Attachment #2

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Malters, Shepherd & Von Holtum

James E. Malters †*

Mark W. Shepherd

David R. Von Holtum
(1936-2009)

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Paralegal

Abby Schutte
Paralegal

† Senior Civil Trial Specialist Certified by the Minnesota State Bar Association

* Also admitted in South Dakota and Iowa

April 28, 2021

March 4, 2022

South Dakota Aeronautics Commission
Becker-Hansen Building
700 E. Broadway Ave.
Pierre, SD 57501

Re: SD Aeronautics Commission Meeting – 3/17/2022

Greetings:

Michael Bollweg, through his attorney James Malters, requests to be included on the South Dakota Aeronautics Commission agenda of March 17, 2022.

The purpose of this request is to be heard on the issue of the board taking some stance on the building of large wind turbines in western Hyde and eastern Hughes County near his property.

The PUC of South Dakota will be holding hearings concerning the permitting of a large wind farm, North Bend by ENGIE. This project will include up to 78 wind turbine towers that will be approximately 600 feet high. There are arguments in submission papers for those hearings that since the FAA does not object or take a position concerning the permitting of this project that there are no legitimate aviation concerns. It is Petitioner's opinion that the FAA only looks at these projects as it affects airports and instrument approaches.

Petitioner believes that the South Dakota Aeronautics Commission has a broader mandate and should take a position of concern. Although the proposed project does not directly affect existing airports and instrument approaches, it does affect aerial spraying safety and Petitioner's ability to spray his fields. In support of this position is the following:

1. Comments by Petitioner Bollweg addressing his concerns and the foundation for his beliefs.

2. The reports by Professor Cody Christensen of South Dakota State University concerning how wind turbines affect agricultural spraying safety and his proposal for minimum set backs for turbines from fields being sprayed.

3. The recommendations of the South Dakota Aviation Association (SDAA) and the National Agricultural Aviation Association CEO Andrew Moore (NAAA) including their studies of the distances needed to turn around from fields being sprayed and proposed safety margins.

4. Petitioner, living in a rural area also has concerns of how these wind farms affect access to safe use of emergency helicopters for providing emergency care.

5. There are currently two existing industrial wind farms in neighboring Hyde County which include 119 turbines. North Bend is proposing up to an additional 78. Couple these numbers with additional current proposals in Hughes, Hyde and Sully Counties adding even more wind farms, will in essence eliminate special VFR flights by filling in the airspace that could be used by South Dakota's general aviation community. The cumulative effects are of great concern. South Dakota prides itself as "Great Faces and Great Places."

6. One of the ways that general aviation meets the challenges of the distances is use of general aviation aircraft. Petitioner is requesting that the South Dakota Aeronautics Commission send a comment to the South Dakota PUC indicating that safety concerns with regard to aviation and the construction are valid concerns that the board requests that they take into account. Further, pursuant to S.D. Codified Laws § 49-41B-17, the parties to a proceeding under this chapter, unless otherwise provided, include:

> (3) Each municipality, county and governmental agency in the area where the facility is proposed to be sited, if timely application therefore is made as determined by the commission pursuant to rule.

The South Dakota Aeronautics Commission has the right to advise the PUC as to their position that the proposed project does increase the risk to agricultural applicators, medivac helicopters, and general aviation pilots and aircraft.

Sincerely yours,

/s James E. Malters

JAMES E. MALTERS
For the Firm

JEM/as

Enclosures

Attachment #2

BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF SOUTH DAKOTA

IN THE MATTER OF THE APPLICATION BY NORTH BEND WIND PROJECT, LLC FOR A PERMIT TO CONSTRUCT AND OPERATE THE NORTH BEND WIND PROJECT IN HYDE COUNTY AND HUGHES COUNTY, SOUTH DAKOTA

SD PUC DOCKET EL21-018

PRE-FILED TESTIMONY OF DR. CODY CHRISTENSEN

Q. State your name.

A. My name is Dr. Cody Christensen.

Q. State your employer.

A. South Dakota State University.

Q. State your specific job at South Dakota State University.

A. I am the program coordinator for aviation at South Dakota State University. I am the only tenured professor at South Dakota State University in that capacity. My job involves teaching pilots, service, and research related to aviation education. My resume is attached as Exhibit A.

Q. Explain the range of duties you perform.

A. My job includes preparing future commercial pilots to be able to safely handle many types of airplanes, including airline aircraft. Safety, complying with federal aviation regulations, and airplane operating limits is essential to these occupations. There is little room for error in handling airplanes.

Q. On whose behalf was this testimony prepared.

A. This testimony was prepared on behalf of Michael Bollweg, Judi Bollweg, Bollweg Family, LLLP, and Tumbleweed Lodge.

Q. What were you asked to do.

A. I was asked to review and render a professional opinion concerning agricultural flight operations around wind turbines, specifically around T112N, Ro74W section 10 and 11 in Hughes County, South Dakota.

Q. What did you conclude.

A. There are three main considerations when addressing the pilot perspective of operations around obstacles. The three factors include margin of safety, operation of aircraft, and aircraft performance factors associations with the flight.

- The first main consideration when evaluating an operating area, whether that be a field to spray or a ground-based maneuver designated by the Federal Aviation Administration (FAA) for training such as an Eight on Pylon, is the margin of safety. The margin of safety when obstacles are present in a field decreases options in the event of an emergency such as a powerplant failure or stall/spin situation. From personal experience I know that operating directly behind or in between wind turbines creates considerable turbulence that can lead to loss of control events- a leading cause of aircraft accidents in the United States. Additionally, flying with known obstacles increases workload because the operator must evaluate the proper course of action with little to no room for error. The margin of safety decreases as the height and number of obstacles increases.
- It should be noted that the calculations in the pilot's operating handbook assume standard conditions of 29.92 barometric pressure setting, 59° and sea level. Higher temperatures and altitudes diminish performance. Harrold, South Dakota, is just under 2,000 feet above sea level.
- The second consideration when operating around obstacles that are unavoidable is that of pilot training and pilot response. Professional agricultural pilots knowingly take considerable, calculated risks related to obstacles other pilots do not take. They are responsible for flying between 3-12 feet above the ground, making multiple low

passes, multiple takeoff and landings, and operating at the max capacity of the aircraft. Doing this operation on a zero wind, cool day, with no elevation or obstacles take precision and professional skills few possess. Adding additional obstacles that decrease the margin of safety and decrease the reaction time a pilot has to deal with unforeseen situations such as mechanical issues, bird strikes, wire strikes, wind changes, and product issues decreases the safety of the operation.

- The final major concern when operating around obstacles is the aircraft performance, including climb rate, turn radius, and environmental conditions. The climb rate of a standard Air Tractor 502, a common midlevel agricultural application aircraft, is 664 feet per minute and a typical working speed of 135mph. Every second the airplane is traveling approximately 198 feet per second while on target. At the end of a field the pilot would turn off the spray and begin a climb, followed shortly by a climbing turn usually away from the spray pass to complete a course reversal to realign for the next spray pass. In a normal situation with no obstacles, ending the spray and the initial climb out might all occur within five to eight seconds, resulting in a straight-line distance of almost ¼ mile. The turnaround for ag operators, generally considered a 45° downwind turn, followed by a 225-course reversal to come back on target requires a 30-45° turn to do a back-to-back turn. The time of the course reversal is approximately 25 seconds, resulting in close to one mile of total distance traveled per swath. Assuming a 30° bank, the calculated turn radius of an aircraft going 135mph is 2,119 feet and the diameter of the turn is 0.8 miles. It should be noted that for an Air Tractor 502, it is close to one mile to make a turn, but for an Air Tractor 802, currently the largest single engine commercially used ag application airplane, that distance increases to 1.82 miles to complete a turn.

- As early discussed, an Air Tractor 502 climb rate is 664 feet per minute or approximately 11 feet per second (fps) climb rate. Considering at the end of the field, an applicator pulls up into a climb, it would take 18 seconds (200ft/ 11fps) to clear a 200 feet obstacle located at the end of a field. Using a working speed of 135MPH or 198fps the aircraft would travel forward 3,564ft (198fps*18 sec to climb) to clear a 200ft obstacle. If a 600-foot obstacle was considered, it would take 54 seconds to outclimb the obstacle and would travel forward over two miles (198fps *54sec= 10,800ft). Even assuming the pilot slowed to 111mph (best rate of climb at max weight) the distance covered is still 1.6 miles (162fps *54 sec). This assumes the pilot adds max power, performs a perfect climb, the airplane performs perfect, and the field conditions were conducive to a climb (sea level, standard atmosphere, low humidity, calm or head winds prevailing). Anything less than perfect conditions would decrease the climb rate.
- The other option would be instead of pulling up to climb over an obstacle to fly around it, below it, or through the blade arc or guy-wire, all of which are not prudent options, especially considering any abnormal operations. Additionally, the turbulence created by the wind turbines would have a direct and immediate impact on the pilot operating downwind of the turbine.
- In reviewing the plat map of 112N, R 074W, section 10 and 11 in Hughes County, SD I am most concerned about the placement of towers 8, 9, 14, &15 within the

sections and any towers that are adjacent such as #20-22 as they are well within a normal margin of safety for a typical pilot to safety spray that area. Based on the map and field layout, an east/west swath pattern would prevail and the presence of wind turbines or any obstacle at the end of those fields, especially on two sides, would be detrimental to safety. In my opinion, I would advise against a pilot maneuvering in the field presented with obstacles in the placement suggested.

Q. Did the PUC ask you any follow up questions.

A. The staff of the PUC asked me certain follow up questions.

- First, they asked where I obtained my calculations and numbers for aircraft performance. That reply is attached and dated 11/3/21. Those numbers were taken off the specifications for the airplanes that are spraying the Bollweg fields currently. Those are hard numbers from which deviations are illegal and dangerous. My calculations are conservative, and are minimum clearance distances for safe operations. There may be pilots that deviate from these calculations. That does not mean that they are safe operations and the thin margins of safety may eventually catch up with them; mistakes in aviation are unforgiving.
- The PUC asked if I maintain that a pilot cannot safely fly around a turbine that is shut down and not moving as ordered for the Crowned Ridge Wind II Project, and I do not maintain that. If the wind towers were not in operation, it would substantial decrease the turbulence created by the wind turbines. As long as the distance from the field to the obstacle can be maintained, pilots could safety operate around a wind turbine.

- The PUC asked me to explain how flying around a wind turbine that is shut down is different than flying around stationary obstacles, such as a power line, grain bin, house, trees, or cell tower. My response to them was that as a professional pilot and flight instructor, I do not see a major difference between obstacles when height and circumference are adequately considered. I would not try to outmaneuver an obstacle without proper setback clearances for any stationary obstacles such as a wind turbine, powerline, grain bin, house, trees, or cell tower. The height and size of the obstacle must be taken into consideration when operating an aircraft in the vicinity of known obstacles. I would recommend if a 100 ft grain bin was located within the area of operation, it would be considered much like a 100-foot shut down wind turbine would be except that a wind turbine can rotate so the orientation of the blades in relation to the aircraft turn would have to be taken into consideration. An operator could fly closer to a 100 ft grain bin because the climb required to clear a 100ft bin is less than a taller obstacle. A 600-foot-tall grain bin with the same circumference as a 600-foot- tall wind turbine would be treated with equal caution. I have yet to encounter a 600-foot-tall grain bin so the best description would be trying to operate in downtown Manhattan with 60 story buildings on multiple sides. It would be possible to operate around them, but the distance between the building (wind turbine/grain bin/obstacle) would need to be sufficiently away to allow for a proper turn. The margin of error decreases and safety margins virtually disappear. If the PUC request was to evaluate a new tower that was 600ft tall with known guy wires, I would treat it the same as a 600-foot wind turbine using the height and circumference of the obstacle. The tower along with the guywires constitute an obstacle that is not able to be flow through. Yes, it is possible to fly under, over, or through guy wires but the margin of safety decreases with each pass. Flying under or through stopped wind turbine blades is much like guy wires. As a professional pilot I would not fly under shut down wind turbine blades, nor would I teach that maneuver to any student.

- Finally, the PUC asked me if I was aware of any governmental entity that has ordered a similar setback for wind turbines from a property line to facilitate aerial spraying. I am not aware of any governmental entity that has ordered a similar setback for wind turbines from property line to facilitate aerial spraying. My job was to evaluate the threats to safety to agricultural spray aircraft posed by the turbines. That analysis had to do with the hard science of physics as it applied to aircraft and pilot performance. No political considerations were evaluated. Governmental agencies sometimes take other factors into consideration.

Dated this ____ of 1/7/2022 | 10:08 PST, 2022.

DocuSigned by:
Cody Christensen
336A5E8F802F492...

DR. CODY CHRISTENSEN

Attachment #2

CODY CHRISTENSEN

Cody.Christensen@sdstate.edu

143 Wagner Hall Box 2275A Brookings, SD 57007 Ph: 605-688-4983

EDUCATION

- University of South Dakota (USD) Vermillion, SD May 2013
  - *Doctorate of Education; Educational Administration; Adult and Higher Education*

- South Dakota State University (SDSU) Brookings, SD December 2006
  - *Masters of Education; Curriculum and Instruction*

- South Dakota State University (SDSU) Brookings, SD May 2005
  - *Bachelor of Science in Education; Career and Technical Education*

AVIATION LICENSES AND CERTIFICATIONS

- FAA Airline Transport Pilot Certificate (AMEL)
  - Type Rating: Beechcraft 1900D
- FAA Commercial Pilot Certificate (ASEL)
- Medical: Second Class- no restrictions
- FCC Restricted Radiotelephone Operator Permit
- FAA Gold Seal Instructor ratings
  - CFI, CFII, MEI, IGI

AVIATION EXPERIENCE

Associate Professor/Program Coordinator -South Dakota State University Brookings, SD 01/09-Present

- Oversee Aviation Program including five full time staff and 15 part time staff
- Teach multiple aviation related courses in accordance with FAA regulations
- Publish articles and conduct peer reviewed research
- Secure grants and funding to continue supporting aviation program mission
- Oversee Aviation Accreditation Board International specialized accreditation
- Coordinate, secure funding, and organize summer aviation ACE (Aerospace Career and Education) Camp for high school aged students
- Progress check instructor and CFI instructor

Captain- Great Lakes Airlines Cheyenne, WY 01/07- 12/08

- Act as Pilot in Command of a 19 seat Beechcraft 1900 airliner
- Ultimately responsible for the safe and efficient operation of the aircraft and crew
- Utilize Crew Resource Management techniques to create a positive cockpit environment
- Supervise fueling, baggage handling, deicing procedures to ensure compliance with company policies
- Effectively communicate with ground, flight and support staff to ensure a safe, on time flight

Ground Instructor- Great Lakes Airlines Cheyenne, WY 05/08-12/08

- Instruct captains/first officers in aircraft systems, emergency procedures, company policies and procedures
- Qualify former pilots who were rehired to the company
- Conducted emergency drills including evaluation, fire detection and prevention, and hijacking
- Advised pilots on proper procedures during emergency operations

PEER REVIEWED ARTICLES

Leonard, A., **Christensen, C.,** & Hendricks, J. (2020). Needs Based Assessment of Agricultural Pilots in the Upper Midwest. International Journal of Aviation, Aeronautics, and Aerospace, 7(1). https://doi.org/10.15394/ijaaa.2020.1434

Smith, M.; Smith, G., Bjerke, E., **Christensen, C.**, Carney, T., Craig, P., and Niemczyk, M. (2017). Pilot Source Study 2015: A Comparison of Performance at Part 121 Regional Airlines Between Pilots Hired Before the U.S. Congress Passed Public Law 111-216 and Pilots Hired After the Law's Effective Date. *Journal of Aviation Technology and Engineering*: Vol. 6: Iss. 2, Article 4.

Adjekum, D. K., Walala, M., Keller, J., **Christensen, C.,** DeMik, R. J., Young, J. P., & Northam, G. (2016). An Analysis of the Effects of Demographic Variables and Perceptions on the Safety Reporting Behavior in Collegiate Flight Programs. International Journal of Aviation Sciences: Vol. 1. Iss.2. Available at: https://www.ijas.us/images/V1Issue2/AdjekumEtAl2016.pdf

Smith, G., Bjerke, E., Smith, M., **Christensen, C.**, Carney, T., Craig, P., and Niemczyk, M. (2016). Pilot Source Study 2015: An Analysis of FAR Part 121 Pilots Hired after Public Law 111-216—Their Backgrounds and Subsequent Successes in US Regional Airline Training and Operating Experience," Journal of Aviation Technology and Engineering: Vol. 6: Iss. 1, Article 9. Available at: http://dx.doi.org/10.7771/2159-6670.1140

Adjekum, D. K., Keller, J., Walala, M., **Christensen, C.,** DeMik, R. J., Young, J. P., & Northam, G. J. (2016). An Examination of the Relationships between Safety Culture Perceptions and Safety Reporting Behavior among Non-Flight Collegiate Aviation Majors. *International Journal of Aviation*, *Aeronautics, and Aerospace, 3*(3). http://dx.doi.org/10.15394/ijaaa.2016.1134

Bjerke, Elizabeth; Smith, Guy; Smith, MaryJo; **Christensen, Cody**; Carney, Thomas; Craig, Paul; and Niemczyk, Mary (2016). Pilot Source Study 2015: US Regional Airline Pilot Hiring Background Characteristic Changes Consequent to Public Law 111-216 and the FAA First Officer Qualifications Rule. *Journal of Aviation Technology and Engineering*: Vol. 5: Iss. 2, Article 1. Available at: http://dx.doi.org/10.7771/2159-6670.1133

Adjekum, D. K., Keller, J., Walala, M., Young, J. P., **Christensen, C.,** & DeMik, R. J. (2015). Cross-Sectional Assessment of Safety Culture Perceptions and Safety Behavior in Collegiate Aviation Programs in the United States. International Journal of Aviation, Aeronautics, and Aerospace, 2(4). http://dx.doi.org/10.15394/ijaaa.2015.1074

Christensen, C. & Card, K. A. (2014). *Specialized Aviation Flight Accreditation Under Public Law 111-216 Aviation Program Administrators' Perceptions*. Collegiate Aviation Review.32 (2).

Christensen, C. & Dunn, B. (2011) Fleet characteristics of collegiate aviation flight programs. *Collegiate Aviation Review*, 29 (2), 13-20

MAGAZINE ARTICLE (EDITOR REVIEWED)

Christensen, C. (2011) *The art of professionalism*. CFI to CFI. 2(1).

PRESENTATIONS

Christensen, C. The Status of Aviation Education in South Dakota. (2018). South Dakota Pilots Association in Brookings, SD.

Christensen, C. The status of aviation education in South Dakota. (2018). South Dakota Airports Conference in Deadwood, SD.

Christensen, C., Aviation Education Flight Simulator, (2017). South Dakota Airports Conference in Mitchell, SD.

Christensen, C. & Leonard, A. (2016). Millennials in Aviation. University Aviation Association Conference in Omaha, NE.

Christensen, C., Carney, T., Niemczyk, M. (2016) *Pilot Source Study*. University Aviation Association International Conference in Omaha, NE.

Christensen, C. (2016) *Pilot Source Study Updates and Aviation in South Dakota*. South Dakota Aeronautics Commission Meeting. Deadwood, SD.

Smith, G., Bjerke, E., Smith, M., Christensen, C., Carney, T., Craig, P., & Niemczyk, M. (2016). Pilot Source Study 2015: US Regional Airline Pilot Hiring Background Characteristic Changes Consequent to Public Law 111-216 and the FAA First Officer Qualifications Rule. Aviation Accreditation Board International Conference-Town Hall meeting in Atlanta, GA.

Dow, A., Christensen, C., & Marshall, S. (2015). Reaching New Heights in Recruitment for Smaller Aviation Programs. University Aviation Association Conference in Snowbird, UT.

Christensen, C. & Leonard, A. (2014). Benefits of Early Alerts on Flight Training. University Aviation Association Conference in Daytona Beach, FL.

Christensen, C. (2014). Specialized Aviation Flight Accreditation Under Public Law 111-216 Aviation Program Administrators' Perceptions. University Aviation Association Conference in Daytona Beach, FL.

Christensen, C. (2014). FAA Airspace Review. Presented at the East River Aviation Symposium. Brookings, SD.

Christensen, C. & Leonard, A. (2013). *Integrating a Mobile Training Lab into an Aviation Curriculum.* Presentation at the International University Aviation Association Conference, San Juan, PR.

Christensen, C. (2013). *Influence of military service on student success in an aviation program.* Abstract presentation at the International University Aviation Association Conference, San Juan, PR.

Christensen, C. & Leonard, A. (2012). *Integrating Aviation Concepts into Curriculum.* Presentation at the SD STEM Initiative, Sioux Falls, SD.

Christensen, C. (2011). *Implications of Public Law 111-216 and outcomes based accreditation on specialized aviation accreditation.* Presentation at the International University Aviation Association Conference, Indianapolis, IN.

Christensen, C. (2011). *South Dakota Aviation Safety Initiative*. South Dakota Aeronautics Commission. Pierre, SD.

Christensen, C. and Dunn, B. (2011). *Fleet characteristics of collegiate aviation flight programs.* Presentation at the International University Aviation Association Conference. Indianapolis, IN.

Christensen, C. (2011). *Perfecting the preflight.* FAA national safety-stand down event. Brookings, SD.

Christensen, C., Hovland, W., Kelm, W., Hoogerhyde, S., Leonard, A., & Kwasniewski, G. (2011) *Setting Personal Minimums*. Federal Aviation Administration Safety Seminar. Brookings, SD.

Christensen, C. (2011). *Energizing PowerPoint's using Prezi's in the classroom and conference environments*. Faculty Showcase presented by the Teaching Learning Center. Brookings, SD

CONFERENCE PUBLISHED ABSTRACT (COMMITTEE CHAIR REVIEWED):

Christensen, C. & Leonard, A. (2015). Needs Based Assessment of Agricultural Pilots in the Upper Midwest. University Aviation Association Conference in Snowbird, UT.

Christensen, C. & Leonard, A. (2013). *Integrating a Mobile Training Lab into an Aviation Curriculum.* Conference proceedings at the International University Aviation Association Conference, San Juan, PR.

Christensen, C. (2013) *Influence of military service on student success in an aviation program.* Abstract conference proceedings at the International University Aviation Association Conference. San Juan, PR.

Christensen, C. (2011). *Implications of Public Law 111-216 and outcomes based accreditation on specialized aviation accreditation.* University Aviation Association Conference, Indianapolis, IN.

DISSERTATION

Christensen, C. (2013). *Aviation program administrators' perceptions of specialized aviation accreditation under public law 111-216*. (Doctoral dissertation), University of South Dakota, Vermillion, SD.

GRANTS:

Increasing the Aviation Workforce in South Dakota. $159,083. Federal Aviation Administration (not funded)

SDSU Mobile Simulator. $11,000. South Dakota Space Grant Consortium. 2016-2018

Aerospace Career and Education Camp. $5,000. South Dakota Aeronautics Commission. 2016. (PI: Christensen, C.)

South Dakota Aviation Symposium. $2,500. South Dakota Space Grant Consortium. 2016 (Co-PI: Christensen, C. & Funk, C.)

SDSU Mobile Aviation Simulator. $75,000. South Dakota Aeronautics Commission. 2016. (PI: Christensen, C)

SDSU Mobile Aviation Simulator. $42,000. Brookings School District. 2016. (PI: Christensen, C)

Aerospace Career and Education Camp. $5,000. South Dakota Aeronautics Commission. 2015. (PI: Christensen, C)

Scholarly Travel Grant. $1,000. SDSU Office of Academic Affairs and Department of Consumer Sciences. 2013. (PI: Christensen, C)

Aerospace Career and Education Camp. $5,000. South Dakota Aeronautics Commission. 2014. (PI: Dalsted, K. & Co-PI: Christensen, C)

Accreditation Self-Study Funding. $6,400. SDSU Office of Academic Affairs, 2012. (Co-PI: Christensen, C, Co-PI: Leonard, A., Co-PI: Boulware, J.).

Increasing Aviation Activity in South Dakota. $2,500. South Dakota Space Grant Consortium. 2011-2012. (PI: Christensen, C)

Assessment and development plan for aviation program accreditation. $5,400. SDSU Office of Academic Affairs, 2011 (PI: Christensen, C & Co-PI: Leonard. A.).

Online course redevelopment for Advanced Flight Principles. $1,500. College of EHS Academic Excellence funds, 2011. (PI: Christensen, C)

Capital utilization among aviation flight programs. $1,000. College of EHS Academic Excellence funds. 2011 (PI: C. Christensen, C. & Co-PI: Dunn, B).

Female mentor in the SDSU Aviation program. $2,400 SDSU Foundation-Women in Giving, 2009-2011. (PI: Christensen, C)

MEMBERSHIPS & AFFILIATIONS

- FAASTeam safety counselor (2010-current)
    - 2016 SD FAASTeam Rep of the Year
- SDSU Flying Jacks-Advisor (2012-current)
- University Aviation Association (2009-current)
- Alpha Eta Rho Aviation Fraternity-Advisor (2009-2012)
- Aircraft Owners and Pilots Association (2001-current
- Brookings County Youth Mentor (2012-2016)
- South Dakota Pilots Association (2009-current)
- Women in Aviation member (2011-current)

09/02/2021

James Malters
727 Oxford St.
Worthington, MN 56187

Mr. Malters,

My name is Dr. Cody Christensen, I serve in a professional capacity as the only tenured aviation faculty member in South Dakota wherein my role at South Dakota State University, I am tasked with teaching, service, and research related to aviation education. My primary role within the university is teaching new pilots, commercial pilots, and advanced systems in aviation operations. I have been a licensed pilot for over twenty years, a FAA Goal Seal flight instructor for 15 years, and hold certificates in both single and multiengine aircraft including an Air Transport Pilot (ATP) certificate. I am answering your questions as a former airline captain for a small regional airline operating into and out of the Midwest, including South Dakota and the area depicted in Hughes County.

This letter is in request to addressing agricultural flight operations around wind turbines, specifically around T112N, R074W section 10, and 11 in Hughes County, SD. Three main considerations must be factored when addressing the pilot perspective of operations around obstacles. Those three factors include margin of safety, operation of aircraft, and aircraft performance factors associated with the flight.

The first main consideration when evaluating an operating area, whether that be a field to spray or a ground-based maneuver designated by the Federal Aviation Administration (FAA) for training such as an Eight on Pylon, is the margin of safety. The margin of safety when obstacles are present in a field decreases options in the event of an emergency such as a powerplant failure or stall/spin situation. From personal experience I know that operating directly behind or in between wind turbines creates considerable turbulence that can lead to loss of control events- a leading cause of aircraft accidents in the United States. Additionally, flying with known obstacles increases workload because the pilot must evaluate the proper course of action with little to no room for error. The margin of safety decreases as the height and number of obstacles increases.

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The other option would be instead of pulling up to climb over an obstacle to fly around it, below it, or through the blade arc or guy-wire, all of which are not prudent options, especially considering any abnormal operations. Additionally, the turbulence created by the wind turbines would have a direct and immediate impact on the pilot operating downwind of the turbine.

In reviewing the plat map of 112N, R 074W, section 10 and 11 in Hughes County, SD I am most concerned about the placement of towers 8, 9, 14, &15 within the sections and any towers that are adjacent such as #20-22 as they are well within a normal margin of safety for a typical pilot to safety spray that area. Based on the map and field layout, an east/west swath pattern would prevail and the presence of wind turbines or any obstacle at the end of those fields, especially on two sides, would be detrimental to safety. In my opinion, I would advise against a pilot maneuvering in the field presented with obstacles in the placement suggested.

Respectfully,

Cody Christensen, Ed.D
Airline Transport Pilot
FAA Gold seal flight instructor

Attachment #2

11/03/2021

James Malters
727 Oxford St.
Worthington, MN 56187

Mr. Malters,

In regards to the follow up question asked by the SD Public Utilities commission:

> *"In order to accommodate a safe turn radius at the end of a field for an agricultural application aircraft, what is Mr. Christensen recommending as an appropriate setback for a wind turbine from the property line to safely spray that field. Please explain and provide supporting calculations."*

I recommend a setback for a wind turbine no less than 0.8 miles from the end of field.

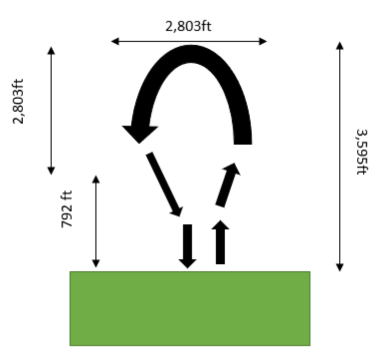
The calculations used to support the 0.8-mile setback include:

A straight out or teardrop/lightbulb pattern leaving the field including a climb, a 180° turn back on target = 3,595ft lateral distance from end of field.

Four seconds to climb and space for lateral distance = 792ft

Then 180° turn = 2,803ft radius

Lateral distance (792ft) +turn (2,803ft) = 3,595ft lateral distance from end of field = 0.68 miles *15% margin of error = 0.782 mile, rounded up to 0.8-mile minimum setback from obstacles, such as wind turbines.



Calculation:

-Assuming no obstacles, at the end of field, approximately four seconds to climb (135MPH= 198fps*4 sec) = 792ft

-A radius turn is equal to the velocity squared (V^2) divided by 11.26 times the tangent of the bank angle as described in the *Pilot Handbook of Aeronautical Knowledge* (2016):

$$R = \frac{V^2}{11.26 \times \text{tangent of bank angle}}$$

V= 135mph

Air Tractor 502 working speed *Air Tractor AT-502 FAA Approved Flight Manual*. (1987).

Tangent bank angle = 30°

$$\frac{18{,}225}{11.26 \times 0.57735} = 2{,}803\text{ft radius}$$

Based on the standard Air Tractor 502 (smaller size compared to Air Tractor 802), a setback of 0.8 miles is required with minimal margin of error. This would not take into consideration a faster working speed, non-standard atmospheric days, tailwinds, or pilot error outside of a marginal 15% addition to the calculation. Additionally, this calculation does not add any safety distance margin for the turbulence (which can be considerable) coming off the blades of the turbines.

Based on the provided calculation, I recommend a setback for a wind turbine no less than 0.8 miles from the end of field.

Respectfully,

Cody Christensen, Ed.D.
Airline Transport Pilot
FAA Gold seal flight instructor

Works Cited

Pilots Handbook of Aeronautical Knowledge. (2016). (FAA-H-8083-25B) https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/

Air Tractor AT-502 FAA Approved Flight Manual. (1987). Air Tractor, INC. Olney, Texas.

January 4, 2022

James Malters
727 Oxford St.
Worthington, MN 56187

Mr. Malters,

In regards to the STAFF'S FOURTH SET OF DATA REQUESTS TO MR. MICHAEL BOLLWEG EL21-018:

(a) Does Dr. Christenson maintain that a pilot cannot safely fly around a turbine that is shut down and not moving as ordered for the Crowned Ridge Wind II Project?

No.

If the wind towers were not in operation, it would substantial decrease the turbulence created by the wind turbines. As long as the distance from the field to the obstacle can be maintained, pilots could safety operate around a wind turbine.

(b) Please explain how flying around a wind turbine that is shut down is different than flying around other stationary obstacles, such as a power line, grain bin, house, trees, or cell tower.

As a professional pilot and flight instructor, I do not see a major difference between obstacles when height and circumference are adequately considered. I would not try to outmaneuver an obstacle without proper setback clearances for any stationary obstacles such as a wind turbine, powerline, grain bin, house, trees, or cell tower. The height and size of the obstacle must be taken into consideration when operating an aircraft in the vicinity of known obstacles.

I would recommend if a 100 ft grain bin was located within the area of operation, it would be considered much like a 100-foot shut down wind turbine would be except that a wind turbine can rotate so the orientation of the blades in relation to the aircraft turn would have to be taken into consideration. An operator could fly closer to a 100 ft grain bin because the climb required to clear a 100ft bin is less than a taller obstacle.

A 600-foot-tall grain bin with the same circumference as a 600-foot- tall wind turbine would be treated with equal caution. I have yet to encounter a 600-foot-tall grain bin so the best description would be trying to operate in downtown Manhattan with 60 story buildings on multiple sides. It would be possible to operate around them, but the distance between the building (wind turbine/grain bin/obstacle) would need to be sufficiently away to allow for a proper turn. The margin of error decreases and safety margins virtually disappear.

If the PUC request was to evaluate a new tower that was 600ft tall with known guy wires, I would treat it the same as a 600-foot wind turbine using the height and circumference of the obstacle. The tower along with the guywires constitute an obstacle that is not able to be flow through. Yes, it is possible to fly under, over, or through guy wires but the margin of safety decreases with each pass. Flying under or through stopped wind turbine blades is much like guy wires.

As a professional pilot I would not fly under shut down wind turbine blades, nor would I teach that maneuver to any student.

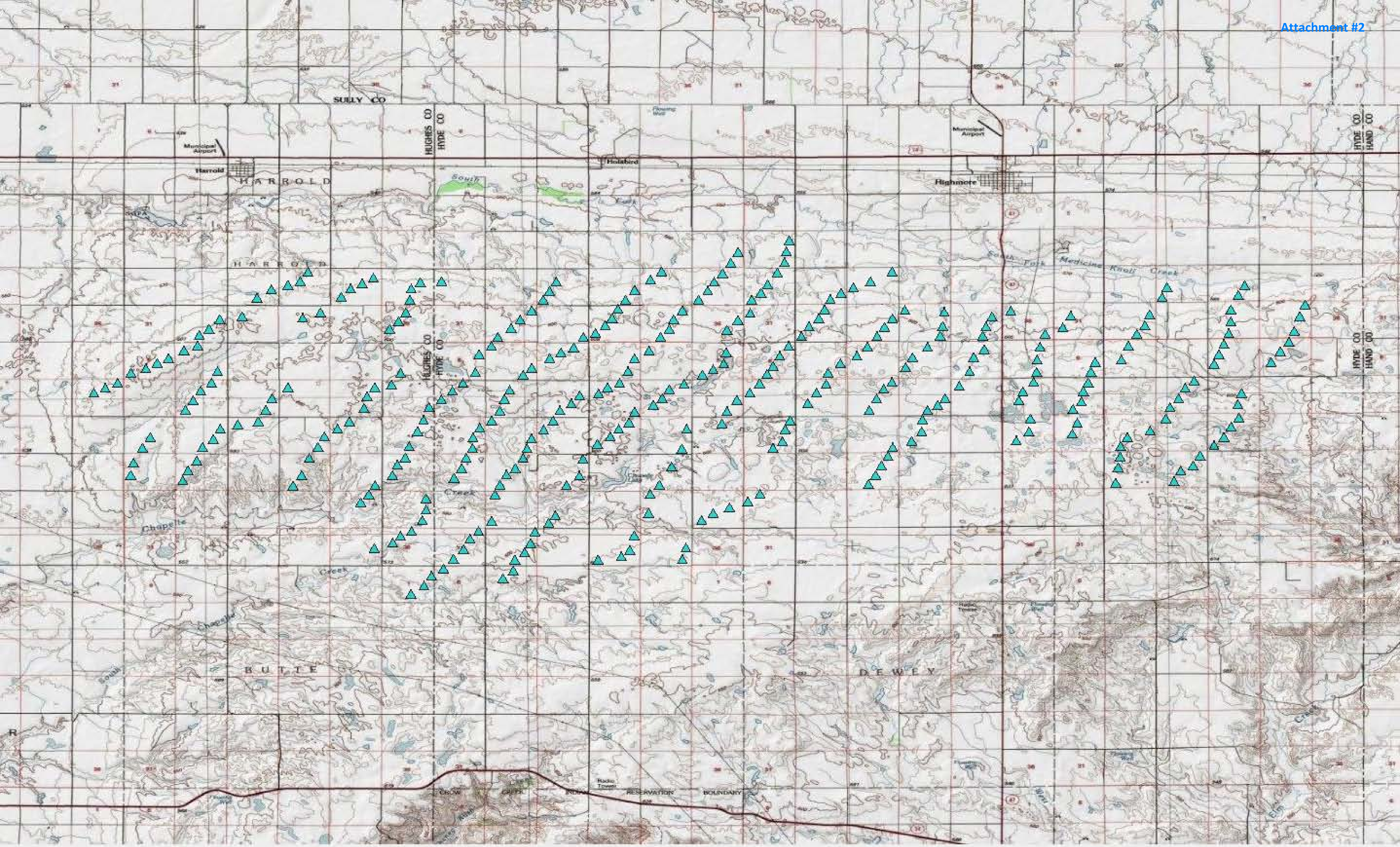
4-3) Refer to the response to staff data request 2-4. Mr. Christensen recommend a setback for a wind turbine no less than 0.8 miles from the end of the field. Is Mr. Christensen aware of any governmental entity that has ordered a similar setback for wind turbines from a property line to facilitate aerial spraying? If so, please provide supporting documentation.

I am not aware of any governmental entity that has ordered a similar setback for wind turbines from property line to facilitate aerial spraying. My job was to evaluate the threats to safety to agricultural spray aircraft posed by the turbines. That analysis had to do with the hard science of physics as it applied to aircraft and pilot performance. No political considerations were evaluated. Governmental agencies sometimes take other factors into consideration.

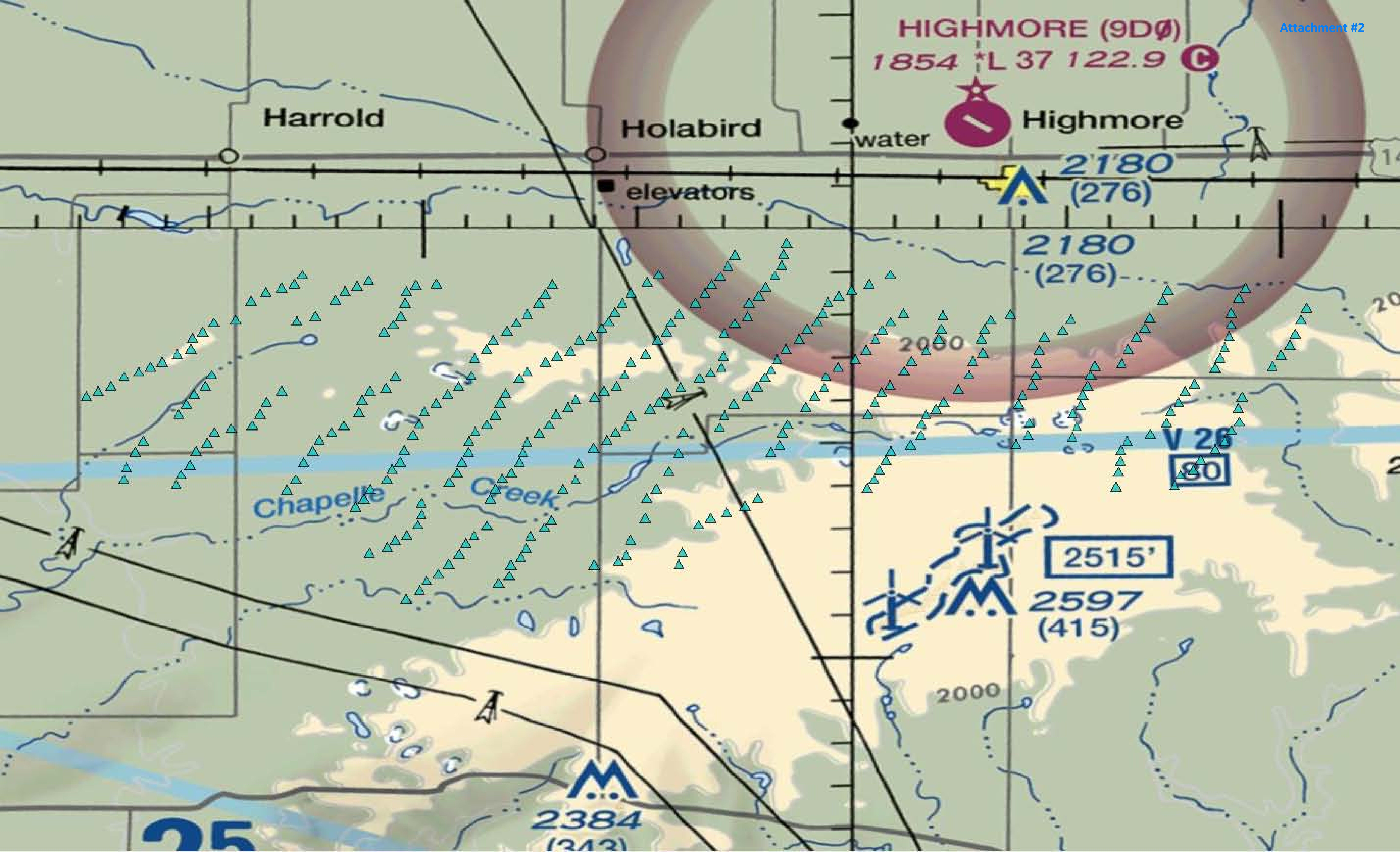
Respectfully,

Cody Christensen, Ed.D.
Airline Transport Pilot
FAA Gold seal flight instructor

Attachment #2



Attachment #2



Attachment #2

NATIONAL AGRICULTURAL AVIATION ASSOCIATION

July 30, 2020

South Dakota Public Utilities Commission
Capitol Building, 1st Floor
500 E. Capitol Ave
Pierre, SD 57501-5070
Phone (605) 773-3201

Dear Chairman Hanson, Vice Chairman Nelson, Commissioner Fiegen, and Utility Analyst Thurber:

The National Agricultural Aviation Association (NAAA) would like to bring to your attention our concern with towers erected without considering the safety of aerial applications made to South Dakota’s cropland. These could be utility towers, wind-energy towers, or other, similar structures.

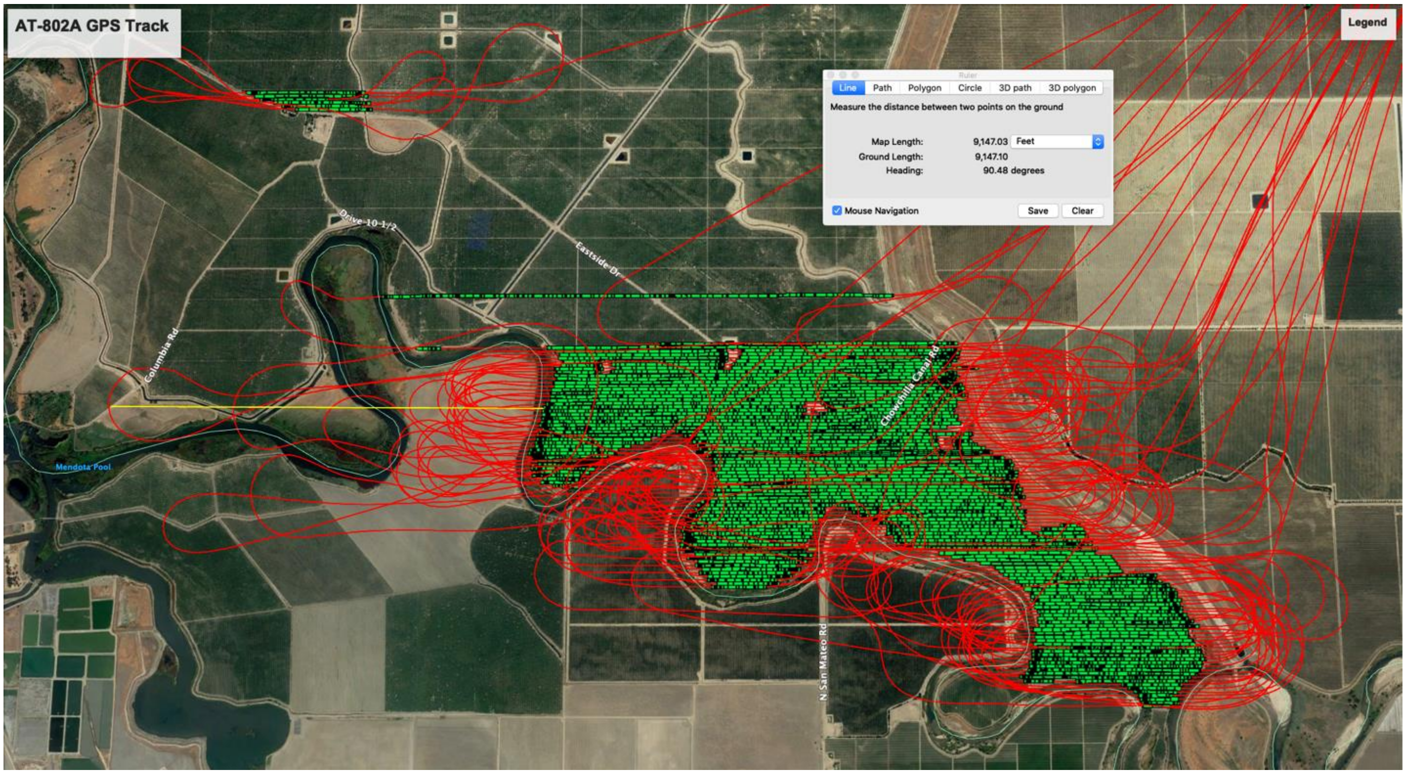
In terms of background about the aerial application industry, it is responsible for treating over 127 million acres of U.S. cropland either by seeding, fertilizing, or applying plant protecting pesticides. The NAAA represents over 1,600 members in in the field of aerial application, which consists mostly of small business owners and pilots licensed as commercial applicators that use aircraft to enhance the production of food, fiber and bio-fuel; protect forestry; protect waterways and ranchland from invasive species; and provide services to agencies and homeowner groups for the control of mosquitoes and other health-threatening pests. Within agriculture and other pest control situations, aerial application is a vitally important method for applying pesticides, for it permits large areas to be covered rapidly—by far the fastest application method of crop inputs—when it matters most. It takes advantage, more than any other form of application, of the often too-brief periods of acceptable weather for spraying and allows timely treatment of pests while they are in critical developmental stages, often over terrain that is too wet or otherwise inaccessible for ground applications. It also treats above the crop canopy, thereby not disrupting the crop and damaging it, nor compacting the soil.

Although the average aerial application company is comprised of but six employees and two aircraft, as an industry these businesses, as earlier stated, treat nearly 127 million acres of U.S. cropland each season, which is about 28% of all cropland used for crop production in the U.S.—this doesn’t include the substantial amount of aerial applications that are made to pasture and rangeland. Aerial pest control for managers of forests, rangeland, waterways and public health also add to these many millions of acres treated annually. While there are alternatives to making aerial applications of pesticides, these options have several disadvantages compared to aerial application. In addition to the speed and timeliness advantage aerial application has over ground application, there is also a yield difference. Driving a ground sprayer through a standing crop results in a significant yield loss. Research from Purdue University found that yield loss from ground sprayer wheel tracks varied from 1.3% to 4.9% depending on boom width. While this study was conducted in soybeans, similar results could be expected in other crops as well. Research summarized by the University of Minnesota describes how soil compaction from ground rigs can negatively affect crop yields due to nitrogen loss, reduced potassium availability, inhibition of root respiration due to reduced soil aeration, decreased water infiltration and storage, and decreased root growth. Aerial application offers the only means of applying a crop protection product when the ground is wet and when time is crucial during a pest outbreak. A study on the application efficacy of fungicides on corn applied by ground, aerial, and chemigation applications (attached with these comments) further demonstrates that aerial application exceeds ground and chemigation application methods in terms of yield response. The success of aerial application using manned aircraft has resulted in an industry that will celebrate 100 years in 2021. Throughout its 100-year history, the industry has constantly improved itself through the use of research and technology. Aerial applicators constantly strive to incorporate the latest technology that can improve accuracy, including GPS guidance, flow control for variable and constant rate applications, and on-board weather monitoring equipment. Electronic valves that will allow flow to be controlled on individual nozzles is currently being evaluated for use on agricultural aircraft.

Regarding towers, they can be extremely difficult for aerial applicators to see, as their work is conducted while flying at over 100 mph just 10 feet off the ground. From 2008 – 2018, there were 22 agricultural aviation accidents from collisions with METs, communication towers, towers supporting powerlines and wind turbines resulting in nine fatalities. For all general aviation, there have been 40 tower related accidents and incidents resulting in 36 fatalities over the same 11-year period. As such, NAAA has developed the following information on safe distances towers should be located from cropland. It has come to NAAA's attention that a wind farm sponsor in South Dakota has proposed a setback of a mere 500 feet, which is far too short a distance for making safe aerial applications in a field adjacent to a wind turbine or tower location site with a fixed-wing aircraft.

NAAA has calculated a safe distance using aircraft speed and average turn time to estimate the total distance required to make a safe turn via a fixed-wing ag aircraft. An AT-802A with a working speed of 145 mph was used as the example aircraft. The working speed was taken from the midpoint between 130 and 160 mph as denoted on Air Tractor's specifications page for the AT-802A: https://airtractor.com/aircraft/at-802a/. An agricultural turn time of 45 seconds was used; this information was gleamed from operators' experience and used in comments made to EPA on several pesticide re-registrations. A speed of 145 mph is equal to 213 feet per second; 45 seconds to turn multiplied by 213 feet per second is equal to 9,585 feet or 1.82 miles needed to make the turn.

The second method NAAA used to provide evidence on the distance required to make a turn while conducting an aerial application was via GPS as-applied aerial application maps and Google Earth. Google Earth was used to measure the distance into the field that two turns required. The first was one of the shorter turns from the application from when the aircraft was lighter. This turn pushed 2,273 feet or 0.43 miles into the adjacent field. The second was from a longer turn made when the aircraft was fully loaded. This turn penetrated 9,147 feet or 1.73 miles into the adjacent field.



A Google Earth map showing an application made by an AT-802A. Green represents the flight path spray on, while red represent the flight path with spray off. The yellow line is the ruler tool used to measure the total length into the field a longer turn required: 9,147 feet (1.73 miles).

NAAA hopes that you the South Dakota Public Utilities Commissions finds the above information helpful and takes into account the dangers wind turbines and other obstacles represent to the safety of agricultural aviators in South Dakota where agriculture is such an integral part of the economy.

Thank you for the opportunity to share this information.

Most sincerely,

Andrew D. Moore
Chief Executive Officer

North Bend Wind Project

06/04/2021

Legend

Turbine Locations

Proposed Met Locations

Residences

Existing Transmission

230 kV

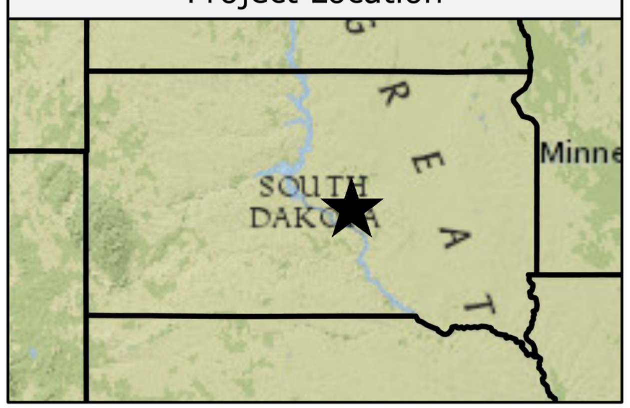
345 kV

Project Landowners

County

Township & Range

Project Location



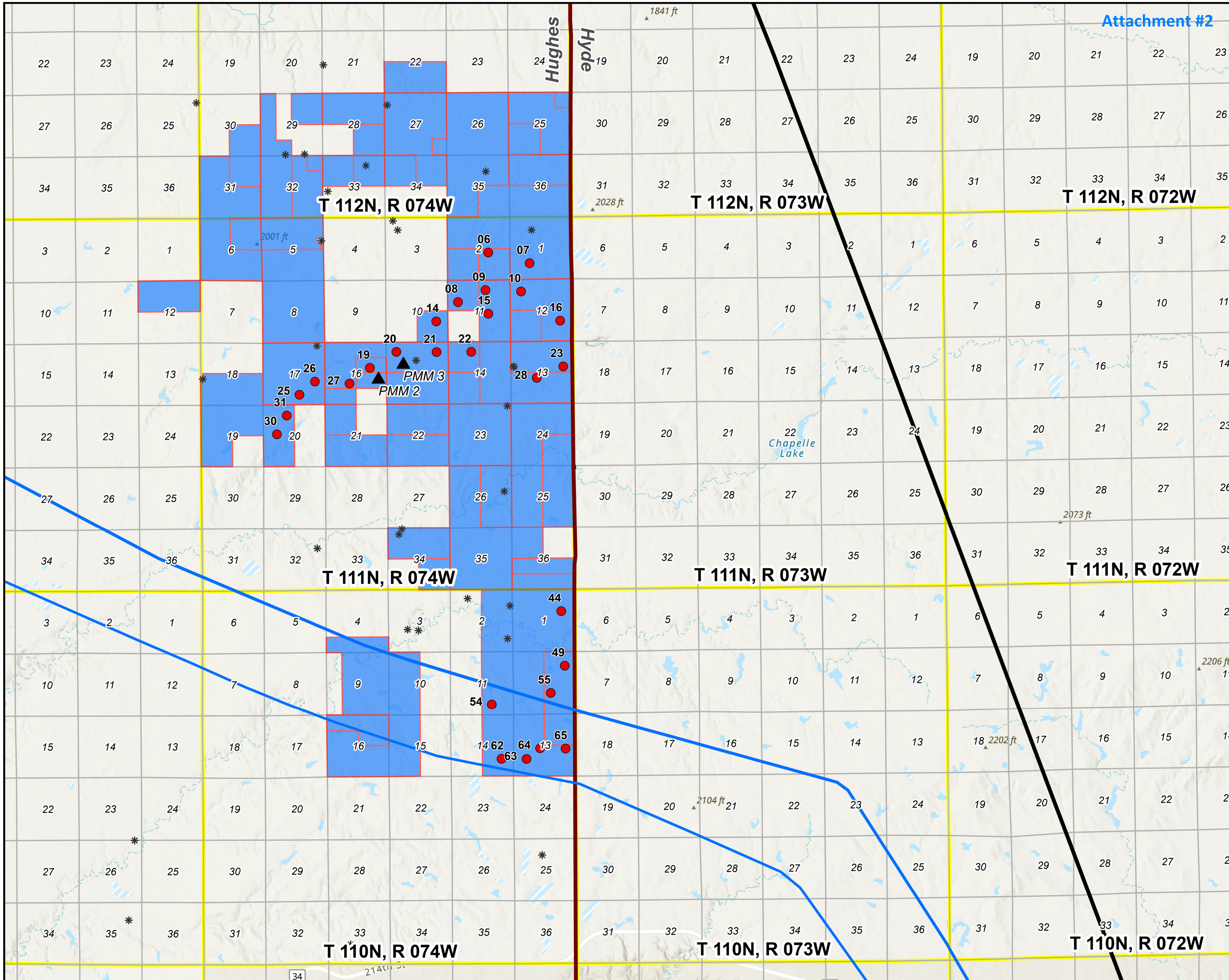
Reference

NAD 1983 State Plane South Dakota, South

Miles 0 1 2

N

PRELIMINARY - SUBJECT TO CHANGE



ENGIE

North Bend Wind Project

06/04/2021

Legend

Turbine Locations

Proposed Met Locations

Residences

Existing Transmission

230 kV

345 kV

POI

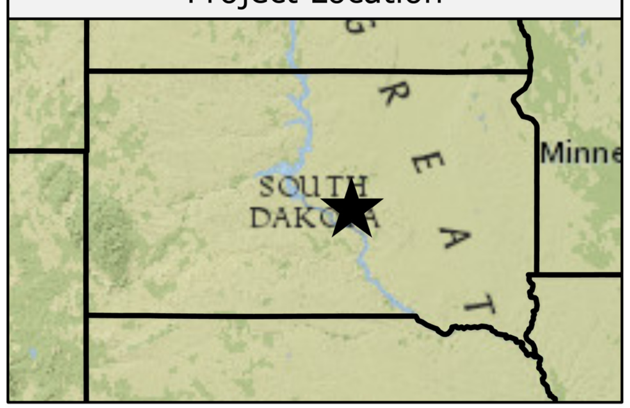
Project Substation

Project Landowners

County

Township & Range

Project Location



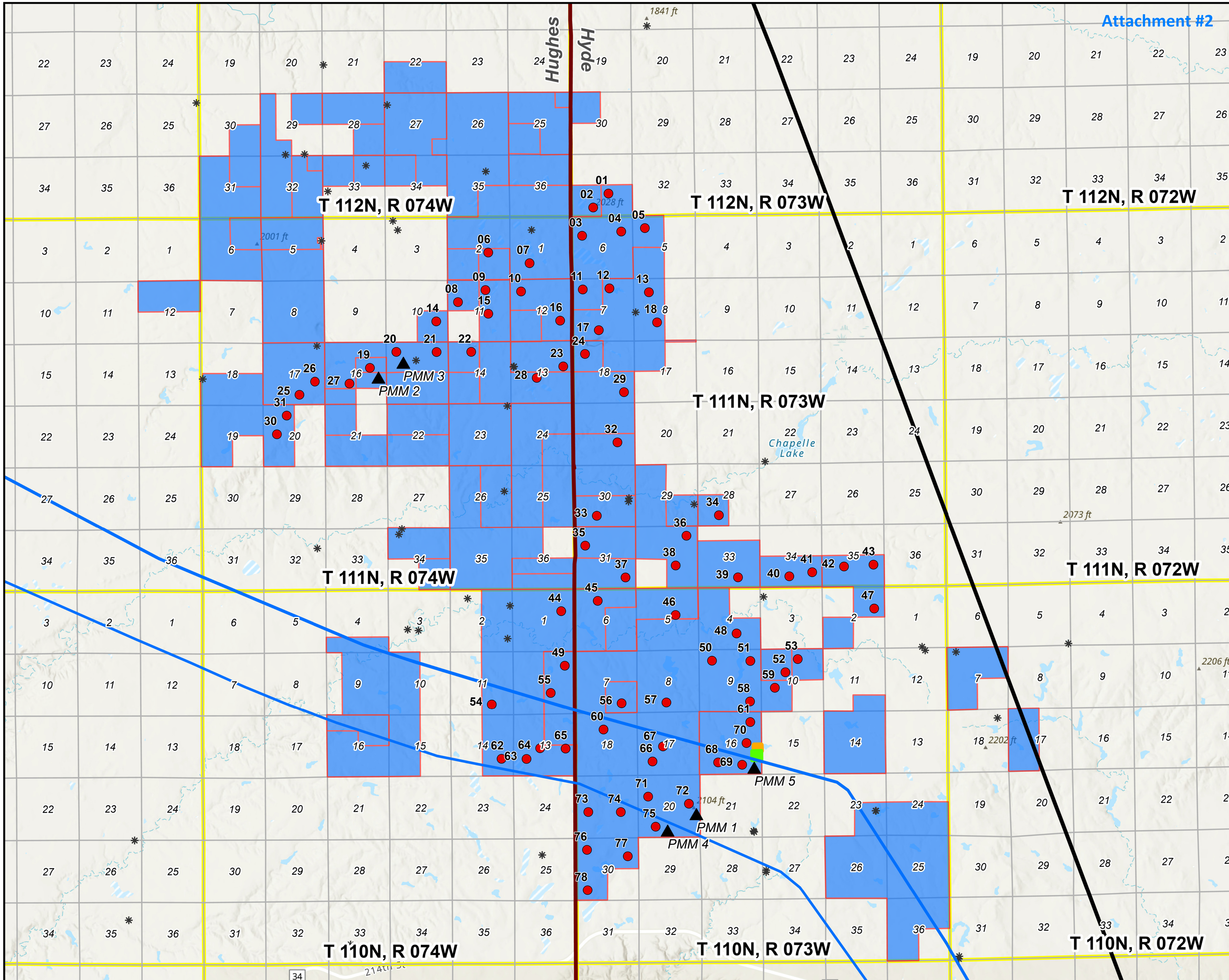
Reference

NAD 1983 State Plane South Dakota, South

0 1 2 Miles

N

PRELIMINARY - SUBJECT TO CHANGE



South Dakota Aviation Association

October 12, 2017

Dear Hughes County Commissioners,

The South Dakota Aviation Association would like to express our opinion on the issue of setbacks for the wind turbines to be placed on the proposed wind farms in Hughes County, SD.

As Aerial Applicators, our industry depends on air space. Our number one concern for our membership, and any pilot, is safety. Wind turbines, even when properly lit, are an obvious safety risk to everyone in our industry, but even greater are the MET towers and transmission lines that come along with these wind farms. MET towers sneak in under the lighting rules and are extremely hard to see. Transmission lines needed to take the power away are very prominent, earth tones in color and additional threat.

In addition, those who place wind turbines on their property are limiting the use of spray planes on their own farmland, but also their neighbors use. Aerial Applicators need 1 mile or more to turn around safely. A 500 foot setback is not enough for a loaded airplane. If a neighbor's property would be surrounded on one or more sides by wind turbines, the odds of hiring an Aerial Applicator would be extremely difficult.

Unfortunately, our Association knows first hand what happens when airplanes and wind turbines collide. We ask that you please consider the safety of not only our pilots, but all pilots when making your decisions this evening. Please see the attached images of what wind turbines, MET towers and transmission lines look like through our view.

Thank you for your time,

The South Dakota Aviation Association Board of Directors

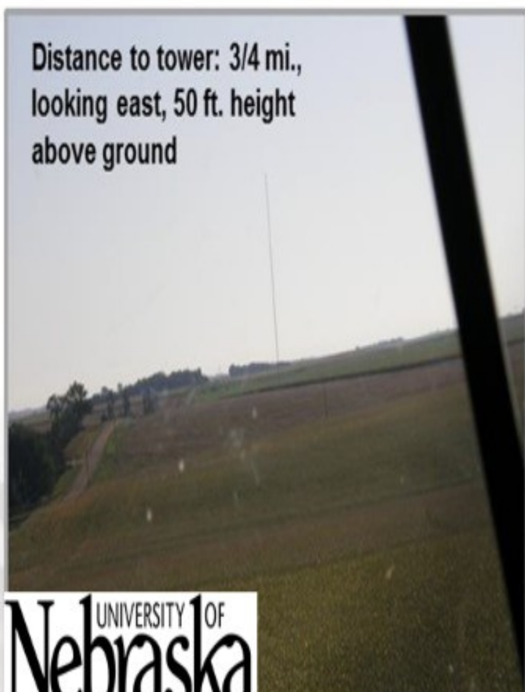
SOUTH DAKOTA AVIATION ASSOCIATION
30977 165TH STREET
GETTYSBURG SD 57442
www.sdagaviation.com
Sdaviation@gmail.com

Attachment #2

Attachment #2

MET Tower Melts Into the Background

Pictures taken on September 17, 2010
Near Meadow Grove, NE (Madison County)
All pictures taken of the same tower, 9:37 a.m. to 9:45 a.m.
By Larry Schulze, Pilot: Brian Wilcox, Nebraska Aviation Trades Association




AT-802A GPS Track
Legend
Ruler
Line
Path
Polygon
Circle
3D path
3D polygon
Measure the distance between two points on the ground
Map Length: 2,273.53 Feet
Ground Length: 2,273.55
Heading: 89.88 degrees
Mouse Navigation
Save
Clear
Drive 10-1/2
Eastside Dr
Columbia Rd
Chowchilla Canal Rd
Mendota Pool
N San Mateo Rd


AT-802A GPS Track
Legend
Ruler
Line
Path
Polygon
Circle
3D path
3D polygon
Measure the distance between two points on the ground
Map Length: 9,147.03 Feet
Ground Length: 9,147.10
Heading: 90.48 degrees
Mouse Navigation
Save
Clear
Drive 10-1/2
Eastside Dr
Columbia Rd
Chowchilla Canal Rd
Mendota Pool
N San Mateo Rd

Attachment #2

Wind Turbines Could Cause Farmers to Lose the Advantages of Aerial Spraying…

An Ag Pilot Could Lose a Lot More.

Aerial spraying, or "crop dusting," gets more challenging with every wind turbine project erected on America's farmland.

Ag pilots have been injured and, sadly, even killed in incidents involving wind turbines and related meteorological towers. The result has been expensive litigation and landowner liability.

Landowners are being asked to make crucial decisions that will impact farmers and their neighbors for years to come. Ag aircraft can treat large areas of land quickly and safely, and may be the only option for treating crops when wet fields, intense insect infestations or dense crop foliage exist. The presence of wind turbines can restrict and, in many cases, eliminate the option of aerial application.

Be sure to consider all the facts before "green lighting" a wind energy installation on your land.

Learn Before You Lease

Learn more at AgAviation.org/towers

This message proudly sponsored by:

NAAA
NATIONAL AGRICULTURAL AVIATION ASSOCIATION

and

SDAA
South Dakota Aviation Association

Attachment #2

Drone measures effect of wind turbines on farmland

By Patrick C. Miller | September 27, 2017

Using a small UAS to collect data, researchers have found that wind turbines can have an impact on the farmland beneath them.
PHOTO: U.S. DEPARTMENT OF ENERGY

Embry-Riddle Aeronautics University used a small unmanned aircraft system (UAS) to study the effects of wind turbines on farmland beneath them and found that they can impact soil, crops and livestock.

Farmers can earn extra income by allowing wind turbines to be placed in their fields. Based on data collected from the UAS, researchers discovered that depending on weather conditions, the spinning blades can positively or negatively impact crop yields. For example, a wind turbine might inhibit crop disease during wet weather or it could speed moisture loss during a drought.

Kevin Adkins, an assistant professor of aeronautical science and director of Embry-Riddle's Gaetz Aerospace Institute in St. Lucie County, Florida, flew a drone into wind turbine wakes to measure differences in relative humidity levels. He and his colleague Adrian Sescu of Mississippi State University published their research findings in the International Journal of Green Energy.

They found that below the hub of a single spinning wind turbine, relative humidity can decrease by as much as 3 percent downwind while humidity increases above the hub. The researchers concluded that this impact is magnified within a broader turbine array. "This occurs as drier air is mixed downward and moister air is mixed upward," they wrote.

The research was conducted at two Midwestern wind farms. An instrument-equipped quadcopter was flown into two different wind-turbine wakes where it hovered at key points to collect upstream and downstream data. The hub of one turbine was 305 feet above a field of winter wheat. The second turbine had a hub height of 262 feet. Baseline meteorological conditions were assessed.

The quadcopter was equipped with GPS and a suite of instruments to capture temperature and relative humidity levels. Following a prescribed flight path over a four-day period, it made a series of sweeps through the wind turbines' wake zone.

After analyzing the data, Adkins and Sescu found that the descending blades were delivering drier air downward, while the ascending blades were displacing moister air upward—away from the surface of crop fields. They believe this could have significant implications for crops, soil and livestock.

"For farmers, reduced relative humidity over fields could have an impact on their crop productivity," Adkins said. "It's my hope that farmers will take this new information and utilize it, leveraging their specialized knowledge."

Most prior investigations of wind-turbine impacts on near-surface meteorology have been based on computer modeling, Adkins said. "The implementation of the unmanned aerial system provides proof of concept for a platform that can also be used for the measurement of other atmospheric parameters with high spatial resolution," the researchers wrote.

Attachment #2

Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
10101 Hillwood Parkway
Fort Worth, TX 76177

Aeronautical Study No.
2021-WTE-1897-OE

Issued Date: 11/29/2021

Lauren Kaapcke
North Bend Wind Project
3760 State Street, Suite 200
Suite 200
Santa Barbara, CA 93105

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Wind Turbine 1
Location:	Pierre, SD
Latitude:	44-24-14.09N NAD 83
Longitude:	99-45-37.19W
Heights:	1906 feet site elevation (SE)
	625 feet above ground level (AGL)
	2531 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure would have no substantial adverse effect on the safe and efficient utilization of the navigable airspace by aircraft or on the operation of air navigation facilities. Therefore, pursuant to the authority delegated to me, it is hereby determined that the structure would not be a hazard to air navigation provided the following condition(s) is(are) met:

As a condition to this Determination, the structure is to be marked/lighted in accordance with FAA Advisory circular 70/7460-1 M, Obstruction Marking and Lighting, white paint/sychronized red lights-Chapters 4,13(Turbines),&15.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

__X__ At least 10 days prior to start of construction (7460-2, Part 1)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part 2)

See attachment for additional condition(s) or information.

This determination expires on 05/29/2023 unless:

(a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
(b) extended, revised, or terminated by the issuing office.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is subject to review if an interested party files a petition that is received by the FAA on or before December 29, 2021. In the event a petition for review is filed, it must contain a full statement of the basis upon which it is made and be submitted to the Manager of the Rules and Regulations Group. Petitions can be submitted via mail to Federal Aviation Administration, 800 Independence Ave, SW, Washington, DC 20591, via email at OEPetitions@faa.gov, or via facsimile (202) 267-9328.

This determination becomes final on January 08, 2022 unless a petition is timely filed. In which case, this determination will not become final pending disposition of the petition. Interested parties will be notified of the grant of any review. For any questions regarding your petition, please contact Rules and Regulations Group via telephone – 202-267-8783.

This determination is based, in part, on the foregoing description which includes specific coordinates and heights. This determination is valid for coordinates within one (1) second latitude/longitude and up to the approved AMSL height listed above. If a certified 1A or 2C accuracy survey was required to mitigate an adverse effect, any change in coordinates or increase in height will require a new certified accuracy survey and may require a new aeronautical study.

If construction or alteration is dismantled or destroyed, you must submit notice to the FAA within 5 days after the construction or alteration is dismantled or destroyed.

Additional wind turbines or met towers proposed in the future may cause a cumulative effect on the national airspace system. All information from submission of Supplemental Notice (7460-2 Part 2) will be considered the final data (including heights) for this structure. Any future construction or alteration, including but not limited to changes in heights, requires separate notice to the FAA.

Obstruction marking and lighting recommendations for wind turbine farms are based on the scheme for the entire project. ANY change to the height, location or number of turbines within this project will require a reanalysis of the marking and lighting recommendation for the entire project. In particular, the removal of previously planned or built turbines/turbine locations from the project will often result in a change in the marking/lighting recommendation for other turbines within the project. It is the proponent's responsibility to contact the FAA to discuss the process for developing a revised obstruction marking and lighting plan should this occur.

In order to ensure proper conspicuity of turbines at night during construction, all turbines should be lit with temporary lighting once they reach a height of 200 feet or greater until such time the permanent lighting configuration is turned on. As the height of the structure continues to increase, the temporary lighting should be relocated to the uppermost part of the structure. The temporary lighting may be turned off for periods when they would interfere with construction personnel. If practical, permanent obstruction lights should be installed and operated at each level as construction progresses. An FAA Type L-810 steady red light fixture shall be used to light the structure during the construction phase. If power is not available, turbines shall be lit with self-contained, solar powered LED steady red light fixture that meets the photometric requirements of an FAA Type L-810 lighting system. The lights should be positioned to ensure that a pilot has an unobstructed view of at least one light at each level. The use of a NOTAM (D) to not light turbines within a project until the entire project has been completed is prohibited.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

This aeronautical study considered and analyzed the impact on existing and proposed arrival, departure, and en route procedures for aircraft operating under both visual flight rules and instrument flight rules; the impact on all existing and planned public-use airports, military airports and aeronautical facilities; and the cumulative impact resulting from the studied structure when combined with the impact of other existing or proposed structures. The study disclosed that the described structure would have no substantial adverse effect on air navigation.

An account of the study findings, aeronautical objections received by the FAA during the study (if any), and the basis for the FAA's decision in this matter can be found on the following page(s).

This determination cancels and supersedes prior determinations issued for this structure.

If we can be of further assistance, please contact Lan Norris, at (404) 305-6645, or Lan.norris@faa.gov. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2021-WTE-1897-OE.

Signature Control No: 482124612-502793442 (DNH -WT)
Mike Helvey
Manager, Obstruction Evaluation Group

Attachment(s)
Additional Information
Case Description
Map(s)

Additional information for ASN 2021-WTE-1897-OE

All FAA determinations and circularized cases are public record and available at the FAA's public website; https://oeaaa.faa.gov. The distribution for proposals circularized for public comments includes all "known" aviation interested persons and those who do not have an aeronautical interest but may become involved with specific aeronautical studies. Notification includes both postcard mailers and email notifications to those with registered FAA accounts. The FAA does not have a database for all persons with an aeronautical and non-aeronautical interest. Therefore, the public is encouraged to re-distribute and forward notices of circularized cases to the maximum extent possible. Additionally, it is incumbent upon local state, county and city officials to share notice of circularized cases with their concerned citizens.

A list of commonly used acronyms and abbreviations is available at the end of this document. A full list is available at the FAA's public website at https://oeaaa.faa.gov/oeaaa/downloads/external/content/FAA_Acronyms.pdf .

1. PROPOSAL DESCRIPTION

Proposed are 78 wind turbines for a wind farm project previously studied and determined under Aeronautical Study Numbers (ASN) 2020-WTE-6722-OE through 2020-WTE-6778-OE. The proposed wind farm would be located approximately 9.72 NM to 17.18 NM southwest of the Airport Reference Point (ARP) for Highmore Municipal (9D0), Highmore, SD.

For the sake of efficiency, all of the wind turbines in this project that have similar impacts are included in this narrative.

The proposed wind turbines' described heights and locations are expressed in Above Ground Level (AGL) height, Above Mean Sea Level (AMSL) height and latitude (LAT)/longitude (LONG).

ASN	AGL	AMSL	LAT	LONG
2021-WTE-1897-OE	625	2531	44-24-14.09N	99-45-37.19W
2021-WTE-1898-OE	625	2537	44-24-29.75N	99-45-25.56W
2021-WTE-1899-OE	625	2549	44-24-47.14N	99-45-10.48W
2021-WTE-1900-OE	625	2555	44-24-58.11N	99-44-52.07W
2021-WTE-1901-OE	625	2576	44-24-56.24N	99-44-11.46W
2021-WTE-1902-OE	625	2574	44-25-09.31N	99-43-47.36W
2021-WTE-1903-OE	625	2576	44-25-22.58N	99-43-16.26W
2021-WTE-1904-OE	625	2595	44-25-22.22N	99-42-29.07W
2021-WTE-1905-OE	625	2609	44-25-48.13N	99-42-29.21W
2021-WTE-1906-OE	625	2615	44-26-04.17N	99-42-03.53W
2021-WTE-1907-OE	625	2601	44-26-14.09N	99-41-31.24W
2021-WTE-1908-OE	625	2590	44-26-45.55N	99-41-27.62W
2021-WTE-1909-OE	625	2597	44-26-12.67N	99-40-49.51W
2021-WTE-1910-OE	625	2601	44-26-36.34N	99-40-39.24W
2021-WTE-1911-OE	625	2623	44-26-59.00N	99-39-37.37W
2021-WTE-1912-OE	625	2652	44-27-22.62N	99-39-24.13W
2021-WTE-1913-OE	625	2641	44-27-34.24N	99-39-06.08W
2021-WTE-1914-OE	625	2641	44-27-02.27N	99-38-51.47W
2021-WTE-1915-OE	625	2635	44-27-05.00N	99-38-23.71W

2021-WTE-1916-OE / 625 / 2613 / 44-26-13.94N / 99-39-37.13W

2021-WTE-1917-OE / 625 / 2602 / 44-26-14.67N / 99-39-05.84W
2021-WTE-1918-OE / 625 / 2614 / 44-26-11.16N / 99-38-19.60W
2021-WTE-1919-OE / 625 / 2593 / 44-25-47.95N / 99-40-03.95W
2021-WTE-1920-OE / 625 / 2607 / 44-25-39.69N / 99-39-18.72W
2021-WTE-1921-OE / 625 / 2610 / 44-25-45.84N / 99-38-10.32W
2021-WTE-1922-OE / 625 / 2586 / 44-24-59.88N / 99-40-31.94W
2021-WTE-1923-OE / 625 / 2606 / 44-25-09.31N / 99-40-00.74W
2021-WTE-1924-OE / 625 / 2603 / 44-24-47.29N / 99-38-49.76W
2021-WTE-1925-OE / 625 / 2584 / 44-24-05.15N / 99-38-57.93W
2021-WTE-1926-OE / 625 / 2582 / 44-23-03.63N / 99-39-22.82W

2021-WTE-1927-OE / 625 / 2591 / 44-22-46.04N / 99-37-38.00W
2021-WTE-1928-OE / 625 / 2601 / 44-23-03.23N / 99-36-59.77W
2021-WTE-1929-OE / 625 / 2559 / 44-21-43.65N / 99-40-05.43W
2021-WTE-1930-OE / 625 / 2583 / 44-21-52.04N / 99-39-22.57W
2021-WTE-1931-OE / 625 / 2585 / 44-22-11.49N / 99-38-49.81W
2021-WTE-1932-OE / 625 / 2603 / 44-22-21.17N / 99-37-50.90W
2021-WTE-1933-OE / 625 / 2603 / 44-21-39.61N / 99-37-51.51W
2021-WTE-1934-OE / 625 / 2618 / 44-22-10.77N / 99-36-38.02W
2021-WTE-1935-OE / 625 / 2638 / 44-22-11.27N / 99-35-37.93W
2021-WTE-1936-OE / 625 / 2646 / 44-22-14.52N / 99-35-11.08W

2021-WTE-1937-OE / 625 / 2655 / 44-22-19.08N / 99-34-33.76W
2021-WTE-1938-OE / 625 / 2660 / 44-22-20.39N / 99-33-59.26W
2021-WTE-1939-OE / 625 / 2701 / 44-21-43.59N / 99-33-58.88W
2021-WTE-1940-OE / 625 / 2584 / 44-20-25.80N / 99-41-27.57W
2021-WTE-1941-OE / 625 / 2634 / 44-19-39.92N / 99-41-16.64W
2021-WTE-1942-OE / 625 / 2635 / 44-19-39.65N / 99-40-47.40W
2021-WTE-1943-OE / 625 / 2635 / 44-19-48.56N / 99-40-31.36W
2021-WTE-1944-OE / 625 / 2633 / 44-19-48.09N / 99-40-01.59W
2021-WTE-1945-OE / 625 / 2654 / 44-20-03.83N / 99-39-17.00W
2021-WTE-1946-OE / 625 / 2644 / 44-20-25.97N / 99-38-55.58W

2021-WTE-1947-OE / 625 / 2643 / 44-20-26.32N / 99-38-03.12W
2021-WTE-1948-OE / 625 / 2630 / 44-21-01.05N / 99-37-09.32W
2021-WTE-1949-OE / 625 / 2624 / 44-21-23.72N / 99-36-40.27W
2021-WTE-1950-OE / 625 / 2704 / 44-19-36.66N / 99-38-19.96W
2021-WTE-1951-OE / 625 / 2701 / 44-19-49.25N / 99-38-07.56W
2021-WTE-1952-OE / 625 / 2712 / 44-19-35.42N / 99-37-03.20W
2021-WTE-1953-OE / 625 / 2716 / 44-19-33.27N / 99-36-35.07W
2021-WTE-1954-OE / 625 / 2695 / 44-19-51.49N / 99-36-29.77W
2021-WTE-1955-OE / 625 / 2677 / 44-20-09.09N / 99-36-25.12W
2021-WTE-1956-OE / 625 / 2666 / 44-20-26.56N / 99-36-25.21W

2021-WTE-1957-OE / 625 / 2665 / 44-20-37.87N / 99-35-56.02W
2021-WTE-1958-OE / 625 / 2681 / 44-20-50.81N / 99-35-43.52W
2021-WTE-1959-OE / 625 / 2668 / 44-21-01.78N / 99-35-28.91W

2021-WTE-1960-OE	625	2680	44-18-54.66N	99-39-35.60W
2021-WTE-1961-OE	625	2680	44-18-54.41N	99-38-57.55W
2021-WTE-1962-OE	625	2714	44-19-07.18N	99-38-25.44W
2021-WTE-1963-OE	625	2704	44-18-41.87N	99-38-16.92W
2021-WTE-1964-OE	625	2728	44-19-00.91N	99-37-37.78W
2021-WTE-1965-OE	625	2675	44-18-22.87N	99-39-37.47W
2021-WTE-1966-OE	625	2665	44-18-17.21N	99-38-49.83W
2021-WTE-1967-OE	625	2656	44-17-48.93N	99-39-37.15W
2021-WTE-1968-OE	625	2578	44-25-22.14N	99-41-48.48W
2021-WTE-1969-OE	625	2602	44-25-54.22N	99-41-28.13W
2021-WTE-1970-OE	625	2605	44-25-19.63N	99-39-35.11W
2021-WTE-1971-OE	625	2563	44-22-38.45N	99-39-36.68W
2021-WTE-1972-OE	625	2596	44-20-35.11N	99-40-18.46W
2021-WTE-1973-OE	625	2585	44-20-57.86N	99-40-01.75W
2021-WTE-1974-OE	625	2659	44-21-00.55N	99-36-24.43W

2. TITLE 14 CFR PART 77 - OBSTRUCTION STANDARDS EXCEEDED

a. Section 77.17(a)(1); exceeds a height of 499 feet AGL at the site of the object. The proposals would all exceed this standard by 126 feet.

b. Section 77.17(a)(3); a height within a terminal obstacle clearance area, including an initial approach segment, a departure area, and a circling approach area, which would result in the vertical distance between any point on the object and an established minimum instrument flight altitude within that area or segment to be less than the required obstacle clearance.

The following proposed turbines would increase the Minimum Safe Altitude (MSA) for Highmore Municipal (9D0) Highmore, SD. The RNAV (GPS) RWY 13 and RNAV (GPS) RWY 31 would increase from 3600 feet AMSL to ______ feet AMSL.

3700 feet AMSL
2021-WTE-1897-OE
2021-WTE-1906-OE
2021-WTE-1907-OE
2021-WTE-1910-OE
2021-WTE-1911-OE
2021-WTE-1912-OE
2021-WTE-1913-OE
2021-WTE-1914-OE
2021-WTE-1915-OE
2021-WTE-1916-OE

2021-WTE-1917-OE
2021-WTE-1918-OE
2021-WTE-1920-OE
2021-WTE-1921-OE
2021-WTE-1923-OE
2021-WTE-1924-OE

2021-WTE-1928-OE
2021-WTE-1932-OE
2021-WTE-1933-OE
2021-WTE-1934-OE

2021-WTE-1935-OE
2021-WTE-1936-OE
2021-WTE-1937-OE
2021-WTE-1938-OE
2021-WTE-1941-OE
2021-WTE-1942-OE
2021-WTE-1943-OE
2021-WTE-1944-OE
2021-WTE-1945-OE
2021-WTE-1946-OE

2021-WTE-1947-OE
2021-WTE-1948-OE
2021-WTE-1949-OE
2021-WTE-1954-OE
2021-WTE-1955-OE
2021-WTE-1956-OE
2021-WTE-1957-OE
2021-WTE-1958-OE
2021-WTE-1959-OE
2021-WTE-1960-OE

2021-WTE-1961-OE
2021-WTE-1965-OE
2021-WTE-1966-OE
2021-WTE-1967-OE
2021-WTE-1969-OE
2021-WTE-1970-OE
2021-WTE-1974-OE

3800 feet AMSL
2021-WTE-1939-OE
2021-WTE-1950-OE
2021-WTE-1951-OE
2021-WTE-1952-OE
2021-WTE-1953-OE
2021-WTE-1962-OE
2021-WTE-1963-OE
2021-WTE-1964-OE

The following proposed turbines would increase the MSA for Miller Municipal (MKA) Miller, SD. The RNAV (GPS) RWY 15 and RNAV (GPS) RWY 33 would increase from 3600 feet AMSL to ________ feet AMSL.

3700 feet AMSL

2021-WTE-1935-OE
2021-WTE-1936-OE
2021-WTE-1937-OE
2021-WTE-1938-OE

3800 feet AMSL
2021-WTE-1939-OE

c. Section 77.17(a)(4); a height within an en route obstacle clearance area, including turn and termination areas, of a Federal Airway or approved off-airway route, that would increase the minimum obstacle clearance altitude.

The following proposed turbines would increase the Minimum Obstruction Clearance Altitude (MOCA) along Victor Airway 120 (V-120) from PIERRE (PIR) VORTAC, 100 radial to MITCHELL (MHE) VOR/DME from 3400 feet AMSL to ________ feet AMSL.

3700 feet AMSL
2021-WTE-1941-OE
2021-WTE-1942-OE
2021-WTE-1943-OE
2021-WTE-1960-OE
2021-WTE-1961-OE
2021-WTE-1965-OE
2021-WTE-1966-OE
2021-WTE-1967-OE

3800 feet AMSL
2021-WTE-1962-OE
2021-WTE-1963-OE
2021-WTE-1964-OE

3. TITLE 14 CFR PART 77 - EFFECT ON AERONAUTICAL OPERATIONS

a. Section 77.29(a)(1); impact on arrival, departure, and en route procedures for aircraft operating under visual flight rules. At a height greater than 499 feet AGL, the proposed wind farm would extend into airspace normally used for VFR en route flight and may be located within 2 statute miles (SM) of potential VFR Routes as defined by FAA Order 7400.2, Section 6-3-8. The turbines within 2 SM of a VFR Route would have an adverse effect upon VFR air navigation.

b. Section 77.29(a)(6); potential effect on ATC radar, direction finders, ATC tower line-of-sight visibility, and physical or electromagnetic effects on air navigation, communication facilities, and other surveillance systems. The turbines would be within the radar line of sight (RLOS) of the Gettysburg, SD (QJB) CARSR and may affect the quality and/or availability of the primary radar signals.

4. TITLE 14 CFR PART 77 - FURTHER STUDY AND PUBLIC COMMENTS

In order to facilitate the public comment process, all 78 studies were circularized under ASN 2021-WTE-1926-OE on 08/27/2021, to all known aviation interests and to non-aeronautical interests that may be affected by the proposal. There was one comment submitted by the South Dakota Aeronautics Commission as a result of the circularization concluding on 10/03/2021. The comment(s) is summarized as follows:

Comments: South Dakota (SD) has limited radar coverage in most areas. This proposed windfarm appears to be adjacent to another farm with shorter turbines, the obvious confusion could easily lead to another fatal accident similar to the April 27, 2014 crash where an aircraft collided with one of the turbines in this other field resulting in the death of the 4 people on the plane.

There are rules that apply to obstructions in controlled airspace. These rules were created long before 600+ foot wind turbines were proposed. Current SD rules allow obstructions to be erected without, aeronautics commission approval, if they do not exceed the maximum heights. With no over whelming justification requiring the turbines to be erected in this airspace, I will oppose any proposal that makes it tougher to fly in the airspace the commission has authority over.

FAA Response: In accordance with FAA Order 7400.2, Par. 6-1-1, an aeronautical study must be conducted for all complete notices received by the FAA. As required, an extensive aeronautical study was conducted on this wind farm proposal which included an evaluation of the impact to Radar coverage, navigational facilities, IFR procedures and VFR operations. The study considered available traffic data within the vicinity of the wind farm and determined that there was not a significant volume of traffic. Therefore, the wind turbines are not considered to have a substantial adverse effect on VFR or IFR traffic. Flight operations conducted below the minimum safe altitudes specified in 14 CFR Part 91, such as agricultural, land surveys, law enforcement, etc., are not considered in determining the extent of adverse effect. Additionally, the FAA does not have land-use authority for privately owned/leased property and does not issue building permits. A determination issued by the FAA does not relieve the project sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body. Questions or comments regarding the justification for commercial land development projects, lease/purchase agreements, site selection, etc., should be directed to the private property owners, state, county and/or local city municipalities.

5. BASIS FOR DETERMINATION

a. IFR Effects - The aeronautical study identified an IFR effect(s) for 9D0, MKA airports and V-120. MSAs are the minimum obstacle clearance altitudes within a specified distance from the navigation facilities upon which procedures are predicated. MSA altitudes are designed for emergency use only and are not routinely used by pilots or by air traffic control. Consequently, MSAs are not circulated for public comment as they are not considered a factor in determining the extent of adverse effect. MOCAs assure obstacle clearance over the entire route segment to which they apply and assure navigational signal coverage within 22 NM of the associated VOR navigational facility. For that portion of the route segment beyond 22 NM from the VOR, where the MOCA is lower than the MEA and there are no plans to lower the MEA to the MOCA, a structure that affects only the MOCA would not be considered to have substantial adverse effect. Other situations require study as ATC may assign altitudes down to the MOCA under certain conditions. Further study revealed that only the MOCA along V-120 is effected and is not routinely assigned by ATC. The proposed structures would have no other effect on any other existing or proposed arrival, departure, or en route IFR operations or procedures.

b. VFR Effects - The aeronautical study identified no effect on any existing or proposed VFR arrival or departure operations. The proposals would be located beyond the traffic pattern airspace for any known public use or military airports. The aeronautical study identified no effect on any existing or proposed VFR arrival or departure operations. At 625 feet AGL, the structures would be located within the altitudes commonly used for en route VFR flight. In coordination with ATC, an analysis of potential VFR Routes and available traffic data indicated that an average of less than one VFR aircraft per day may be affected by the proposed wind farm. In accordance with FAA Order 7400.2, the proposed wind farm would not affect a significant volume of aircraft and therefore, it is determined they will not have a substantial adverse effect on en route VFR flight operations.

c. RADAR Effects - The aeronautical study identified the proposed turbines as being within the RLOS of the Gettysburg, SD (QJB) CARSR as described above. The proposed turbines may affect the quality and/or availability of the QJB primary radar signals. There would be no effect on the secondary (Beacon) radar system. Impacts to radar only require a review by the responsible ATC facility and military services. Further study determined the structures would have no substantial adverse effect on military or air traffic operations at this time.

d. Charting and Cumulative Effects - The proposed structures would be charted on VFR sectional aeronautical charts and appropriately obstruction marked/lighted to make them more conspicuous to airmen should circumnavigation be necessary.

The cumulative impact of the proposed structures, when combined with other proposed and existing structures, is not considered to be significant. Study did not disclose any substantial adverse effect on existing or proposed public-use or military airports or navigational facilities, nor would the proposals affect the capacity of any known existing or planned public-use or military airport.

6. Determination - It is determined that the proposed construction would not have a substantial adverse effect on the safe and efficient utilization of the navigable airspace by aircraft or on any air navigation facility and would not be a hazard to air navigation providing the conditions set forth in this determination are met.

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ACRONYMS & ABBREVIATIONS

AGL, Above Ground Level
AMSL, Above Mean Sea Level
ARP, Airport Reference Point
ARSR, Air Route Surveillance Radar
ARTCC, Air Route Traffic Control Center
ASN, Aeronautical Study Number
ASR, Airport Surveillance Radar
ATC, Air Traffic Control
ATCT, Air Traffic Control Tower
CARSR, Common Air Route Surveillance Radar
CFR, Code of Federal Regulations
DME, Distance Measuring Equipment
FAA, Federal Aviation Administration
FUS, Fusion
GPS, Global Positioning System
IFR, Instrument Flight Rules
LAT, Latitude
LONG, Longitude

Min, Minimum
MSL, Mean Sea Level
MVA, Minimum Vectoring Altitude
NA, Not Authorized
NAS, National Airspace System
NEH, No Effect Height
NM, Nautical Mile
NOTAM, Notice to Airmen
NPF, Notice of Preliminary Findings
OE, Obstruction Evaluation
Part 77 - Title 14 Code of Federal Regulations (CFR) Part 77, Safe, Efficient Use and Preservation of the Navigable Airspace.
RLOS, Radar Line of Sight
SE, Site Elevation
SM, Statute Miles
TERPS, Terminal Instrument Procedures
TPA; Traffic Pattern Airspace
V, Victor Airway
VFR, Visual Flight Rules
WTW, Wind Turbine West

Attachment #2

Case Description for ASN 2021-WTE-1897-OE

Wind Turbines as part of North Bend Wind Project

Attachment #2

Sectional Map for ASN 2021-WTE-1897-OE