

# Sand surge

*In Minnesota and Wisconsin, frac sand mining has lifted local economies—and stirred opposition*

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Photography by Bob Firth

Large piles of frac sand at a Superior Silica Sands facility near New Auburn, Wis.

**F**rac sand mining has been good for business at Park Service & Convenience, the only grocery store in Maiden Rock, Wis. The store derives over 40 percent of its annual revenue from Wisconsin Industrial Sand Co., a nearby mine that produces sand for use in oil and natural gas extraction. Workers buy gasoline, cigarettes, snacks and other items, and the firm purchases fuel and bottled drinks for its 50 employees.

“Without that, this business wouldn’t be open,” said Steve Pomahatch, a part-time employee who recently sold the store after running it for 17 years, adding that mine jobs are vital to sustaining the community of only 120 people. “The frac sand mine is the best thing that’s ever happened to this village,” he said.

Maiden Rock isn’t the only community in the eastern part of the Ninth District that is benefiting from intensified mining of frac sand. Over the past five years, a sand rush has taken hold in west-central Wisconsin and southeastern Minnesota as mining companies seek out deposits of quartz sand suitable for “fracturing” shale rock to release oil and gas. Since 2007, over 40 frac sand mines have either opened or expanded their operations in Minnesota and Wisconsin, and over two dozen new mines have been proposed. The sand ends up at the bottom of wells in shale oil and gas fields throughout the coun-

try, including the Bakken oilfields in western North Dakota and eastern Montana.

But this burgeoning industry faces obstacles in the region that may slow mine development in coming years.

For rural communities struggling to recover from the recession, new and expanded sand mines are a boon; they bring relatively well-paying jobs, increased spending at local businesses and a stronger tax base. But not everything about frac sand is golden. Mining development also can impose costs, such as lost revenues in other industries, environmental harm and diminished public health and safety.

In many communities, new or proposed sand mines have provoked public outcry, leading counties and townships to pass moratoriums on new frac sand operations. As of June, moratoriums were in force in seven counties and several townships in Minnesota and Wisconsin.

The scale and pace of sand mining development in the region over the next few years depend partly on how communities adapt to mining activity, balancing the resource demands of mines against the impact of those demands on competing land uses, the environment and public welfare.

Logistics also has a bearing on where sand mining is likely to prosper and grow. In Minnesota, transportation bottlenecks, in particular a lack of rail

capacity, may prove as big a barrier to mine development as pushback from mining opponents.

## Golden sands

Geologic fate gave petroleum-rich shale beds to some areas of the country, such as western North Dakota, Texas and Pennsylvania. West-central Wisconsin and southeastern Minnesota got silica sand, tying the region economically to one of the nation’s fastest growing energy industries.

In the hydraulic fracturing process, a mixture of water, chemicals and sand is injected into wells under high pressure to open cracks and pores in shale rock, freeing trapped oil and gas. Tough grains of silica sand prop open (frac sands are also known as proppants) the fissures, allowing fluids and gases to flow into the wellbore. Fracking a single well consumes up to 1,600 tons of sand.

Not just any sand will do the job; the best frac sand consists of nearly pure quartz, with spherical granules—a type of sand that is abundant across large swaths of Minnesota and Wisconsin. In many areas, sandstone formations laid down in ancient seas are close to the surface, making them easy to dig.

Silica sand has been mined in the region for over a century for use in glass-making, foundry molds and abrasives. But in the 2000s, the shale oil and gas

boom dramatically increased demand for frac sand, encouraging increased production and large-scale mine development. Nationwide, frac sand production almost doubled from 2009 to 2010, to 12.1 million tons, according to the U.S. Geological Survey.

The figure is undoubtedly low; state data are scant, but last fall the Wisconsin Department of Natural Resources (DNR) estimated that the state was producing slightly more frac sand annually than the national USGS figure.

High-grade frac sand commands a premium in the marketplace: \$60 to \$80 per ton, over five times the price of construction sand and gravel. Oil companies and oilfield service firms can pay over \$300 per ton for processed sand delivered to the wellhead. No wonder that large mining firms, many of them based outside the region, have invested hundreds of millions of dollars in mines and processing facilities.

The typical frac sand mine is much larger than a traditional sand mine, ranging in size from 50 acres up to several hundred acres. Mining companies build big to take advantage of economies of scale, said Tom Woletz, a senior manager with the Wisconsin DNR who tracks frac sand mines in the state. “They’re not dinking around,” he said. “They want to get in and move a lot of mineral fairly quickly.”

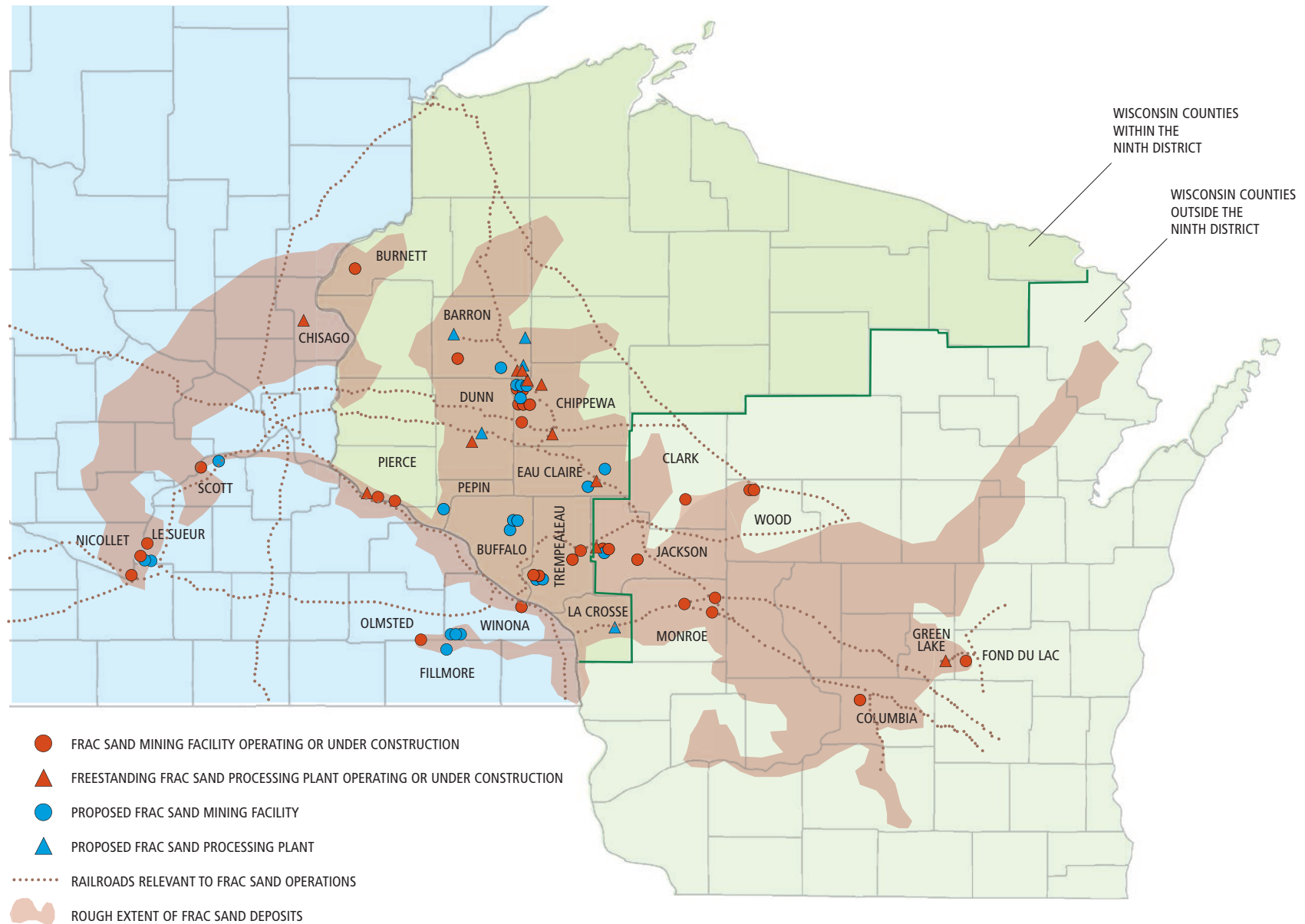
Most mining operations include pro-

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# The district's sandbox

*Existing and proposed frac sand mine operations*



Sources:  
Mine locations: State and county permitting records; industry contacts / Sand deposits: U.S. Geological Survey / Rail data: Minnesota and Wisconsin departments of transportation

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*“There’s talk of open pit mines and processing facilities going in behind the village, and that traffic would come right past our front door.”*

—Alan Nugent, gallery owner, Stockholm, Wis.



Along the scenic Mississippi River frac sand mining means more railroad and trucking jobs...



... but also worry for entrepreneurs such as Alan Nugent who rely on tourist traffic.





Superior Silica Sands mine and washing plant near New Auburn, Wis.



Mine spending is crucial for Park Service & Convenience in Maiden Rock, Wis.



Dried sand shipped from this New Auburn plant is a valuable commodity.



Wisconsin Industrial Sand recently expanded its facility in Maiden Rock.



Night-shift mine workers come for breakfast at the Sunshine Cafe in New Auburn.

*“Frac sand is the biggest and best thing that’s happened in our lifetime in Barron County. I see frac sand becoming one of the county’s biggest sources of [business] revenue, moving forward.” —Bob Missling*

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cessing and shipping facilities either onsite or nearby—sand washing and drying plants, and loading docks for trucks or railcars. These facilities are expensive—construction costs for a new processing plant average \$50 million—but they can be up and running in a matter of weeks once building and environmental permits are secured. Mining is simply a matter of excavating a pit or biting into sandstone bluffs with backhoes and front-end loaders.

**Dig, baby, dig**

Frac sand mining is well established in Wisconsin, with concentrations of activity in the Maiden Rock area, near Chippewa Falls, and in Trempealeau and Monroe counties (see map on page 11). The DNR estimates that there are over 60 frac sand mines in the state, although many of them are small pits or operations that have mined silica sand for decades. Since 2007, 10 new frac sand mines and seven processing plants have opened in Wisconsin counties within the district.

Many new, large mines are situated on rail lines, the most economical shipping method. (Rail patterns dictate that most frac sand mined in the region goes to shale oil and gas fields in the eastern and southern United States, rather than to the Bakken.) For example, mines in Chippewa and Barron counties ship sand on small, rural rail lines to connect to the networks of Canadian National, BNSF and other continental railroads.

Major frac sand operations in the district portion of Wisconsin include a new \$60 million processing plant in Chippewa Falls owned by EOG Resources Inc., a Texas-based oil and gas company that mines sand for its own use; two sand processing plants and associated mines near the Village of New Auburn on the border between Barron and Chippewa counties; and the Maiden Rock mine, an underground facility that last year nearly doubled its frac sand production to over 1 million tons annually. Wisconsin Industrial Sand, a subsidiary of a large minerals supplier based in Ohio, also operates sand mines in Bay City and Menomonie.

Numerous new sand mining operations are in the works in Wisconsin, among them another mine under construction in Barron County and a large mine and processing plant being developed in Eau Claire County by Hi-Crush Proppants of Houston, Texas. On a smaller scale, established gravel and sand pits are expanding to exploit the frac sand market, and cranberry farms are excavating frac sand as a sideline.

In Minnesota, the frac sand industry is less developed, with only five known mines in operation. Unimin Corp., a national producer of industrial minerals, owns two of the biggest—the Kasota and Ottawa mines

north of Mankato.

The sand surge rolled into Minnesota later than it did in Wisconsin—new mine proposals by large mining firms started cropping up in 2010. That’s partly due to geology; accessible deposits of high-grade sandstone are less extensive in Minnesota than in Wisconsin, found mainly in a handful of southeastern counties and the Minnesota River Valley. Another impediment to mine development in Minnesota is logistics—the task of getting millions of tons of sand to distant markets.

In contrast to Wisconsin, southeastern Minnesota has little rail capacity to ship sand to transportation hubs such as Winona and the Twin Cities. Hundreds of miles of rural rail lines have been abandoned since the 1970s, leaving trucks as the only viable means of moving sand overland. In addition, much rail and barge capacity in Winona is already taken up by agricultural commodities, said Jeff Broberg, a Rochester-based environmental consultant who has represented frac sand mine developers. “People haven’t really come to grips with the economics or the logistics,” he said. “The logistical bottleneck is huge.”

Despite these limiting factors, several new mines have been developed or proposed over the past couple of years. The 110-year-old Biesanz Stone Co. quarry in Winona began mining frac sand in 2011, and last fall several mines were on the drawing board in the southwestern corner of Winona County, an area with outcrops of St. Peter sandstone. Another proposed mine in Scott County southwest of the Twin Cities would cover 1,000 acres along the edge of the Minnesota River Wildlife Refuge—including the grounds of the Minnesota Renaissance Festival held each fall.

**Paychecks and millionaires**

In just a few years, frac sand mining has lifted local economies—mostly in Wisconsin—by providing well-paying jobs, raising household incomes and pumping revenue into area businesses.

Unemployment in Barron County, Wis., topped 11 percent at one point during the recession. But since 2010, sand mining companies have invested hundreds of millions of dollars in the predominantly rural county—making its economic development director bullish on the future.

“Frac sand is the biggest and best thing that’s happened in our lifetime in Barron County,” Bob Missling said. “I see frac sand becoming one of the county’s biggest sources of [business] revenue, moving forward.”

Mining companies offer badly needed jobs to rural areas. No official job numbers exist for sand mining in the district—the industry is too new. But it’s evident that expanded mining has contributed to rising



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private employment since the recession. On average, one frac sand mine employs between 10 and 20 people, while 40 to 50 people work at a typical processing plant, according to industry sources. So over the past five years, new mines and processing plants—not counting existing, expanded mines—have created roughly 500 jobs in the district portion of Wisconsin.

Hi-Crush Proppants' \$48 million mine and processing plant, nearing completion on the outskirts of Augusta, Wis., southeast of Eau Claire, will employ up to 75 workers, said Chad McEver, vice president of business development for Hi-Crush. Pay for entry-level plant workers starts at \$16 per hour, with skilled equipment operators and supervisors earning higher wages.

At many mines, large numbers of trucks are needed to haul frac sand to processing plants and rail terminals, creating job openings for truck drivers and crews. EOG Resources contracts with a local trucking firm to haul sand to its Chippewa Falls processing plant, and in Winona there's plenty of work delivering sand to riverside trains and barges for CD Corp., a local firm with 40 employees and a fleet of 30 trucks.

Business slackened during the recession when coal shipments from Winona declined, said co-owner Dan Nisbit. But increased flows of frac sand, mostly from Wisconsin mines, have more than made up for that; since 2010, CD Corp.'s revenues have increased 35 percent and it has hired seven more workers. "We saved several jobs and were able to add jobs; otherwise, we would have had significant layoffs," Nisbit said.

Besides jobs, sand mining has created a "wealth effect" in rural communities—lucrative payments to landowners who sell or lease their land to mining companies. Last year, Windsor Permian, a Texas oil and gas firm, paid over \$16,000 an acre—well above market value—for a potential mining site near Red Wing, Minn. In west-central Wisconsin, farmers have been offered six-figure mineral rights fees, plus royalties of \$1.50 to \$3 per ton for their frac sand, said Gerald Duffy, a Twin Cities attorney who has represented landowners in the area.

Spending by sand millionaires—along with purchases of goods and services by mining companies, mining-related businesses and their workers—percolates through local economies, benefiting enterprises with little connection to mining.

That spending allows Park Service & Convenience in Maiden Rock to stay open year-round rather than closing during the winter, when tourist traffic slows to a trickle. And in New Auburn, the patronage of mine workers is crucial for the Sunshine Café, a downtown diner. Business was poor before the plants came, said owner Cindy Sarauer, who bought the cafe a year ago; now mine workers coming off the night shift help fill tables at breakfast. "People are working, so they have

money to come out and eat," she said.

Local governments and taxpayers in rural areas also benefit from increased economic activity linked to mining. Chippewa Falls saw lodging tax receipts increase 23 percent between 2010 and 2011, in part because of overnight stays by mining company executives and their clients, according to city officials. And residents of the New Auburn area could see their school district mill rates drop by 40 percent or more over the next few years, as two new sand processing plants in the area start paying property taxes.

## Lines in the sand

Economic gains from frac sand mining don't come without costs; mining activity can damage infrastructure and the natural environment, and compromise public health and safety. Many of these costs are borne by taxpayers, or by society at large in the form of extra personal expense or forgone benefits.

Truck hauling from sand mines exacts a heavy toll on rural roads and bridges, for instance. A recent Winona County study on the impact of sand mining on county roads found that daily truck traffic to and from two average-sized mines would wear out pavement at 10 times the rate of normal, mixed traffic.

As a rule, mining activity raises residential property values by increasing average household income; people can afford more expensive housing. But studies of gravel and coal mining in other parts of the country show that homes situated near a mine or major sand truck route lose value.

Although silica sand mining is not considered as environmentally harmful as metallic mining, it's an extractive industry that strips away vegetation and topsoil. Storm water runoff from mines can muddy wetlands and streams (as occurred in May, when sand-laden water from a frac sand mine near Grantsburg, Wis., leaked into the St. Croix River). However, in both Minnesota and Wisconsin, mining firms are required to reclaim land once mining stops, returning it to agricultural use or to its natural condition as woodland or prairie.

Mining activities throw up a lot of fine silica dust, which is not regulated as an air pollutant. Exposure to silica dust has been shown to cause a number of lung diseases, including silicosis and cancer, although there's no conclusive evidence linking these conditions to sand mining.

Some of this fallout from mining may affect other industries, such as agriculture, outdoor recreation and tourism. In Stockholm, Wis., a picturesque river community a few miles south of the Maiden Rock mine, Alan Nugent worries about the impact of increased sand truck traffic on his general store and art gallery, one of about 30 tourism-oriented businesses in the village.

Foot traffic and revenues haven't suffered so far, but Nugent fears that could change if

... and impacts alternate land uses and infrastructure.



Tourists come to sand country to shop ...



... sail

... bike



... and enjoy the view.



In some areas, sand has supplanted corn and soybeans as a cash crop.



Truck traffic has increased on rural roads—and in small towns like Maiden Rock.





The best frac sand consists of tiny, rounded grains of nearly pure quartz.



Many frac sand facilities are built adjacent to rail lines.



In Winona, Minn., a key transport hub, frac sand moves by truck ...



by rail ...



... and by river barge.

Photography by Bob Firth

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sand mines are developed in the uplands behind Stockholm. "I'm more worried about the future than just what's happening now," he said. "There's talk of open pit mines and processing facilities going in behind the village, and that traffic would come right past our front door."

In many communities, sand mining has sparked protests from residents who have formed groups such as Maiden Rock Concerned Citizens and Save the Hills Alliance to monitor mining activity and challenge projects at normally uneventful township and village board meetings. "Those are laid-back, small groups where nothing controversial ever happened at their meetings, and now they're being confronted by these advocates opposed to mining," said Missling of Barron County economic development. "It's tough—you get neighbor pitted against neighbor."

Local governments across the region have responded to the controversy swirling around frac sand mining by imposing bans on new mining operations or expansions. Although federal and state governments have some oversight of nonmetallic mines, sand mining in Minnesota and Wisconsin is mostly regulated at the local level, through zoning codes and land use permits that require mining companies to fulfill certain conditions before starting operations.

Moratoriums on sand mining enacted by municipal, town and county boards over the past year are intended as a timeout in the sand rush—a chance for community leaders and planners to consider stricter regulations for sand mining. "We needed to take the time to really make sure that we have adequately addressed health, safety and welfare impacts," said Jason Gilman, planning director for Winona County—one of five counties in southeastern Minnesota that have declared moratoriums on silica mining and processing.

Winona County's three-month moratorium expired in May, but bans in Goodhue, Wabasha, Fillmore and Houston counties are slated to remain in effect at least through the end of the year. In Wisconsin, moratoriums are in place in Buffalo, Dunn and Pepin counties (a six-month ban in Eau Claire County expired June 1) and in a number of townships in these and other west-central counties.

### Blending into the landscape?

New sand mines are likely to appear on bluff tops and in valleys across the region as mining companies seek to satisfy high demand for frac sand in shale oilfields. There's no sign of a letup in shale oil drilling; in March, increased production in the Bakken oilfields made North Dakota the country's second-biggest oil producer, edging it ahead of Alaska. And rising energy prices in a rebounding global economy can only stimulate more drilling—and more digging in the nation's sandbox.

"As the price of oil goes up, you're going to see the need for things related to pulling oil out of the ground increase," said Dave Marcouiller, a resource economist at the University of Wisconsin-Madison.

However, within a few years, mining development may slow if frac sand production increases to the point where demand is satisfied and proppant prices fall. Or if transporting frac sand proves too cumbersome and expensive in some areas. Broberg and other industry sources believe that frac sand mining in southeastern Minnesota will remain small in scale until more rail and barge capacity is developed to ship sand to oil and gas fields.

And especially in Minnesota, uncertainty reigns about what will happen when moratoriums expire—a surge of development, renewed bans or something in between. "We really don't know what will happen; we know there's a lot of speculation," Gilman said. In Winona County, startup and regulatory costs may prompt some small, local mine developers to withdraw their proposals, he added.

But governments are seeking solutions to allow mining to expand while satisfying critics and protecting government assets and budgets. Winona County let mine development resume under revised regulations that include a road impact fee charged to new businesses that transport frac sand by truck. The impact fee—22 cents per mile for each ton of sand—will help fund ongoing repairs to county roads that suffer excessive wear and tear from sand hauling, Gilman said. New and expanded mining operations must also comply with county rules on dust monitoring, noise abatement, hours of operation and other matters.

Some Wisconsin townships have hammered out development agreements with mining companies intended to address the concerns of constituents and safeguard public resources. Last summer, the Town of Howard, where EOG Resources operates one of two Chippewa County mines, negotiated an agreement with the company that sets out rules of operation for the mine over the next 20 years. Among the requirements are a ban on mining operations from May 1 through Oct. 15 and a provision for offering fair market value to nearby residents who wish to sell their land. The pact has become a model for other Wisconsin townships seeking to forge their own agreements with mining firms.

Not that the dust has settled over frac sand mining in Wisconsin. In Maiden Rock, the Village Board and the Concerned Citizens group oppose Wisconsin Industrial Sand's plans to double the acreage of its mine. The citizens group has filed a lawsuit to stop the expansion.

Clearly, it will take awhile for frac sand mining to blend into the economic and political landscape—for communities in the region to figure out how to reap the economic rewards of mining while minimizing its societal costs. Broberg sees such an accommodation being reached, with sufficient planning by local governments, mining firms and other stakeholders in the industry.

"We're at a very infant stage with this," he said, "and there are going to be investments made to realize the economic benefit of sand mining—in all the areas that people have talked about, like logistics, and traffic, and health and safety. I think the appropriate balance can be found, and it will have to be worked out as this [industry] matures." **f**