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MEMORANDUM

TO: PEI Energy Corporation

From: Carl Brothers

ATTN: Spencer Long

Date: November 1, 2019

SUBJECT:

Eastern Kings Wind Plant – Phase 2 (EKWP2)
Project Management and Design Status Report – October 31, 2019

Spencer:

Frontier Power Systems was contracted by the PEI Energy Corporation to carry out the project management and some elements of the project design work for the EKWP2 wind project. There have been several key elements of the initial project development activities that have been completed. We would like to take this opportunity to summarize the work completed, to date, and to provide you with some documentation related to this work. A Project Description document, prepared to provide a current summary of the project, is attached as Appendix A.

Wind Plant Design

Work on the wind plant design commenced several years ago with the installation of wind monitoring equipment at three locations on PEI, to identify site alternatives for the two pending wind projects – (30 MW in 2020 and 40 MW in 2024) that were under development by the Corporation.

Wind Resource Assessment

The first step in a wind plant design is to quantify the wind resource to confirm that a commercial wind resource exists. Wind monitoring towers were installed in Irishtown and Rock Barra and an existing tower in Eastern Kings was instrumented to measure the wind resource in the Eastern Kings area. When initial wind data and preliminary economic analysis indicated that Eastern Kings was the most attractive site for the 2020 development, a Lidar unit was procured and installed, within the area of the anticipated project expansion, to validate the wind resource within the new project area. These wind resource assessment studies were concluded in early 2019 and those studies confirmed the wind resource in the Eastern Kings area was as expected, and that the Eastern Kings project presented the most economic location for the Corporation's

project expansion.

Wind Flow Modelling
With the wind resource accurately identified in two locations near the planned wind plant and, with data existing from earlier wind monitoring campaigns, a wind flow modelling exercise was conducted to provide a detailed map of the wind resource over the planned project area. This modelling exercise was carried out using WAsP, an advanced wind modelling software developed more than 20 years ago and continually improved since then. The output from WAsP is a high-resolution map of the annual wind data, characterized over specific segments of the development area with very high resolution. This wind resource grid (wrg) is used in subsequent analysis with specific wind turbines, to assess the annual energy generation.

Wind Turbine Selection
Frontier prepared an RFP, on behalf of the Corporation, which was presented to qualified wind turbine manufacturers in early 2019. Five global wind turbine suppliers offered their technology, some in different configurations (different tower heights, rotor diameters, power rating, etc.). A total of eight different turbine options were proposed, with details on capital cost, warranty and service options as well as a wide range of technical data related to performance, noise emissions, mechanical and electrical details and many related documents fully describing the technology offered. This allowed us to assess the procurement and operating costs of all the wind turbine options presented.

Wind Plant Modelling
With the performance and noise data provided by each of the wind turbines manufacturers, a sophisticated modelling package, Windfarmer, was used to estimate the annual energy generation with a specified number of each wind turbine installed within the project area. Windfarmer is programmed with the detailed characteristics of each wind turbine, the wind resource data from the WAsP model, the topographical data and the land base data (with the required exclusions due to wetlands and properties, etc.) to compute the annual electricity generated from the wind plant.

Wind Turbine Technical and Financial Analysis & Recommendation
With the capital cost and operating cost information provided by the manufacturer and using the annual energy generation provided by the Windfarmer model, a business case was generated for each of the wind turbine options. The project revenues and expenses were calculated over the 20-year operating lifetime of the wind plant and the Levelized Cost of Energy (LCOE) and Net Present Value (NPV) of each of the wind turbine options was computed. The turbine with the lowest LCOE usually correlates to the turbine with the highest NPV and that turbine is deemed to be the most financially attractive turbine for the project.

We ranked all the turbines from lowest to highest and recommended that detailed negotiations be carried out with the most financially attractive option. In this case, the most attractive offering was the Enercon E3- E138 4.2 MW turbine on a 108-meter tower. Negotiations are nearing a conclusion for the procurement of this turbine. Technical details on this turbine are provided in Appendix B.

Community Engagement
The Corporation has been acutely aware of community sensitivities related to wind project development following the abrupt change of plans in 2012 to move the planned project from Eastern Kings to Hermanville. The community has been badly divided over the issue of further wind plant development and the Corporation has treaded carefully to build an improved relationship with the community. We have supported these efforts as required but several things have become clearer to all:

- Divisions, within the community, have not entirely receded;
- The Corporation has expended a significant effort to engage the community to ensure the project development process has unfolded in a respectful way that meets the needs of the community.

Landowner Engagement
Frontier worked with the Corporation to identify the landowners within the project area of interest. A total of 60 PIDs were identified within the project area. Of these 10 were government owned and 50 were privately owned.

We evaluated a number of revenue sharing scenarios to equitably distribute landowner revenue and assisted in the development of lease options that were presented to the landowners during personal meetings. Landowners were extremely interested and supportive. Of the 50 privately owned PIDS, 42 agreed to participate in the project. Four landowners were opposed to the project and four landowners have yet to commit.

Figure 1 shows an aerial photo of the project area with the participating and non-participating landowner's PIDs identified. The 1 H and 4 H setbacks, used for determining the compensation packages are also shown. Participating and non-participating landowners are also indicated.

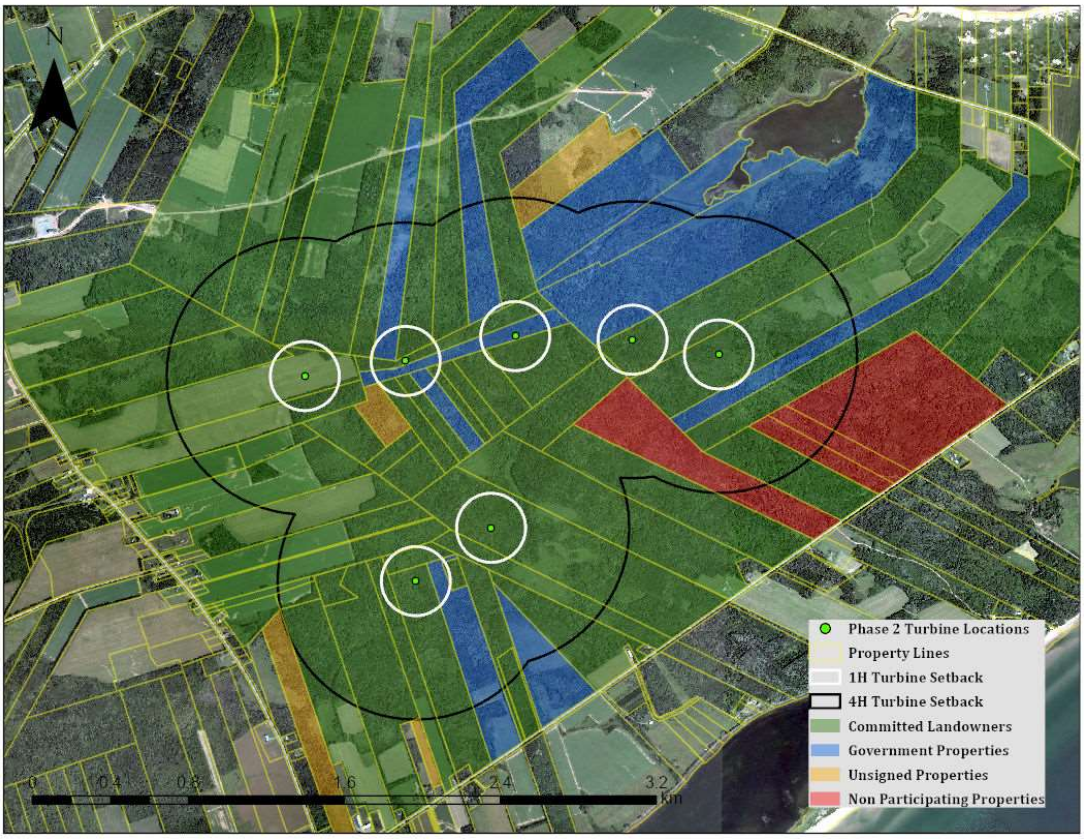

Figure1

Final Wind Plant Layout

When the participating landowner base was completed, the final project area was finalized. This information, as well as the information associated with the specified environmental setbacks (to wetlands, property lines, etc,) and municipal setbacks (distances from shore, non-participating dwellings, local waterways, etc.), was entered into the modelling software, Windfarmer, to optimize the layout of the wind plant. Additional information, including the wind resource grid, limits on noise levels were also programmed into the software. When all the information was loaded, the software optimization routine was initiated, and the modelling software optimized the layout of the wind plant to generate as much electricity as possible without violating any of the specified setbacks or noise levels previously entered. These optimization runs often take 24-48 hours to complete but when they are completed, three important findings are indicated:

1) The turbine locations conform to the specified setbacks, as entered into the model, prior to running the software. This includes the community bylaw requirements that the turbines be 2,000 meters from the shore and 1,000 meters from non-participating dwellings. **Frontier Power Systems confirms that the layout, as summarized in Figure 2 below, is compliant with all provincial, municipal and regulatory setbacks;**

2) The computed annual energy generation is maximized within the range of identified constraints and

3) The final turbine locations are identified, in a completely unbiased manner. This is a particularly important to landowners, all of whom would like to have a wind turbine on or near their land. During initial discussions, landowners were assured that an unbiased

process would be used to finalize the siting of the turbines and we confirm that the output from this modelling exercise is the demonstration of that. **The selection of final turbine locations was determined by the computer model and had no human influence.**

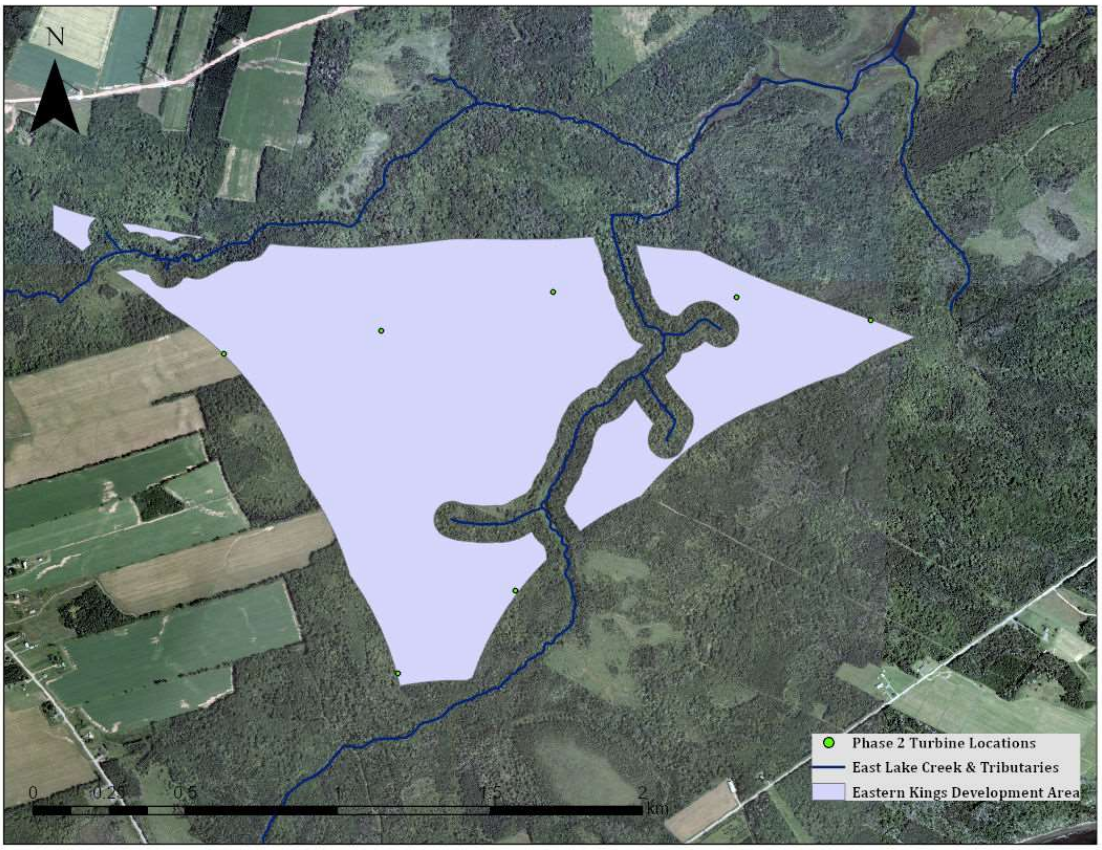

Figure 2

Activities Subsequent to Finalized Layout
With the finalization of the turbine locations, a number of subsequent design activities could be completed.

Wind Turbine Manufacturer Certification of Layout
The locations of the wind turbines, as well as the topographical details of the wind project area and the wind data and wind models developed were passed on to the wind turbine manufacturer so they could complete their independent review of the layout to confirm that the siting of the turbines did not pose any structural or operational problems for any of the turbines, being placed too close to an adjacent turbine for instance, and that the operating life of the turbine can be confirmed. This process is underway. Final results are not released but initial reports are that the layout is satisfactory.

Noise Analysis
Finalizing of the wind turbine locations also meant that the impact of noise from the turbines on adjacent dwellings could be completed. The noise analysis report is attached is Appendix C. Because the wind turbine from Phase 2 are placed significantly further from dwellings than the turbines in the first phase of the project and, because the noise signature from the newer turbines,

is less than the original V90 turbines – a testament to improving technology – noise levels on the dwellings adjacent to the second phase of turbines is less than that of the dwellings affected by Phase 1.

In the graphic within Appendix C, the distinctively smaller noise signal from the newer turbines is evident and the reduced noise impact on the dwelling on the Elmira Road and the East Lake Road to the south are modest. We are confident that noise, from this development, is unlikely to raise concerns in the community.

Flicker Analysis

Similarly, the finalized location of the turbines enables the impact of flicker, on each of the dwellings within the flicker zone, to be documented. The flicker report, attached as Appendix D, shows the influence of flicker on dwellings in proximity of the wind plant. Flicker occurs when the blades of a wind turbine pass between the sun and a receptor causing a shadow on the receptor. This typically occurs for a few minutes per day and is affected by the season. A dwelling located to the west of a wind plant is likely to be affected by the rising sun and a dwelling located to the east is likely to be affected by the setting sun. Dwellings to the north of the wind turbine may be affected more in the winter when the sun is lower on the horizon and those dwellings to the south more affected when the summer when the sun is higher in the sky. The flicker event only occurs for a few minutes, if the sun is shining. The impact of the flicker on Phase 2 is less than it was for the first phase and no reports of concern over flicker have been noted on the first phase. Because the turbines are so far from dwellings, the flicker incidence for the Phase 2 turbines is likely to be minimal.

Radio Interference Study

Impacts from the wind plant on radiocommunication and radar systems also must be considered prior to finalizing layout. Frontier has completed a comprehensive study on the potential impact of the wind plant on systems of this nature. The study was undertaken using guidelines set out by the Radio Advisory Board of Canada along with the Canadian Wind Energy Association. The study concluded that the wind plant is not expected to have any detrimental impacts on radiocommunication systems within the Eastern Kings area. The entire report is attached as Appendix E.

Other Critical Project Related Activities

<u>Civil Works</u>

Geo-Technical Studies

Geotech must be conducted prior to the commencement of many of the final design activities. The geo-technical work is need to confirm the structural bearing capacity of the subsoil within the wind plant where roads and foundations will be installed, to ensure the soil has sufficient capacity to carry the significant loads presented by the wind plant components, particularly the wind turbines. This work, which will commence by late November, must be completed prior to the commencement of construction period, in order to enable the important design work to move forward. One cannot build roads until it is confirmed that the subsoil conditions are suitable to

carry the loads the road must carry. This work will be completed before the end of December.

Road layout

A preliminary road layout is indicated in Figure 3. there will be two entry roads, one from the Elmira Road easterly to the project area and one running north from the East Point Road. Final locations of the roads will be confirmed when the geotechnical studies are completed.

Preliminary Foundation Design

A preliminary foundation design, completed by a certified engineering firm, is attached as Appendix F. The final dimensions, and the eventual specification of the concrete mix and the layout of the rebar will follow the geotechnical studies when the subsoil conditions are confirmed with the Geotechnical studies.

Electrical Works

One of the reasons why this area presented such favorable economics is because the substation required to connect the wind plant to the utility's transmission system was built in 2006. A slight increase in capacity will be required in the transformation equipment but most of the components in the present substation are adequate for the additional wind energy capacity. The routing of the collector lines for the wind plant are also shown in Figure 3

System Impact Assessment

Maritime Electric Company Limited (MECL) is conducting a system impact study to ensure the additional capacity on their system does not present operational or safety risks to their systems. It is expected there will be no major issues, but this should be confirmed by December 2019.

Interconnection Study Dynamics

MECL is also assessing the combined effects of the three operational wind plants in the area will have on their systems operation. Again, no major impacts are expected from these studies but some modifications to safety settings may be required to optimize operation.

Interconnection Study Harmonics

We have subcontract Strum Engineering Associates to conduct a harmonics study on the two wind plans connecting to the Eastern Kings substation, to assess whether the dynamic response of the two separate wind plants can operate in parallel without problems, or whether additional control or electrical infrastructure may be required to ensure stable and optimized operation of the two facilities.

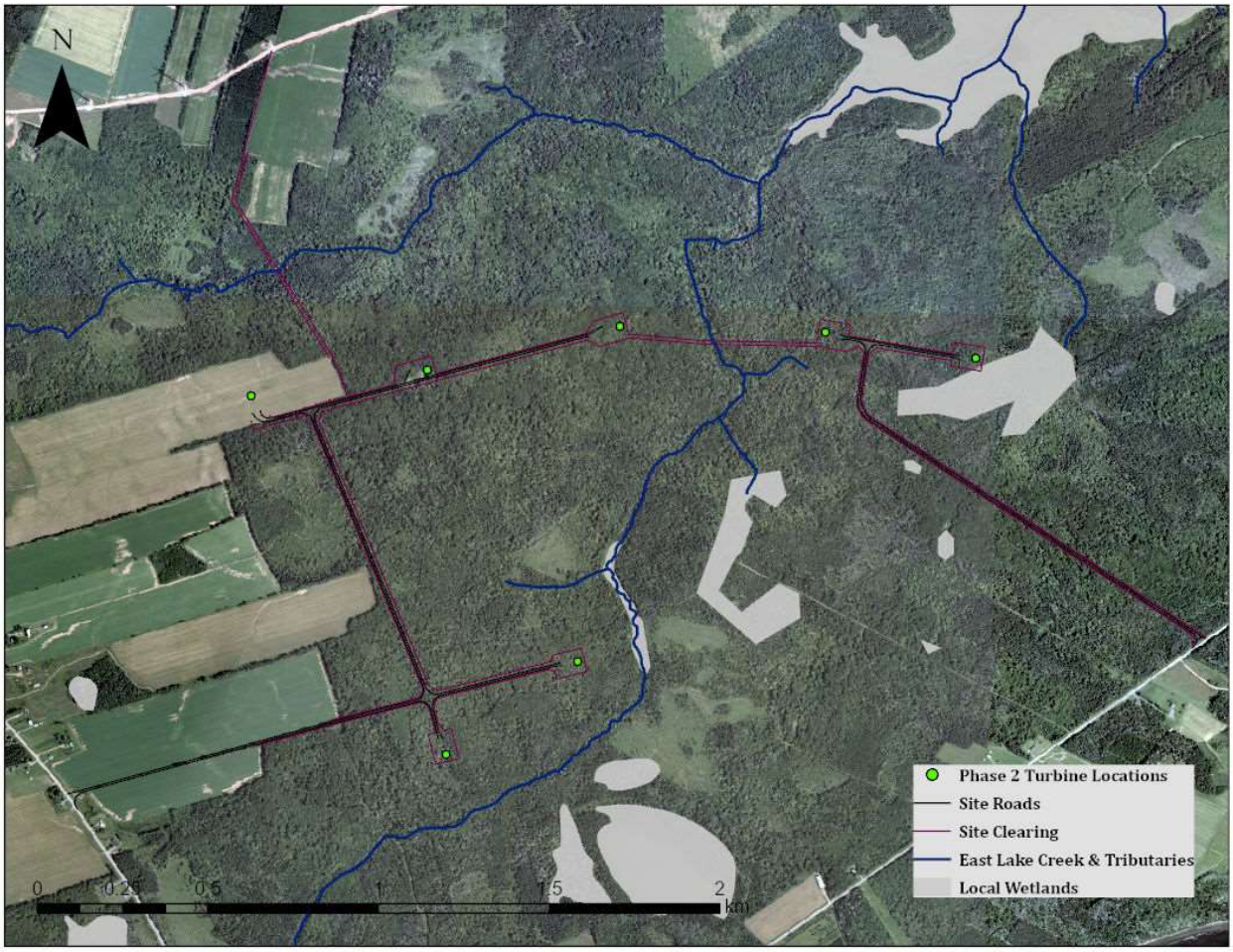
N
Phase 2 Turbine Locations
Site Roads
Site Clearing
East Lake Creek & Tributaries
Local Wetlands
0
0.25
0.5
1
1.5
2
km

Figure 3

Pending activities

The project schedule, as we currently anticipate it to be, is attached as Appendix G.

We are assuming that project approval will be received in order for site clearing to be completed before spring. If project approval is delayed and clearing work is not completed before spring, the nesting period for birds will not be permitted until the summer. This presents the most significant risk to the project schedule as it will result in penalties arising from the delayed component delivery and push the construction period into the fall and winter months when high winds will dramatically increase construction costs.

If the clearing can be completed before nesting season, road construction and foundation construction can commence as soon as the site is accessible in the spring followed by delivery of the turbine components in August and installation immediately thereafter. The wind plant is expected to commence commercial operation in November 2020.

I hope this provides you with a comprehensive summary of the project activities to date. We are excited to help the Corporation continue to move this important project forward.

Best Regards,

Carl Brothers, P.Eng.,
President

Appendices Attached:
Appendix A – Project Description
Appendix B – Turbine Description
Appendix C – Noise analysis
Appendix D – Flicker analysis
Appendix E – -Radio Interference Study
Appendix F – Foundation Design
Appendix G – Project Schedule