) established by the U.S.

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71 Supra note 66.

72 For more information on the health impacts of frac sand mining, see supra note 2.
Environmental Protection Agency.\textsuperscript{73} Industrial sand operations do not cause airborne particulate matter to reach concentrations that could cause chronic health conditions such as silicosis.\textsuperscript{74}

Scientific investigations by universities, state regulators, and other independent third-party air sampling experts have concluded industrial sand mining is a low-risk industry. As the results of these studies become better known, temporary reductions in property values stemming from concerns about the safety of industrial sand facilities are likely to diminish over time ... unless environmental groups and NIMBY activists continue to raise them and gullible or complicit reporters continue to give them undeserved attention.

\textbf{Property Value Agreements}

While current homeowners in the neighborhood of a new mine may be convinced that any change in the local environment will inevitably hurt property values, the fact is property values rarely fall. The concerns or perceptions of harm held by current homeowners are not universally shared by future owners. Although some potential buyers may choose not to buy a home near a mine, a sufficient pool of buyers for such properties exist and fair market value generally is obtained, subject to normal market variations.

In some communities, public concern over the potential negative impact of industrial sand operations on property values has led to “property value agreements,” whereby local mining ordinances or developers’ agreements require mine operators to guarantee the value of property within an arbitrarily specified distance from the mine. Agreements of this nature have been negotiated between industrial sand operators and local property owners in Trempealeau County, Wisconsin.\textsuperscript{75} Similar agreements are sought with other developments such as wind farms.

Implementation of a property value agreement is an inherently local effort. Every sand mine is unique, as are its surrounding environment and demographics. Assessing the value of residential real estate, in particular, is subjective and difficult, because the owner almost certainly has a personal relationship with the property and has invested sweat equity in it. He or she is likely to be convinced that \textit{any} change to the property made by someone else or caused by something else will have a negative affect on the property’s value.

\textsuperscript{73} Ryan James Grant, “Community based air quality monitoring near proppant sand facilities,” Iowa Research Online, University of Iowa, August 2015, http://ir.uiowa.edu/cgi/viewcontent.cgi?article=5903&context=etd.

\textsuperscript{74} Ibid.

\textsuperscript{75} Alison Dirr, “Frac sand mines credited for rising, dropping property values,” Wisconsin Center for Investigative Journalism, March 30, 2014, http://wisconsinwatch.org/2014/03/frac-sand-mines-credited-for-rising-dropping-property-values/.
Property value agreements are rarely complex. They tend to be based on a simple determination of fair market value prior to mine development, typically by a mutually agreed upon licensed real estate appraiser or similar professional. If the owner sells the property for less than the determined fair market value, the mine operator must pay the owner the difference between the selling price and the fair market value. Commonly, such agreements also provide the mine operator will purchase properties that do not sell within a set period of time, such as six or 12 months.

It is clearly appropriate in some instances for mine developers to make concessions and appropriate offers to neighbors, and they often have done so. However, using local ordinances to force such concessions to property owners within arbitrarily determined distances is not justified by the evidence or research discussed in this paper.

Part Five
Conclusions

Mining is an indispensable part of life. It is not a threat to tourism, scenic beauty, or property values.

Mining is an indispensable part of life: If an object is not farmed, it must be mined. Every American citizen born in 2015 will require millions of pounds of minerals, metals, and fuels in his or her lifetime, and these materials must be obtained through mining. Even so-called “green technologies” depend on mining because they require vast quantities of traditional metals, minerals, rare earth elements, and fossil fuels.

Mining is not a threat to tourism, scenic beauty, or property values.

- Wisconsin Department of Tourism data for the years 2010 through 2014, when industrial sand activity expanded dramatically in the state, show most sand-producing counties experienced growth in all tourism measures. Industrial sand mining may actually help increase tourism-related revenues through the living-wage jobs it creates in these communities, along with activities such as trout stream habitat restoration projects in which mining companies have participated.

- Scenic natural bluffs are unlikely to be affected by industrial sand mining. It is very rarely economically feasible to access sandstone deposits buried deep beneath thick layers of limestone rock. In some situations, underground mining techniques can be used, as they have been for nearly a hundred years along the Mississippi River Corridor – an area still prized for its scenic beauty.

- In the exposed sandstone hills where industrial sand mining is feasible, mining is far less permanent than many other forms of development, such as commercial shopping outlets,
where stores can remain vacant for years. Reclamation of mining sites begins when mining in one section of the mine has concluded, and substantial diversity in plant and animal species can be observed within only a few years.

- As is true of any development, concerns about the impact of industrial sand mining on property values may be valid in some situations. It is important to address those concerns with information that applies to the specific local circumstances. In some situations, industrial sand companies have entered into property value agreements guaranteeing residents that the operations will not prevent them selling their property at fair market value.

Too often, concerns about the impact of industrial sand mining operations are driven by irresponsible fear-mongering. Anti-mining activists often feed the public’s intense emotional reaction to change by issuing “reports” that do not inform, but cause consternation and whip up fear. Experts in risk communication identify four ways to understand the emotional reactions a community might have to a proposed new development. Mental noise, perception of threats, elements of trust, and dominance of negatives can limit the ability of individuals in a community to examine an issue rationally and can cause them to become unnecessarily concerned.

The way to address emotional reactions is to acknowledge them, understand them, and respond to them with scientific evidence and real-world data. – which is what we have aimed to do in this series of Heartland Policy Studies.

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Krumenacher is a professional geologist with licensure nationally and in several states and is a certified hazardous materials manager. He has managed and conducted geologic, hydrogeologic, and engineering studies, remedial investigations, environmental assessments, pre-acquisition environmental due diligence, and hazardous waste management at various properties including surface and underground mines; large industrial, commercial, and urban redevelopment projects; federal Superfund sites; and state-lead environmental projects.

He has provided testimony regarding aggregate and industrial mineral mining before municipal, township, and county units of government as well as nongovernment organizations, local environmental groups, and community advisory councils to help address residents’ concerns about mining. Krumenacher is actively involved with several mining associations, including the National Stone Sand and Gravel Association, Illinois Association of Aggregate Producers, National Industrial Sand Association, Industrial Minerals Association–North America, Wisconsin Industrial Sand Association, and Society for Mining Metallurgy and Exploration.

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Orr is the author of Heartland Policy Study No. 132, “Hydraulic Fracturing: A Game-Changer for Energy and Economies” (November 2013), and his letters to the editor and op-eds have been published in USA Today, The Houston Chronicle, The Washington Times, The Hill, American Thinker, and Human Events. He is the author of “Frac Sand Study: Lots of Scare, Little Science,” published in the Milwaukee Journal Sentinel in October 2014. He has spoken to nearly a dozen audiences and recorded more than a dozen podcasts on energy and environment topics for The Heartland Institute, available on Heartland’s YouTube channel at HeartlandTube.

Orr writes, “I grew up on a dairy farm, and I want to preserve rural America, and rural American values. Along with agriculture, I am fascinated by geology, mining, groundwater, and other environmental issues.”