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With respect to the Ohio Siting Board, I would like to start by reading your mission statement.

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*"Our **mission** is to support sound energy policies that provide for the installation of energy capacity and transmission infrastructure for the benefit of the **Ohio** citizens, promoting the state's economic interests, and protecting the environment and land use."*

That is a strong powerful statement, "protecting the environment and land use". If you permit these wind turbines to be built over one of the most expansive karst in the state you will fall short of your mission statement.

There are many reasons to oppose the proposed wind turbines in Seneca, Sandusky, Erie, and Huron counties. I have not separated the counties because the karst that underlays those counties are one and the same.

According to the American Geological Institute, "Karst areas are among the world's most diverse, fascinating, resource-rich, yet problematic terrains. They contain the largest springs and most productive groundwater supplies on Earth. ... many critical processes in karst occur underground, requiring monitoring of groundwater flow and exploration. They are also the landscapes most vulnerable to environmental impacts. Their groundwater is the most easily polluted.

Karst regions require special care to prevent contamination of vulnerable groundwater supplies and to avoid building in geologically hazardous areas. Living in karst environments may result in destabilization of the delicate equilibrium between surface and underground components of karst resulting in alteration of drainage patterns and increasing incidents of catastrophic sinkhole collapse, particularly in areas of unplanned urban growth. "

One of the best resources is our own Department of Natural Resources, which have studied the karst regions in Ohio and especially the four county area where the turbines are proposed to be built. The ODNR have multiple resources available to the public to learn about the karst area .If that were not enough, they have done a remarkable job putting an interactive karst map on their website that shows how extensive the karst area is.

There are hundreds if not thousands of articles explaining that building over a karst can be catastrophic. (I have brought two different resources for your viewing pleasure.) They explain the fragility of a karst system, how the aquifer system works within the karst system and the high risk of collapse and contamination to an ecosystem.

The aquifer that is within the karst area directly flows into Lake Erie. We already have seen the algae blooms that is what happens when farm chemicals, animal waste, and other pollutants make their way into a very delicate ecosystem.



Above is a screen shot of ODNR's interactive karst map. This screen shot includes Seneca, Sandusky, Erie, and Huron Counties. Underneath all those dots are either a field verified karst, suspected karst, and natural springs. This map is wonderful, as it shows the magnitude of the karst area that covers our four counties. Apex would like them to be divided by area but that is impossible because the four county area is one big karst! The next page shows one dot of the many dots above.

With the interactive program, from the ODNR, you can see that each dot has the potential to be massive. Each dot is interconnected in ways that you can't see from a dot on a map.

Interactive Karst Map from the ODNR



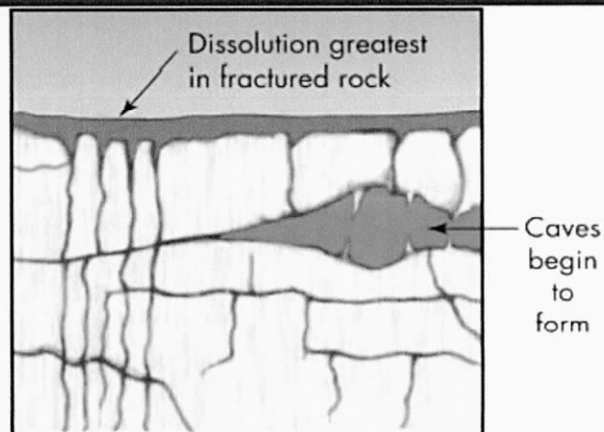
● Approximate location for 3 of the proposed wind turbines. ☆ Indicate private wells that draw off the karst above. The gray and brown areas are a screen shot of ODNR's interactive karst website. As you can see from this photo above the karst is extensive. Most of the karst is unseen from the surface. The aquifer system connects to other karst in the area.



This area is directly over the karst from the previous page. The surface water is a much smaller part of the actual karst. The blue dot also on the previous page reflects the location that these pictures were taken. The road closes yearly because of rain, this brings in some pretty amazing birds and has become an eBird hotspot for birders. Eagles have been spotted visiting the karst/aquifer area.

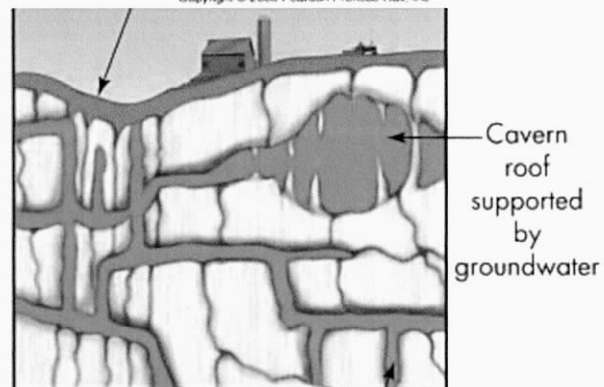
Sinkholes

- Groundwater dissolves soluble rock, creating fractures and caves.
- Dissolving continues to form larger caves and fractures.



(a)

Copyright © 2008 Pearson Prentice Hall, Inc.



(b)

Fractures enlarged by dissolution

Copyright © 2008 Pearson Prentice Hall, Inc.

You can visually see in the illustration above the fractures in the karst and how the underground aquifer system works. You can also visually see what makes our area so unstable.

The following are excerpts from the Fremont News Messenger article that was written by Daniel Carson and published Aug. 2, 2019. I have enclosed the article within this packet. Ms. Montague, APEX Clean Energy spokesperson, was interviewed via email and she stated that a "series of steps were laid out to detect karst and avoid groundwater sources." Had APEX checked with the ODNR they would have found extensive research regarding the karst region and how the ground water is affected when the karst is disturbed.

"APEX is developing projects in the Oklahoma and Texas that have karst features." Kenneth S. Johnson, William J. Bangsund, Neal A. Hines published an article regarding the risk in siting wind turbines in Blaine County, Oklahoma. "Catastrophic collapse of a wind turbine is clearly unacceptable, and minor settlement could also be a risk. Differential settlement by even 3 cm across a 15-m-wide turbine foundation could lead to the turbine tilting out of tolerance..."

I have done extensive research on the "developing projects", that is stated above, but have not found one turbine located over a karst in Oklahoma. There were some that were planned in 2017 but have never come to fruition. APEX is welcome to correct me if I am wrong.

"If a turbine location is determined to be in a potential karst area, additional testing is conducted,"

Our Ohio Department of Natural Resources has done an outstanding job of mapping Ohio's karst areas. I have enclosed in your packet a copy of the ODNR publication. As you can see by that publication, karst have been studied in Ohio since the 1980's. There is so much information on karst that I was able to gain multiple government sources stating that building over a karst can be catastrophic! Why would Apex choose one of the largest most vulnerable areas in Ohio to place 600 feet turbines on?

"The typical and expected foundation of the turbine models under consideration in northern Ohio wind projects extend to a maximum depth of approximately 10 feet, which she described as not significant enough to impact groundwater. Turbines are intentionally sited away from wells and other water sources."

Well Ms. Montague you do not understand how a karst and aquifer work. The soil filters the groundwater, it then filters through the karst into the aquifer system. ODNR states, "The many passageways formed in karst terrain allow for high connectivity between the land surface and the water table". The pilings that Apex will have to put in to stabilize the turbine can be up to 30 feet deep with multiple pilings on one turbine. Imagine the damage that will do to the karst system and aquifer system. You visually can see by the illustration provided what will happen if you start disturbing the karst and the aquifer system it supports. Also, existing turbines are 400 feet tall, ours will be 655 feet tall, you cannot compare foundations or make the claim the same type will work. That is physics, when something goes up the foundation must be larger.

Our own Department of Natural Resources has wonderful information for all of us. All academia versed in karst specifically mention how unstable the limestone is and how easily it is to destroy or contaminate an aquifer system. We have some of the best experts in the country, specifically the ODNR, versed in karst and aquifer systems and yet we are not listening to them. Sinking pilings into the ground will only fracture the karst even further and compromise the drinking water by letting groundwater go directly into the aquifer. You see how massive our karst is and it supplies fresh drinking water to thousands of residents within the four county area. How much will it cost to repair the damage that these turbines will do to the aquifer system? Once an ecosystem is destroyed you can not bring it back. This is a project that is so massive that it is beyond my comprehension, how this has even gotten this far in the process with the locations that they have proposed. This is much bigger than just putting up turbines this is our homes, our water sources, you can not put a monetary amount on that. We are talking the entire four county area is at critical risk. It's concerning to me that we are taking something that could be detrimental to our quality of life, water, and compromising its integrity. It's also concerning that we are talking about the money this project will bring. What will the cost be if hundreds if not thousands of wells are contaminated? What will the cost be if the 600+ turbines subside? I guarantee it will cost the state more money than these wind turbines will ever contribute to the great State of Ohio.

I respectfully ask that you deny the application of 17-2295-EL-BGN, Republic Wind Farm for the reasons stated above.

Deborah J. Didion

6040 County Road 113

Bellevue, Ohio 44811

Literature Cited

The following are websites that you can learn more about karst and aquifers and the impact they can have when disturbed.

http://www.geo.hunter.cuny.edu/~fbuon/GEOL_231/Lectures/Karst%20Landforms.pdf

<https://www.usgs.gov/news/earthword-karst>

<https://karstwaters.org/educational-resources/water-quality/>

<https://www.americangeosciences.org/sites/default/files/karst.pdf>

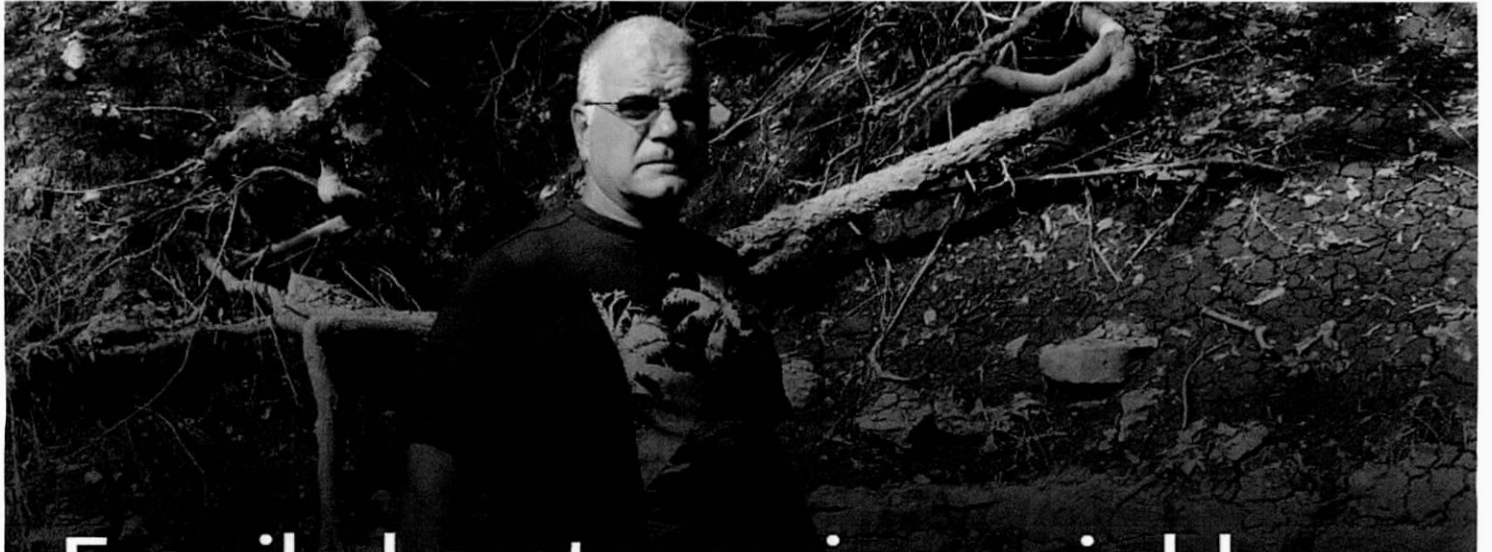
<https://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/Karst/karstmap.pdf>

https://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/OpenFileReports/OFR_2013-1.pdf

<https://karst.iah.org/karst>

http://www.gepgis.eu/en/wp-content/uploads/2013/08/Znacilnosti-kraskih-vodon_www_eng.pdf

<http://www.geosociety.org/gsatoday/archive/25/1/pdf/i1052-5173-25-1-38.pdf>



Fragile karst worries neighbors of proposed wind turbines

SOME LANDOWNERS IN SANDUSKY AND SENECA COUNTIES ARE CONCERNED ABOUT THE PREVALENCE OF KARST IN THEIR AREA ALONG THE PATH OF A PROPOSED WIND FARM.

Daniel Carson, Fremont News-Messenger

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Sinkholes, disappearing streams, caves and springs are some of karst terrain's signature features, and these geologic hazards can be found throughout eastern Sandusky and Seneca counties.

So what will happen if these karst formations collide with proposed wind energy development in the region?

APEX Clean Energy says it will take great pains to build its proposed Republic Wind Farm around sensitive karst areas. The company's Republic plans include 47 turbines that could reach as high as 602 feet.

Sandusky County residents Deb and Casey Didion aren't convinced.

Every three or four years, water bubbles up from a Riddle Road karst area near the Didions' Bellevue home.

It forms a temporary lake on each side of elevated railroad tracks and floods the road.

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Two of 47 proposed Republic Wind Farm industrial wind turbines are slated to go in a neighbor's corn field between the Didions' property and that karst area.

When earth is moved and concrete poured to build those turbine foundations, the Didions fear there will be catastrophic environmental impacts on well water systems, a massive redirection of the region's underground water flow and possible flooding if karst seams are fractured or filled.

"It's just fragile. You don't want to open them up. You don't want to plug them," Casey Didion said Monday, as he, his wife and Seneca Anti-Wind Union leader Deb Hay voiced their concerns about the turbines, karst and regional wind energy development in general.

Geotechnical process explained

The Republic Wind Farm project, as well as other proposed wind projects in Seneca, Sandusky, Erie and Huron counties, has generated fierce opposition from hundreds of landowners like the Didions.

APEX Clean Energy Spokesman Natasha Montague told the News-Messenger her company plans to start construction on the Republic project in 2020.

Ohio's Power and Siting Board still has not voted on whether to approve the Republic Wind field and there will likely be future public hearings locally and in Columbus this year on the project.

In an email, Montague laid out a series of steps she said the company takes to detect karst and avoid groundwater sources.

Apex is developing projects in areas of Oklahoma and Texas that have karst features, she noted.

Montague said Apex's geotechnical investigation process begins with preconstruction engineering, during which a third-party engineer conducts boring tests at turbine locations.

These tests help flag for the potential existence of karst.

If a turbine location is determined to be in a potential karst area, additional testing is conducted (such as electrical resistivity imaging or shear wave testing) to search for karst features.

Should the third-party engineer determine a location is unsuitable for turbine placement, a different turbine location will be activated, Montague said.

"Again, the geotechnical investigation begins long before preconstruction engineering. The groundwater hydrogeological and geotechnical report, which is included in our project application, is reviewed by the Ohio Power Siting Board prior to when we will begin borings," Montague said.

Montague said the typical and expected foundation of the turbine models under consideration in Apex's northern Ohio wind projects extend to a maximum depth of approximately 10 feet, which she described as not significant enough to impact groundwater.

She said turbines are intentionally sited away from wells and other water sources.

An OPSB staff report on the Republic project recommended that the agency's board authorize construction of the proposed wind farm, subject to 57 conditions.

The report noted that 27 of Apex's 47 proposed Republic turbines are situated in areas exhibiting karst features, according to the company.

Hay and the anti-wind union responded to the OPSB report and pointed out the 57 conditions identified by the state agency include: lack of appropriate siting for multiple turbines, interference with navigable airspace including air ambulance, interference with operations of the Seneca and Sandusky County airports, avoidance and mitigation of all existing microwave paths/licensed communication systems, multiple impacts to native wildlife, and concerns related to nighttime sound levels.

Her Seneca County home near Township Road 178 includes a karst area.

Hay showed the drop off in elevation as she stepped into vegetation that obscured her front yard sinkhole.

"If they change the flow of the water, I could have a lake in my front yard," Hay said.

Hay disputes Apex's assertions about turbine foundation construction and its impacts on groundwater.

She said wind companies will drive piles deep into the ground until they reach bedrock, disturbing multiple layers of black shale and limestone in the Bellevue karst region.

"And if they run into karst, they're just going to grout it. They're just going to fill it with rocks and stones," Hay said.



Deb Hay of the Seneca Anti-Wind Union is worried about construction of wind turbines over and around sensitive karst areas in Sandusky, Seneca and Erie counties.

(Photo: Daniel Carson/The News-Messenger)

Karst identified in Bellevue area

The Ohio Department of Natural Resources mapped nearly 1,000 karst areas in the Bellevue Quadrangle and parts of the Clyde and Castalia quadrangles in 2012 and 2013, with state geologist Douglas Aden producing a report on regional data he collected.

That includes the area near the Didions, who live on County Line Road.

The report's introduction includes the line, "different types of karst features may pose infrastructure complications, roads, utilities, houses and other facilities built in karst areas are at risk of subsidence, collapse and other damage."



Wind turbines in Findlay. APEX Clean Energy is planning to build up to 47 wind turbines in Sandusky and Seneca counties.

(Photo: File)

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He pulled up to a friend's County Road 29 property in Seneca County and hiked back to show off a massive karst area.

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Groundwater flows north through Bellevue's karst region.

Didion said the groundwater eventually makes its way to Lake Erie, going through the Blue Hole area in Castalia.



Riddle Road in Bellevue features an ODNR-identified karst area that has become an eBird hotspot for birders. A pair of Republic Wind Farm wind turbines have been proposed for the field south of the temporary lake formed in the karst area.

(Photo: Daniel Carson/The News-Messenger)

Previous flooding in Bellevue

Aden's 2013 ODNR report noted karst-related flooding that occurred in Bellevue in 2008.

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Rospert lives in Erie County. If he takes a walk across the street, he crosses over into Sandusky County.

Ohio 269 in front of Rospert's house remained closed for three months following the 2008 Bellevue floods.



This sinkhole in Seneca County is one of about 1,000 in the Bellevue karst region.

(Photo: Daniel Carson/The News-Messenger)

When there's an obstruction in the karst, the water just goes in all directions, Rospert said.

The ODNR investigative report recommended best management practices, such as sinkhole structures and grassed buffer strips and waterways, should be put in around sinkholes to minimize ground water contamination and to keep sinkholes open to prevent surface karst-related flooding.

Property owners like Rospert, the Didions and Hay rely on wells for water.

Jeannie Gore, a Bellevue business owner along U.S. 20, said well water contamination is one of her biggest fears with the proposed project.

"If wells get contaminated, we can't sell and move somewhere else. This is our home," Gore said.

In his backyard, Rospert's well also serves as an ODNR monitor site that records ground water levels.

Karst-generated pressure pushed Rospert's basement floor up during the 2008 flood

Rospert wonders what will happen to his well when wind companies start building turbine footers filled with 750 yards of concrete and 100 tons of steel.

"Once you start interrupting this water flow, residents are concerned they're going to lose their wells," Rospert said.

Montague said a stormwater permit is required by the National Pollutant Discharge Elimination System (NPDES) for the Republic Wind project.

She said this permit, administered by the Ohio Department of Natural Resources, ensures that proper stormwater controls are in place so construction can proceed in a way that protects a community's clean water and the surrounding environment.

Lori Riedy, owner of Russell's Flowers, Garden Center and Gifts on Ohio 269, operates her longtime family business a few blocks north of Rospert's home.

Her business depends on access to clean well water, as she has eight greenhouses of plants she waters on a regular basis.

When the 2008 flooding closed Ohio 269, Riedy was entering the busiest season of the year for her greenhouse.

"I've got greenhouses full of plants and nobody coming in to buy them," Riedy said.

Russell's Flowers closed for several days and Riedy helped sandbag other people's homes as she waited for floodwaters to recede in Bellevue.

ODNR's 2009 report noted that flooding due to upwelling ground water in the area in close proximity to Bellevue had happened only six times since 1800.

The last two occurrences prior to 2008 were in 1969 and 1937. All three of these occasions were in response to heavy precipitation events.

Riedy doesn't want wind turbine construction to result in plugged sinkholes and trigger a repeat of 2008's disaster.

"It's going to have an effect in our drainage and wells," she said.

Future of Republic Wind project

Apex will prepare a wind turbine assembly area by grading and removing vegetation within a maximum radius of 300 feet around each turbine location, according to the OPSB staff report.

The most likely type of turbine foundation would be a spread footing foundation. An alternative that could be used is a rock anchored pile-supported foundation, the company reported to the state agency.

The company projects the largest turbines in its Emerson Creek Wind project to produce pressure of approximately 1,050 pounds of pressure per square foot on surrounding earth and bedrock existing below the surface of turbine foundations.

In OPSB's staff report, the agency reported Apex's project area is comprised of

roughly 19,000 acres of leased private lands involving approximately 440 properties.

OPSB has not yet scheduled its next public hearing on the Republic project

Sandusky County commissioners voted July 25 to rescind the county's Alternative Energy Zone (AEZ), a move applauded by the anti-wind union and the Didions.

As the family waits to see how OPSB will rule on the Republic Wind project, Deb Didion said she and Casey have lived at their Sandusky County home for 33 years.

She understands why some area landowners signed leases with Apex, but didn't think the turbines were worth it to sign a similar lease.



These wind turbines are in Findlay. Apex Clean Energy is planning to build up to 47 wind turbines in Sandusky and Seneca counties.

(Photo: File)

"You can gain all the money you want, but if it impacts your quality of life and lifestyle, it's not worth it," Didion said.

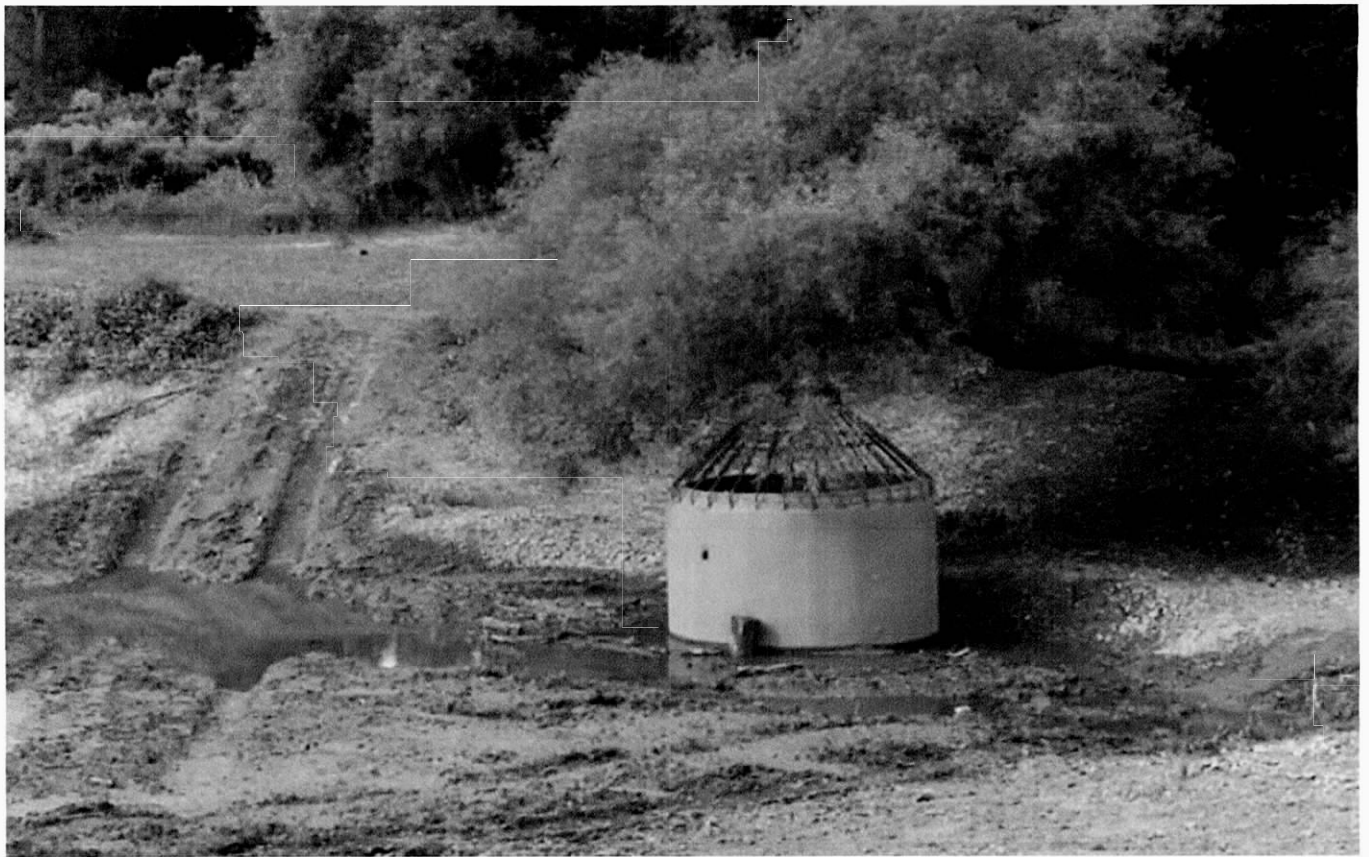
The proposed turbines prompted three of her nearby County Line Road neighbors to sell their homes and move away, Didion said.

dacarson@gannett.com

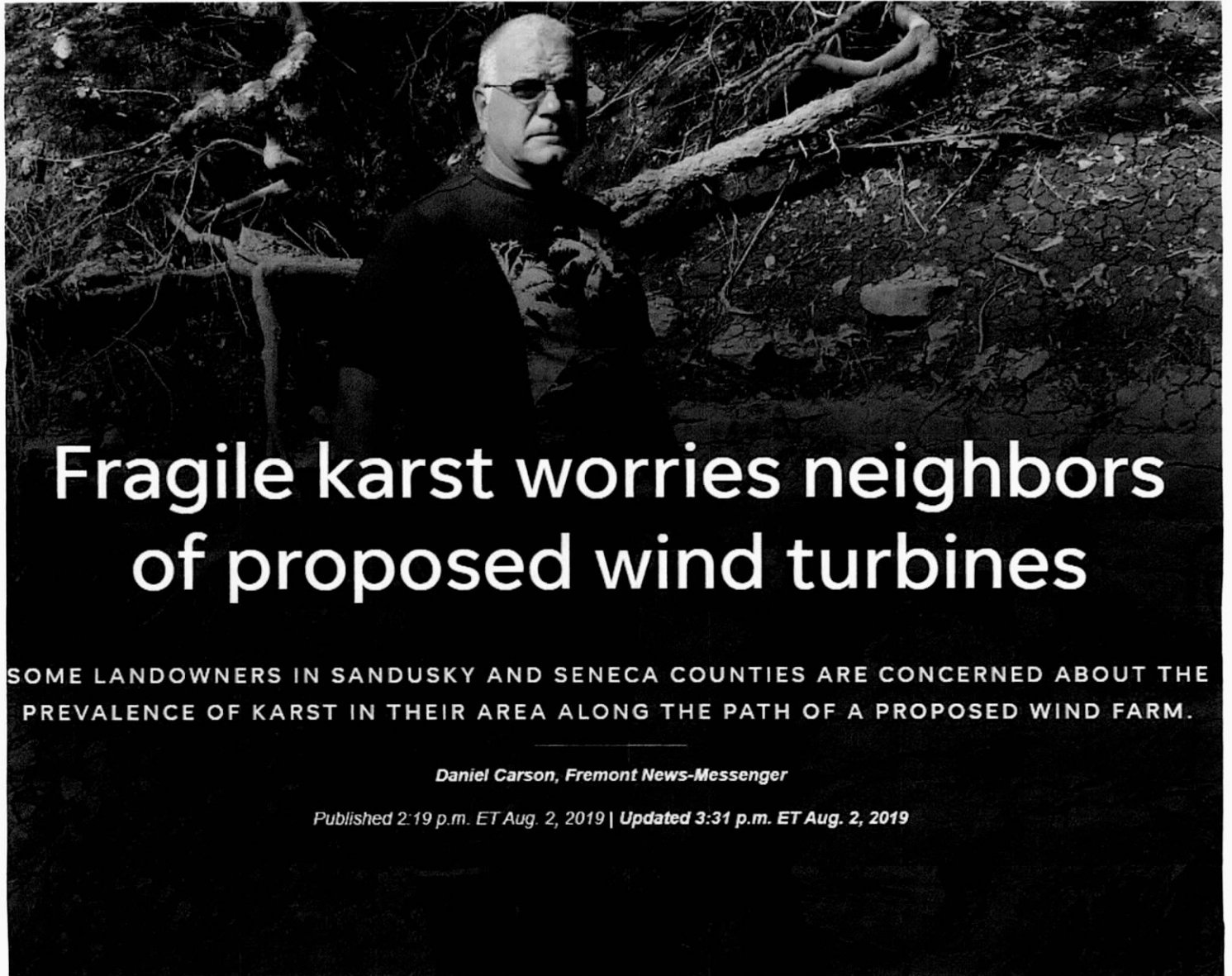
419-334-1046

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ODNR's 2009 report noted that flooding due to upwelling ground water in the area in close proximity to Bellevue had happened only six times since 1800.

The last two occurrences prior to 2008 were in 1969 and 1937. All three of these occasions were in response to heavy precipitation events.

Riedy doesn't want wind turbine construction to result in plugged sinkholes and trigger a repeat of 2008's disaster.

"It's going to have an effect in our drainage and wells," she said.

Future of Republic Wind project

Apex will prepare a wind turbine assembly area by grading and removing vegetation within a maximum radius of 300 feet around each turbine location, according to the OPSB staff report.

The most likely type of turbine foundation would be a spread footing foundation. An alternative that could be used is a rock anchored pile-supported foundation, the company reported to the state agency.

The company projects the largest turbines in its Emerson Creek Wind project to produce pressure of approximately 1,050 pounds of pressure per square foot on surrounding earth and bedrock existing below the surface of turbine foundations.

In OPSB's staff report, the agency reported Apex's project area is comprised of

roughly 19,000 acres of leased private lands involving approximately 440 properties.

OPSB has not yet scheduled its next public hearing on the Republic project

Sandusky County commissioners voted July 25 to rescind the county's Alternative Energy Zone (AEZ), a move applauded by the anti-wind union and the Didions.

As the family waits to see how OPSB will rule on the Republic Wind project, Deb Didion said she and Casey have lived at their Sandusky County home for 33 years.

She understands why some area landowners signed leases with Apex, but didn't think the turbines were worth it to sign a similar lease.



These wind turbines are in Findlay. Apex Clean Energy is planning to build up to 47 wind turbines in Sandusky and Seneca counties.

(Photo: File)

"You can gain all the money you want, but if it impacts your quality of life and lifestyle, it's not worth it," Didion said.

The proposed turbines prompted three of her nearby County Line Road neighbors to sell their homes and move away, Didion said.

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