BRAATEN
Law Firm

May 3, 2018

ND Public Service Commission
600 E. Boulevard, Dept. 408
Bismarck, ND 58505-0480

Via email only to: ndpsc@nd.gov

Re: Case No. PU-11-69
Meadowlark Wind I, LLC
New Frontier Wind Energy Project-McHenry County
Siting Application

Dear Commissioners:

Thank you for providing an opportunity to comment on Meadowlark Wind I, LLC's ("Meadowlark") request to amend Certification Provision No. 15 of the Commission's Order of Continuing Suitability in Case No. PU-11-69. I attended the informal hearing on March 29, 2018, and following the hearing, I requested an opinion from a soil classifier regarding the proposal described by Meadowlark at that hearing. I have attached a letter opinion from Lance Loken, a professional soil classifier and President of Western Plains Consulting.

I am submitting these comments because I have serious concerns with the proposal for treatment of topsoil from Meadowlark. I am not a landowner in Meadowlark's project area, but I am an attorney whose practice is dedicated to serving farmers, ranchers, and other landowners, and protecting landowner rights and the land. I have clients throughout the State of North Dakota, and I am currently negotiating leases for landowners involved in numerous proposed wind projects around the State. In my practice, I have negotiated countless easements, leases, surface use agreements, and other similar contracts on behalf of landowners, and through both my transactional practice and litigation, I am familiar with landowner concerns, especially those related to soil, one of our most precious natural resources. Although I am not writing on behalf of any specific clients, or on behalf of any landowners within Meadowlark's New Frontier Wind Energy Project, I feel compelled to submit these comments on behalf of all landowners in North Dakota. I believe that the Commission's certification and its order are critical to ensuring the policy goal of N.D.C.C. ch. 49-22, which is "to ensure that the location, construction, and operation of energy conversion facilities and transmission facilities will produce minimal adverse effects on the environment and upon the welfare of the citizens of this state...." I do not think that Meadowlark's proposal to amend the Commission's certification complies with these policy goals.

Having heard the proposal from Meadowlark at the informal hearing, I was concerned, but I also recognize that I am not a soil scientist, and that I do not have the pertinent expertise to weigh in on the substance of the proposal. I therefore retained a soil classifier (Mr. Loken) to review the filings, the hearing audio from the March 29, 2018 hearing, and other relevant information, and to

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provide an opinion on the propriety of Meadowlark's proposal. Mr. Loken, as you will see in his letter, does not believe that Meadowlark's proposal is sound. I will let Mr. Loken's opinion and recommendations speak for themselves, but I would like to close by stating that I have seen significant progress made by energy developers in North Dakota in the past decade with respect to preserving and protecting soil health. The language in the Commission's certification has been complied with by numerous pipeline developers, and I can say from experience that pipeline companies, oil and gas operators, and other developers have agreed to and complied with much more stringent soil reclamation requirements in private contracts than what the Commission currently has in its certification.

As a member of the public dedicated to serving our farmers and ranchers, I urge the Commission to protect our precious topsoil, and refuse to allow any deviation from its certification without clear and convincing evidence that the topsoil will be protected.

Sincerely,

/s/ Derrick Braaten

Derrick Braaten

Attachment (Letter from Lance Loken)

Copy: Illona Jeffcoat Sacco (ijs@nd.gov)
Darrel Nitschke (dnitschk@nd.gov)

May 3, 2018

Mr. Derrick Braaten
Braaten Law Firm
109 N. 4th Street, Suite 100
Bismarck, ND 58501

Re: Soils Review - Meadowlark Wind LLC
Proposed Road Construction Techniques
New Frontier Wind Energy Project
McHenry County, North Dakota

Dear Mr. Braaten:

Western Plains Consulting, Inc. (WPC), at your request, has reviewed the North Dakota Public Service Commission (PSC) file, Public Utility (PU) - 11 - 069. The file provides the history of the application and planning related to the permitting and proposed construction of the New Frontier Wind Energy Project. This project is being proposed by Meadowlark Wind, LLC. The project is planned to include approximately 64 towers, connecting power lines, and a 12-mile-long power line to a substation. Access roads would need to be constructed to the towers. This project would encompass an area in Township 151 North, Range 80 West, south of the city of Voltaire, in McHenry County, North Dakota.

WPC understands that your main concern is the road construction technique that Meadowlark Wind, LLC has proposed. As you and the PSC are aware, Meadowlark Wind, LLC proposes to;

- Strip an estimated four (4) inches of topsoil from the road construction area and spread the stripped soil on land adjacent to the road.
- Incorporate Portland cement into the remaining topsoil and subsoil to a depth of 12 inches with a thorough mixing action. Portland cement would constitute about six (6) percent of the mix.
- This road base mixture, known as cement-modified silt-clay soil, would be compacted and allowed to cure, or strengthen.
- Once cured, a sand and gravel layer would be placed over this topsoil/cement mix for the driving surface.

After the wind farm has completed it's life, perhaps 40 years from now, Meadowlark Wind, LLC would remove the road surface material (sand and gravel). The cement-modified silt-clay soil would then be pulverized, and the topsoil that had been reserved by thin spreading along the roads would be lifted and replaced on the former roadbed.

Meadowlark Wind, LLC has claimed that the pulverized roadbed, with the stripped topsoil replaced, would leave a good quality topsoil, and that the calcium

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addition from the cement would be beneficial to the soils, and there would be good vegetation production on these reclaimed areas.

The Braaten Law Firm requested an opinion from WPC on whether this would be an acceptable method. WPC reviewed the relevant documents in the PSC PU-11-069 file, performed an independent review, performed some research, and interviewed a civil engineer and a professor in soil science regarding this process.

WPC reviewed the USDA-NRCS Web Soil Survey for Township 151 North, Range 80 West. The dominant soils across this township are soils developed in fine- and coarse-loamy glacial till. Many of these soils have calcic horizons. Calcium is not deficient in these soils. The fine-loamy soils are subject to shrink-swell conditions due to their montmorillonite clay content, which has a greater than 2:1 shrink-swell potential. This means that when the soil becomes wet, the clays swell, and when the soil dries, the clays shrink or contract, and in these types of soils the shrink/swell is greater than a 1-to-1, which is found in kaolinite clays. Shrink-swell action is adverse to road stability. This can make road building challenging, and a geotechnical and civil engineer should be consulted to ensure that the engineered road bed is suitable for the types of soils present and intended traffic in the areas of the wind tower access roads.

Additionally, any of the soils that may be crossed in the toeslope or lower topography positions will be subject to seasonally wetter conditions, especially the calciaquolls soil series (Hamerly, Fram, Vallers, etc.). These soils have seasonal water tables in the spring and during wet periods. Some years before the frost is out, these soils have low bearing strength below the 16 inch depth due to a perched water table above the frost that is supersaturated. These soils are given an A-6 American Association of State Highway and Transportation Officials (AASHTO) classification. Roads constructed on these soils in lower topographic positions will be subject to additional stress due to wetter conditions, as the roadbed preparation does not appear to account for engineering the subgrade on the proposed roads. The roadbed will be more susceptible to being pounded out of shape and/or damaged on the wetter sites, especially from heavy truck traffic. WPC did not find documentation that confirmed the road construction techniques proposed by Meadowlark Wind, LLC would withstand such conditions, and poses the question: Is the road construction plan suitable for the planned activity? The additional settling when vehicles are driven on or across these road segments might breakup the cement-modified silt-clay soils, and require rebuilding road segments.

Lance Loken, Geologist and Professional Soil Classifier with WPC, worked for Braun Intertec as an Environmental Geologist in the early years of his employment history. As a result, he was in daily contact with geotechnical engineers that worked on a variety of construction projects. During those years, Mr. Loken learned that geotechnical engineers did not want topsoil to be present in any base construction activity. The main concern they expressed was that topsoil will not compact, and did not provide a stable surface for construction.

Mr. Loken interviewed Mr. Scott Olsen, a retired civil engineer from Bismarck, North Dakota. Mr. Loken described the process that was planned. Mr. Olson was aware of this technique, and said it does have favorable results, but not when using topsoil. He was only aware of this road-building technique working well when the topsoil was completely removed and only subsoil material was used. He stated that he would not recommend the road building technique using any topsoil.

Most of the biological activity of the soil is in the topsoil. In today's agriculture soil compaction has a negative impact on soil health. Intentionally compacting the soil and hardening it will in a short time eliminate most of the biological function and reduce a friable soil to hard mass. This compaction of the soil greatly impacts the microbe environment by reducing pore space, altering water movement, and greatly reducing air movement. Totally reversing this cementing action and restoring the soils to complete and total functioning will be difficult and time consuming, if possible.

Mr. Loken interviewed Larry Cihacek, Ph.D. from the NDSU Soil Science Department. Professor Cihacek's experiences have been similar in that no topsoil should be part of a base of a construction project. He doubted that the "topsoil" involved in the mix would still be topsoil in 40 years. He doubted there would be any nutrient benefit, especially from the calcium as North Dakota soils typically have adequate to extra calcium available. He did point out that during the time the topsoil was in the cement/concrete mix, the organic matter would probably break down, resulting in shrinkage of the soil component. Mr. Loken believes if the organic matter breaks down and the topsoil experiences shrinkage, it could damage the structural viability of the cement-modified silt-clay soils. WPC notes that topsoil mixed into the cement-modified silt-clay soils will cease to be topsoil. Topsoil has extensive biological life. Cement-modified silt-clay soils have vastly reduced water and air holding capacity available for biological life. However, the organic matter from topsoil will break down and degrade, resulting in the shrinkage mentioned above. Additionally, these cement-modified silt-clay soils will degrade the soils under the mix as there will no longer be much, if any, moisture infiltrating from the surface, and no rooting will occur in the subsoils. The underlying soils will probably lose their status as either suitable plant growth material (topsoil) or a remaining suitable plant growth material (subsoil).

Professor Cihacek also commented that if too much calcium was present, there may be a risk of forming caliche-type material. Caliche is also known as a petrocalcic horizon. The Glossary of Soil Science Terms defines caliche:

> ***Caliche.*** *A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.*

The Keys to Soil Taxonomy (2010) defines petrocalcic horizons:

> ***Petrocalcic Horizon:*** *The petrocalcic horizon is an illuvial horizon in which secondary calcium carbonate or other carbonates have accumulated to the extent that the horizon is cemented or indurated.*

Wikapedia also had a listing:

> *Caliche beds can cause problems for agriculture. First, an impermeable caliche layer prevents water from draining properly, which can keep roots from getting enough oxygen. Salts can also build up in the soil due to the lack of drainage. Both of these situations are detrimental to plant growth. Second, the impermeable nature of caliche beds prevents plant roots from penetrating the bed, which limits the supply of nutrients, water, and space so they cannot develop normally. Third, caliche beds can also cause the surrounding soil to be basic. The basic soil, along with calcium carbonate from the caliche, can prevent plants from getting enough nutrients, especially iron. An iron deficiency makes the youngest leaves turn yellow. Soil saturation above the caliche bed can make the condition worse.*

And finally from the *Illustrated Guide to Soil Taxonomy - 2014, Part 3—Diagnostic Horizons and Characteristics 3-105*:

The petrocalcic horizon is a root-restrictive subsoil horizon that is cemented by calcium carbonate. Lateral continuity is such that spaces where roots can penetrate are more than 10 cm apart. This horizon is essentially an advanced stage calcic horizon where so much secondary calcium carbonate has accumulated in the layer that the pores have become plugged and cemented.

WPC notes that the development of the cement-modified silt-clay soils essentially matches, to some degree, the descriptions above. If true, cement-modified silt-clay soils formation will permanently ruin the suitable plant growth material properties of the treated soil.

Mr. Loken understands that the use of the cement-modified silt-clay soils is suitable for permanent roads, not for temporary roads that are planned to be eventually reclaimed for agricultural use. From the documents reviewed, WPC was uncertain if Meadowlark, LLC has a road maintenance plan for the life of this project. WPC questions how roads constructed with the cement-modified silt-clay soils would be maintained. Mr. Loken also researched issues related to calcium and nutrients.

Some plants are susceptible to lime-induced chlorosis from high calcium carbonate levels in the soil. Lime-induced chlorosis is a physiological disorder which is characterized by a light green to yellow color of the youngest leaves and which results from a lack of active iron. The lime-induced chlorosis may not be due to a lack up uptake of iron by the roots, by rather in the inability of the roots to metabolize iron. Lime-induced chlorosis can often be a severe problem in growing crops on calcareous soils. This statement was from the *Principles of Plant Nutrition. 3rd Edition*. K Mengel and EA Kirkby. International Potash Institute. Bern, Switzerland. 1982.

Another concern with the application on soils that already have adequate calcium is a condition referred to as over-liming. The following is from *The Nature and Property of Soils, 8th Edition*. Nyle C. Brady. 1974. *Excess lime addition can lead to a soil pH that is too high for optimum plant growth on soils. Plants can be detrimentally affected. This can lead too:*

1. *Deficiencies of available iron, manganese, copper and/or zinc may be induced.*
2. *Phosphate availability may decrease because of the formation of complex and insoluble calcium phosphates.*
3. *The absorption of phosphorus by plants and especially its metabolic use may be restricted.*
4. *The update and utilization of boron may be hindered.*
5. *The drastic change in pH may in itself be detrimental.*

Stripped Topsoil Reservation/Spreading

According to the New Frontier Wind Project proposal, land use in the project area is 34 percent cropland, 26.6 percent grassland herbaceous, 21 percent pasture, 6.6 percent wetland, 4 percent open water, 3.4 percent developed, and 2.8 percent deciduous forest. The Project's proposal to strip topsoil

from the road construction sites (and other construction sites?) and spread it on adjacent land raises a number of concerns;

1. Spreading topsoil on grassland herbaceous area or pasture (grass/hay/other) would harm or kill herbaceous vegetation unless it is spread very thin. This is major concern on native prairie locations.

2. Spreading topsoil thinly over grassland herbaceous area or pasture (grass/hay/other) would likely enable wind-blown or soil-borne weed seeds to sprout and invade the plant communities.

3. There is no practical way to recover topsoil spread over grassland herbaceous area, pasture, wetland, or forest area without destroying the vegetation.

4. Hauling all the stripped topsoil to cropland areas probably is not feasible, as some landowners may not own any cropland, or none near the project area. Spreading topsoil on a different landowner's cropland would have substantial risks that render it impractical, such as disputes about the amount of topsoil that was deposited and the amount that may be recovered.

Following are relevant facts found on the Portland Cement Association's Website, regarding properties of cement-modified silt-clay soils for construction purposes;

> "Cement-treated bases have provided economical, long-lasting pavement foundations for over 70 years. These pavements combine soil and/or aggregate with cement and water, which are then compacted to high density."
>
> "Moisture intrusion is the nemesis pavement bases. Cement-stabilized pavements form a moisture-resistant base that keeps water out and maintains higher levels of strength, even when saturated."
>
> "The improvement in engineering properties of a soil due to the addition of small quantities of cement can be measured in several ways including:
>
> - Reduction in the amount of silt and clay size particles
> - Increase in shearing strength
> - Decrease in volume-change properties"

WPC notes that the aforementioned properties favorable for construction are clearly adverse to plant growth;

1. What engineers refer to as "moisture intrusion" is indeed adverse to a road base. However, soils that have a fast rate of "moisture intrusion" (aka infiltration rate) and a large volume of "moisture intrusion" (aka water holding capacity) are definitely favorable for plant growth.

2. A reduction in silt and sand-size particles is apparently the result of these soil particles being cemented together. It is questionable if pulverizing the soil at the end of the access road life would restore the soil to its natural texture, and hence to its original productivity. The cement-modified silt-clay soils, once pulverized, will most likely

result in a making a rubble of small stones and pebbles, and not fully break up the material and soil structure may never fully be reestablished. The excess calcium in the cement-modified silt-clay soils added to the natural calcium in the soil may result in the concerns listed above, i.e., creating a petrocalcic horizon and/or adversely affecting vegetation growth.

3. A decrease in volume-change properties means a reduction in the shrink-swell potential of soil. Shrink-swell actions in soil have a loosening effect that helps maintain or improve soil permeability and water holding capacity.

Meadowlark Wind, LLC's Late-Filed Exhibit No. 5 - Part 3 is a letter from Jason W. Oberg, PE, Blattner Energy, Inc. to Dan Moller, in reference to topsoil impacts from cement/lime dust exposure. Mr. Oberg stated, "The most conclusive reports we have found to date specific to cement dust mixed with topsoil determined better growth potential with cement than without. Causes are believed to be the presence of calcium (lime) which is known to promote vegetative growth (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1182479/)."

WPC points out that none of the soils in the proposed project area are deficient in calcium and would not benefit from more calcium being added. Adding more calcium to soils in the project area may actually have an adverse impact on the plant growth by making other nutrients, such as iron, less available.

The Oberg letter also stated, "Some fertilizers contain cement kiln dust (CKD) which aids plant nutrition (https://www.farmshow.com/a_article.php?aid=11493)". WPC notes the linked article refers to CKD use in Missouri, where soils are typically acidic and calcium-deficient. Unlike the Missouri soils, the soils in the proposed project area range from neutral to alkaline, and certainly will not benefit from the addition of cement or CKD.

The Oberg letter further stated, "Higher concentrations of lime are known to preserve organic strata (topsoil) (*Agricultural College Survey of North Dakota, by Daniel Willard, page 63*). WPC notes that the article was dated 1905-1906 and the header was titled, "*SOIL SURVEY OF THE CANDO AREA*". Towner County, where Cando is located, is more than 60 miles east/northeast of the project area, and has significantly different soils than those in the project area. WPC also notes that although Mr. Oberg's paraphrasing of the document is correct, the journal article referred to the inherent high lime content of the Cando-area soils and neither stated nor implied that adding lime or other calcium source would be beneficial to those soils or crop production. Mr. Oberg was falsely implying that adding calcium to the soils in the New Frontier Wind Energy Project area would be beneficial.

WPC regards Meadowlark Wind, LLC's proposed plan to strip $\pm$ 4 inches of topsoil as vague and unacceptable. Average topsoil thickness in the project area is more than six inches and probably exceeds 16 inches in some places. To have any hope of restoring productivity to its original level after the Site is decommissioned, ALL topsoil must be segregated from the subsoil and never mixed. For the same reason, Meadowlark Wind, LLC's proposed plan to mix any remaining topsoil and subsoil with cement to a depth of 12 inches below the surface of the stripped area is also unacceptable.

WPC notes that most of the subsoil in the project area is suitable plant growth material to a depth of more than 36 inches. Even if Meadowlark Wind, LLC submits a revised plan that entails stripping,

segregating, and saving all topsoil, WPC regards the proposed cement-modified silt-clay soil road base as a permanent degradation of the subsoil/suitable plant growth material.

WPC contacted the Portland Cement Association. They provided a document titled *Guide to Cement-Modified Soil (CMS)* by GE Halstad, WS Adaska, and WT McConnell. WPC noted some statements of concern in this document:

- *Field and laboratory tests show that changes in the physical characteristics of a soil/aggregate by cement modification are permanent. The soil/aggregate does not revert back to its original state, even after many cycles or years of weathering and service.*

- *Portland cement, a good calcium-based soil modifier, can provide sufficient calcium ions to replace the monovalent cations on the surfaces. This ion exchange process occurs within hours, shrinking the layer of water between clay particles, and reducing the plasticity of the soil/aggregate.*

The shrinking of the layer of water between the clay particles reduces the water holding capacity of the soil.

- *The reduced size of the double layer due to cation exchange, as well as the increased internal friction of clay particles due to flocculation and agglomeration, result in a reduction in plasticity, an increase in shear strength, and an improvement in texture.*

- *The pozzolanic reactions take place slowly, over months and years, and can further strengthen a modified soil/aggregate as well as reduce its plasticity and improve its gradation.*

WPC suspects that attempting to reclaim cement-modified silt-clay soils by pulverization might reduce the cementitious hydration bonds, but may not restore soil structure.

In the e-mail from the Portland Cement Association, Mr. Adaskas had the following statements.

Attached is our current publication on cement-modified soil which you can forward to Mr. Anderson. Note there are four processes that take place when you modify a clayey soil: cation exchange, particle restructuring, cementitious hydration and pozzolanic reaction. If you're simply modifying the soil to reduce the plasticity and make the soil more friable, the end result is a low strength material with very little cement (2-4%). I'm not an agronomist, but with this type of treatment, it should be rather easy to have a soil that would support plant growth by simply treating the soil with black dirt and an acidic fertilizer. An added benefit is that soil friability is permanent so the treated soil would be more free draining and should provide a better media for plant growth.

Other than the CMS guide, I don't have any literature to support my comments above, soil-cement is regularly used in farm lands to provide low grade roads to access wind farms and fracking operations. The same question is asked about reverting these roads back to farm land. I haven't heard any objection so far.

WPC noted in his last statement that he didn't have any literature supporting his comments in the first paragraph. The need is apparent for adequate research to be performed to determine if this methodology is suitable for use in North Dakota. At this time, WPC cannot recommend this technique due to the doubts we have raised.

Before approving a permit application that includes the creation of cement-modified silt-clay soil, the PSC should require Meadowlark Wind, LLC to prove that pulverizing all cement-modified silt-clay soils in the project area will return all those soils to natural productivity levels in an acceptable time frame, and provide specific criteria and costs for doing so. If Meadowlark Wind, LLC is persistent in their request to utilize cement-modified silt-clay soil without proof they can successfully restore the site to its original productivity, Meadowlark Wind, LLC should be required to provide a plan and post a bond sufficient to cover the costs of removing and disposing of all the cement-modified silt-clay soil in the project area, and replacing it with suitable plant growth material. WPC believes this alternative is not economically feasible and may cause adverse environmental effects off-site. WPC recommends that the Public Service Commission reject this proposed road-building technique.

Thank you for the opportunity to comment on the New Frontier Wind Energy Project. If you have any questions, please call me at (701) 221-3113, or I can be reached on my mobile phone at (701) 400-6642.

Sincerely,

Lance G. Loken, Senior Soil Scientist
ND Professional Soil Classier #68, President