Firelands Wind, LLC
Case No. 18-1607-EL-BGN

Application Part 7 of 17

<u>Part 7 includes</u>:

- **Exhibit L** — **Ice Throw Analysis**
- **Exhibit M** — **Complaint Resolution Plan and Sample Notification Letter**
- **Exhibit N** — **Turbine Safety Manuals**
- **Exhibit O** — **Health and Safety Policy and Facility Safety Manual**
- **Exhibit P** — **Emergency Action Plan**
- **Exhibit Q** — **Communication Studies**
- **Exhibit R** — **Raptor Nest Survey and Monitoring Reports**

Date Filed: January 31, 2019

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Firelands Wind, LLC
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Exhibit L
Ice Throw Analysis

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Exhibit L

ICE THROW ANALYSIS

Emerson Creek Wind Farm

Firelands Wind, LLC

Erie, Huron, and Seneca Counties

Ohio

January 2019
EDR Project No. 17119

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1. PROJECT OVERVIEW

Firelands Wind, LLC (the Applicant), a wholly-owned subsidiary of Apex Clean Energy, Inc., is proposing to construct a 298-megawatt (MW) wind energy generation facility with up to 87 turbines and the necessary associated project infrastructure. The project site lies within three counties in north-central Ohio. Lake Erie forms the northern boundary of Erie County. Huron County lies directly south of Erie County with Seneca County to the west. Multiple turbine models are under consideration for the project. Given the nature of this analysis, the largest turbine is modeled here to represent the most conservative potential outcome. The Nordex N149 / 4.5 turbine has a hub height of 125 m and a 149 m rotor diameter.

The Applicant is requesting a Certificate of Environmental Compatibility and Public Need from the Ohio Power Siting Board (OPSB).

2. INTRODUCTION

Ice throw refers to the release of an ice fragment from a rotating turbine blade. Its occurrence is the product of ice accretion on the blades and the appropriate conditions to allow release from the blade. For ice throw to occur, a control breakdown within the turbine is necessary. Modern wind turbines have control systems in place to shut down during significant icing events, mitigating most ice throw. Ice accumulation from atmospheric icing on a turbine blade occurs in two primary ways, precipitation icing and in-cloud icing. Precipitation icing forms as liquid precipitation comes into contact with a turbine blade. During a narrow temperature range precipitation icing may result from wet snow, though this generally occurs on structures at a standstill. In contrast, freezing rain can adhere at a high rate to rotating blades and result in ice with a high density. In-cloud icing forms as supercooled water droplets deposit onto the blade surface. A wider range of accretion and density result from this meteorological occurrence, influenced by the thermodynamics at the surface (Battisti 2015). These formation processes dominate in different regions. For instance, freezing rain is the primary mechanism by which ice accumulates on turbine blades in Southern Ontario, while in-cloud icing is more common in mountainous regions, including British Columbia and mountain ranges in Europe (Biswas et al. 2012, Tammelin 1998).

When ice fragments are released from the blade their trajectory is influenced by the wind strength and direction, along with the mass and size of the fragments, amongst other factors (Battisti 2015). Limited data on the impact of these individual factors exist; however, a limited number of observational studies have been undertaken to quantify ice throw behavior. In a 2-year study in the Swiss Alps, researchers collected 121 ice fragments with a maximum weight of 1.8 kg and a maximum throwing distance of 92 m in the area surrounding a 40-m rotor diameter turbine. 40% of the ice found was recovered within 20 m of the turbine base and over 95% of the fragments were less than 500 g (Cattin et al. 2007). A Swedish study conducted between 2014 and 2016 collected 421 ice fragments, of which 336 have a recorded mass. Fifty percent of these 336 fragments were less than 500 g and 85% less than 1 kg. A maximum throwing distance of 142 m was recorded for a 0.10 kg ice fragment at a wind speed of 8.4 m/s (Poyry 2017).

Potential impacts resulting from ice throw are frequently modeled using a simplified ballistic model (Biswas et al. 2012). This model calculates the average trajectories associated with given wind speed profiles for relatively compact ice fragments. For site and turbine specific analyses, this model is considered valid when used to derive impact statistics on the variation in ice throw impacts with distance and direction, and it has been used in multiple ice throw studies (Bredesen et al. 2017, LeBlanc 2007, Renstrom 2015).

3. METHODS

The OPSB requires applicants to evaluate and describe the site-specific potential for ice throw. Specifically, the applicable regulations set forth at 4906-4-09 of the Ohio Administrative Code (OAC) require an ice throw analysis to:

- Include the probability of ice throw impact at the nearest property boundary and public road, and
- Satisfy safety considerations by demonstrating that the probability of 1 kg of ice landing beyond the statutory property line setback for each turbine location is less than 1% per year.

The methodology, as detailed in the following sections, includes identifying conditions under which ice throw could occur, analyzing trends in local wind conditions, and modeling the trajectory of released ice fragments. Further, the probabilities of impact across a grid surrounding each turbine are calculated. A localized regression model is then applied to the results to approximate probability contours around each turbine.

3.1 – LOCATION AND CLIMATE

The project is a wind turbine generation facility with up to 87 wind turbines spread across Erie, Huron, and Seneca Counties in north-central Ohio. Within the project site, land use is dominated by agriculture interspersed with single family residences. Ohio, in general, experiences a humid continental climate with hot humid summers and cold winters. While ice forms on turbine blades in two primary ways, as previously discussed in Section 2, there are minimal studies on the accretion of ice on turbine blades, and to the author's knowledge none in Ohio. However, beyond Ohio there are records of the occurrence of ice accretion on turbine blades due to freezing rain. This method is thought to be the most common method of ice accretion in nearby Southern Ontario and is more likely to impact low-lying lands such as those of the project site (Biswas et al. 2012, Tammelin 1998). Chagnon & Karl considered historic trends in freezing rain between 1948 and 2000 for the continental U.S. (2003). Shown in Figure 1, this analysis found an average of five freezing rain days a year in north-central Ohio. This is taken as a proxy for the frequency of ice event occurrence on an annual basis at the project site, where each day is considered one icing event. Five days per year is considered a moderate level of icing event occurrence within the existing body of ice throw literature (Morgan 1998). This value is used to describe icing event frequency in ice throw studies undertaken in New York, Ontario, the United Kingdom, and multiple Nordic countries (Taylor et al. 2017, Tammelin 1998, Bredesen 2017). Chagnon & Karl also found that freezing rain occurs in the area between November and April (2003). This six-month range is taken as the time frame during which ice throw could occur.

In addition to the accretion of ice on the turbine blades, conditions must exist for ice fragments to release from the blades. To the author's knowledge no standard methodology exists to determine the number of releases based on physical parameters and meteorological conditions. Instead, a simplified method has been developed in the literature from observations of ice accretion and ice throw at existing turbines (Battisti 2015). This ratio of daily ice accretion to the average mass of fragments found around the turbine results in roughly 200 throws per event for an ice fragment of 0.36 kg. For a 1 kg ice fragment, assuming the same average daily ice accretion, this would result in 75 throws. Given the uncertainty in this calculation, for the purposes of this study, this value was rounded up to 100 throws per event. Together with the events per year, this would result in roughly 500 throws per year of 1 kg ice fragments.

3.2 – SITE WIND PROFILE

The Applicant operates a meteorological tower on-site which measures wind speed and wind direction at multiple heights up to 59 m. Wind speed data measured in two fixed directions are interpolated using component averaging to yield a singular wind vector at 59 m (Lubitz 2006, WMO 2008). These data are then extrapolated using a logarithmic law to the turbine hub height (Gualtieri and Secci 2012).

On-site wind speed and direction data measured between November and April over an 8-year period between 2010 and 2018 are analyzed for trends. Wind speeds are binned in 2.5 m/s intervals ranging from 2.5 to 26.5 m/s. This range is selected to reflect the cut-in and cut-out speeds for the turbine considered in this analysis, 3 and 26 m/s. Wind directions are grouped into 16 equal-sized 22.5° bins from 0° to 360°. Trends in wind speed and direction for the site are shown in Figure 2. Between November and April, winds dominate from the southwest, primarily at 8.5 to 14.5 m/s.

3.3 – BALLISTICS MODEL

A ballistic model, described in Biswas et al., is used to model the three-dimensional trajectory of ice fragments released from turbine blades (2012). The turbine considered for the study is selected from a list of potential turbine models under consideration for the site to provide a conservative analysis given its long blade length and height. The Nordex N149 / 4.5 turbine has a hub height of 125 m and a 149 m rotor diameter.

Roughness length, a function of ground cover, is estimated from the known land use of the site. The frontal area is assumed as 0.02 m^2, which for an ice density expected from ice accretion resulting from freezing rain, 900 kg m^{-3}, could take the dimensions of 0.14 m by 0.14 m by 0.056 m. Model inputs are summarized in Table 1. The model is run for a 1 kg ice fragment released at 360 positions of blade angle, 74 positions of release along the blade length, and 8 wind speeds, the midpoints of each wind speed bin. This results in over 200,000 points of impact around a turbine.

For the purposes of this study, the 1 kg ice fragment is assumed compact, and thus the influence of lift is negligible and is not included in this analysis. Ice shed, or ice falling from the blades while the turbine is not in motion, is not considered here, nor is the influence of localized topography on the wind profile or impact distance.

Table 1. Model input parameters

Variable Name	Numeric Value
Air density (ρ)	1.225 $\frac{kg}{m^3}$
Drag coefficient (C_D)	1
Von Karman constant (k)	0.4
Gravitational acceleration (g)	-9.8 $\frac{m}{s^2}$
Ice fragment mass (M)	1 kg
Roughness length (z_0)	0.20 m
Turbine hub height (h)	125 m
Ice fragment frontal area (A)	0.02 m^2

3.4 – PROBABILITY CALCULATIONS

The total probability of impacts for a given area on an annual basis is the culmination of multiple individual probabilities. The calculation methodology is detailed in Figure 3.

4. RESULTS

The results of the study yield an annual probability impact for every 1 m^2 in a 17,281-hectare grid with a turbine at the center. This can be understood as the probability of a 1 kg ice fragment landing within a given square meter on an annual basis. For ease of interpretation and visualization the results are fit with a local regression model (LOESS) which identifies trends in the probabilities, generating impact probability contours around a turbine. As localized topography is not included, and the model input data is considered consistent across the project site, the impact probability contours are the same for each proposed turbine.

4.1 – IMPACT PROBABILITY

Impact probabilities in impacts/m^2/year for a 1 kg ice fragment are shown in Figure 4. The impact probability is skewed northeast of the origin of the turbine. This is consistent with the dominant winds out of the southwest, shown in Figure 2. Northeast of the turbine, the 1% impact contour approaches 75 m (246 feet) as measured diagonally from the turbine base. In contrast, this distance is 35 m (115 feet) to the south, and 45 m (148 feet) to the west. The statutory property line setbacks for these turbines are 417 m[1], a distance which greatly exceeds the distance of the 1% impact contour.

[1] The Ohio Administrative Code, section 4906-4-08(C)(2)(b), requires that wind turbines "shall be at least one thousand, one hundred, twenty-five feet in horizontal distance from the tip of the turbine's nearest blade at ninety degrees to the property line of the nearest adjacent property, including a state or federal highway, at the time of the certification application." The Nordex N149 / 4.5 turbine has a rotor diameter of 149 m (489 feet). Therefore, the turbine setback to the property line of the nearest adjacent property is 417m (417 meters = [149 meters ÷ 2] + [1125 feet/ 3.281 feet/meter]).

4.2 – IMPACT PROBABILITY IN SATISFACTION OF OPSB SAFETY CONSIDERATIONS

Annual impact probabilities at the nearest non-participating parcel boundary and the nearest public road are shown in Figures 5 and 6, respectively[2]. The nearest non-participating parcel boundary is 418 m (1,372 feet) northeast of the proposed location for Turbine 1. The annual impact probability for a 1 kg ice fragment 418 m northeast of the turbine is less than 0.01% (i.e., less than the OPSB safety consideration of 1% annually). The nearest public road to any proposed turbine, Town Highway 69, is 201 m (659 feet) east of the proposed location for Turbine 70. The annual impact probability for a 1 kg ice fragment 201 m east of the turbine is roughly 0.1% (i.e., less than the OPSB safety consideration of 1% annually).

5. CONCLUSION

In summary, the analysis presented here finds that for a 1 kg fragment of ice an impact probability of 1% extends approximately 75 m, the same length as the 75 m blade length of the turbine modeled. Further, the analysis determines the probabilities at the nearest non-participating property boundary and nearest public road to be less than 0.01% and 0.1%, respectively. The analysis makes conservative assumptions by using the largest proposed turbine across the site, assuming a high fixed rotational velocity at the rotor, and using meteorological records as the wind input. In addition, the 1 kg ice fragment is assumed compact, and thus the influence of lift is negligible and is not included in the analysis. Further, the model assumes the turbine continues to operate as ice accretes on the blades, however safety measures stipulated in the OPSB regulation should prevent such occurrences, decreasing the impact probabilities. While uncertainty exists in the rate of ice accretion and release during icing events given the limited available data on field observations presented in the literature, reasonable assumptions were made in this analysis which are consistent with the methodologies presented in multiple sources. Using multiple moderate assumptions generates conservative impact probabilities which likely overestimate the probabilities of the modeled impacts.

6. REFERENCES

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[2] Due to required regulatory setbacks, the Nordex N149 / 4.5 turbine model is not a feasible model to use at three proposed turbine locations (T67, T70, and T82). If the N149 turbine model is selected as the final turbine model for the project, turbines would not be built at those three locations. Since the Nordex N149 / 4.5 turbine model was used in this analysis, the results overestimate the impact probability for those three turbine locations. Annual impact probabilities were analyzed from the Nordex N149 / 4.5 turbines nearest to a public road and non-participating parcel boundary, regardless of whether the N149 turbine model is feasible at each location.

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Figures

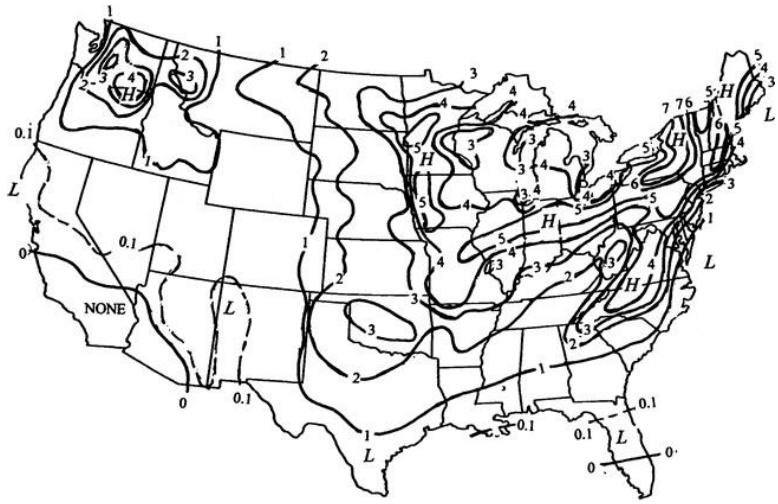


Figure 1. Annual freezing rain days in the U.S. (Chagnon & Karl 2003).

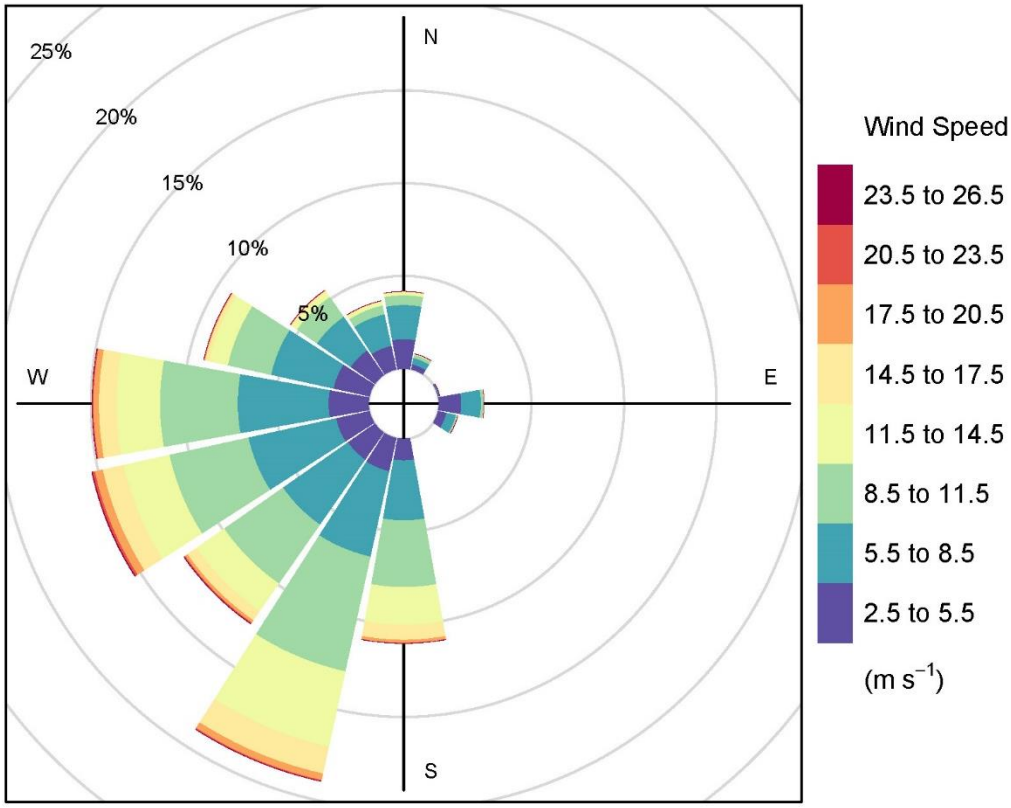


Figure 2. Wind speed and direction between November and April at the project site.

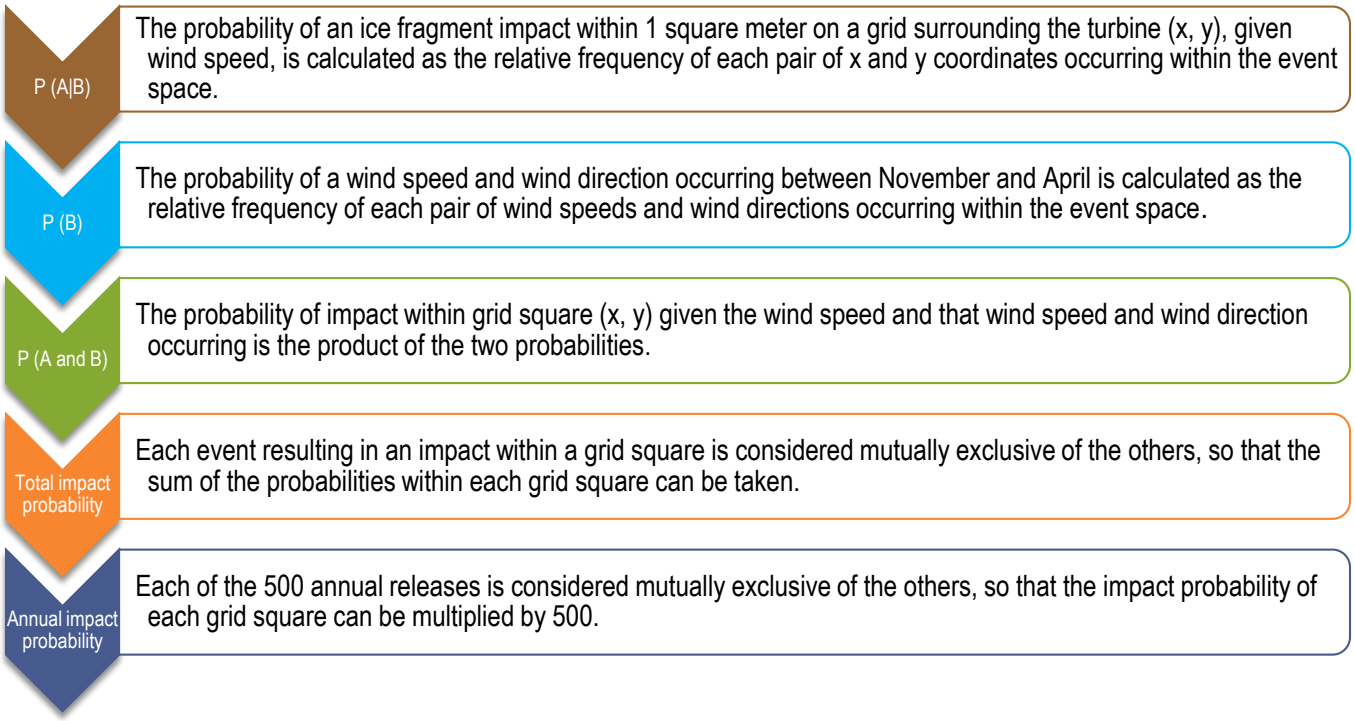
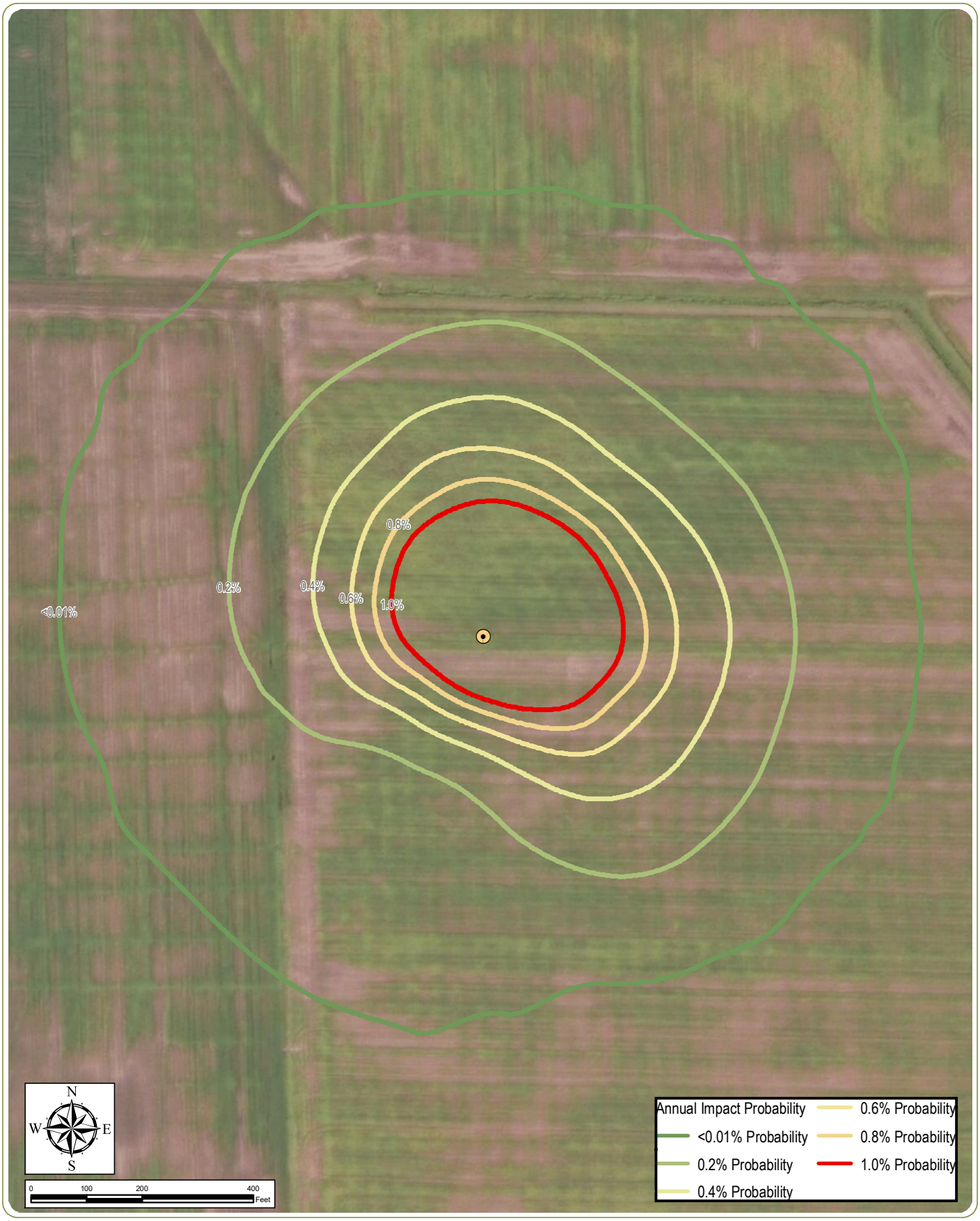


Figure 3. Probability calculation schematic.



Emerson Creek Wind Farm

Erie, Huron, and Seneca Counties, Ohio

Figure 4. Annual Impact Probability

Wind Turbine

Notes: 1. Basemap:ESRI ArcGIS Online "World Imagery" map service. **2.** This map was generated in ArcMap on January 4, 2019. **3.** This is a color graphic. Reproduction in grayscale may misrepresent the data. **4.** Annual impact probability units are impacts/square meter/year. **5.** The 0% probability contour represents a probability approaching zero.

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Emerson Creek Wind Farm

Erie, Huron, and Seneca Counties, Ohio

Figure 5. Annual Impact Probability at the Nearest Nonparticipating Property

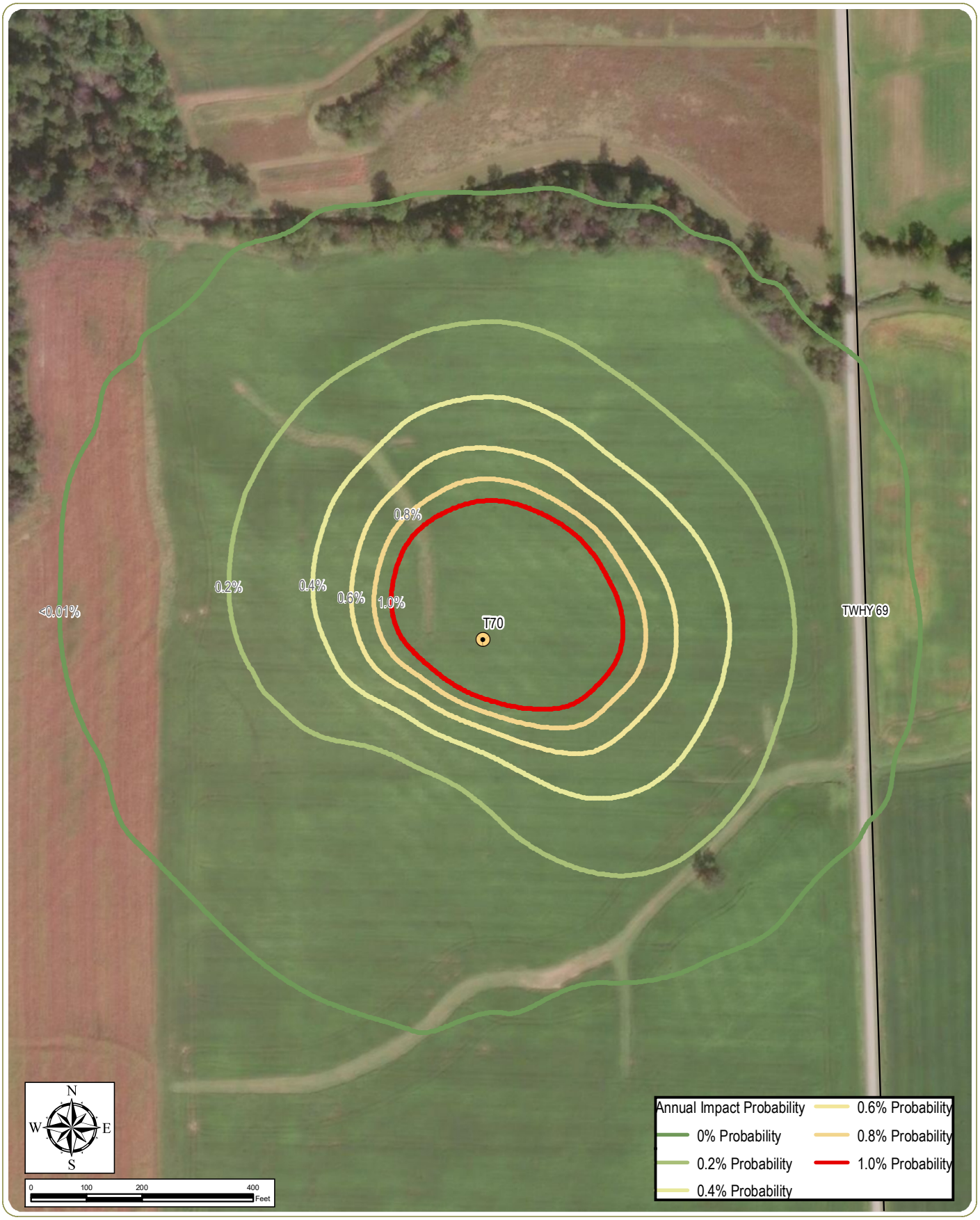
Notes: 1. Basemap:USDA NAIP "2017" orthoimagery map service. **2.** This map was generated in ArcMap on January 4, 2019. **3.** This is a color graphic. Reproduction in grayscale may misrepresent the data. **4.** Annual impact probability units are impacts/square meter/year. **5.** The 0% probability contour represents a probability approaching zero.

Wind Turbine

Public Road

Nonparticipating Property

www.edrdpc.com



Emerson Creek Wind Farm

Erie, Huron, and Seneca Counties. Ohio

Wind Turbine

Public Road

Figure 6. Annual Impact Probability at the Nearest Public Road

Notes: 1. Basemap:ESRI ArcGIS Online "World Imagery" map service. **2.** This map was generated in ArcMap on January 4, 2019. **3.** This is a color graphic. Reproduction in grayscale may misrepresent the data. **4.** Annual impact probability units are impacts/square meter/year. **5.** The 0% probability contour represents a probability approaching zero.

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Exhibit M
Complaint Resolution Plan and Sample Notification Letter

1. **Complaint Resolution Plan**
2. **Sample Notification Letter**

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Exhibit M
Complaint Resolution Plan and Sample Notification Letter

1. Complaint Resolution Plan

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Draft Complaint Resolution Plan

Emerson Creek Wind Farm
Firelands Wind, LLC
Case No. 18-1607-EL-BGN

PURPOSE: To ensure that the Emerson Creek Wind Farm (wind farm) does not make living conditions materially worse for residents of the community by implementing a transparent and effective complaint resolution plan that will address concerns or problems voiced by members of the community.

BACKGROUND: Firelands Wind, LLC (Firelands) is committed to ensuring that an accessible process is in place for community members to voice concerns and for those concerns to be addressed as quickly and effectively as possible.

Maintaining a detailed record of all complaints and the resolutions that follow is an important aspect of the complaint resolution plan.

POLICY: The policy of Firelands is to take all reasonable necessary actions to rectify legitimate interference or disturbances that are a direct result of the wind farm facilities. Where reasonable actions are implemented but do not minimize the interference or disturbance, Firelands will compensate the impacted resident by entering into an agreement with the impacted resident that will provide annual compensation for the life of the wind farm project.

PROCEDURE:

1.) Firelands will establish an 800-phone number prior to the wind farm being commercially operational and will ensure that the phone number is provided to the county commissioners, township trustees, emergency responders, the schools, and public libraries within the project area. A resident who has a complaint about the wind farm may either call the 800# and leave a message 24 hours a day or go to the Operations and Maintenance Facility [or local office ---give address, phone number, e-mail] for the wind farm during regular business hours to register a complaint.

2.) Firelands will be responsible for keeping a logbook, which registers every complaint that is received. The logbook will contain all pertinent information about the person making the complaint, the issues surrounding the complaint and the date that the complaint was received. The logbook will also contain the resolution that Firelands suggests, the date the complaining party agreed to the proposed resolution and the date when the proposed resolution was implemented. Emerson Creek Wind Farm personnel will generate a quarterly report based on the information recorded in the log book about the nature and resolution of all complaints received in that quarter

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and file the report with the Ohio Power Siting Board on the following date of each year (April 15th, July 15th, October. 15th and January 15th).

3.) Residents who register a complaint with Firelands will receive correspondence from the company no later than 48 hours after registering the complaint. The intent of the initial correspondence is to garner more information from the individual's complaint. Within 30 days of the complaint being received, Firelands will initiate reasonable action to resolve the legitimate interference or disturbance that is a direct result of the wind farm facility.

4.) If Firelands and the complaining resident cannot agree to a resolution proposed by Firelands or one negotiated with the complaining resident, Firelands will provide a summary of the complaint and proposed resolution to the complaining resident so that the resident may bring the complaint to the Ohio Power Siting Board.

DRAFT

Exhibit M
Complaint Resolution Plan and Sample Notification Letter

2. Sample Notification Letter

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Attorneys for Firelands Wind, LLC

[DATE]

ADDRESS

Dear Property Owner or Tenant:

Firelands Wind, LLC is preparing to construct the Emerson Creek Wind Farm on leased private land in Groton and Oxford Townships (Erie County) and Lyme, Ridgefield, Sherman, Norwich, and Richmond Townships (Huron County). The wind farm will consist of up to 87 wind turbine generators, along with access roads, electric collection cables, a substation, a laydown yard, an operation and maintenance facility, and meteorological tower(s).

Please be assured that during work on the project described above, all applicable federal, state and local laws, regulations and ordinances will be fully adhered to.

Timeline for Construction of the Project
Construction of the Emerson Creek Wind Farm is expected to begin in the first quarter of 2020 and is scheduled to be in-service by the first quarter of 2021.

Restoration Activities:
Emerson Creek Wind Farm will restore any of your property that is disturbed to the state that it was in prior to the construction activities. Once the work is complete, restoration will begin as soon as weather permits.

Tenants
If you have tenants occupying this parcel, please advise them of this wind energy project.

Questions/Complaints:
Emerson Creek Wind Farm has a complaint resolution process. Should you have any questions concerning this project, please contact _____, at XXX-XXX-XXXX or [email address], who will communicate the information to the appropriate person to address the complaint. If you have a complaint during construction or restoration, your call will be returned in a timely manner. Please be aware that Emerson Creek Wind Farm will make every best effort to resolve issues pertaining to the project. A full description of the complaint process is found as an attachment to this letter.

Sincerely,

_____
On behalf of Firelands Wind, LLC

Exhibit N
Turbine Safety Manuals

1. **Vestas 4MW Platform**
2. **Nordex Safety Manual Class Delta 4000**
3. **Nordex Safety Instruction Class Delta 4000**
4. **Siemens Gamesa Developer Package SG 4.5-145**

CONFIDENTIAL

Firelands Wind, LLC has requested confidential treatment of these documents in accordance with OAC Rule 4906-2-21.

These documents contain confidential trade secret information and, as such, are entitled to confidential treatment under state and/or federal statutes and regulations.

The redacted versions have been filed with the OPSB.

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Exhibit O
Health and Safety Policy and Facility Safety Manual

1. **Occupational Health and Safety Policy**
2. **Facility Safety Manual**

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Exhibit O
Health and Safety Policy and Facility Safety Manual

1. Occupational Health and Safety Policy

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Attorneys for Firelands Wind, LLC

APEX CLEAN ENERGY	Health and Safety Management System	OHSAS 18001
OHS-001	Date: 6/15/17	Occupational Health and Safety Policy

OCCUPATIONAL HEALTH AND SAFETY POLICY

OH&S POLICY

Apex's Occupational Health and Safety Policy is to prevent injury and ill health to our workforce and to continually improve the performance of the OH&S management system, while complying with applicable legal and other requirements.

To this end:

- All supervisors are responsible for ensuring that their employees are trained in approved work procedures to obtain optimal output without accidents and injuries and to ensure that employees follow safe work methods and related regulations.
- All personnel are required to support the OH&S program and make health and safety a part of their daily routine and to ensure that they are following safe work methods.
- All personnel will be held accountable for implementing the OH&S program.
- All relevant laws and regulations are incorporated into our program.

OH&S OBJECTIVE

By continually improving the Occupational Health and Safety Management System, Apex is committed to excellence in health and safety performance that comply consistently with current legislation and regulations, at the best possible cost and delivered on a timely basis.

CORPORATE MISSION

The mission of Apex is to be best-in-class in wind development, construction management, asset management, and operations and maintenance services to the renewable energy industry. We support the empowerment of the workforce and the utilization of a safe workplace—resulting in competitive and innovative quality services for customers—while providing a healthy work environment and creating a positive long-term social, cultural, and economic benefit for the region and its people, employees, customers, suppliers, and stakeholders.

Apex is responsible to the communities in which we work to support and promote a healthy and safe environment. We support the responsible stewardship of human resources in the workplace, where, combined with a continual improvement process, we can make possible sustained economic development and an improved quality of life.

We are committed to "A SAFE AND HEALTHY WORKPLACE"

President and CEO: Date: 6/15/17

Exhibit O
Health and Safety Policy and Facility Safety Manual

2. Facility Safety Manual

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Attorneys for Firelands Wind, LLC

Facility Safety Manual

Date 1/1/2017

Apex Clean Energy, Inc.
310 4th Street NE, Suite 200
Charlottesville, VA 22902

Acknowledgement of Receipt **Safety Manual Compliance Statement** Prepared By: **Safety** Approved by: **VP of Asset Management/Director of Operations**	Version: **1.0** Effective Date: **09/06/15**	APEX CLEAN ENERGY

PLEASE READ, SIGN, and DATE AND RETURN THIS SHEET to the Apex Clean Energy Facility Manager.

This is to acknowledge that I have received a copy of the Apex Clean Energy Facility Safety Manual, which is dated August 6, 2015, and which supersedes all prior documents of its kind. I understand that it contains important information on the general safety policies of the Company and on my privileges and obligations as a person working at this facility.

I will familiarize myself with the material in the Facility Safety Manual and understand that I am governed by its contents. I further understand that the Company may change, rescind or add to any policies, benefits, or practices described in the manual from time to time in its sole and absolute discretion with or without prior notice. I further understand that neither this Facility Safety Manual nor any other communication by a management representative is intended to in any way create a contract of employment, either express or implied.

I agree to keep this document in my possession at my Apex Clean Energy work site at all times, knowing that site personnel may be called into meetings at which revision pages will be issued and must be inserted therein. I further agree that I will not allow any portion of this document to be photocopied by or for anyone without written approval other than Apex Clean Energy site personnel or OSHA or other government personnel. And, I further agree to return the entire document at the time of permanent departure from the facility.

_____ _____

Site Personnel Signature Date

_____ _____

Print Name Company and Site Personnel Number

Facility Safety and Health Policy

Site personnel safety and health have always been a number one priority for Apex Clean Energy. We are committed to providing a safe and healthful work environment for all our site personnel. However, safety and health in the workplace needs to be everyone's responsibility, and is accomplished only through the cooperation of all site personnel.

The Facility Safety Manual

In developing our Facility Safety Manual, Apex Clean Energy utilized the guides to workplace safety and Fed OSHA Compliance that were modeled after publications issued by the California Chamber of Commerce (e.g., Fed OSHA Handbook, Hazard Communication Handbook, SB198 Handbook, Community Right-To-Know, Hazardous Waste Management, Proposition 65 Compliance). Apex Clean Energy will always adhere to the most stringent of safety policies and procedures and regulations. In any case where a safety-related policy, procedure, or regulation of a given state where a project is located is found to be more stringent than in this manual, the most stringent policy or procedure will be enforced.

Every person is issued a copy of the Facility Safety Manual for his/her facility. Each Facility Safety Manual includes the following detailed documentation:

- Illness and Injury Prevention Program (IIPP)
- Fire Prevention Program
- Hazard Communication Program
- Emergency Action Plan specific to the individual Apex Clean Energy facility
- Policies and procedures specific to the individual Apex Clean Energy facility

Our Safety-Related Organization

VP of Asset Management/Director of Operations: Under the authority of the Company CEO, this individual implements and has approval authority over the Company safety programs.

Facility Manager: A Facility Manager is established at each facility to maintain and ensure that our safety programs are adhered to. This person also has clerical responsibilities related to safety at each facility. The Facility Manager is someone from middle or upper management.

Safety Manager: The Safety Manager is established to oversee safety procedures and ensure programs are followed and periodically updated to make certain personnel are safe of any potential harmful situation.

Safety Committees: Facilities with sufficient site personnel bases form safety committees, which comprise the Facility Manager, a Safety Administrator and/or Human Resources representative, and a minimum of five site personnel. Smaller facilities utilize their regular periodic safety meetings as the venue for all site personnel to address safety issues.

Revision History

REVISION NO.	DATE	ORIGINATOR	COMMENTS

Management Responsibilities

1. Legally complying with all applicable State/Federal Occupational Safety Health regulations and complying with all other applicable federal, state, and local regulations covering our activities.
2. Being familiar with all applicable legal regulations related to site personnel safety and notify our affected key site personnel of those regulations, while also facilitating the required training to ensure proper compliance of those regulations.
3. Developing and implementing safety rules designated for the protection of our site personnel and facilities.
4. Demonstrating a positive attitude and set the example for accident prevention.
5. Measuring key site personnel for both production and safety achievement, and to recognize personnel accordingly.
6. Developing company safety policies and activities for implementation, and to provide training when such changes are implemented to ensure understanding and compliance of such policies and activities.
7. Providing Site Personnel a Safety Manual and ensure all Site Personnel understand our company safety policies.
8. Monitoring the overall accident prevention activities.

Facility Manager Responsibilities

1. Being held accountable for all accidents on their facility or under their supervision.
2. Setting the proper example for workers to follow by adhering to company safety policies, procedures, and initiatives.
3. Being responsible at all times to see that work is performed in a safe manner and that safety rules, regulations, and instructions are complied with. Good supervision is the art of getting our people to do safe and productive work.
4. Taking disciplinary action when necessary to enforce safety rules and practices.
5. Being responsible for ensuring that service providers are offering orientation to all their new site personnel/subs on all safety aspects of the job and on the proper method of performing their jobs.
6. Being responsible for the inspection of the work areas and all equipment. Site personnel shall give prompt attention to needed repairs and to safety suggestions and will submit a written list of all deficiencies for correction.
7. Not permitting the use of intoxicating beverages on the job or allowing on the job any site personnel under the influence of alcohol, drugs, or barbiturates.

8. Being responsible for ensuring that all personal injury accidents and property damage accidents are investigated and reported to the office.
9. Determining that needed first-aid, safety equipment, and protective devices are provided wherever necessary.
10. Taking prompt corrective action wherever unsafe conditions and unsafe acts are noted or reported.
11. Seeing that emergency first-aid and hospital phone numbers are readily available at each location.
12. Being aware of emergency action response plans and procedures.

Operations Expectations

1. **Leadership Commitment**: Managers are expected to fully commit to the vision and high ethical standards of the company. By providing a positive, trusting, respectful and disciplined environment for all. Work for the benefit of the company. Managers are expected to maintain a coaching and leading by example environment. Expectations shall be clearly communicated and everyone held accountable. Leaders are good stewards for all the stakeholders (Company, Partners, Employees, Environment, Landowners, Customers and Contractors)
2. **Safety**: Safety will always remain the first priority in the company to protect our most valued resource, our people. Managers shall actively engage and fully support Apex Clean Energy's safety program.
3. **Housekeeping**: Housekeeping is the cornerstone of a highly disciplined and well-managed company. Each site shall have an active housekeeping program at all times.
4. **Procedures and Policies**: Managers shall maintain a procedure driven organization. Managers shall be committed to following, creating and improving policies and procedures for the betterment of the organization. Procedures shall be updated to include lessons learned and continuous improvements. All current Apex Clean Energy Policies shall be posted and referenced on SharePoint.
5. **Regulatory Compliance**: Managers shall proactively manage and support the regulatory compliance process provided by the company.
6. **Open Door Policy**: Managers shall maintain an Open Door Policy and assure this is communicated to all employees. Employees should have assurance that they are working in an environment of fairness and respect for all. Employees should have the opportunity to express grievances and issues without the fear of retaliation.
7. **Disciplined Organization (Procedures, Training and Accountability)**: A Disciplined Organization is defined as an organization that has:
   a) Procedures
   b) Training

c) Accountability

Procedures and Training are essential to ensuring employees are accountable.

8. **Equipment Integrity**: Managers shall assure that equipment is operated and maintained as designed and not compromised.
9. **Management of Change**: Changing the design of any operating system shall require the documented approval of a “competent person” including but not limited to Engineering, the equipment manufacturer and the final approval of the VP OF ASSET MANAGEMENT/DIRECTOR OF OPERATIONS of Operations.

Operations Fundamentals

1. **Annual Budget**: Facility Manager is responsible for providing a reasonable estimated cost to manage the wind farm with supporting documentation and take ownership of the budget process. Facility Managers are responsible to bring forward any budget or funding issues.
2. **Computerized Maintenance Management System**: Compliance with the company CMMS is mandatory. Facility Managers shall take ownership of this system and demonstrate compliance.
3. **Annual and Semi-Annual Scheduled Maintenance**: Facility Managers shall develop an annual scheduled maintenance plan for all equipment and systems. OEM procedures, regulatory compliance and industry best practices shall be the basis for this plan. Reporting monthly progress compared to these plans is mandatory.
4. **Daily Work Schedule**: Facility Managers shall assure their plants follow a disciplined consistent work schedule for both planned and unplanned maintenance.
5. **Managing Availability**: Facility Managers are responsible and accountable for controlled wind farm availability. Assuring funds, spare parts, labor and resources are available is the responsibility of the Facility Manager.
6. **Lubrication Plan**: Facility Managers are responsible to assure their wind farm has and actively managed Lubrication Plan and is a part of the scheduled maintenance program.
7. **Site Audits**: Facility Managers shall implement a site audit and quality assurance program to assure safe operations, equipment integrity and regulatory compliance are maintained.

All site personnel shall give their wholehearted and genuine cooperation to all aspects of safety and health, including compliance with all policies and procedures, and continuously and conscientiously perform their duties in a safe and healthful manner.

All are responsible for inspecting their own workplace, on a daily basis, and for promptly reporting any unsafe or unhealthful condition to their immediate supervisor. If an unsafe or unhealthful condition may be easily corrected by the site personnel without risk of injury, the site personnel may do so and later report such corrective measures to his/her supervisor.

Occupational Safety and Health Administration (OSHA)

1910.38	Emergency Action Plan
1910.39	Fire Prevention Plan
1910.133	Eye and Face protection
1910.135	Head Protection
1910.136	Foot Protection
1910.137	Electrical Protective Equipment
1910.146	Permit Required Confined Space
1910.147	The Control of Hazardous Energy
1910.151	Medical Services and First Aid
1910.176	Material Handling
1910.269	Electrical Power Generation, Transmission, and Distribution
1910 Subpart D	Walking Working Surfaces
1910 Subpart Q	Welding, Cutting, and Brazing
1910.1200	Hazardous Communication
1910.1030	Bloodborne Pathogens
1926.501	Duty to Have Fall Protection

IKEA

IWAY Standard

National Fire Protection Association (NFPA)

NFPA 70E	Standards for Electrical Safety in the Workplace
NFPA 1670	Standards for Technical Rescue

Apex Health and Safety Program

Apex Corporate Health and Safety Program

Apex Forms Index

Apex Operating Procedures

American National Standards Institute (ANSI)

Purpose

To enhance Apex Energy's Environmental, Health, and Safety–related program by bringing together a team with various aspects of wind turbine expertise.

Roles and Responsibilities

Health and Safety Manager

- Provide task force leaders with safety issues that need to be enhanced or changed.
- Provide leadership during safety incidents and/or accidents.
- Provide team with regulatory changes, requirements, and challenges.
- Set goals and timelines for team initiatives.

Safety Commitee Leaders

- Provide expertise of various wind turbine technology.
- Conduct accident investigation, root cause analysis, and corrective actions.
- Being a safety leader.
- Provide solutions and innovation for Environmental, Health, and Safety Program.

Identification of any workplace hazard is the centerpiece of the Company's IIPP. It is critical that site personnel feel free to raise issues regarding workplace health or safety to any member of management, at any time.

An initial inspection shall be conducted by the Facility Manager at the time the IIPP is initially implemented. Thereafter, inspections shall be conducted promptly upon the occurrence of either of the following:

1. Whenever new substances, processes, procedures, or equipment are introduced to the workplace which represent a new workplace hazard.
2. Whenever the Company is made aware of any new or previously unrecognized hazard.
3. Whenever a person raises an issue regarding workplace health or safety. This may be done using the Safety Suggestion/Report of Unsafe Workplace Condition.
4. Whenever any person is involved in any workplace accident, injury, or illness, the site personnel supervisor and the Facility Manager shall fully investigate the accident or injury, which investigation shall include an inspection of the site personnel's work area. (Refer to §H – ACCIDENTS.)

The Facility Manager shall schedule periodic inspections for each of the various work areas of our facility. The frequency of these inspections depends upon the potential health or safety risk to the site personnel; at a minimum, inspections will be performed on the periodic basis that is listed on the facility's IIPP Written Confirmation Form. The Facility Manager shall coordinate and schedule all inspections Periodic inspections and corrective action shall be documented on the Safety Inspection and Correction Report (and maintained by the Facility Manager). Any site personnel may review these forms upon request to the Facility Manager.

Formal periodic safety inspections are part of a mandatory accident prevention program. Safety inspections are a formal review of the work environment conducted to identify physical conditions or site personnel actions that may result in site personnel injuries or illness. Safety inspections are documented on a Safety Inspection and Correction Report. The desired result is to make changes in the work environment or site personnel behavior prior to an accident occurring.

1. The inspection process provides a means to review the work processes performed by the site personnel to determine if the workers are effectively following the safety requirements of their work.
2. Inspections are performed to assist in the effective control of loss producing activity. The more likelihood of a severe injury occurring or probability of a high frequency of minor injuries occurring would require a higher frequency of inspection.
3. When the inspection process identifies substandard items, corrective action must be forthcoming or the credibility of the safety effort may come into question.
4. Inspections allow for the general review of operations to determine the effectiveness of the overall safety system. High numbers of substandard conditions or practices may be symptomatic of the need for management action.

Upon the identification of any workplace hazard, corrective action is generally taken in one or more of the following areas:

- *Physical Redesign of the Work Station:* This is the preferred method, since it is designed to quickly, efficiently, and permanently remove the hazard from the workplace.
- *Training:* Once a safety job procedure has been established, site personnel shall be trained in the safe and proper method to perform the job. This method shall also be used whenever the personnel's supervisor or the Facility Manager determines that common, repetitive, or serious workplace hazards require special site personnel training. Supervisors have the responsibility to monitor site personnel compliance with the training methods provided to the site personnel.
- *Administrative Control:* This method is designed to minimize the amount of time an site personnel is exposed to a workplace hazard, either through job rotation or other means.
- *Safety Equipment and Apparel:* It is vital that site personnel use all appropriate safety equipment, when required by management. Such equipment includes, but is not limited to, hearing protection devices, hardened or steel toed safety shoes, hard hats, safety glasses, or other protective safety equipment or apparel. Not all such equipment or apparel is appropriate for each and every job. All site personnel will receive instructions from their supervisor regarding the safety apparel appropriate to the site personnel's particular job assignments.

Any corrective action shall be taken as quickly as possible. In this regard, special consideration shall be given to the severity of the hazard, the severity of any illness or injury which may have arisen as a result of the hazard, and the potential risk of future illness or injury to site personnel.

Management, working through its project and regional managers, has the overall authority to direct corrective action under this IIPP. No person has any authority to alter, modify, or deviate from any of the Company's established policies, procedures, or practices without the express prior approval of management.

Safety

It is the Company's policy to provide or to have provided by our contractors training in the following areas:

1. General safety training and orientation to all site personnel at the time the IIPP is initially implemented.
2. General safety training and orientation to all new site personnel, prior to the commencement of job assignments.
3. Special training on safe methods to perform particular job assignments.
4. Special training for site personnel who may work with hazardous materials, machinery, or equipment.
5. Special training on the use of any safety equipment or apparel specific to the site personnel job assignments.
6. Special training for site personnel transferred or reassigned to new job assignments which require working with hazardous materials, machinery or equipment.
7. Periodic training on specific hazard topics in the form of company safety meetings (monthly for field personnel or quarterly for office personnel).
8. An explanation of the company's IIPP and general safety policies and procedures.
9. The requirement that all site personnel must immediately report all injuries or illnesses relating to the job.
10. The requirement that site personnel immediately report all workplace hazards to their supervisor and the Facility Manager.
11. The availability of procedures to anonymously report any workplace hazards.
12. A clear statement that no person should attempt to do a job that appears to be unsafe.

General Requirements

Failure of any site personnel to adhere to the following procedures may result in immediate or progressive disciplinary action, up to and including termination of employment and permanent removal from site.

Definition of "Accident": Any unplanned occurrence resulting in illness, injury, or material damage.

Notes

At facilities where there are no "Supervisors" per se, then the Facility Manager assumes the Supervisor's responsibilities listed below.

- Any accident must be reported immediately to an appropriate supervisor by the involved site personnel(s). In turn, the supervisor must immediately notify the Apex Facility Manager, Safety Manager, and VP of Asset Management/Director of Operations.
- An initial Accident Report must be completed and submitted to the Facility Manager on the day of the accident, without regard to nature of illness or injury, need for medical treatment, or extent of material damage.
- All involved site personnel and witnesses must each complete a on the day of the incident. If any site personnel is physically or mentally unable to complete the form at the time of the incident, he will be required to complete the form as soon as he is able to do so. The site personnel's work partner or witness will still be required to complete the form at the time of the incident.
- In the event that an accident results in an injury requiring medical treatment, or causes material damage reasonably estimated by Apex Clean Energy to cost in excess of $500.00 to repair or replace, all site personnel involved in the accident will be required to submit to a post-accident urine drug screen and a breath alcohol test.
- Throughout this document, the terms "he," "his," or "him" are used generically and are not to be construed as being gender-specific.

Accidents Involving Personal Injury

Notifications to the supervisor and Safety Manager John Boyle must be made immediately: (219) 771-9534.

A copy of this IIPP shall be issued to all current and newly hired site personnel. If they have any questions or comments regarding this IIPP, site personnel should feel free to speak to their supervisor, the Facility Manager or any member of management.

It is our Company's policy that there be open, two-way communication between management and site personnel regarding all issues relating to workplace health or safety. The Facility Manager serves as a liaison between site personnel and management by: (1) bringing to the attention of management all identified workplace hazards and recommended corrective action; and, (2) bringing to the attention of site personnel all recognized workplace hazards an appropriate corrective action. The Facility Manager shall periodically issue written bulletins to site personnel pertaining to workplace health and safety issues which may, from time to time, arise.

Site personnel are encouraged to communicate any issues relating to workplace health or safety using any of the means described in this IIPP. No personnel shall suffer any retaliation by reason of the site personnel raising any health or safety issue under the procedures outline in this IIPP. However, nothing contained in this IIPP shall limit, in any way, Apex Clean Energy's right to take disciplinary action, up to and including possible termination, permanent removal from site, for job performance reasons, or for any violation of the Company's policies, procedures, or practices, including any violation of the general safety rules of the Company, or any other reason which the Company may deem appropriate

Safety and health information will be communicated to site personnel through the following methods:

- Site personnel orientations, conducted at the time of hire, will stress the importance of safety and will encourage all personnel to report all hazards to their supervisor or to top management. The "Individual Site personnel Safety Orientation" form shall document this type of training.
- General safety meetings
    a) Site personnel safety meetings will be held at least once a month for non-office site personnel and once per quarter for office site personnel to keep site personnel informed of safety and health matters. Site personnel are required to attend safety meetings as directed by their supervisors.
    b) Site personnel safety meetings will cover specific topics of job safety and as an open forum for site personnel to voice their opinions, suggestions about company safety.
    c) Site personnel safety meetings will be documented on a Safety Meeting form.

Unless an Apex Clean Energy facility holds other regularly scheduled group meetings (e.g., an established safety committee), the site personnel safety meetings will additionally function as the ad hoc committee to review results of inspections, accident and hazard mitigation investigations, and site personnel safety suggestions.

Tailgate: Site Personnel Safety Meetings (Project Facilities)

Tailgate meetings should be referenced as meetings when heavy equipment will be put in use or the need for a special safety meeting is needed before a job is started

Tailgate meetings will be documented on a “Tailgate Meeting” form

A bulletin board will be maintained to inform site personnel on matters of workers’ safety and health. It will include at least the following:

- Emergency telephone numbers
- Workers’ Compensation insurance carrier information
- Workers’ Compensation insurance carrier doctor/clinic information
- OSHA Form #300 “Log & Summary of Occupational Injuries and Illnesses” must be posted no later than February 1st of the year following the year covered by the records and remain posted until April 30th.
- If an OSHA citation is received for a violation of a safety order, it must be posted at or near each place where a violation occurred for a period of three days or until the hazard has been abated.

Responses to Site Personnel or Anonymous Submitters of Safety Suggestions

Facilities with safety committees will post the meeting minutes.

Safety Data Sheets (SDSs) and other hazard communications materials will be readily accessible to all site personnel.

If any site personnel feels uncomfortable in speaking to his or her supervisor, the Facility Manager, or other member of management, regarding any workplace hazard which the site personnel believes exists, the site personnel may use the Site Personnel Safety Suggestion/Report of Unsafe Workplace Condition form for this purpose or may simply submit the perceived hazard, and any recommended corrective action, on a blank piece of paper. In either case, the site personnel need not identify his name, department, or job title. Management, the Facility Manager, and/or the safety committee will review all suggestions and determine if any corrective action is necessary. A written response to the person submitting the suggestion (or to the anonymous submitter) will be posted. If a hazard (imminent danger) has been reported, management will respond to the reported hazard within 24 hours of its receipt.

The orderly and efficient operation of the Company requires that site personnel adhere to rules and proper personal standards of conduct at all times. These rules and standards are necessary to protect the health and safety of all site personnel, to maintain uninterrupted work, and to protect the Company's goodwill and property.

The Company applies corrective discipline in a progressive manner, whereby increasingly severe penalties are given each time the site personnel is disciplined. With the exception of a very serious offense, site personnel are rarely discharged for a first offense.

Minor Offenses

The sequences of penalties for non-life-threatening types of offenses are as follows:

First Offense: Documented Verbal Warning: A documented verbal warning is considered a clear indication that repetition of the offense may eventually call for discipline. The supervisor who delivers the warning should concentrate on helping site personnel figure out ways to prevent the incident from recurring. This becomes part of the site personnel's permanent record.

Second Offense: Written Warning: A written warning is considered much more serious, and becomes a part of the site personnel's permanent record. A copy is given to both the site personnel and the supervisor. This warning should describe the offense and corrective action and/or training required to help prevent the incident from recurring.

Third Offense: Suspension: This is a 3-day suspension from the project. The suspension days are normally executed so that they fall mid-workweek, rather than contiguous with a weekend or holiday. This time period allows both the company and the site personnel time to think over the seriousness of the offense and make a commitment to better behavior or performance in the future. A written record, which is permanently entered into the site personnel's employment file, will describe the offense and corrective action and/or training required to help prevent the incident from recurring; a copy is given to both the site personnel and the supervisor.

Fourth Offense: Discharge: Termination of employment or permanent removal from project. A record will be placed into the site personnel's employment file stating the offense and reason for termination.

Major Offenses

These are dangerous, life threatening types of offenses that may be considered adequate justification for termination of employment or permanent removal from the project for the first offense.

Operating Policies

Introduction

The operation of vehicles is indispensable in conducting company business. The way in which each vehicle is handled will directly affect the losses of the entire company. Fleet losses are potentially one of the most costly types of losses that an operation can incur.

The types of exposures that involve the fleet program include: property damage, bodily injury, fatalities, liability suits, and Worker's Compensation cases.

The claims cost that would result from losses incurred can mount to dollars that will adversely affect our efforts to accomplish company objectives. To help prevent vehicle accidents and the type of loss exposures associated with them, the following guidelines have been established:

Policy

Apex Clean Energy is committed to protecting its employees and the vehicles owned, leased, or rented (hereafter referred to as "company vehicles") by Apex Clean Energy. The success and the safety of our employees depend on the mutual cooperation of each employee who has been entrusted with the responsibility of driving a company vehicle or their own vehicle while conducting company business.

In order to reduce vehicle accidents and to limit the Company's liability because of driver negligence, the company has adopted a Fleet Safety Program.

Responsibility

The management of Apex Clean Energy recognizes its primary responsibility to provide a safe environment for its employees, its clients, and the public. In an effort to meet this responsibility, we have implemented a comprehensive Vehicle Loss Control Program. This program is designed to manage all phases of our fleet safety. The cooperation of all employees is expected and required.

There may come a time when an Apex Clean Energy facility will be visited by a State or Federal OSHA inspector or other type of government inspection agency. This policy has been developed to enable the inspection process to work as smooth and constructive as possible for both the inspector and Apex Clean Energy.

If at any time a person working on site is approached by an OSHA inspector or any other type of government inspection agency, the person will treat this official in a respectful and considerate manner. However, if the official is unescorted by a management figure, it is the site person's responsibility to advise the official that he/she must notify Apex Clean Energy management of his/her presence on site prior to initiating the inspection.

At an Apex Energy facility, the proper person to be notified and to assist the official in the inspection is the Facility Manager. At the Apex Clean Energy headquarters office, the proper persons are the Director of Operations or the VP of Asset Management/Director of Operations

of Asset Management. In the event an appropriate an Apex Clean Energy person is not obtainable, the official will be informed of such and be requested to schedule an appointment or return at a later date.

When the proper Apex Clean Energy person has been notified, that person and the inspector will commence with the investigation. All Apex Clean Energy site personnel are asked to fully cooperate with the inspector and answer all questions to the best of their knowledge. Your cooperation will be greatly appreciated by all parties involved.

Purpose

The purpose of this policy is to inform all Apex Clean Energy personnel that responsibility for the safety of visitors is primarily internal, and to instruct Apex personnel in the procedures for ensuring it.

Policy

In general, it is the responsibility of all Apex Clean Energy site personnel to make every attempt to ensure the safety of all persons who visit our warehouse, shop and/or field sites.

Specifically, it is the responsibility of the Apex Clean Energy site personnel who is escorting a visitor to take steps to ensure the safety of that visitor by personally demonstrating compliance with all Apex Energy Codes of Safe Practice and by respectfully insisting that the visitor does likewise.

Any Apex Clean Energy site personnel who fails to act according to this policy may be subject to disciplinary action up to and including termination, regardless of whether or not an accident or injury occurs as a result of his/her negligence.

Scope

The use of cranes is common in our industry and personnel engaged in lifting shall be trained in lifting operations and the hazards associated.

Policy

A minimum of four competent people must be involved prior to conducting any lift.

Person in Charge, or "PIC":

- Reviews the lift plan (Are required controls in place?)
- Ensures that the lift follows the lift plan.
- Ensures everyone understands their roles & responsibilities.
- Ensures that everyone involved has tested and understands radio communication.
- Ensures people are kept clear of overhead loads, swing areas, areas of potential impact.
- Designates an area for setting down the load.
- Selects or designates the "Signaler."
- Verifies crane and loose lifting gear is within its certification date.

Signalman:

- Shall be trained and certified.
- Shall be the only source of communication with crane operator.
- Ensure the signals are discernible (audible or visual) between Signaler and Crane Operator across the entire lift area.
- Make sure all personnel are clear of lift area prior to starting the lift and during the lift.
- Provide clear signals for starting, moving, and stopping the lift.
- Do not handle any rigging duties during signaling for the lift.

Rigger:

- Works under the direction of the PIC to rig and handle the load.
- Rigger is skilled in performing the following tasks when necessary:
  a. Assembles rigging to lift and move equipment or material.
  b. Makes sure that rigging of wire ropes is in accordance with procedures and job orders
  c. Sets up bracing and attaches load to rigging with grappling tools
  d. Places equipment out of service that would compromise any lift

e. Tilts, tips, and turns suspended loads

f. Maneuvers loads over, under, or around obstacles

g. Uses multi-point suspension techniques

h. Ensures a tag line is included on each load

Crane Pperator:

- Certified in the operation of the crane selected for the lift.
- Responsible for the pre-use inspection of the crane and ensures crane controls are in proper functioning order.
- Only accepts direction from the “Signaler” during a lift.
- Assists with planning the lift.
- Observes rigging operations.

Apex Clean Energy shall select and require employees to use appropriate hand protection at all times. Apex shall base the selection of the appropriate hand protection on an evaluation of the performance characteristics of the hand protection relative to the task(s) to be performed, conditions present, and the hazards and potential hazards identified.

Gloves are often relied upon to prevent cuts, abrasions, burns, and skin contact with chemicals that are capable of causing local or systemic effects following dermal exposure. OSHA is unaware of any gloves that provide protection against all potential hand hazards, and commonly available glove materials provide only limited protection against many chemicals. Therefore, it is important to select the most appropriate glove for a particular application and to determine how long it can be worn, and whether it can be reused.

It is also important to know the performance characteristics of gloves relative to the specific hazard anticipated (e.g. chemical hazards, cut hazards, flame hazards, etc.). These performance characteristics should be assessed by using standard test procedures. Before purchasing gloves, the employer should request documentation from the manufacturer that the gloves meet the appropriate test standard(s) for the hazard(s) anticipated.

Introduction

Apex Clean Energy recognizes that its site personnel have the right and need to know the potential fire hazards that exist in our workplace. It is also essential that we take all necessary precautions to protect our workplace from fire damage, and most importantly, to protect our site personnel from injury or loss of life as a result of a fire. With this policy, Apex Clean Energy intends to ensure the transmission of necessary information to site personnel regarding fire prevention in theworkplace.

This policy is established to:

- Identify potential fire hazards and their proper handling and storage procedures and potential ignition sources.
- Identify housekeeping procedures for controlling the accumulation of flammable and combustible waste materials.
- Identify procedures for ensuring regular and proper maintenance of equipment and installed systems are carried out to prevent accidental ignition of combustible materials.
- Identify persons responsible for maintenance of equipment and systems installed to prevent or control ignition of fires.
- Identify persons responsible for control and accumulation of flammable or combustible waste materials.
- Ensure that site personnel are trained on the elements of this program.

It is the responsibility of the Apex Clean Energy Facility Manager to maintain this Fire Prevention Program. A copy is provided to each site personnel.

Introduction

Apex Clean Energy recognizes that its site personnel have the right and need to know the properties and potential safety and health problems of substances to which they may be exposed in the workplace. With this policy, Apex Clean Energy intends to ensure the transmission of necessary information to site personnel regarding substances in the workplace, pursuant to:

Applicable regulations of other states in which Apex Clean Energy may conduct business.

A hazardous substance is defined as any substance that is a physical hazard or a health hazard. Hazardous substances generally have a Safety Data Sheet (SDS) provided by the manufacturer.

This policy is established to:

- Ensure compliance with the applicable state and federal standard.
- Safeguard the health and safety of site personnel.
- Create guidelines to follow for implementation and maintenance of a hazard communication program.

A written copy of this Hazard Communication Program is provided to each site personnel and is to be made available at all times for all site personnel to review.

Note that hereinafter, the terms “Apex Clean Energy” and “Facility Manager” shall all denote those persons who then hold those or analogous positions at each individual Apex Energy facility.

- The Hazard Communication Program is written and implemented;
- An inventory of all hazardous substances is conducted and that a Hazardous Substances List is developed and kept up to date;
- Safety Data Sheets (“SDS”) are on file for each hazardous substance listed on the Hazardous Substance List;

- All site personnel have access to the SDS's and understand how to use them; All hazardous substances are properly labeled;
- Proposition 65 (California) measures regarding carcinogens and chemicals that pose reproductive hazards are covered;
- Hazards associated with non-routine tasks are properly considered; A site personnel training program is implemented;
- Site personnel in shared work areas and outside contractors are made aware of all hazardous substances to which they may be exposed and that they have the information needed to protect themselves; and
- Outside contractors provide information on all hazardous substances which they bring into the Apex Clean Energy work place.

Responsibilities of All Site Personnel

All site personnel are expected to comply with the provisions of this program and its intent, which is to minimize injuries to site personnel.

It is the responsibility of the site personnel to report to Apex Clean Energy management or their supervisor if he thinks that he has been over-exposed to a hazardous substance.

All site personnel shall give their wholehearted and genuine cooperation to all aspects of safety and health, including compliance with all policies and procedures, and continuously and conscientiously perform their duties in a safe and healthful manner.

Hazardous Substance List

Under the authority of the Director of Plant Operations, the Facility Manager who oversees the purchasing and/or warehouse areas shall be responsible for compiling and maintaining a Hazardous Substance List of all hazardous substances present.

Concurrently, all Managers and Supervisors are responsible for notifying the above named person whenever a hazardous substance is introduced to the workplace via other than the normal purchasing process.

Availability

The Hazardous Substance List will be made readily accessible to all site personnel.

Apex Clean Energy recognizes that site personnel have the right and need to know the procedures to follow in the event of an emergency.

This Emergency Action Plan ("EAP") is maintained to ensure the safety of all site personnel at an Apex Clean Energy facility in the event of a major emergency which could occur within our facility or at the fields in which we work. The EAP includes provisions for:

- Medical emergency
- Building evacuation
- Building utility
- Failure fire
- Earthquake
- Adverse weather
- Hazardous material spill
- Crime/violent behavior/civil disturbance/bomb threat

The EAP is established to:

- Identify alarm and emergency evacuation procedures.
- Identify procedures to be followed by site personnel who remain to operate critical business operations before they evacuate.
- Identify rescue and medical duties for all site personnel following emergency evacuation.
- Identify persons who can be contacted for further information or explanation of duties under this plan.
- Establish training guidelines for site personnel regarding this plan and what they need to know in order to protect themselves.

Purpose

This procedure provides the minimum requirements to be followed when performing work on new or existing electrical systems and should be used in conjunction with Energy Isolation (Lockout/Tagout).

Scope

This Policy applies to all employees and on-site contractors engaged in operations covered by Apex Clean Energy procedures.

These Electrical Safety requirements apply to all operations involving work on or near an energized installation. Only qualified personnel may work on exposed electrical equipment.

Policy

Testing Equipment

1. Rated test equipment shall be checked before and after a test to confirm reliability of such equipment/instrument used for testing, including visual inspection of all associated connections, cables, and cords for free external defects and mechanical damages.
2. All electrical test equipment, including Digital Voltmeters, Ohmmeters, etc., shall be recalibrated annually in accordance with industry best practices.
3. When working on motor control centers (MCC), panel distribution, pad-mount transformer cabinets, and high voltage switchgears, a non-contact voltage proximity meter with warning light indicator and audible alarm that is rated for the voltage being tested shall be used.

Verification of Electrical Isolation When Performing Lockout/Tagout

1. When exposed parts are de-energized and locked and tagged out, only a qualified personshall be permitted to use test equipment on exposed circuit elements and electrical parts of equipment to verify complete de-energization. Thus, verification of “zero state
2. This test also determines if any energized condition exists due to inadvertently inducedvoltage or unrelated voltage back-feed.

For full applicability of Energy Isolation/LOTO procedures, refer to the document “Apex Clean Energy Lockout Procedure.”

De-Energizing Live Parts

Whenever possible and practical, live parts shall be de-energized and locked and tagged out before they can be worked on.

In order to verify that the electrical equipment has been de-energized authorized personnel shall use rated voltage detectors to test each phase conductor.

Applicable permit to work (PTW) to de-energize any electrical equipment, and live parts shall be in accordance with the PTW procedure document.

Examples of impossibility or impracticability include the following situations:

- Re-energizing would introduce additional or increased hazards (such as deactivation of emergency alarm systems, shutdown of hazardous location ventilation equipment, or removal of critical illumination from an area).
- It is not feasible due to equipment design or operational limitations (i.e., testing of electrical circuits that can only be performed when energized or working on circuits that form an integral part of a continuous industrial process that otherwiserequires a complete shutdown in order to permit work on one circuit or piece of equipment).

If the exposed live parts are not de-energized, the following practices shall be used to protect exposed personnel:

- Only qualified persons may perform the work.
- Proper electrical PPE shall be worn.
- When overhead lines are involved, guarding, isolating, or insulating materials shall be used to protect the individual from direct body contact or indirect body contact via tools, equipment, and other conductive materials.
- Sufficient illumination shall be provided.
- When confined spaces such as manholes or vaults are involved, protective shields, barriers, or insulating materials shall be used to avoid inadvertent contact with energized parts.
- All doors, hinged panels, etc. shall be secured to prevent their swinging into personnel.
- Handle conducting materials in contact with the employee appropriately to prevent them from contacting energized parts.
- Use only portable ladders with non-conducting side rails (fiberglass).
- Conductive clothing or jewelry (e.g., watch bands, bracelets, rings, keychains, necklaces, metallic aprons, or metal headgear) shall not be worn.
- Conductive cleaning materials (e.g., steel wool, metallic cloth, silicon carbide, or any conductive liquid solutions) shall not be used in proximity to energized parts unless processes or procedures are put in place and followed to prevent contact with energized parts.

Only load-rated switches, circuit breakers, or other devices specifically designed for the purpose of disconnecting energy sources may be used for opening, reversing, or closing circuits under load conditions.

After a circuit is automatically de-energized by a fuse or circuit breaker, it shall not be re-energized until the equipment and circuit have been identified as safe for energizing. Manual re-closing of circuit breakers or re-energizing circuits by replacing afuse more than once is prohibited until the underlying problem is identified and corrected.

Bypassing protective devices or using a fuse or circuit breaker with a rating too high to protect the circuit or equipment involved is prohibited.

The following procedures shall be followed when working at electrical control panels:

- Proper PPE designed to provide thermal protection from arcing shall be worn (see Protective Equipment section).
- Before operating switches or breakers, confirm all protective panels are closed and fastened.
- To disconnect the electrical power from the equipment, always move the control switch to the off position before moving the main switch to the off position.
- To connect the electrical power, always confirm all control switches are off before engaging the master switch.

When operating the control or main switch, **NEVER STAND IN FRONT** of the electrical panel. Always stand to the side of the panel to operate the switch. Never look at the control panel. Should the panel explode, your eyes and body must not be in a direct line with the explosion.

Protective Equipment

- Thermal protection from electrical arc flash must be used when qualified persons are working on live overhead transmission lines or other exposed live energy. When wearing an arc flash suit, the entire arc flash suit, including the hood's face shield, shall have an arc rating that is suitable for the arc flash exposure.
- An electrical flash suit made of 10 ounce, 50 percent Nomex/50 percent Kevlar brand fabric equipped with hood and polycarbonate view plate shall be worn even if other electrical protective equipment, such as rubber insulating aprons and leather gloves, are worn. The flash suit must conform to current NFPA standards.
- Only rubber insulating protective equipment, such as fiberglass test equipment, insulating blankets, matting, covers, line hoses, gloves, and sleeves that are manufactured and tested per the specifications in the applicable American Society for Testing and Materials (ASTM) standard shall be used.
- Refer to OSHA Standard 29 CFR 1910.137 for additional guidance.

Scope Qualified Electrical Worker (QEW)

Apex employees must receive training in avoiding the electrical hazards associated with working on or near exposed energized parts prior to performing energized electrical work. The following items will be included in the training of Qualified Electrical Workers (QEWs):

- Skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment.
- Performing on-the-job training with a skilled technician
- Skills and techniques necessary to determine the nominal voltage of exposed live parts
- Clearance distances corresponding to the voltage of exposed live parts
- Selection and use of personal protective equipment, tools, insulating and shielding materials and equipment for working on or near energized parts
- Selection and use of proper work practices for working on or near energized parts

QEWs must also be trained in recognizing sign and symptoms of electrical shock, heart fibrillation, electric burns, and proper first aid protocols for these conditions. They must have training in:

- Basic Cardio Pulmonary Resuscitation (CPR)
- Automatic External Defibrillator (AED)
- Contacting emergency personnel

QEW Level I and QEW Level II

QEW Level I

- Persons trained in the safe operation of electrical systems 1,000 volts and below including turbine and substation components. These persons can work on or around energized electrical systems in this voltage range.
- QEW Level I personnel shall not operate any electrical equipment above 1,000 volts.

QEW Level II

- Persons trained in the safe operation of electrical systems, low and high voltages, including turbine and substation components. These persons can work on or around energized electrical systems. Qualified personnel who are permitted to perform energized electrical workon equipment or systems operating at greater than 1,000 volts.
- The scope of work for a QEW Level II person would be the electrical systems associated with a wind turbine and its associated substation.
- QEW Level II may operate high voltage electrical equipment under abnormal conditions. This includes troubleshooting substation relays, breakers, transformers, or any other equipment rated above 1,000 volts.

- Conducting any abnormal switching on equipment is not allowed until adiscussion with the subject matter experts has taken place. At that point,further direction will be given by the subject matter experts.

Observers

During the time that work is being performed on any exposed conductors or exposed parts of equipment connected to high voltage systems, a QEW or any other employee trained in First Aid/CPR/AED, must be in close proximity without impacting either individuals safety at each work location to:

- Act primarily as an observer for the purpose of preventing an accident
- Render immediate assistance in the event of an accident

Training Requirements and Competency Assessment

- See training matrix with applicable course titles

Documentation of Training and Experience

- All training must be documented which is necessary to demonstrate that individuals have met the training and experience requirements for the types ofwork being performed. Experience is measured and documented by use of theJob Performance Measure.

QEWs who have obtained the required training must demonstrate their knowledge prior to performing energized electrical work on both high and lowvoltage circuits.

Prior to contractors performing work within the high voltage infrastructure, their training records must be validated by the Facility Manager to ensure that contracted employees have the documented skills, knowledge, training, and experience to perform the work.

For full applicability of Apex's Qualified Electrical Program and procedure, refer to the document "Apex Clean Energy Lockout Procedure."

Scope and Purpose

The purpose of this document is to ensure that all field employees understand how to safely climb, navigate, and recognize hazards associated with a specific wind turbine.

This document is valid for all turbine types; however, training and testing must be performed for each turbine type employee has contact with.

Prerequisites

This training is performed and monitored by a Site Representative who has been authorized and trained to do so.

This training may only be performed after reviewing:

- Site Orientation
- Safety Manual
- Emergency Action Plan

Once training is complete, the evaluation form at the end of this document should be completed, one per trainee, and submitted Apex Clean Energy along with a completed “Technical Training” form for the group. A copy of these documents should be retained by HR in each employee’s personnel file; original will be maintained by Facility Manager.

Orientation

Climbing Safety

Explain the following:

1. Why hard hats must be worn while in turbine areas or where other overhead hazards exist.
2. Why only issued or authorized fall arrest equipment may be used during tower or nacelle work. Remind site personnel that equipment must not be altered for any reason and must be inspected every time the equipment are used; faulty equipment will not be used at any time.
3. That when personnel are four feet (4’) above the ground or higher, fall arrest equipment must be used and a minimum of one lanyard must be attached to an approved anchor point of the tower, nacelle or hub at all times. Approved scaffolds are exempt.
4. That fall protection equipment which has sustained a fall or impact must be inspected by safety personnel before being reused.
5. Why serviceable lanyards or climbing belts will not be used for other than fall arrest purposes.
6. That unless pre-authorized, Site personnel are not allowed to work at elevated locations exposed to winds over 40 mph (17.8 m/s) over an average time of 10 minutes or based on manufacture recommended. (Authorization must be obtained from Facility Manager)

7. That unless pre-authorized, no climbing or crane work will be permitted on icy or snow covered towers. (Authorization must be obtained from Facility Manager)
8. That no climbing is allowed when lightning is within a 50 mile radius.
9. That hands must be free of any item and shoes must be cleaned of excessive dirt before climbing.
10. Why climbing a turbine only when it is offline is safest unless otherwise trained and authorized by Facility Manager.
11. That unless their presence is absolutely necessary, they should stay clear of turbine runaway areas or any other hazardous zone.
12. That anyone who is observed using the winch line for anything other than their intended purpose will result in immediate removal of the entire crew from the project site and a ban from working on an Apex Clean Energy managed site in the future, pending investigation.
13. Why it is prohibited to climb or work on a turbine **alone**. A second site personnel must be present and at a minimum at the base of the turbine tower. The only exception to working alone is when it can be proven that other procedures can be put in place that demonstrate to be as safe as the current procedure. A work-alone approval shall be provided at the sole discretion of the Facility Manager.

Tower Safety

Explain the following:

1. Tower approach and parking procedures, especially how wind speed, direction, and weather may affect choices. Vehicles shall not be parked directly under the wind turbine while work is being performed above, the vehicle must be a minimum of half the rotor diameter from the turbine and shall be parked with the front of the vehicle facing the wind direction when possible unless this creates a hazard or requires driving off road. The vehicles parking brake will be set and if parked on uneven surfaces the wheels will be choked.
2. The importance of tower safety, especially the importance of 100% Tie off and 3 point contact
3. On calling the OCC and the Site Turbine Shut Down/Startup Training Procedure. Radio or cell phone contact with OCC must happen before and after climb.
4. How to recognize any hazardous energy sources
5. That a ladder safety device (cable grab or glider) must be used to climb tower ladders. If there is not a safety cable in tower Site personnel must lanyard climb maintaining 3 point contact.
6. How to connect and disconnect from ladder safely and effectively. Climbing wet tower ladders is permitted, but only if the tower ladder is equipped with a safety cable from ground to nacelle.

7. The use of the climb assist, if applicable.
8. Never stand or climb below any other climber, only one person allowed on ladder and safety cable at any given time.
9. The requirements of reporting and correcting any loose parts found on a tower or nacelle. The first person to climb the tower ladder should wipe any grease or oil from the ladder.

   Note: Ensure site personnel is able to perform all steps of tower safety.

Climbing Safety

1. Have Site personnel climb ladder to the top of tower, while constantly monitoring employee(s) progress. If any difficulties or safety issues arise, climb test must be aborted.

Nacelle Safety

Explain the following:

1. The importance of nacelle safety, especially regarding hand and foot placement along with any PPE or Tie off requirements which may be applicable
2. Specific danger zones in the nacelle and demonstrate ways to mitigate the hazards
3. Any Lock out-Tag out (LOTO) procedures which may be applicable. Note: Ensure personnel is able to perform all steps of nacelle entry.

Hub Safety

Explain the following:

1. The importance of hub safety, especially the requirements of 100% tie off, if applicable
2. How to perform proper hub LOTO
3. Any specific danger zones in the hub or transition to the hub and demonstrate any ways to mitigate the hazards

   Note: Ensure site personnel is able to perform all steps of hub entry.

Hazard Assessment

Explain the following:

1. Any specific danger zones present in the turbine and how to mitigate hazards
2. How to recognize any hazardous energy sources
3. When and where PPE is to be utilized
4. Applicable communication methods

Scope

This procedure covers the foot protection requirements for site personnel working in all areas at risk for foot injury.

Visitors will generally not need special foot protection, unless there is a perceived risk of exposure in which Apex Clean Energy may require needed protection to alleviate such risk. In this instance this protection will need to be provided by such visitors. Apex Clean Energy will not provide foot protection.

Purpose

The purpose of this procedure is to ensure that site personnel of will have adequate foot protection.

Policy

1. Safety footwear, meeting ANSI requirements shall be worn by all personnel that are assigned to shop and field work, including managers. Open toed shoes are not considered adequate foot protection for those environments.
2. Foot protection is required in all areas where a risk of foot injuries is present.
3. All site personnel that are assigned for fieldwork shall wear safety boots that provide adequate ankle support. Tennis shoes of any kind are not acceptable.
4. All site personnel required to climb towers shall wear safety shoes with a distinct heel of approximately one inch (1”).
5. Footwear shall be of leather material.
6. Provide an oil/slip resistant sole.
7. Provide ankle support.
8. Have steal or composite shank.
9. All site personnel assigned for work in the shop areas shall wear safety shoes.
10. Footwear that is defective or inappropriate to the extent that its ordinary use creates a possibility for foot injuries shall not be worn.

Purpose

This plan has been designed to ensure that our site personnel recognize workplace fall hazards and undertake all necessary safety measures to prevent them. The plan addresses both conventional and non-conventional fall protection measures.

Definitions

Personnel shall be trained in fall prevention practices for the following job duties:

1. Climbing and working on wind turbines
2. Climbing ladders, both fixed and portable
3. Working at elevations above six feet from the ground or other elevated platforms more than six feet above sub levels

Training and Enforcement

All site personnel exposed to fall hazards, will be thoroughly trained in these procedures at the time of their initial job assignments. Additional training will be provided whenever the company:

1. Becomes aware of a new or previously unrecognized hazard; or
2. Develops new or improved safety procedures.

Work operations will be continually monitored to ensure enforcement of these safety policies and procedures. Each site personnel must strictly follow these policies and procedures, except in the extraordinary circumstance when doing so would expose the site personnel to a greater hazard. If site personnel believes that such an extraordinary circumstance exists, the site personnel must first:

1. Notify his or her supervisor of a concern that the safety procedure creates a greater hazard; and
2. Have the concern addressed and resolved before proceeding.

Compliance with these safety rules is a condition of employment. Supervisors and managers have the responsibility to immediately correct any unsafe practice and to discipline site personnel, up to and including termination, for failure to follow any procedure in this program.

Site personnel are also required to immediately notify management of any unsafe or hazardous conditions or practices.

Safety Procedures

Personnel shall be trained and familiar with the selection, inspection and effective use, as described from the manufacturer for the following personal protective equipment:

- Full body harness

- Lanyard
- Rope grab or cable glider
- Lifelines
- A Self Rescue Kit

Personnel responsible for working on wind turbines shall abide by the following procedures:

Climbing

When climbing ladders with rope lifeline, personnel shall wear a full body harness with a rope grab or glider attached to the back D-ring of the harness, limiting fall to no more than six feet. When climbing turbines with steel wire lifelines, a lad safe or glider should be attached to the front D-Ring on harness, with connection point from lifeline to D-Ring being no greater than nine inches. If unable to connect to front D- ring, site personnel may connect to back D-ring with soft stop lanyard as short in length as possible to limit fall potential. Turbines without lifelines shall be ascended and descended while using two lanyards equipped with rebar hooks on one end which will be used to keep the site personnel attached to the ladder at all times.

ONLY ONE PERSON ON A LIFELINE AT A TIME.

Personnel shall keep one hand on the ladder at all times when climbing. For duties requiring site personnel to work while positioned on the ladder, a separate lanyard must be used to secure to the ladder and the back D-ring of the full body harness. The lifeline shall not be used for fall restraint or positioning.

Site personnel shall not carry items in their hands. Hands will be kept free for climbing only.

Nacelle Work

Personnel working in the nacelle of wind turbines shall, at all times, wear a full body harness if there is a fall potential. They must be secured to an acceptable anchorage through means of a lanyard. This lanyard shall be connected to the back D-ring of the full body harness and prevent the site personnel from falling no more than six feet or contacting a lower level from any position. Lanyard will at all times be kept away from moving machinery at all times.

Working in the nacelle of a turbine which has excess oil or grease present, must be performed after the slip hazard is removed.

Working in the nacelle of a turbine where ice is present on the surface where one must stand, is prohibited.

Prior to moving from one level to another, site personnel shall attach a lanyard to prevent a fall of more than six feet or a fall from the adjacent level.

Working in weather that poses a serious risk shall be avoided.

Site personnel are prohibited from climbing or working on a turbine alone. A second site personnel must be present; whose distance is at a minimum the base of the turbine tower. However, this requirement may be modified if a JSA is performed, and it is proven that other procedures can be put in place that demonstrate to be as safe (at a minimum, as the current

procedure). This decision shall be at the Sole Discretion of the project Owners site representative. Site personnel must also be in radio or cell phone contact before and after climb. Working alone, or working on a turbine that they have not been trained on is strictly prohibited.

Ladders (Portable and Non-Turbine)

Personnel required to climb portable or fixed ladders that are not used in conjunction with servicing turbines shall follow the procedures below to prevent injury from falls.

1. Portable ladders shall be used in accordance with manufacturer's recommendations and requirements. Personnel shall be familiar with the selection and use of portable ladders.
2. The use of ladders with broken or missing rungs or steps, broken or split side rails, or other faulty or defective construction is prohibited. When ladders with such defects are discovered they shall be immediately taken out of service and red tagged.
3. Both hands shall be kept free for gripping the side rails while climbing. Items shall not be carried in hands while climbing.
4. Proper placement of the ladder feet is critical; the feet shall be of the non- skid type to prevent slipping. Ladders used outside shall have appropriate feet for the terrain. Portable ladders shall be used at such a pitch that the horizontal distance from the top support to the foot of the ladder is about one-quarter of the working length of the ladder, (the length along the ladder between the foot and the top support). Ladders shall not be used in a horizontal position as platforms, runways or scaffolds.
5. No one shall be permitted to stand and work on the top three rungs or cleats of a ladder unless they are members of the structure that provide a firm handhold or the site personnel is protected by a personal fall protection system.
6. Site personnel shall not climb ladders if they are injured, ill, feeling nauseated or dizzy.

Elevated Platforms and Man-Baskets

Engineering shall be implemented as the first means of correcting fall hazards from elevated platforms or work levels. The procedures below are to be followed when engineering and design cannot be implemented in order to remove the hazards. Personnel working on elevated platforms shall follow the procedures below for reducing the risk of falls from elevated platforms or work levels.

Site personnel will not climb over railings or walls to get on or off platforms. Ladders shall be used or stairwells where applicable. Do not work on elevated platforms, decks or roofs that are not designed to hold personnel or that have loose or damaged surfaces.

Man-baskets shall be designed and approved for lifting personnel. Manbaskets shall be equipped with approved personnel attachment eyes for attaching safety lanyards.

Site personnel shall wear a full body harness and lanyard with soft stop which limits the fall distance to six feet, the lanyard shall be attached to the back D-ring.

Site personnel shall not use the side rails to position themselves higher while working in the manbasket. The manbasket shall be equipped with a brake or other means to prevent it from tipping while occupied. The manbasket shall be equipped with side rails and a toe board.

Site personnel in manbasket shall remain in continuous sight or in communication with the operator.

Site personnel in manbasket must be limited in number, depending on work being performed, man basket design and hoisting equipment limitations.

Have materials and equipment evenly distributed and secured while the man basket is lifted.

Not enter or exit a suspended man basket while it is raised unless the man basket has an installed gate and the man basket is physically secured to the structure to which the site personnel are entering or exiting.

Keep all parts of their body inside the man basket during raising, lowering and positioning unless they are performing the duties of a designated signalperson.

Purpose

This policy is to protect the health and safety of its site personnel's. In the area of tower evacuations this is very important, for any emergency occurring up tower the Tower Rescue Team members will be notified immediately.

Definitions

Serious Injury: An injury to a person that involves any of the following conditions (but not limited to):

1. Chest pain or discomfort
2. Respiratory arrest (not breathing) or breathing difficulties
3. Chest injuries
4. Obvious signs of shock
5. Head, neck, and or spine injuries
6. Loss of or altered levels of consciousness
7. Amputation
8. Electrocution

Life Threatening: An injury to a person that involves any of the following conditions:

1. No pulse: Cardiac arrest (heart attack)
2. Not breathing: Respiratory arrest
3. Uncontrollable bleeding

Equipment Rules

1. The rescue equipment shall be stored in a clean dry place out of the direct sun.
2. The equipment shall be accessible at all times by any site personnel.
3. After every practice drill the equipment shall be inspected and logged and put back in its proper storage place.

If any piece of equipment becomes damaged or unsafe for any reason, turn it in to the safety officer and notify corporate safety officer of equipment replacement.

Typical Rescue Equipment Includes

1. Sked extrication device
2. First aid equipment with universal bloodborne pathogen protection
3. Back board with spyder straps and head immobilization blocks

4. Swiss roll with load line, carabineers, and ascender
5. Two (2) anchor straps

All applicable PPE worn by the rescuer(s) including any for EMS personnel.

Personnel

Ideal rescue teams include four (4) to six (6) rescuers:

1. Trained and qualified site personnel to perform tower rescue
2. CPR/First Aid trained site personnel

There shall be one person at each designated location that is in charge of maintaining all equipment used, which includes but not limited to:

1. Inspecting
2. Cleaning
3. Ordering replacements if necessary

Training

Initial training will be held with all affected site personnel, and after the initial training session there shall be refresher training held no less than every three (3) months. At least once annually, an unscheduled, “live and spontaneous” rescue will be implemented. A practice mannequin is to be used as the injured personnel. Test will be administered and kept in personnel file.

The team leader and or the area manager can schedule the exercise at any time.

Rescue Procedure

1. ALL practice exercises will be done with a mannequin in the backboard/sked. Never practice using a live person.
2. When a serious injury is called into the supervisor or manager, 911 shall be called immediately.
3. All team members shall be notified by the manager/supervisor and directed to the accident site. At that point all team members shall radio back to let the manager know that they have responded.
4. The first responder to the injury site should take a look around the vicinity and take care of any unsafe conditions.
5. Either the first or second responder, preferably an EMT, climbs to access the injury(s) and start any treatment for life threatening emergencies.

Getting the victim ready to go down to the ground (packing them up) consists of:

1. Immobilizing the spine on backboard if determined to be needed by EMTs; if not sure, package victim on backboard/sked
2. Placing the victim in the backboard
3. Placing the victim securely in the sked litter
4. Attaching a tag line to the sked litter that is controlled from the ground

Attachment Points

For lowering victim in harness, attach load line to front D-ring and belay line to back D-ring or for lowering victim in backboard/sked attach load line to sked and belay line to victims front D-ring.

1. Lower the victim to the ground in the safest and smoothest manner possibly using a tag line to keep control of the victim. Someone shall be waiting on the ground for the victim.
2. At this point EMS will be ready to take over care of the victim. Be ready to help in any way that they may need.
3. Within a 4-to-6-hour period the equipment shall be retrieved from the hospital, if applicable, and properly inspected, cleaned, and replaced (if needed).

Conclusion

The team leader and the manager shall make sure that all rescuers are accounted for on debriefed on operation.

Have all the rescuers report to the corporate safety officer, in writing, what happened before the accident (if known) and during the rescue.

The Corporate Safety Officer shall make a follow up investigation and report.

The report shall be forwarded to the vice-president, area managers, and human resources.

Purpose

The purpose of this procedure is to describe methods of identifying confined spaces and actions necessary to protect Apex Clean Energy and subcontractors' workers from uncontrolled hazards when entering confined spaces.

Scope of Application and Validity

This procedure is developed to be able to counteract potential hazard arising from work performed in confined spaces.

The procedure is a guideline that set's up minimum requirements regarding work in confined spaces. A confined space is any space that contains all three of the following:

- Is large enough and so configured that an employee can bodily enter and perform assigned work;
- Has limited or restricted entries and exits which would make escape or rescue difficult (e.g. tank, furnace, vessel, vat, silo, sewer, hopper, bin, vault, boiler, pit, ditch, pipe, well, enclosed generators, enclosed turbines, MSRs, etc.); and
- Is not designed for continuous employee occupancy.

Permit-required confined space means a confined space that has one or more of the following characteristics:

1. Contains or has a potential to contain a hazardous atmosphere;
2. Contains a material that has the potential for engulfing an entrant;
3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section;
4. Contains any other recognized serious safety or health hazard; or
5. Does not have the Confined Space Reclassification Form posted at the entryway.

Lead Authorized Person means the person responsible to ensure the requirements of the confined space permit are maintained for the duration of the work and to ensure the personnel under his/her direction abide by the requirements of the Confined Space Permit. The Lead Authorized Person is also responsible to ensure all of their personnel and their equipment are out of the Confined Space and it is safe to close up, before closing the Confined Space.

Permit-Required Confined Space Program

- Potentially hazardous confined spaces on Apex Clean Energy/U.S. jobsites must be identified and the hazards evaluated before work begins. Some examples of confined spaces are enclosed generators, hubs, yaw section, etc.

- Known hazards, such as a toxic atmosphere or mechanical hazards, within a confined space must be identified and controlled before entry may be made into a confined space.
- A permit must be issued by the Site Manager or his designee before entry can be made.
- Signs shall be posted near permit spaces to notify employees of hazards that may be present and that only authorized personnel may enter the permit spaces.
- Entrance into a confined space by unauthorized employees shall be prevented through such measures as training, posting signs, barriers, etc
- Confined space entrants, attendants, rescue personnel, and supervisors shall be trained to perform respective assignments involving confined spaces.
- Equipment used during a confined space entry must be inspected and suited for the type of environment that may be encountered.
- Procedures and equipment must be available and in good working condition for emergency rescue.
- The owner (or host employer) is responsible for providing contract or subcontract employees with all available information on permit spaces at the jobsite.

Permit Systems

A written permit is required to identify all conditions that must be evaluated to ensure safe entry.

The entry permit:

a) Defines the conditions under which the permit space may be entered.

b) States the reason(s) for entering the space.

c) Identifies the anticipated hazards of the entry.

d) Identifies entries where the individual authorizing the entry does not assume direct charge of the entry.

e) List the eligible attendants.

f) List the eligible entrants.

g) Lists the individuals in charge of the entry.

h) States the length of time for which the permit may remain Valid.

The following information must be included on the permit:

a) Hazards within the permit space.

b) Measures for isolation of the permit space.

c) Measures such as lockout/tag out, equipment and procedures for purging, inserting, ventilating, and flushing used to remove or control potential hazards.

d) Acceptable environmental conditions quantified with regard to the hazards identified in the permit space, which must be maintained during entry.

e) Types of testing and monitoring equipment used to verify acceptable entry conditions.

f) Rescue and other services which would be summoned in case of emergency and the means of communication with those services.

g) The communication procedures and equipment used by authorized entrants and attendants to maintain contact.

h) Personal protective equipment, such as clothing and retrieval lines, provided to ensure employee safety.

i) Signature, together with the name printed or otherwise legible, of the individual authorizing the entry and verifying that all actions and conditions necessary for providing safe entry have been performed.

Rescue Team

The Site Manager or his designee shall ensure availability of a rescue team, in-plant rescue team, an outside rescue team services or site specific arrangements. The following requirements apply:

- The rescue teams must practice making permit space rescues at least once every twelve (12) months, by means of simulated rescue operations in which they remove dummies, mannequins or personnel through representative openings and portals whose size, configuration, and accessibility closely approximate those of the permit spaces from which rescues may be required.
- At least one member of each rescue team must maintain current certification in basic first- aid and cardiopulmonary resuscitation (CPR) skills.
- Designated rescuers from outside rescue teams must be made aware of the hazards which may be encountered when called on to perform rescues within a controlled permit space.
- Non trained personnel shall only attempt non-entry rescue to When a non-permit confined space has been exited because unacceptable conditions have arisen, any subsequent entry may not be made until the space is restored to permit confined space conditions.

Site Staffing

A minimum staffing level of three (3) personnel must be on site when performing confined space work.

- To be described by site Emergency Action Plan (EAP) to facilitate rescue

Guideline for Site Personnel

The purpose of this document is to outline safety procedures when working with an open flame in the nacelle of a wind turbine.

Policy

Occasionally it is necessary to use a propane torch or cutting torch in the nacelle of a wind turbine. If any other method is available to achieve the task, it should be used. Working with an open flame should be avoided unless necessary. Careful planning is essential before working with an open flame in the nacelle due to flammable materials, restrictive spaces and limited escape paths in a wind turbine. In these instances a hot work permit must be filled out.

Preparation

The personnel involved in the work must obtain a Hot Work Permit before starting. The Hot Work Permit will outline items to be considered before, during and after the task is completed. All equipment must be inspected before leaving for the work site and again before the work is begun. This includes gas hoses, flame tips, bottles, regulators, PPE, communication equipment and firefighting equipment. Special escape or rescue equipment may also be required. At the work location one person must remain on fire watch during the time open flame is used. For example, if the task requires two people to complete a third will have to stand by with firefighting equipment. If the work is being completed in the nacelle an additional person will be required for fire watch on the ground. The number of people on fire watch stationed on the ground is wind dependent; however, at least one person is required. No other work will be allowed in the turbine until the open flame work is complete. This will help avoid any obstructions to an escape route from the turbine. All personnel involved must review and understand the procedure to be used and the Hot Work Permit. All standard safety procedures including clearances, Lockout/Tagout and PPE also apply.

If rescue or escape equipment is required is must be in place before starting work. All technicians must be wearing their fall protection equipment to aid in escape or rescue. If any equipment is found to be defective the task must be stopped immediately. The work must not be started again until the defective equipment has been properly repaired or replaced.

Open Flame Work

During work with an open flame the technicians must always be conscious of the proximity of other materials to the heat source. The technician assigned to fire watch must have an extinguisher ready and watch for sparks, hot debris or other signs that the heat is not controlled. If unsafe conditions are observed, the flame must be extinguished and work must stop until the conditions are safe again. Once work is completed, hot material and equipment must be placed in a safe position until cooled. Ensure that all materials are cooled before leaving the work area.

Scope

All employees who have or may have the potential for exposure to blood or other potentially infectious materials in the workplace.

Key Responsibilities

Apex Safety Manager has overall responsibility for developing and implementing the Exposure Control Procedure for all facilities.

Site Manager and Supervisors are responsible for exposure control in their respective areas.

Employees

- Know what tasks they perform that have occupational exposure
- Plan and conduct all operations in accordance with our work practice controls
- Develop good personal hygiene habits

Policy

Employees with reasonable anticipated occupational exposure to bloodborne pathogens shall participate in training before their initial assignment and within one year of any previous training.

Training shall include:

- What bloodborne pathogens are; how to protect themselves from exposure
- Methods of warnings (signs, labels, etc.)
- The OSHA requirements of bloodborne pathogens
- Availability of the Hepatitis B vaccine that have occupational exposure at no cost

Reviews and Update of the Procedure

The procedure is reviewed annually and updated whenever we establish new functional positions within our facility that may involve exposure to biohazards.

Exposure Determination

There are no job classifications in which some or all employees have occupational exposure to bloodborne pathogens that may result from the performance of their routine duties.

Designated employees are trained to render first aid and basic life support. Rendering first aid or basic life support will expose employees to bloodborne pathogens and will require them to adhere to this program.

This exposure determination has been made without regards to the Personal Protective Equipment that may be used by employees.

Purpose

To establish an on-site stretch and flex program to prevent injuries by removing their causes. For ergonomic hazards, this can be achieved through taking steps to eliminate or reduce worker exposure to conditions that lead to cumulative trauma disorders and related injuries.

Ergonomic injury risks include forceful movements, repetitive motions, awkward positions, and lack of rest.

Stretching helps prevent muscle soreness and injury. Tight muscles have a tendency to tear easily causing injury. Muscle groups should also be stretched and strengthened. Balanced and strong stretched muscles are important for joint health.

The stretches described below can prepare the body for everyday work stresses while strengthening the specific muscles that are commonly associated with strains and sprains. Stretching should not exceed 10 minutes. During any of the stretch and flex exercises, you should never bounce or have quick movements; only stretch to a point of mild tension. The stretch and flex program should be conducted prior to any work being performed.

Scope

Conduct stretching prior to performing work and/or as needed throughout the day. Performing this initiative is optimized when done after the site's Plan of the Day (POD) as a group.

Purpose

To establish an area of protection known as a “work zone” to prevent unauthorized personnel from entering into an area of potential danger, injuries caused by dropped objects from heights, and providing a means of controlling the work site. Apex requires employees to protect worker’s health and safety on the job.

Defining the Work Zone

The work zone must be discussed and established during the JSA meeting. During the JSA meeting, the width of the work zone must be assessed. Factors such as wind, type of work, area in which dropped objects are probable, and approach distances shall be considered.

Turbines: It is understood that the topography and design of each wind project is different, therefore, prior to undertaking of any regular maintenance work on the wind turbine. As a general rule when working on or around a wind turbine the work zone will be identified as the area associated as the turbine pad. The work zone can vary depending upon the height at which personnel are working, the size of the turbine pad and the topography of the surrounding area, however; it shall be of sufficient size to protect personnel from hazards.

Setting Up the Work Zone

Work zones shall be created by using orange traffic cones with signs denoting “Danger Authorized Personnel Only.” Setting up a work zone should be accomplished by securing the area. After determining the width of the work zone, cones should be placed along the work space depending on factors such as wind, type of work, area in which dropped objects are probable, and approach distances. They must be set up in a way that prevents un-authorized access by blocking entry to the affected area.

Turbines: Work Zones around turbine shall be created by using orange traffic cones with signs denoting “Danger Authorized Personnel Only.” Setting up a work zone for a wind turbine should be accomplished by securing the turbine pad. After determining the width of the work zones, cones shall be set up in a way that prevents un-authorized access by blocking entry to the affected area. Examples of how to accomplish this are;

- Setting the cones up across the access of the turbine pad
- Setting up the cones to block the access road on each side of the wind turbine.

Crane Operations: When determining the radius of the drop zone, the area must accommodate all equipment used for lifting operations. This area is considered “sterile” and is exclusive to personnel associated with lifting operations.

Substation: While working within or around substations and collection systems, approach boundaries must be adhered to. When determining the work zone, the minimum distance of 10 feet must be utilized.

Maintaining Security of the Work Zone and Drop Zone

Once the work zone/drop zone is set up and secured any personnel needing to enter into the work zone for either work purposes or pass through are required to get clearance from the personnel who have established the drop zone before entering. Communication can be established via communications media, or verbally if possible as long as it's done without sacrificing the integrity of the zone. The security of the zone is to be maintained until the work zone is rescinded.

Exhibit P
Emergency Action Plan

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Firelands Wind, LLC
Emerson Creek Wind Farm

Preliminary

EMERGENCY ACTION PLAN ("EAP")

January 2019

Firelands Wind, LLC **Emerson Creek Wind Project** ***Preliminary*** **Emergency Action Plan**	

INTRODUCTION

Apex Clean Energy US recognizes that site personnel have the right and need to know the procedures to follow in the event of an emergency. With this policy, Apex Clean Energy intends to ensure the transmission of necessary information to site personnel regarding emergency action.

This Emergency Action Plan ("EAP") is maintained to ensure the safety of all site personnel at Apex Clean Energy facility in the event of a **major** emergency which could occur within our facility or at the fields in which we work. The EAP includes provisions for:

1. medical emergency
2. building evacuation
3. building utility failure
4. fire
5. earthquake
6. adverse weather
7. hazardous material spill
8. crime / violent behavior / civil disturbance
9. bomb threat
10. turbine fire

The EAP is established to:

1. Identify alarm and emergency evacuation procedures.
2. Identify procedures to be followed by site personnel who remain to operate critical business operations before they evacuate.
3. Identify rescue and medical duties for all site personnel following emergency evacuation.
4. Identify persons who can be contacted for further information or explanation of duties under this plan.
5. Establish training guidelines for site personnel regarding this plan and what they need to know in order to protect themselves.

Responsibility

The responsibility for maintaining this Plan has been assigned to the **Facility Manager**.
Herein the term "Manager" or "Management" shall mean any Manager or Supervisor, unless otherwise specified.

Site personnel Training

New site personnel will be oriented to the EAP via a copy and review of this document in combination with their orientation to other Apex Clean Energy safety policies.

Beyond new hire orientation, the Facility Manager, or the persons direct supervisor shall be responsible for providing training

A copy of this Emergency Action Plan ("EAP") is provided to each site person and is to be available at all times for all site personnel to review.

PRELIMINARY

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PRELIMINARY

I. APEX CLEAN ENERGY EMERGENCY MANAGEMENT ORGANIZATION

Emergency Organization Chart

EMERGENCY RESPONSE (ALL SITE PERSONNEL)			
First Aid/Survival	**Security**	**Maintenance**	**Communications**
• Evacuation • Emergency supplies • Injury assessment • First aid • Light search and rescue • Vehicles and other heavy equipment for rescue • Light firefighting • Site personnel shelter	• Security personnel to protect lives and property (e.g., equipment lock-up, sentry posting) • Signage, plywood and plastic sheeting, security ribbons, flares • Property damage assessment (physical threats; structural damage)	• Utilities control (building utilities shut-off; field high-voltage procedures) • Hazardous materials decontamination • Debris removal • Auxiliary power equipment	• Operate communications equipment (PA, phones, pagers, field radio) • Compile and relay disaster information as needed (site personnel roll call, injury lists) • Notify outside emergency services • Deploy messengers • Set-up message board

MANAGEMENT GROUP		
Preparation	**Response in an Emergency**	**Business Recovery**
• Develops and maintains overall emergency plan and policies • Reviews recommendations for mitigative measures and training; makes necessary decisions; authorizes use of finances • Ensures site personnel training on policies and procedures • Maintains supply of emergency cash • Develops, maintains and distributes forms, maps, personnel assignment flowcharts, etc.	• Overall coordination and personnel deployment • Declares existence of an emergency based on status and damage assessment reports from teams • Authorizes evacuation when necessary • Interfaces with local utility companies • Interfaces with area Emergency Operation Centers regarding extent of disaster and availability of mass shelter • Responds to media and public inquiries	• Responsible for business recovery • Maintains documentation necessary to resume business • Determines value and estimates damages • Handles insurance claims • Handles loan applications • Interfaces with Apex Clean Energy US corporate entities

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II. LISTS

EMERGENCY CONTACTS LIST

Emergency Medical Services
Seneca County Emergency Medical Services
81 Jefferson Street, Tiffin, Ohio 44883
419-448-1111 or 911

North Central Emergency Medical Services
12513 US Highway 250 N, Milan, Ohio 44846
419-499-2515 or 911

Huron County Emergency Medical Agency
255 Shady Lane Drive, Unit B, Norwalk, Ohio 44857
419-332-7313 or 911

Erie County Emergency Medical Agency
2800 Columbus Avenue, Sandusky, Ohio 44870
419-627-7617

Medical Helicopter
Life Flight
2213 Cherry Street, Toledo, Ohio 43608
1-800-241-5433

Hospital
The Bellevue Hospital
1400 West Main Street
Bellevue, Ohio 44811
Phone: 419-483-4040 or 911

Firelands Regional Medical Center
348 Milan Ave
Norwalk, Ohio 44857
Phone: 419-663-0285 or 911

Fisher-Titus Medical Center
272 Benedict Ave
Norwalk, Ohio 44857
419-668-8101

Police
Seneca County Sheriff's Office
3040 S. State Route 100, Tiffin, Ohio 44883
419-447-3456

Huron County Sheriff's Office

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255 Shady Lane Drive #A, Norwalk, Ohio 44857
419-668-6912

Erie County Sheriff's Office
2800 Columbus Avenue, Sandusky, Ohio 44870
419-625-7951

Ohio State Highway Patrol
Norwalk Patrol Post
300 S Norwalk Road West, Norwalk, Ohio 44857
419-668-3711

Federal Bureau of Investigation (FBI) Sandusky Resident Agency
6100 Columbus Avenue, Sandusky, Ohio 44870
419-626-8383

Occupational Safety and Health Administration (OSHA) Toledo Area Office
420 Madison Avenue, Suite 600, Toledo, Ohio 43604
419-259-7542

PJM
Phone: 866-400-8980

APEX & O&M EMERGENCY CONTACT LIST
Owner's Rep: Apex Asset Management
Address: 310 4th St. NE, Ste 200 Charlottesville, VA 22902
Ph #: (434) 282-2119

VP of Asset Management: David Balfrey
Office Ph #: 434-220-3790
Cell Ph # 312-402-7198

Health and Safety Manager: John Boyle
Office Ph#: 219-771-9534

Director of Operations: Neil James
Office Ph#: 432-599-5515

Communications Manager Dahvi Wilson
Office Ph #: (434)-220-6351
Cell Ph # 434-326-3502

Facility Manager: To Be Determined

Deputy Facility Manager: To Be Determined

Apex Remote Operations Control Center (ROCC)
ROCC Ph# 434-328-2305
Additional Line 844-442-4752

PRELIMINARY

III. EMERGENCY RESPONSE PROCEDURES

CORPORATE EMERGENCY RESPONSE

In an event of a crisis or an emergency at the site, the site manager will have support from the corporate office.

All Wind Farm Emergencies require a response from the corporate office with essential personnel. The essential staff identified includes the Safety Manager, a staff engineer, Operations Directors and possible public relations support. This team is to be used at the discretion of the Site Manager. At any time during a crisis or an emergency, the Site Manager can request additional support or stand down the responding essential corporate personnel. At the corporate level, all emergency responses will be operations driven managed by Vice President of Asset Management.

EMERGENCY COMMUNICATION OPERATIONS

ALL FIELD SITE PERSONNEL SHALL CARRY OR HAVE ACCESS TO COMMUNICATIONS MEDIA, AND IS IDENTIFIED BY HIS/HER SITE PERSONNEL NAME/NUMBER. SUBCONTRACTORS OFTEN CARRY THEIR OWN COMMUNICATIONS MEDIA AND ARE IDENTIFIED BY NAME.

COMMUNICATIONS MEDIA IS USED FOR COMMUNICATION BETWEEN THE SITE PERSONNEL IN THE FIELDS AND THE OFFICE PERSONNEL FOR THE PURPOSES OF:

Field status reports
Power outage coordination
Emergency conditions
Other daily work performance

IT IS ABSOLUTELY NECESSARY THAT EVERYONE HAVE COMMUNICATIONS MEDIA AT ALL TIMES DURING WORKING HOURS.

Power Outage Coordination:

When communications media is being used to coordinate power outages for transformer maintenance or substation maintenance, you will need to know which fields are affected so as to call the appropriate offices for clearance of their field personnel.

Call-In Report a Field Injury:

1. Confirm the severity of injury; are emergency personnel required?
2. Obtain an Accident Report Form and ask all of the questions thereon of the caller. Fill out the form as you talk.
3. Confirm that someone from the field will meet emergency personnel at the appropriate rendezvous point.

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4. Have the completed Accident Report in hand and contact 911 to relay the information.

FIELD INJURY PROCEDURE

A. FIRST PERSON AT THE ACCIDENT SCENE

Upon arriving at the scene of an injury related accident, the first person shall survey the scene (is it safe?), then notify management personnel of the following:

1. Severity of the victim(s) injury.
2. Emergency personnel "are" or "are not" required.

B. ACCIDENT REPORT

If emergency personnel are required, the management personnel shall:

1. Obtain an "Accident Report"
2. Copy information received via radio to the form.
3. Ensure that all areas of the form are completed.
4. Continue to monitor communications for further developments.

C. CALL 911

The designated 911-call person shall:

1. Dial 911 immediately.
2. Relay all of the information on the accident form to the 911 operator.

D. NOTIFY THE FOLLOWING PERSONS

After the call to 911, the designated 911 call person shall notify all of the following personnel (if possible):

1. Plant Manager
2. Remote Operations Control Center - ROCC
3. Director of Plant Operations
4. Safety Officer

MEDICAL EMERGENCY

Medical cases generally fall under the following categories:

1. Minor Medical Case – Medical cases requiring minimal lay care and presenting no disability potential. Frequently do not require professional medical care.

2. Urgent Medical Case – Medical cases that are not life threatening and not likely to result in permanent or serious disability. Require professional medical care.

3. Emergency Medical Case – Those medical cases that, if not properly attended to, could result in serious injury or death. Permanent disability is possible. Require professional medical care.

PROCEDURE:

1. Do not move victim unless safety dictates.
2. Notify "base" of the extent of the medical emergency and your location.

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3. See "Field Injury – Emergency Operations Procedure".
4. If the injury appears to be life threatening, be prepared to give "base" as much information as possible so that they can relay the information to the professional (911) EMT's.
5. See "Accident Report".
6. If the injury is not life threatening or not likely to result in permanent disability, first aid care may be provided by a trained site personnel or the injured person will be transported to our industrial clinic by a supervisor.

LOCATION OF FIRST AID SUPPLIES:

1. Office: Large first aid kit
2. Each vehicle is equipped with an individual first aid kit.

BUILDING EVACUATION

SITE PERSONNEL GUIDELINES:

1. Building evacuation will occur upon instruction by Management personnel. Notification to building site personnel will be made via the telephone or intercom system.
2. Be aware of all marked exits from your area and building. Know the routes from your work area. Marked exit signs are installed in all buildings.
3. Take note of physically handicapped individuals in your area that may need assistance.
4. When instructed to evacuate, walk quickly to the nearest marked exit and ask others to do the same.
   DON'T: Run, lag behind, scream, stop to get personal belongings, smoke, leave any doors open, or return to the building until you are instructed to do so.
5. All personnel should meet at:

   <u>SEE SECTION "V" FOR O & M BUILDING EVACUATION MAP</u>
6. If it is safe, remain in this location until roll call has been taken by a Manager. Do not leave premises until accounted for and given permission to do so by Management. Valuable time could be wasted searching for personnel that have not followed correct procedures.
7. Keep fire lanes, hydrants and walkways clear for emergency crews and equipment.
8. During emergency situation, only personnel authorized by Management will be allowed in the building to perform such responsibilities as shutting down power, potentially hazardous equipment, heat sources, gases, machine and other electrical equipment.
9. Should you become trapped in a building, **DO NOT PANIC:**
   a. If a window is available, place an article of clothing outside the window as a marker for rescue crews.
   b. If there is no window, tap on the wall and shout at regular intervals to alert emergency crews.

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BUILDING UTILITY FAILURE

SITE PERSONNEL GUIDELINES:
In the event of a major utility outage in an Apex Clean Energy US building during working hours, notify a member of Management.

If there is potential danger to the building occupants or if the utility failure occurs after hours, on the weekend, or a holiday, notify a member of Management.

Do not evacuate a building unless directed to do so by Management, the policy or fire department.

Do not return to an evacuated building unless directed to do so by Management personnel.

Electrical / Light Failure
It is advisable to have a flashlight nearby for emergencies.

Plumbing Failure / Flooding / Water Leak:
1. Cease using all electrical equipment.
2. Notify a Manager immediately.
3. Evacuate the immediate area to prevent injuries.

Natural Gas Leak:
1. Cease all operations.
2. Notify a Manager immediately.
3. Evacuate the area immediately.

****DO NOT SWITCH LIGHTS ON / OFF OR UNPLUG ANY ELECTRICAL EQUIPMENT – ELECTRICAL ARCING COULD TRIGGER AN EXPLOSION. ****

Ventilation Problems:
1. If smoke or odors come from the ventilation system, immediately notify a Manager.
2. If necessary, cease all operations and vacate the area.

****DO NOT RETURN TO AN EVACUATED AREA UNLESS THE "ALL CLEAR" SIGN IS GIVEN BY A MANAGER.****

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FIRE

SITE PERSONNEL GUIDELINES:

1. Field personnel should notify Facility Manager to report the fire emergency. Someone at "Operations Building" will notify the Fire department. Office / Warehouse personnel should immediately dial "911" in the event of a fire.
2. Know the location of fire extinguishers, fire exits, and alarm systems in your area and know how to use them. If a minor fire can be controlled, site personnel may attempt to extinguish the fire using the fire extinguishers or other sources, such as water from a hose – only after "911" has been called.
3. A complete evacuation of the entire building or area will be performed in any fire emergency. All site personnel should proceed to the nearest exit. Last ones to exit should close doors behind them.
4. Seek out any handicapped personnel in the area and provide assistance when exiting.
5. Managers or site personnel will assist in the evacuation and will meet the Fire Department to direct them to the proper location. Once the Fire Department has arrived, the responding incident commander will take charge of all rescue operations and suppression activities.

   Office / Warehouse Muster Point
   O&M Front parking lot
6. Keep clear of fire lanes, hydrants, and walkways for emergency crews and vehicles.
7. Personnel should remain at this location until accounted for by Management. Do not leave premises until accounted for and given permission to do so. Valuable time could be wasted searching for personnel who have not followed correct procedures.
8. Only members of Management can declare the state of emergency over and give permission to re-enter.

Should you become trapped in a building during a fire:

a. If a window is available, place an article of clothing (shirt, coat, etc.) outside the window for the rescue crews.

b. If there is no window, stay near the floor where the air will be less toxic. Shout at regular intervals to alert emergency crews of your location. **DO NOT PANIC.**

c. If the door is warm, do not open it. If smoke is entering the room through cracks around the door, stuff something in the cracks to slow the flow.

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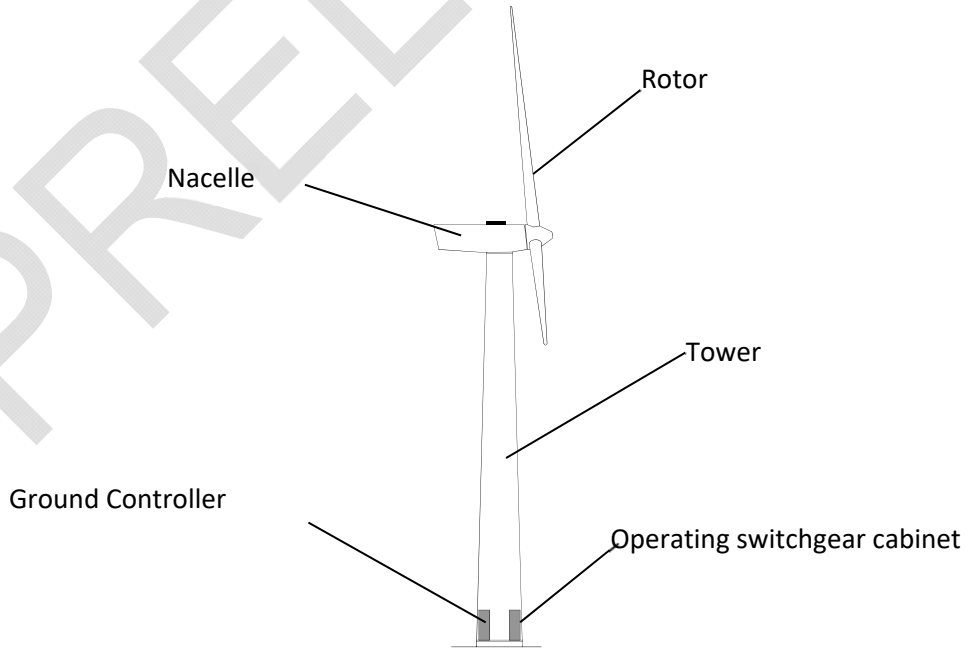
Turbine Fire

1. Dial 911
2. Notify Facility Manager and Remote Operations Control Center (ROCC)
3. Verify turbine affected is isolated from the electrical system.
4. Establish a sterile zone (approximately 100 ft) around the base of the turbine.
5. Allow fire debris to fall freely within controlled area.
6. Watch for fire debris to go beyond the controlled area.
7. Fire Department will manage the fire scene, site personnel will stand by to assist with isolation of additional turbines and electrical equipment if requested by the Fire Department Incident Commander.

Brush Fire

1. Dial 911
2. Notify Facility Manager and Remote Operations Control Center
3. Advise all site employees of the fire emergency and gather team at the muster location.
4. Work with local responders to address fire encroachment near the facility or turbines
5. In the event firefighting teams utilize helicopter or fixed wing aircraft near wind farm the Fire Department Incident Commander may request to pause the turbines for safety.
6. Fire Department will manage the fire scene, site personnel will stand by to assist with isolation of additional turbines and electrical equipment if requested by the Fire Department Incident Commander.
7. All safety requests from the Incident Commander shall be followed by the site team.

Acciona Wind Power 3000 Wind turbine



PRELIMINARY

Internal Sources of Danger

Internal sources of danger	Place	Causes
Fire or arc flash	Wind turbine base wiring	· Short circuit in wiring
	Ground controller	· Short circuit
	Transformer	· Short circuit in wiring
	Tower	· Short circuit in wiring
Fire	Nacelle	· Short circuit in wiring · Short circuit in switchboard · Short circuit in generator · Rotor rotation with brake on
Explosion	Ground controller	· Capacitor explosion
	Operating switchgear cabinet	· Short circuit

External Sources of Danger

External sources of danger	Place	Causes
Fire	Wind turbine surrounding area	· Grass fire not caused by farm's activity · Work with cutting or abrasive tools · Short circuit in maintenance tasks
Lightning	Outdoor part of wind turbine	· Electrical storm
Injured person	Wind turbine surrounding area	· Various causes

PRELIMINARY

EARTHQUAKE (OFFICE / WAREHOUSE)

GUIDELINES FOR OFFICE / WAREHOUSE / SHOP PERSONNEL:

1. Stay in the building. Many injuries occur while people run through the building to the outside. It is possible to be hit by flying objects, falling plaster or other debris.
2. Assist any handicapped persons in the area and find a safe place for them.
3. Drop, cover, and hold. Try to take cover under a table or other sturdy furniture. Kneel, sit, or stay close to the floor. Hold onto furniture legs for balance. Be prepared to move with your cover. Face away from windows.
4. Doorways may not be the safest location for protection. Violent motion could cause doors to slam against your body, crush your fingers, or inflict other serious injuries. More importantly, you could become a target for flying objects.
5. You could kneel, sit, or stay close to the floor, next to a structurally sound interior wall. Place your hands on the floor for balance, as the ground may move violently for several minutes.
6. Try to avoid airborne objects. Move away from overhead fixtures, windows, bookcases, file cabinets, etc.
7. If you are outside, go to a clear area away from buildings, trees, and power lines.
8. Keep calm. Do not move. Wait for emergency instructions from Management.

IMMEDIATELY AFTER THE QUAKE:

1. Be prepared for aftershocks. Although usually less intense than the main quake, they can cause further structural damage.
2. Gas leaks might be present. Do not use lanterns, torches, lighted cigarettes, or open flames.
3. Open windows, if possible, to ventilate the building. Watch out for broken glass.
4. If fire is caused by the earthquake, implement the fire procedures.
5. If evacuation is ordered:
   a. Evacuate as instructed.
   b. Provide assistance to any handicapped personnel.
   c. Beware of falling debris and electrical wires as you exit.
   d. Personnel should meet at:

   SEE SECTION "V" FOR O & M BUILDING EVACUATION MAP
6. If it is safe, remain in this location until accounted for by Management or Communications personnel. Do not leave premises until accounted for and given permission to do so. Valuable time could be wasted searching for personnel that have not followed correct procedures.
7. Keep fire lanes, hydrants, and walkways clear for emergency crews and equipment.
8. Only members of Management can declare the state of emergency over and give permission to re-enter.

PRELIMINARY

Should you become trapped in building, DO NOT PANIC:

a. If window is available, place an article of clothing outside the window as a marker for rescue crews.

b. If there is no window, tap on the wall and shout at regular intervals to alert emergency crews.

LOCATION OF FIRST AID SUPPLIES:

1. Shop: At eye wash station by double doors.

EARTHQUAKE (FIELD) GUIDELINES

FOR FIELD SITE PERSONNEL

DURING AN EARTHQUAKE:

1. Move to an open area away from turbine towers, power lines, and poles.
2. Get low to the ground and balance yourself. The ground may move violently for several minutes.
3. If there is no open area, seek available shelter (such as your vehicle) to avoid falling objects. Stay in your vehicle if electrical wires fall on it. Wait for professional help – wires may still be live and you could be electrocuted if you stepped outside.

IMMEDIATELY AFTER THE EARTHQUAKE:

1. Be prepared for aftershocks. Although usually less intense than the main quake, they can cause further damage.
2. Use any communication means necessary to notify your supervisor of your status and position.
3. If you feel safe in doing so, attempt to evacuate to your rendezvous location.

SEE SECTION "V" FOR WIND FARM EVACUATION MAP

4. Remain at your designated rendezvous location until you have answered to a roll call by a Manager. Do not leave the premises until accounted for and given permission to do by a Manager. Valuable time could be wasted searching for personnel that have not followed correct procedures.
5. You may be directed to return to the Apex Clean Energy US office location. This does not give you permission to go elsewhere.
6. Only members of Management can declare the state of emergency over and give permission to leave the designated rendezvous location or the Apex Clean Energy US shelter area.

LOCATION OF FIRST AID SUPPLIES:

1. Service trucks

PRELIMINARY

ADVERSE WEATHER

SITE PERSONNEL GUIDELINES:

A serious weather "watch" indicates that conditions for bad weather exist. During a "watch" status, maintain a normal routine. Management will monitor available information report. A "warning" is more serious. The following is a list of emergency situations, definitions of these conditions, and general emergency instructions which should be followed:

Severe Thunderstorms:

Winds exceeding 55 miles per hour and heavy lightning and thunder. Lightning is the greatest danger during a severe thunderstorm.

Special Precautions:

1. Remain indoors.
2. Stay away from open doors, windows, metal pipes, or electrical appliances.
3. Prepare for flash flooding.
4. Follow Management instructions.

Working in Adverse Weather – Lightning

In addition to the General Safety Policy and General Safety Rules of the IIPP, the following shall apply:

1. Morning safety meetings shall cover forecasted weather conditions for the day.
2. Lightning warnings shall reflect a fifty (50) mile radius as an initial advisement to technicians that a storm is in the area, and a thirty (30) mile radius will indicate an immediate weather stand down. Technicians will be required to immediately stop working and head to their vehicles until the storm passes.
3. Stand down directions will be clear. The message "STOP WORK- weather stand down is in effect" shall be communicated when a storm reaches a thirty (30) mile radius from the turbine.
4. Site supervision will confirm all employees are accounted for and down tower. At that time they will be directed to return to the shop or stay in the field until the lightning passes.
5. Lines of communications shall include radios as a primary source.

This policy effects all locations and the procedures are consistent throughout each wind farm.
The seemingly random nature of thunderstorms cannot guarantee the individual or group absolute protection from lightning strikes, however, being aware of, and following lightning safety guidelines can greatly reduce the risk of injury or death

General Information:

During late spring to the summer months, in certain parts of the country, thunderstorms are common. Because of this, all service technicians who work in these areas need to be aware of the possible lightning conditions that may occur on our wind turbine projects during these thunderstorms. Before, during, and after thunderstorms all affected site personnel need to be aware of what to do and where to report.
Safer Locations during Thunderstorms and Locations to Avoid:
No place is absolutely safe from the lightning threat; however, some places are safer than others. Large enclosed structures (substantially constructed buildings) tend to be much safer than smaller or open

PRELIMINARY

Structures. The risk of lightning injury depends on whether the structure incorporates lightning protection, construction materials used, and the size of the structure. Avoid contact with metal or conducting surfaces outside or inside the structures.

Generally speaking, if an individual can see lightning and/or hear thunder he/she is already at risk. Louder or more frequent thunder indicates that lightning activity is approaching and increasing. If the time delay between seeing the flash (lightning) and hearing the bang (thunder) is less than 30 seconds, the individual should be in or seek a safer location. Be aware that this method of ranging has severe limitations in part due to the difficulty of associating the proper thunder to the corresponding flash.

High winds, rainfall, and cloud cover often act as precursors, to actual cloud-to-ground strikes by notifying individuals to take action. Many lightning casualties occur in the beginning, as the storm approaches, because people ignore the precursors. Also, many lightning casualties occur after the perceived threat has passed. Generally, the lightning threat diminishes with time after the last sound of thunder, but may persist for more than 30 minutes. When thunderstorms are in the area but not overhead, the lightning can exist even when it is sunny, not raining, or when clear sky is visible.

When available, pay attention to weather warning devises such as weather radio and/or credible lightning detection systems. However, do not let this information override good common sense as isolated storms are common.

Lightning Safety:
Avoid being in or near wind turbine and communications towers, other high places, open fields, isolated trees, light poles, metal fences, and open water (ocean, lakes, rivers, etc.). After the storm has passed, all site personnel shall wait at least one (1) hour before approaching any equipment. If you hear a hissing or crackling sound, this may be a sign of the wind turbine holding a charge. If these sounds are present, DO NOT TOUCH THE MACHINE.

When inside a building avoid use of the telephone, washing your hands, or any contact with conductive surfaces with exposure to the outside such as metal door or window frames, electrical wiring, telephone wiring, cable TV wiring, plumbing, etc.

When in vehicles during lightning you must not be touching any metallic objects referenced to the outside of the car. Door and window handles, radio dials, CB microphones, gearshifts, steering wheels, and other inside-to-outside metal objects should be left alone during close-in lightning events. If you are driving and get caught in a lightning storm, pull off to the side of the road in a safe manner (in a low area, not on a hill), turn on the emergency blinkers, turn off the engine, put your hands in your lap, and wait out the storm.

Heavy equipment like boom trucks, cranes, backhoes, bulldozers, loaders, graders, scrapers, mowers, etc. which employ an enclosed rollover systems canopy (ROPS) are safe in nearby electrical storms. The operator should shut down the equipment, close the doors, and sit with hands in lap, waiting out the storm. In no circumstances, during close-in lightning, should the operator attempt to step off the equipment to ground in an attempt to find another shelter. If operating a boom truck or crane, make sure to retract the boom and place in the boom rack.

PRELIMINARY

****NOTE – EMERGENCY WORK CAN BE CONDUCTED IN THE SUBSTATION. ONLY QUALIFIED AND TRAINED PERSONNEL WILL BE ABLE TO CONDUCT WORK. A JSA MUST BE COMPLETED AND RISK ASSESSMENT SHOULD REFLECT THE WEATHER AND ITS HAZARDS****

First Aid Recommendations for Lightning Victims:
Most lightning victims can actually survive their encounter with lightning, especially with timely medical treatment. Individuals struck by lightning do not carry a charge and it is safe to touch them to render medical treatment. Follow these steps to try to save the life of a lightning victim:

1. **First:** Call 911 to provide directions and information about the likely number of victims.
2. **Response:** The first priority of emergency care is "make no more casualties". If the area where the victim is located is in a high-risk area (mountain top, isolated wind turbine, open field, etc.) with a continuing thunderstorm, the rescuers may be placing themselves in significant danger.
3. **Evacuation:** It is relatively unusual for victims who survive a lightning strike to have major fractures that would cause paralysis or major bleeding complications unless they have suffered a fall or been thrown a distance. As a result, in an active thunderstorm, the rescuer needs to choose whether evacuation from very high-risk areas to an area of lesser risk is warranted and should not be afraid to move the victim rapidly if necessary. Rescuers are cautioned to minimize their exposure to lightning as much as possible.
4. **Resuscitation:** If the victim is not breathing, start mouth-to-mouth resuscitation. If it is decided to move the victim, give a few quick breaths prior to moving them. Determine if the victim has a pulse by checking the pulse at the carotid artery (side of the neck) or femoral artery (groin) for at least 20 – 30 seconds. If no pulse is detected, start cardiac compressions as well. In situations that are cold and wet, putting a protective layer between the victim and the ground may decrease the hypothermia that the victim suffers which can further complicate the resuscitation.

Location: To Be Determined

Plan Supervisor: To Be Determined

Designated Meeting Place: To Be Determined

O&M Building, SEE SECTION "V" FOR SITE MAP

Back up Designated Meeting Place: To Be Determined

SEE SECTION "V" FOR O & M BUILDING MAP

Note: The persons named above shall be trained in the procedures to follow and have full authority to perform said duties. Training shall be performed annually or when the plan changes. A copy of this plan shall be available to all site personnel. The location manage shall maintain the master copy of this plan and forward a copy to the corporate Safety Officer. A map of any evacuation routes shall be posted and kept up to date by the plan supervisor.

PRELIMINARY

Flooding:

CONCERNS of the Office / Warehouse:

1. Top-off any underground tanks. Make tank access caps water tight, plug vents, and seal off pumping lines.
2. Plug all floor drains and sanitary lines.
3. If possible, disconnect electric motors and store in dry place.
4. Move chemicals to a high shelf.
5. If possible, put merchandise on pallets.
6. Shut off main power and valves.

CONCERNS of the Field:

1. Down power lines.
2. De-energize substation.
3. Open KPF's.
4. Transformers down, exposing primary/secondary lines.
5. Cracks in dikes, exposing primary/secondary lines.
6. Control panels down, exposing secondary lines.
7. Towers over, exposing secondary lines.

Working in Adverse Weather – Tornados

General:
In addition to the General Safety Policy and General Safety Rules of the IIPP, the following shall apply: This policy effects all locations that see annual weather situations. Although we have several types of wind turbines in these areas, the procedures are the same.

Definitions:

Tornado Watch – A tornado watch means that conditions are favorable for tornados to develop.

Tornado Warning – A tornado warning means that either official spotters have sighted a tornado or Doppler Radar has reported a developing tornado. A tornado warning is typically issued for a small area (possibly a county or two) for less than an hour.

Fujita – Pearson Tornado Scale:

1. F-0: 40 – 72 mph, chimney damage, tree branches broken.
2. F-1: 73 – 112 mph, mobile homes pushed off foundation or overturned.
3. F-2: 113 – 157 mph, considerable damage, mobile homes demolished, trees uprooted.
4. F-3: 158 – 205 mph, roofs and walls torn down, trains overturned, cars thrown.
5. F-4: 207 – 260 mph, well-constructed walls leveled.
6. F-5: 261 – 318 mph, homes lifted off foundation and carried considerable distances, autos thrown as far as 100 meters.

PRELIMINARY

General Information:
During late spring to the summer months in certain parts of the country, tornados are commons. Because of this, all service technicians who work in these areas need to be aware of the possible tornado conditions that may occur on our wind turbine projects.

When a tornado is coming, you have only a short amount of time to make life-or-death decisions. Advance planning and quick response are the keys to surviving a tornado. This is why it is so important to conduct tornado drills before and during each tornado season.

When a tornado watch is issued in your area, stay tuned to a weather radio, commercial radio, and/or television to stay informed of changing weather conditions. Remain alert for approaching storms and remember that tornados can occur with little to no warning. Be prepared to take cover on short notice.

When a tornado warning is issued, local EMS will take, as a minimum, the following precautions to alert the public:

1. Sound local sirens (know what is the sequence in your area)
2. Activating the Emergency Alert System (EAS) to interrupt radio and television broadcasts to provide instructions and information to the public

Tornado Safety:
Tornado danger signs (learn and know these tornado danger signs):

1. An approaching cloud of debris can mark the location of a tornado even if a funnel is not visible.
2. Before a tornado hits, the wind may die down and the air may become very still.
3. Tornadoes generally occur near the trailing edge of a thunderstorm. It is not uncommon to see clear, sunlit skies behind a tornado.

Take the following protective actions when a tornado watch has been issued in your area:

1. Have a person designated to monitor a radio or television
2. Notify all affected site personnel of the tornado watch and assure that they are in immediate contact if an emergency arises.
3. If the weather is extreme, remove all site personnel from the field and prepare for the safety of all site personnel.

Take the following protective actions when a tornado warning has been issued in your area:

1. Go at once to a windowless, interior room; storm cellar; basement; or lowest level of the building.
2. Go to an inner hallway or a small inner room without windows, such as a bathroom or closet.
3. Stay away from windows, doors, and outside walls (most deaths occur from flying debris)

If outdoors:

1. If possible, get inside a building.
2. If shelter is not available or there is no time to get indoors, lie in a ditch or a low-lying area or crouch near a strong building. Be aware of the potential for flooding.
3. Use arms to protect head and neck.

PRELIMINARY

If in a car:

1. Never try to out drive a tornado in a car or truck. Tornadoes can change direction quickly and can lift up a car or truck and toss it through the air.
2. Get out of the car immediately and take shelter in a nearby building.
3. If there is no time to get indoors, get out of the car and lie in a ditch or low-lying area away from the vehicle. Be aware of the potential for flooding.

After a tornado, be aware of your surroundings. Also:

1. Turn on radio or television to get the latest emergency information
2. Use the telephone only for emergency calls.
3. Watch for downed power and telephone lines (do not use the phone unless calling 911)
4. Around the projects watch for falling debris, exposed power lines, and chemical spills.
5. Give first aid when appropriate. Don't try to move the seriously injured unless they are in immediate danger of further injury.
6. Stay out of damaged buildings. Return only when authorities say it is safe.
7. Clean up spilled medicines, bleaches, gasoline, or other flammable liquids immediately. Leave the buildings if you smell gas or chemical fumes.

Location: **To Be Determined**

Plan Supervisor: To Be Determined

Designated Meeting Place: To Be Determined

O&M Building, SEE SECTION "V" FOR SITE MAP

Back up Designated Meeting Place: To Be Determined

SEE SECTION "V" FOR O & M BUILDING MAP

Note: The persons named above shall be trained in the procedures to follow and have full authority to perform said duties. Training shall be performed annually or when the plan changes.A copy of this plan shall be available to all site personnel. The location manager shall maintain the master copy of this plan and forward a copy to the corporate Safety Officer. A map of an evacuation routes and shelters shall be posted and kept up to date by the plan supervisor.

PRELIMINARY

Cold Weather Safety:
The purpose of this Safety Document is to provide the site personnel with the basic knowledge needed to work safely in conditions where the possibility of cold exists. At the end of this period of instruction the site personnel should:

a. Be able to identify the conditions and circumstances that can lead to cold injury.
b. Know the signs of cold injury.
c. Explain the first aid treatment for cold injury.

The Cold Environment
The human body can experience a loss of functionality, damage, or death from the cold environment. Temperature is not the only factor resulting in cold injury. Immersion and wind speed can also contribute to the severity of cold injuries.

Immersion can cause a significant and rapid loss of body heat. In water temperatures that are well above freezing, a person can quickly become immobilized and drown.

Immersion Survival Times

Water Temperature Degrees Fahrenheit	30	40	50	60	70
Time for 50% Deaths	15 min	20 min	50 min	2 hrs	Safe
Time for 100% Deaths	1 hr	2 hrs	4 hrs	Some Survive	Safe

In water temperatures as high as 60 degrees there is danger of people being overcome by the cold. Wind turbine sites are often located where there are lakes, rivers, creeks, or ponds. These are also areas where roads may become unstable. There is some chance of crashing into the water. Heavy rain can have the same effect as immersion. In the event a person should experience immersion the first step is to remove them from the cold, the second is to get them dry. As the need arises, use clothing to protect from getting wet.

PRELIMINARY

Wind Chill

Just as exposure to wet and cold can rob heat faster than just temperature alone, so can strong winds. Strong winds enhance the effects of low temperatures.

Wind Speed (MPH)	Perceived Temperature											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-21	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-36	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-49	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148

Little Danger if Properly Clothed

Danger of Freezing Exposed Flesh

Great Danger of Freezing Exposed Flesh

This chart shows combinations of wind and temperature that can lead to cold injuries. In areas where these conditions exist, care should be taken to cover all exposed flesh or stay out of the weather. **Cold Injuries**

Hypothermia

The medical term for a drop in core body temperature is Hypothermia. As temperatures drop the human body adapts various strategies to keep the core temperatures at 98.6 degrees Fahrenheit. "Goose bumps" and shivering are the first signs of a drop in body temperature. The body may restrict flow of blood to the extremities making them more susceptible to freezing. As the extremities get colder there is loss of coordination. As a person gets colder they become apathetic and lose gross motor functions. At some point shivering will cease. The skin will be cold and waxy, muscles will be rigid, and the heart rate slows. As the core temperature drops, the pupils dilate and the person will go into a coma. At a core body temperature below 86 degrees Fahrenheit, there is a chance of cardiac arrest.

PRELIMINARY

Local Cold Injury Local cold injury is commonly called "frost bite". Frost bite occurs when body tissue gets cold enough to freeze. It is most likely to affect the tips of the fingers, toes, ears, nose, cheek bones, and chin. While when first exposed to cold a body part will burn and sting, eventually as exposure time lengthens, there will be a loss of sensation. The skin may turn waxy grey or yellow. If the condition is allowed to continue, the tissue will freeze and cause permanent tissue damage.

Treatment

Prevention is always preferable to treatment. Heat is lost through the body by several means, not the least of which is radiation. It is important to cover all exposed areas of the body. Hands and head are often neglected when dressing for the cold environment. Head coverings should cover as much of the head, neck, and face as possible. Gloves should be insulated as should footwear. Clothes should be loose and layered. Clothing may need to be shed and donned several times during a work day. As one works, the clothes might need to be removed to keep from overheating. The clothes will need to be put on again during periods of inactivity.

Hypothermia

First priority in hypothermia / cold injury treatment is to remove the patient from the cold environment. Keep the person warm and dry. Use blankets, sleeping bags, etc. to cover exposed areas. Shelter the patient from the wind. If in the field, the cab of a vehicle with the heater running will provide a warm environment. If the patient is in advanced hypothermia (confused, no shivering) handle them gently and do not allow patient to exert themselves. There is possibility if cardiac arrest. Seek medical attention.

Local Cold Injury

In the event one suspects a local cold injury, remove the person from the cold. Never try to thaw any tissue if there is a possibility of it refreezing. Carefully remove any jewelry, wet or restrictive clothing. Leave the clothing if it frozen to the skin. Cover the skin with loose clothing or bandage to prevent friction or pressure. Never rub or massage the affected. If the area is hard and frozen, do not attempt to rewarm it by applying heat. Seek medical attention.

PRELIMINARY

HAZARDOUS MATERIAL

SITE PERSONNEL GUIDELINES:
Material Safety Data Sheets (MSDS's) are kept on premises on all chemicals we use.

These data sheets are located: **ON SAFETY BOARD IN WAREHOUSE / SHOP AREA**
For spills, leaks, and incidents when a fire is not involved, the following steps should be taken, if appropriate:

1. Do not make contact with the chemical. Evacuate all personnel in the area immediately. Seal off the area if possible to prevent further contamination of others until someone from Management arrives.
2. Seek out any handicapped personnel in the area and provide assistance when exiting.
3. Report the incident immediately to anyone in Management.
    a. Type of incident. Are there any injuries?
    b. Name and quantity of the material, if known.
    c. Possible hazards to persons or the environment, if known.
    d. Be sure to state if you feel that the spill or its vapors may cause an immediate threat to human life so that evacuation procedures may be implemented.
4. Anyone who is contaminated by the spill should avoid contact with others as much as possible. Washing-off contamination and first aid should be started immediately.
5. Do not try to contain or clean up spills. This will be conducted be someone designated by Management.
6. If it is safe, remain in this location until accounted for by roll call by Management. Do not leave premises until accounted for and given permission to do so. Valuable time could be wasted searching for personnel that have not followed correct procedures.
7. Keep fire lanes, hydrants, and walkways clear for emergency crews and equipment.

Only members of Management can declare the state of emergency over and give permission to re-enter.

SPILL RESPONSE

These spill response guidelines shall be followed for all fluid spills that are utilized in the operation of the site including hydraulic oil, brake oil, gear box oil and de greaser cleaner.

1. Contact Apex Remote Control Operations Center (ROCC) and advise of the incident.
2. Utilized the spill response kits that located throughout the operations and maintenance building, trucks, and substation control room.
3. Isolate spill area from personnel exposure
4. Dike and contain the spill with the use of absorbent boom and pig mats. Determine quantity of material lost
5. Contact pre-qualified vendor to properly dispose of material
6. Provide an incident report to Apex Safety and Operations.
7. Apex Environmental Manager will determine if recordable criteria have been met and next steps.

PRELIMINARY

CRIME / VIOLENT BEHAVIOR / CIVIL DISTURBANCE SITE

PERSONNEL GUIDELINES

How to report:
You may contact any Manager or call "911" yourself to access the police department.

Reporting Crimes in Progress:
If you are a victim or a witness to any in-progress criminal offense, report the incident as soon as possible, providing the following information:

1. Nature of the incident. MAKE SURE that the 911 dispatcher understands that the incident is IN PROGRESS!
2. Location of the incident.
3. A description of the suspect(s) involved.
4. A description of any weapons involved.
5. A description of any property involved.

Stay on the line with the dispatcher until a police officer arrives at the scene. Keep the dispatcher informed of any changes in the situation so that updated information can be relayed to the responding units. Even if you are the victim and unable to communicate further, try to keep the line open.

Reporting Crimes Not in Progress:
Even though it seems futile, all crime should be reported.
Be prepared to provide the following information to the investigating officer:

1. When the incident occurred.
2. If a property crime, what was taken or damaged.
3. The named and/or descriptions of any suspects or witnesses.

Civil Disturbance Response Plan
Any site personnel noting a possible civil disturbance should contact a Manager immediately. If necessary, all entrances and exits will be secured. Should unauthorized intruders gain access onto premises, refrain from any contact with the intruders. All site personnel should remain in the area, remain calm, and follow instructions from Management. Should intruders gain access into the building and damage property, site personnel should not interfere? The personal safety of our personnel is more important than the protection of our property.

PRELIMINARY

BOMB THREAT

SITE PERSONNEL GUIDELINES:
All bomb threats must be treated as a serious matter and must be considered real until proven otherwise. The procedures described below should be implemented regardless of whether the bomb threat appears to be real or not.

Bomb Threats through Mail or Suspicious Packages:

1. Do not handle the envelope or package. Clear the area and call "911". In addition, contact any manager.
2. The building will not be evacuated until Management personnel or local authorities have given orders to do so.

Bomb Threats over the Phone:

1. Keep the caller on the line as long as possible and try to obtain the following information:
   a. When is the bomb going to explode?
   b. Where is the bomb located?
   c. What kind of bomb is it?
   d. What does it look like?
   e. Why did you place the bomb?
2. Also, try to record the following information:
   a. Time of call
   b. Age and sex of caller
   c. Speech pattern, accent, possibly nationality, etc.
   d. Emotional state of caller
   e. Background noise
3. Immediately notify your supervisor or a Manager. Await further instructions. The building will not be evacuated until Management personnel or local authorities have given orders to do so.

PRELIMINARY

TURBINE FIRE

When a turbine on the site is on fire do the following:

- Call 911 so the fire department can be dispatched.
- Stay away from the danger area of falling debris.
- Set up a sterile zone and do not allow vehicles to park below the turbine.
- Direct all media inquiries to the Facility Manager.

PRELIMINARY

Hurricane

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph 64-82 knots 119-153 km/h	**Very dangerous winds will produce some damage:** Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph 83-95 knots 154-177 km/h	**Extremely dangerous winds will cause extensive damage:** Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111-129 mph 96-112 knots 178-208 km/h	**Devastating damage will occur:** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156 mph 113-136 knots 209-251 km/h	**Catastrophic damage will occur:** Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157 mph-higher 137 knots higher 252 km/h	**Catastrophic damage will occur:** A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

PRELIMINARY

Emerson Creek Wind Farm Hurricane Procedure

1. Hurricane Procedure Policy

This plan is for all personnel working at the Emerson Creek Wind Farm.

It is our policy that safety of site personnel is the primary concern. Apex Clean Energy will activate this procedure well before a hurricane reaches the project to assure the safety of site personnel.

2. Notification

In the event of an approaching Hurricane the following people must be notified;
Emerson Creek Wind Farm Facility Manager: To Be Determined
Emerson Creek Wind Farm Deputy Facility Manager: To Be Determined
John Boyle, Apex Safety Manager: Office # 219-771-9534
Neil James, Apex Director of Operations: Cell phone# 432-599-5515
Apex ROCC: Office# 434-328-2305

3. Hurricane Procedure

48 HOURS FROM LANDFALL- About two days before a hurricane is expected to affect your location, begin implementing the following actions.

- Review the hurricane emergency action plan with all involved personnel.
- Check building roofs. Make repairs to coverings and flashing as time allows.
- Remove all loose items from the roof, secure equipment doors and covers, and remove debris.
- Verify roof drains are clear of trash and other obstructions.
- Fill fuel tanks serving emergency generators and other vital services.
- Verify dewatering pumps are in service and working.
- Verify outside storm drains and catch basins are clean.
- Remove debris from outdoor areas that may become "missiles."
- Remove loose, outdoor, inactive equipment.
- Back up computer data.

36 HOURS FROM LANDFALL-– At 36 hours before anticipated landfall, time will be limited. Make sure you will have the staff needed to complete all of the following actions, and leave plenty of time to evacuate personnel.

- Protecting or relocating vital business records
- Removing all loose outdoor storage or equipment
- Anchoring portable buildings or trailers to the ground
- Securing outdoor storage or equipment that cannot be moved
- Installing manual protection systems (e.g. shutters, plywood covers and floodgates)
- Raising critical equipment off floors
- Moving critical equipment from basement and other below-ground areas

PRELIMINARY

- Covering critical stock and equipment with waterproof tarpaulins
- Turning off fuel gas services
- Turning off non-essential electrical systems
- Verifying all fire protection systems are in service (e.g. water supplies, fire pumps, sprinklers, fire alarms and special extinguishing systems)
- Setting up flood barriers at all first floor doors and entrances
- Temporarily closing up buildings under construction to avoid entry of wind-driven rain

24-32 HOURS BEFORE LANDFALL- **ALL PERSONNEL SHALL EVACUATE THE SITE**

DURING THE HURRICANE- **Personnel shall remain off site. ROCC will operate the site remotely.**

AFTER THE HURRICANE- Apex Facility Management will return to the site to conduct a safety assessment of the O&M building, warehouse, substation, and other critical components. When returning to the site, bring additional supplies and cameras to document conditions.

- Survey the site for hazards: Live electrical wires, broken glass and sharp metal, Leaking fuel gases or flammable liquids, damaged building features or contents that could shift or collapse, Paved or hardscape areas undermined by wave action and subject to collapse, Flammable atmosphere in vapor space of flammable storage tanks, etc.
- Verify the status of protection systems. Check water supplies, fire pumps, automatic sprinklers, fire alarms and security systems.
- Manage impairment for protection systems: or Expedite repairs, Post fire watch in area with impaired fire protection, Post security personnel in areas where building or site access is not suitably controlled.
- Survey the damage and initiate repairs immediately: Promptly notify contractors to avoid waiting in line for service.
- Establish repair priorities, including the building envelope, utilities and fire protection systems

AFTER THE HURRICANE HAZARD ASSESSMENT- If the site is deemed safe to return by the Apex Facility Manager, an ALL CLEAR will be issued and communicated to awaiting site personnel. Site personnel may return to the site once an ALL CLEAR is issued.

PRELIMINARY

IV. FORMS

ACCIDENT REPORT

Involved site personnel and witnesses much complete a form ASAP following any accident or near miss. Give completed form to your immediate supervisor.

PRELIMINARY

Firelands Wind, LLC **Emerson Creek Wind Project** ***Preliminary*** **Emergency Action Plan**	APEX CLEAN ENERGY

Prepared By:		**Date:**	
Accident Date:		**Accident Location:**	

☐ Injury ☐ Non-Injury ☐ Fatality ☐ Material Damage ☐ Vehicle Damage

If Injury (or fatality), who was injured and what was the nature of the injury?

If vehicle/material damage, what was damaged?

If this form is being prepared by an injured site personnel:

☐ Yes ☐ No I refused medical treatment at this time.

Names of all persons and witness involved	Employer

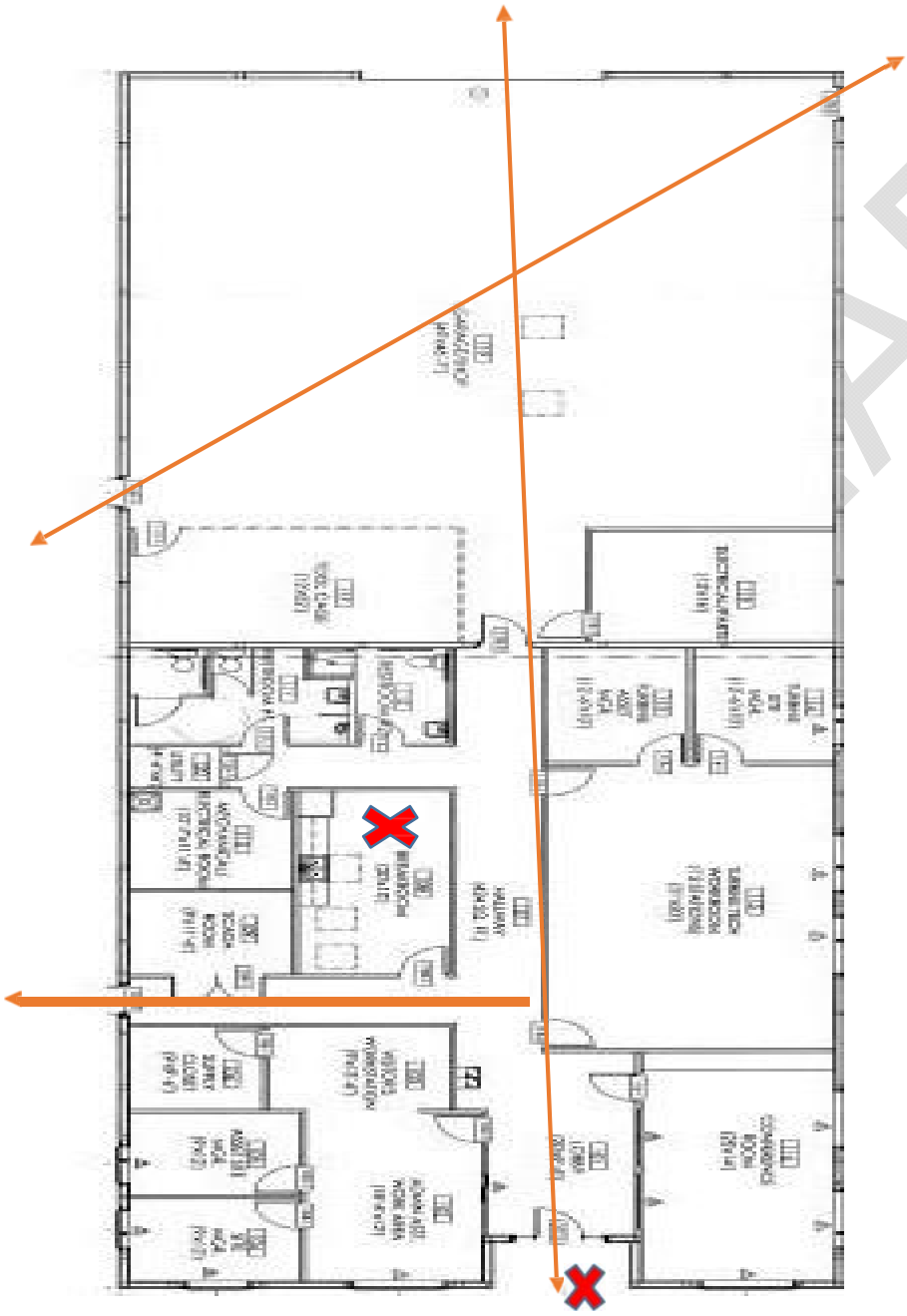
Brief description of the accident and what you believe was the cause:

Supervisor's Comments / Action Taken:			
Supervisor's Signature:		**Date:**	

PRELIMINARY

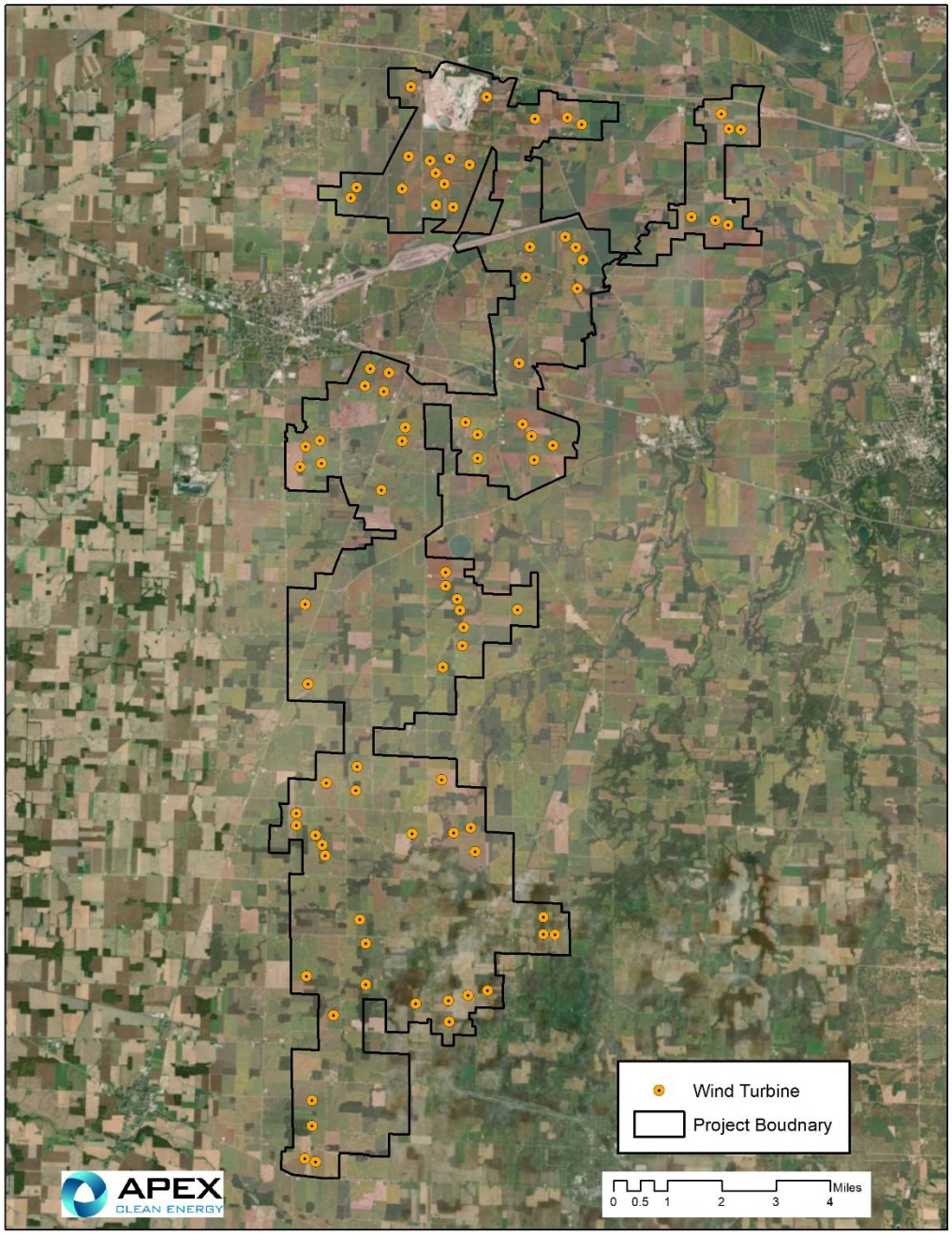
V. MAPS

O & M Building Evacuation Map



NOTES: Representative O&M Building Plan; To Be Updated with Emerson Creek Wind Farm O&M in Final EAP.
Exits Marked with Arrows – Muster Point (1) KITCHEN – Muster Point (2) Front Entrance – PARKING LOT

Site Map


Wind Turbine
Project Boudnary
0 0.5 1 2 3 4
Miles
APEX
CLEAN ENERGY

Turbine Coordinates

Turbine	Latitude	Longitude	Easting	Northing
T1	41.33709	-82.7973	349610	4577737
T2	41.33485	-82.7705	351853	4577442
T3	41.33147	-82.6871	358825	4576927
T4	41.32752	-82.6842	359059	4576484
T5	41.32744	-82.68	359405	4576468
T6	41.31851	-82.7977	349536	4575674
T7	41.31805	-82.7831	351344	4575426
T8	41.31661	-82.7761	350345	4575175
T9	41.31416	-82.7879	350596	4574852
T10	41.3113	-82.7849	349346	4574706
T11	41.30976	-82.7998	350350	4574226
T12	41.30562	-82.7876	350857	4574161
T13	41.30513	-82.7816	357937	4573872
T14	41.3038	-82.697	358653	4573775
T15	41.30306	-82.6884	359025	4573635
T16	41.30186	-82.6839	354188	4573276
T17	41.29777	-82.7416	353140	4572979
T18	41.29491	-82.754	354497	4572964
T19	41.29502	-82.7378	354715	4572600
T20	41.29178	-82.7352	353014	4572078
T21	41.28677	-82.7553	354553	4571744
T22	41.28405	-82.7369	352819	4569529
T23	41.26378	-82.757	348396	4569363
T24	41.26148	-82.8098	348244	4568858
T25	41.2569	-82.8115	348798	4568694
T26	41.25553	-82.8048	351228	4567779
T27	41.24774	-82.7756	352926	4567712
T28	41.24745	-82.7553	349444	4567624
T29	41.24601	-82.7968	351584	4567411
T30	41.24449	-82.7712	353180	4567359
T31	41.24431	-82.7522	349341	4567218
T32	41.24233	-82.798	353823	4567087
T33	41.24198	-82.7445	346474	4567059
T34	41.24037	-82.8321	351585	4566709
T35	41.23817	-82.7711	353266	4566658

PRELIMINARY

T36	41.23802	-82.751	346951	4566553
T37	41.2359	-82.8263	346312	4566449
T38	41.23484	-82.8339	348733	4565759
T39	41.22909	-82.8049	350634	4563323
T40	41.20751	-82.7816	350633	4562919
T41	41.20388	-82.7815	350980	4562522
T42	41.20036	-82.7773	346461	4562366
T43	41.19811	-82.8311	351176	4561655
T44	41.19259	-82.7747	351138	4561116
T45	41.18773	-82.775	350550	4560477
T46	41.18187	-82.7819	346548	4559973
T47	41.17658	-82.8295	348005	4557521
T48	41.15478	-82.8115	350518	4557129
T49	41.15172	-82.7815	347093	4557038
T50	41.15027	-82.8222	347967	4556813
T51	41.1484	-82.8118	346199	4555776
T52	41.142	-82.8327	350877	4555552
T53	41.13873	-82.8326	349645	4555532
T54	41.13904	-82.7708	346776	4555489
T55	41.13759	-82.7768	351517	4554997
T56	41.13718	-82.7915	347062	4554879
T57	41.13625	-82.8256	348088	4552977
T58	41.1327	-82.769	353545	4552541
T59	41.13082	-82.8221	348267	4552275
T60	41.1156	-82.7444	346501	4551303
T61	41.11388	-82.8094	348263	4551051
T62	41.11096	-82.7443	351881	4550874
T63	41.1076	-82.8071	350723	4550571
T64	41.09851	-82.8279	349753	4550478
T65	41.09658	-82.8068	347305	4550131
T66	41.09565	-82.7637	350744	4549945
T67	41.09427	-82.7706	351296	4550732
T68	41.09271	-82.7774	350723	4550571
T69	41.09169	-82.7889	349753	4550478
T70	41.08812	-82.818	347305	4550131
T71	41.08708	-82.777	350744	4549945
T72	41.31742	-82.7901	350171	4575540
T73	41.30984	-82.816	347988	4574744

PRELIMINARY

T74	41.30705	-82.8179	347821	4574437
T75	41.26051	-82.8031	348951	4569244
T76	41.19783	-82.7558	352771	4562205
T77	41.19745	-82.7762	351065	4562197
T78	41.13371	-82.8232	346973	4555202
T79	41.11089	-82.7403	353883	4552527
T80	41.06526	-82.8249	346667	4547606
T81	41.0585	-82.8247	346668	4546855
T82	41.04964	-82.8271	346447	4545876
T83	41.04885	-82.8232	346772	4545781
T84	41.32969	-82.7417	354248	4576820
T85	41.32917	-82.7531	353297	4576782
T86	41.32792	-82.7365	354685	4576614
T87	41.24198	-82.8271	346898	4567229

PRELIMINARY

VI. EMERGENCY ACTION PLAN RECEIPT

PLEASE SIGN BELOW AND RETURN THIS PAGE TO THE PLANT MANAGER.

Apex Clean Energy ("APEX CLEAN ENERGY) recognizes that its site personnel have the right and need to know the procedures to follow in the event of an emergency. With this policy, APEX CLEAN ENERGY intends to ensure the transmission of necessary information to site personnel regarding emergency action.

I have received a copy of the APEX CLEAN ENERGY EMERGENCY ACTION PLAN, and I have reviewed and understand its contents.

_____ _____

Signature of Site personnel Date

_____ _____

Site personnel Name (please print) Employee #

Emerson Creek Wind Farm

PRELIMINARY

Firelands Wind, LLC
Case No. 18-1607-EL-BGN

Exhibit Q
Communication Studies

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Attorneys for Firelands Wind, LLC

ENGINEERING REPORT
CONCERNING THE EFFECTS UPON
FCC LICENSED RF FACILITIES
DUE TO CONSTRUCTION OF THE
EMERSON CREEK WIND ENERGY PROJECT
In
ERIE & HURON COUNTIES, OHIO

Prepared for:
Apex Clean Energy, Inc.
Charlottesville, VA

January 14, 2019

By: B. Benjamin Evans
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ENGINEERING REPORT
CONCERNING THE EFFECTS UPON
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EMERSON CREEK WIND ENERGY PROJECT
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I. INTRODUCTION

This engineering report describes the results of a study and analysis to determine the locations of federally-licensed (FCC) microwave and fixed station radio frequency (RF) facilities that may be adversely impacted as a result of the construction of the Emerson Creek Wind Energy Project in Erie and Huron Counties, Ohio. This document describes impact zones and any necessary mitigation procedures, along with recommendations concerning individual wind turbine siting. All illustrations, calculations and conclusions contained in this document are based on FCC database records[1].

Frequently, wind turbines located on land parcels near RF facilities can cause more than one mode of RF impact, and may require an iterative procedure to minimize adverse effects. This procedure is necessary in order to ensure that disruption of RF facilities either does not occur or, in the alternative, that mitigation procedures will be effective. The purpose of this study is to facilitate the siting of turbines to avoid such unacceptable impact.

The Emerson Creek wind project as currently planned involves the construction of between 66 and 71 wind turbines[2] on a stretch of land roughly between the city of Willard in Huron County and the village of Castalia in Erie County. The wind turbines being considered for the project will have a hub height of between 105 and 125 meters and a maximum rotor diameter of 150 meters. For the purposes of these studies, the 105-meter hub height and the 150-meter rotor

[1] The databases used in creating the attached tables and maps are generally accurate, but anomalies have been known to occur. Generally, for wind turbine siting, an on-site verification survey is often suggested as part of the due diligence process.

[2] While up to 71 turbines will actually be built, a total of 87 locations were studied for this report which includes alternative turbine sites.

diameter were assumed, since these dimensions would have the most potential impact on the microwave paths in the area.

Using industry standard procedures and FCC databases, a search was conducted to determine the presence of any existing microwave paths crossing the subject property, land mobile and other RF facilities within or adjacent to the identified area and broadcast signals receivable in the area. A specific turbine layout[3] has been submitted for analysis. Accordingly, this report will address the potential conflicts that may be caused by the proposed turbines.

The following tabulation and analysis consists of three sections:

1. Microwave point-to-point path analysis[4]
2. Land mobile, public safety and other communications tower sites
3. Broadcast AM, FM and TV

The attached figures were generated based upon the operating parameters of the FCC-licensed stations as contained in the FCC station database, with corrections of the antenna locations as needed.

The following analysis examines the pertinent FCC licensed services in the area for impact. This analysis assumes that all licensed services have been designed and constructed according to FCC requirements and good engineering practice. If this is not the case, the impacted facility must share responsibility with the wind project developer for the costs of any mitigation measures[5].

Each of the RF analyses is described separately in the sections that follow.

II. ANALYSIS OF MICROWAVE LINKS

An extensive analysis was undertaken to determine the likely effect of the new wind turbine project upon the existing microwave paths, consisting of a Fresnel x/y/z axis study. The microwave paths have been overlaid on Google Earth™ maps, and the images of the microwave paths and the proposed turbines are also available in a KMZ file.

---

[3] The turbine layout shown in this report is from Apex's Layout 57.

[4] Only point-to point microwave facilities were considered (for instance, a study of earth station facilities is not included).

[5] For instance, some microwave paths may have insufficient ground clearances as they are presently configured.

Important Note: Microwave path studies are based upon third party and FCC databases that normally exhibit a high degree of accuracy and reliability. Although Evans performs due diligence to ensure that all existing microwave facilities are represented, we cannot be responsible for errors in FCC databases that may lead to incomplete results. However, should such situations occur, Evans would perform an engineering analysis to determine how the additional facilities can be accommodated or, if wind turbine structures are already built, determine a method to re-direct an impacted beam path.

For this microwave study, *Worst Case Fresnel Zones* (WCFZ) were calculated for each microwave path. The mid-point of a microwave path is the location where the widest (or worst case) Fresnel zone occurs. Possible geographic coordinate errors must be taken into account[6]. The radius *R* of the Worst Case Fresnel Zone, in meters, is calculated for each path using the following formula:

$$R \cong 8.65\sqrt{\frac{D}{F_{GHz}}}$$

where D is the microwave path length in kilometers and F_{GHz} is the frequency in gigahertz.

In general, the WCFZ is defined by the cylindrical area whose axis is the direct line between the microwave link endpoints and whose radius is *R* as calculated above. This is the zone where the siting of obstructions should be avoided. Evans Engineering Solutions has identified 42 unique licensed microwave paths from the FCC database that are within 0.5 mile of the project area boundary. These microwave paths are listed in Table 1 and mapped in Figures 1 and 2.

Call Sign 1	Call Sign 2	Site 1 Name	Site 2 Name	Freq. (MHz)	WCFZ (m)	Licensee
WAA858	WQFI840	Belloh	Belsoh	6123.1-6835	6.9	Norfolk Southern Railway Co.
8233428	8233450	Site A	Site B	10835/11325	5.4	Local TV & Electronics, Inc.
WPOQ355	WQVW473	Bellevue	Lyme	10975/11465	5.8	Ohio RSA-2 LP/New Cingular
WNTV619	KQG77	Station	Castalia	6650/6810	8.2	Ohio Turnpike Commission
WQUP720	WQUP721	DE70XC054	DE54XC044	17865/19425	5.5	Spring Spectrum LP
WPUR690	*Receive only*	WKFM Studio	WLKR/WVAC	944.5/947	24.1	Elyria-Lorain Broadcasting Co.
WQRW547	WQRW954	CL03XC005	CL60XC754	17865/19425	6.3	SprintCom, Inc.
WRBM895	WRBM897	Bellevue South	Clyde South	17980/19540	6.5	Amplex Electric, Inc.
WQOY684	WQPC438	Landfill Twr	New Jail	10775/11265	8.5	County of Huron
WQYT575	WQYT658	Bellevue South	Havana	5945.2/6197.24	12.1	Verizon Wireless LLC
WQRW547	WQRW866	CL03XC005	CL33XC076	10835/11325	9.8	SprintCom, Inc.

[6] Many microwave facilities were built before accurate methods were available to establish exact geographic coordinates (such as GPS). It is not unusual for database errors of up to 4 or 5 seconds to occur, which can affect the positioning of critical turbines located near Fresnel paths.

Call Sign 1	Call Sign 2	Site 1 Name	Site 2 Name	Freq. (MHz)	WCFZ (m)	Licensee
WQRW547	WQRW848	CL03XC005	CL33XC046	10775/11265	10.3	SprintCom, Inc.
WQOH565	WQON201	Site 23	Site 24	6093.45/6345.49	14	SW Networks
WAL371	WQYY434	Erie Microwave	Carriage Sub	6034.15/6286..19	15.5	FELHC, Inc.
WQUM352	WQZV625	FIT01	WII01	10995/11485	11.5	North Coast Wireless Comm.
WQOH566	WQON201	Site 25	Site 24	6093.45/6345.49	15.5	SW Networks
WQUY965	WQZC699	Fremont	Castalia	10715/11215	12	BLHC, LLC
WAA857	WAA858	Attica	Bellevue	5974.85-6815	16.5	Norfolk Southern Railway Co.
WQOY683	WQOY684	NW LND Twr	Landfill Twr	954.75/958.35	42.9	County of Huron
KQG77	WHI784	Castalia	TP 6	5974.85-6745	17.3	Ohio Turnpike Commission
WQQX778	WQXU839	ASR1234443	ATC280217	11155/11645	12.7	Wireless Internetwork, LLC
WPZQ250	*Receive only*	WFRO FM	WNRR Site	945.5	44.8	BAS Broadcasting, Inc.
WQHG487	*Receive only*	Margaretta WT	Berlin Hts Twr	941.6125	46.3	County of Erie
WPOQ484	*Receive only*	Sandusky	Bellevue	950	47.4	BAS Broadcasting, Inc.
KQG77	WHI786	Castalia	Humm Road	6093.45-6845	19	Ohio Turnpike Commission
WESTLODI*	*Receive only*	West Lodi	ASR1234443	11200	14.5	Wireless Internetwork LLC
WAA859	WAA858	Berloh	Belloh	6695/6855	18.9	Norfolk Southern Railway Co.
WQPB813	WQPB814	Bellevue	Wakeman	6004.5-6315.84	20.9	Kryptick Technologies
WQPB810	WQPB813	Fremont	Bellevue	6004.5-6725	21.2	Kryptick Technologies
WQWF989	WQWF990	Birmingham Silo	1014962	5945.2-6345.49	21.3	New Line Networks LLC
WQPL304	*Receive only*	1014962	Birmingham	11215/11325	15.9	Geodesic Networks LLC
WQQX778*	*Receive only*	ASR1234443	Republic ATC	11200	16.2	Wireless Internetwork LLC
WQOT875	WQOT919	Amhurst	Parker Town	5974.85/6226.89	22.4	Coralinks
WPUG349	WPUM945	Fremont	Sandusky	6063.8/6315.84	22.3	W.A.T.C.H. TV Company, Inc.
WQTQ663	WQTZ737	Bellevue	Clarksfield	6004.5/6256.54	22.9	World Class Wireless, LLC
WQWF971[7]	WQWF986	Bellevue	Clarksfield	6004.5-6315.84	22.9	AQ2AT LLC
WQJZ740	*Receive only*	Castalia Studio	WGGN-DT Xmtr	7000	22.1	Christian Faith Broadcast, Inc.
WQOT918	WQOT919	Elmore	Parker Town	6152.75/6404.79	24.2	Coralinks
WQQX871	WQXU839	ATC81579	ATC280217	10995/11485	18.1	Wireless Internetwork, LLC
WQCH243	*Receive only*	Castalia Studio	WLRD Site	946	63.3	Christian Faith Broadcast, Inc.
WQPH316	WQPH317	ATC98991	ATC99002	6685/6845	25.2	High Voltage Communications
ASR12344*	*Receive only*	ASR1234443	ASR1201436	6175	26.3	Wireless Internetwork LLC

*Wireless Internetwork has completed prior coordination for these proposed microwave links but, as of the date of this search, has not filed applications with the FCC to build them.

Table 1 – Licensed Microwave Links in and near Emerson Creek Project Area

As seen in Figures 3 through 15, many planned turbines would be close to microwave paths. However, based on the current turbine layout, no turbine would conflict with any FCC-licensed or known planned microwave link.

[7] WQWF971/WQWF986 traverses same path as WQTQ663/WQTZ737

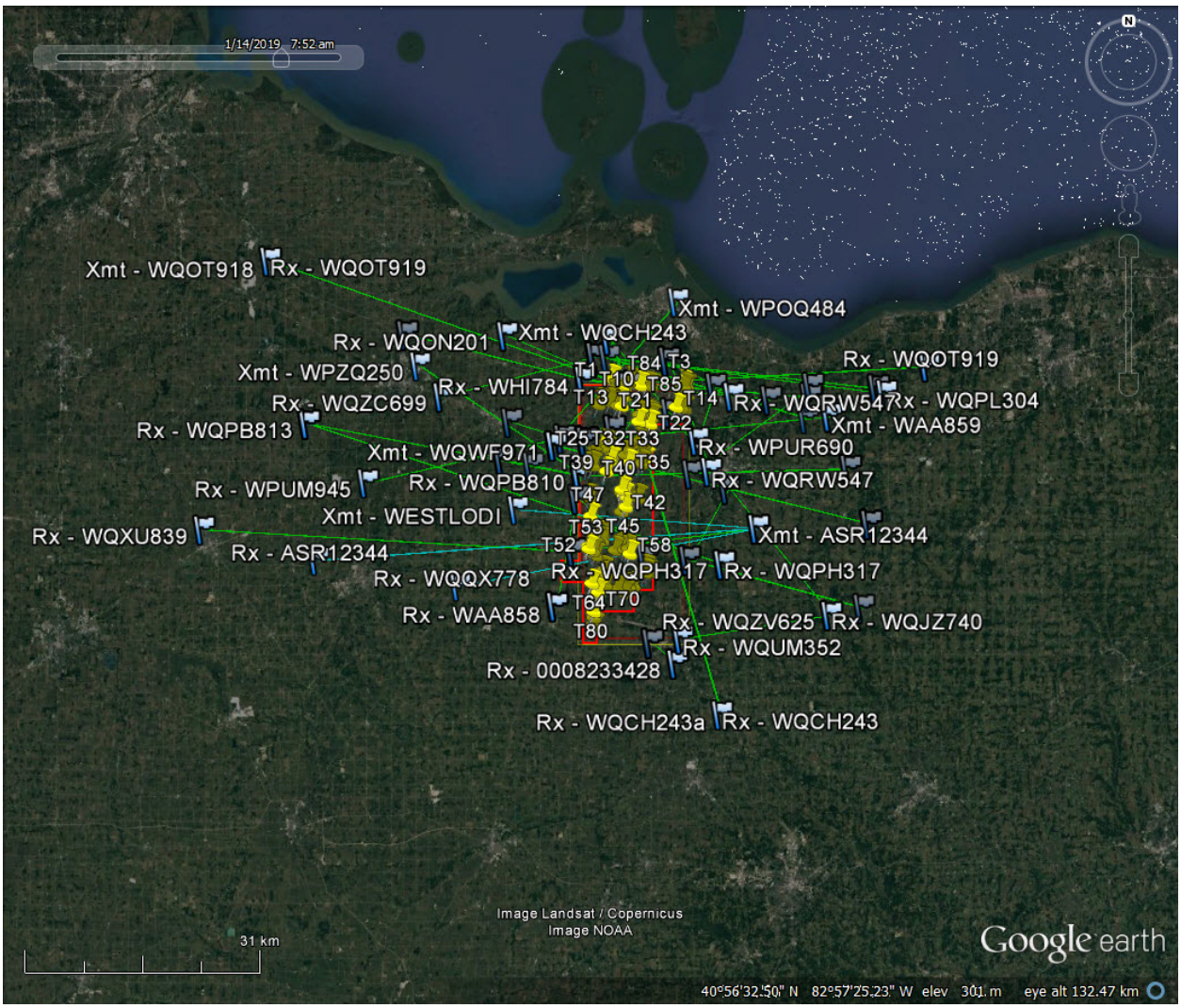

Figure 1 – Licensed Microwave Paths in or near Emerson Creek Project Area

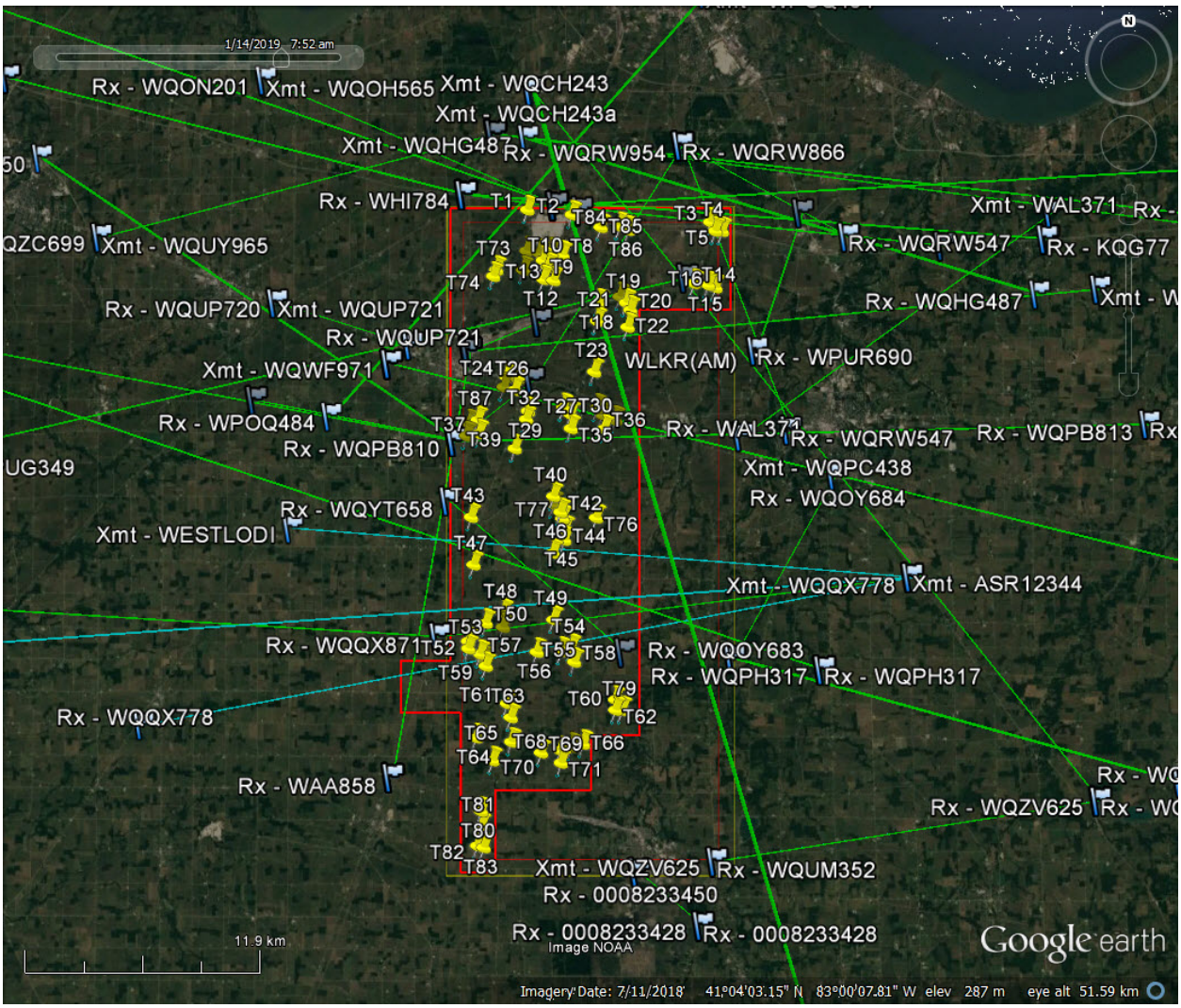

Figure 2 – Close-Up of Licensed Microwave Paths in or near Emerson Creek Project Area

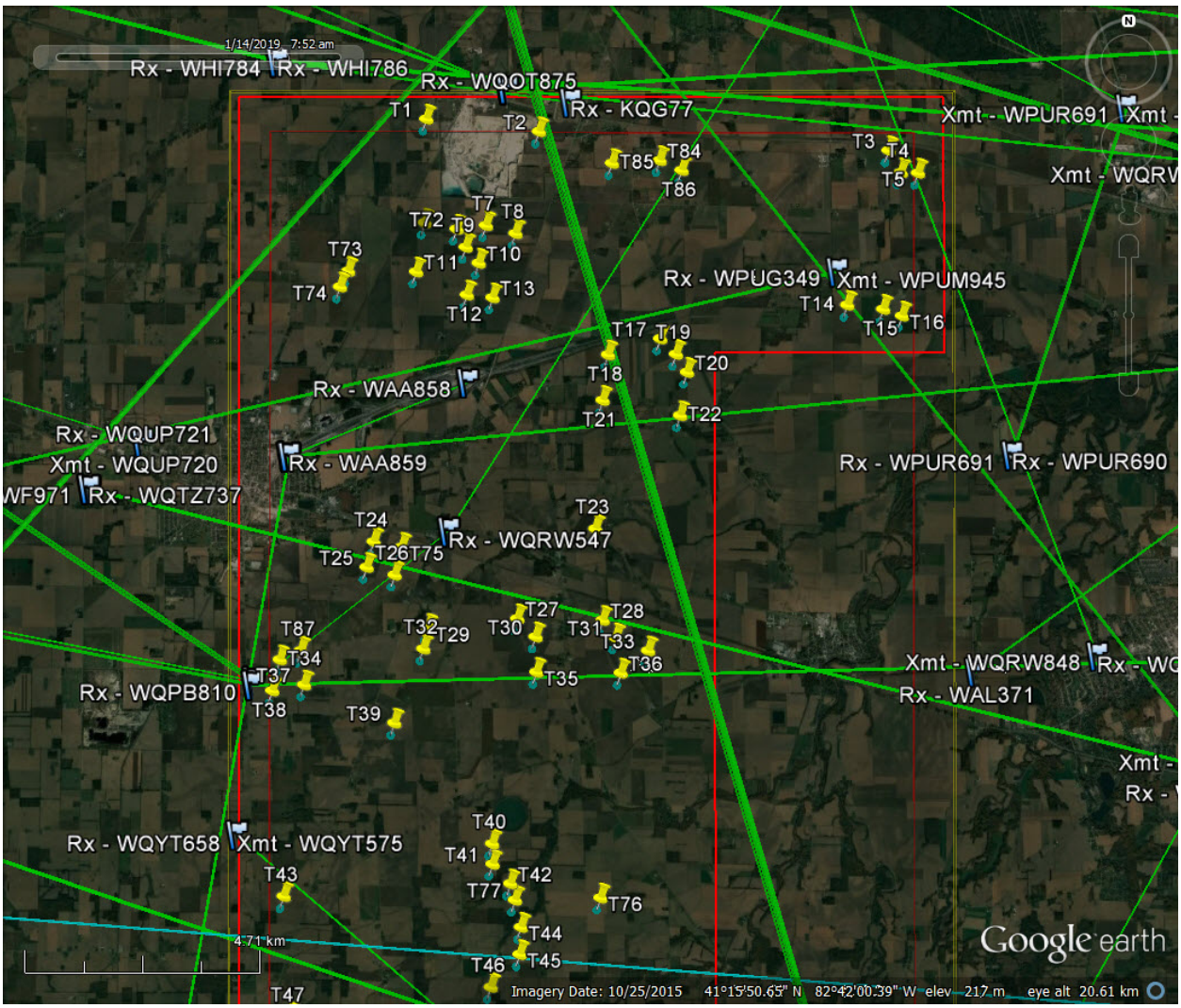

Figure 3 – Microwave Paths in North Half of Turbine Area

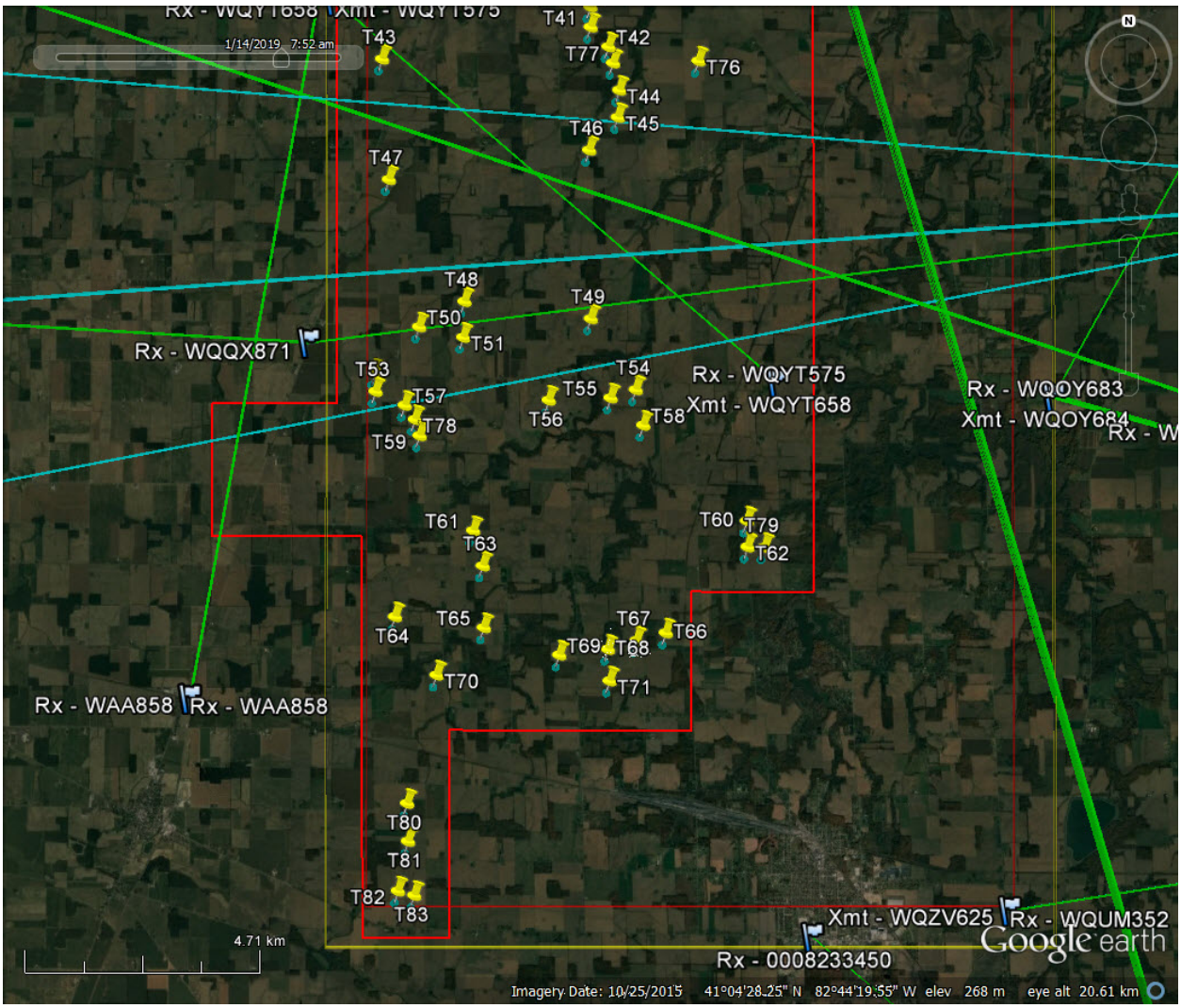

Figure 4 – Microwave Paths in South Half of Turbine Area

Figure 5 – Turbines 2, 84 and 86 near Microwave Paths

As can be seen in the image above, Turbines 2, 84 and 86 would not penetrate the WCFZ of any FCC-licensed microwave link.

Figure 6 – Turbine 5 close to Microwave Path WQRW547/WQRW848

As can be seen in the image above, Turbine 5 would not penetrate the WCFZ of the microwave link.

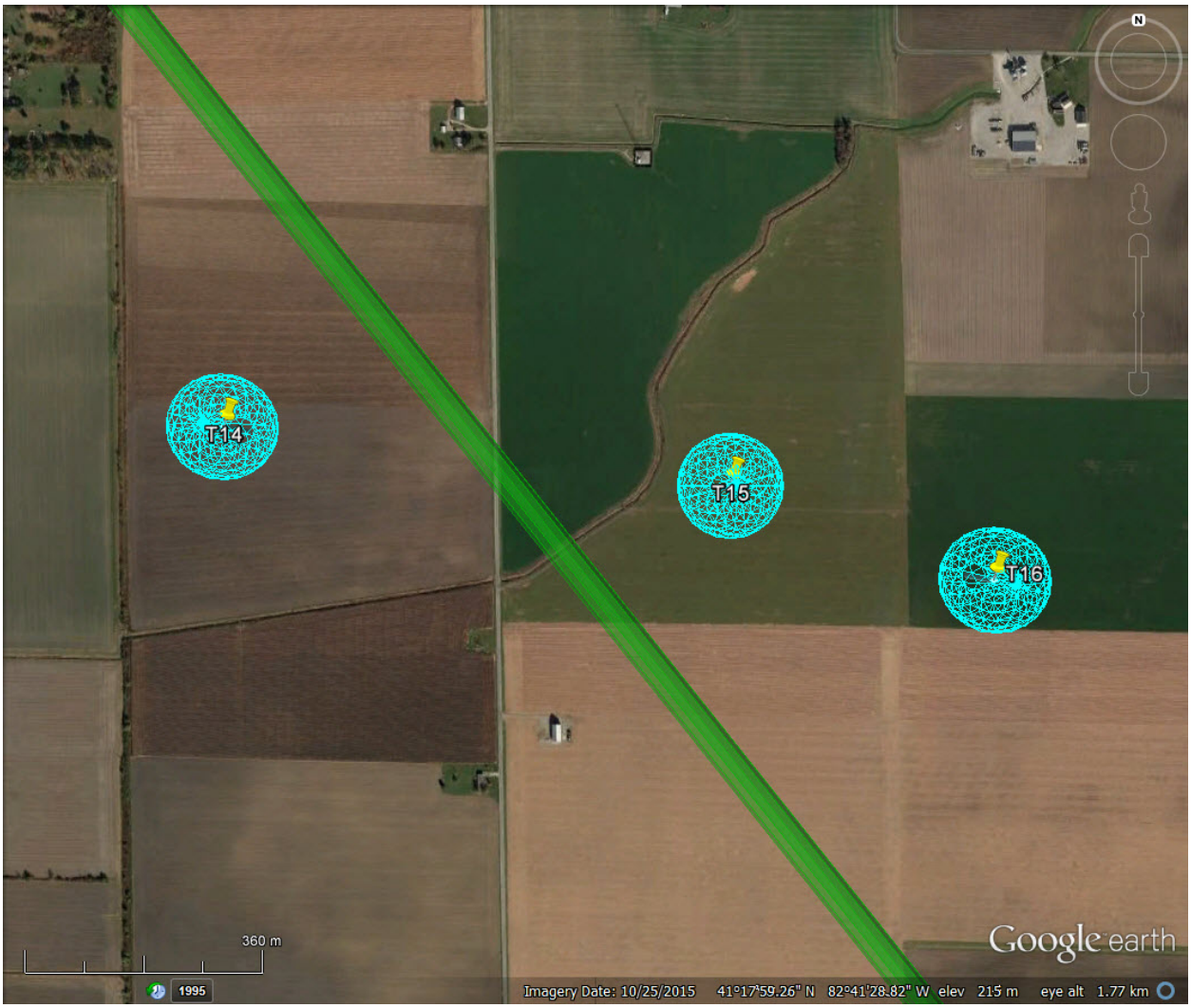

Figure 7 – Turbines 14 and 15 near Microwave Path WQJZ740

As can be seen in the image above, Turbines 14 and 15 would not penetrate the WCFZ of the microwave link.

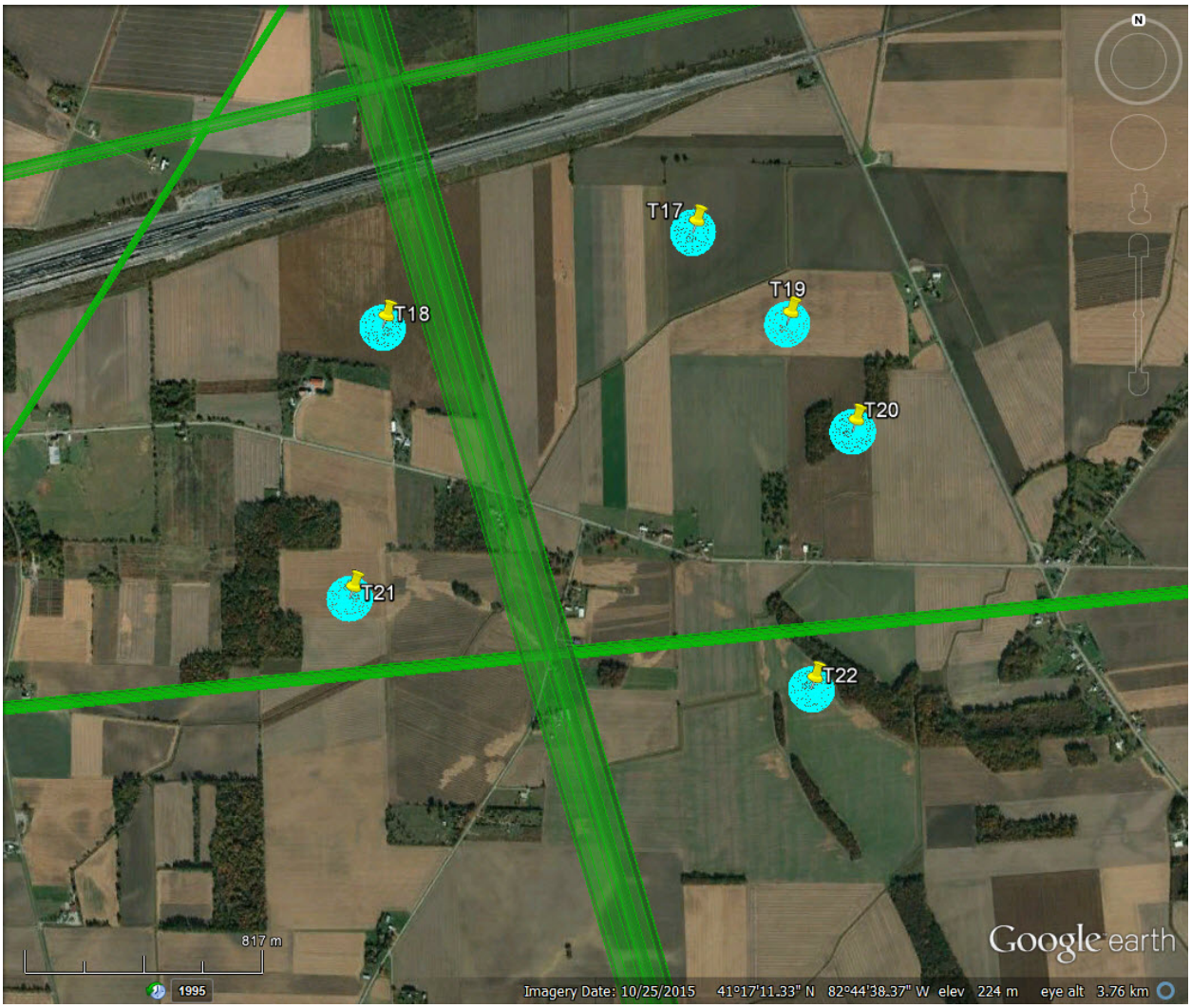

Figure 8 – Turbines 18, 21 and 22 near Microwave Paths

As can be seen in the image above, none of the turbines would penetrate the WCFZ of any FCC-licensed microwave link.

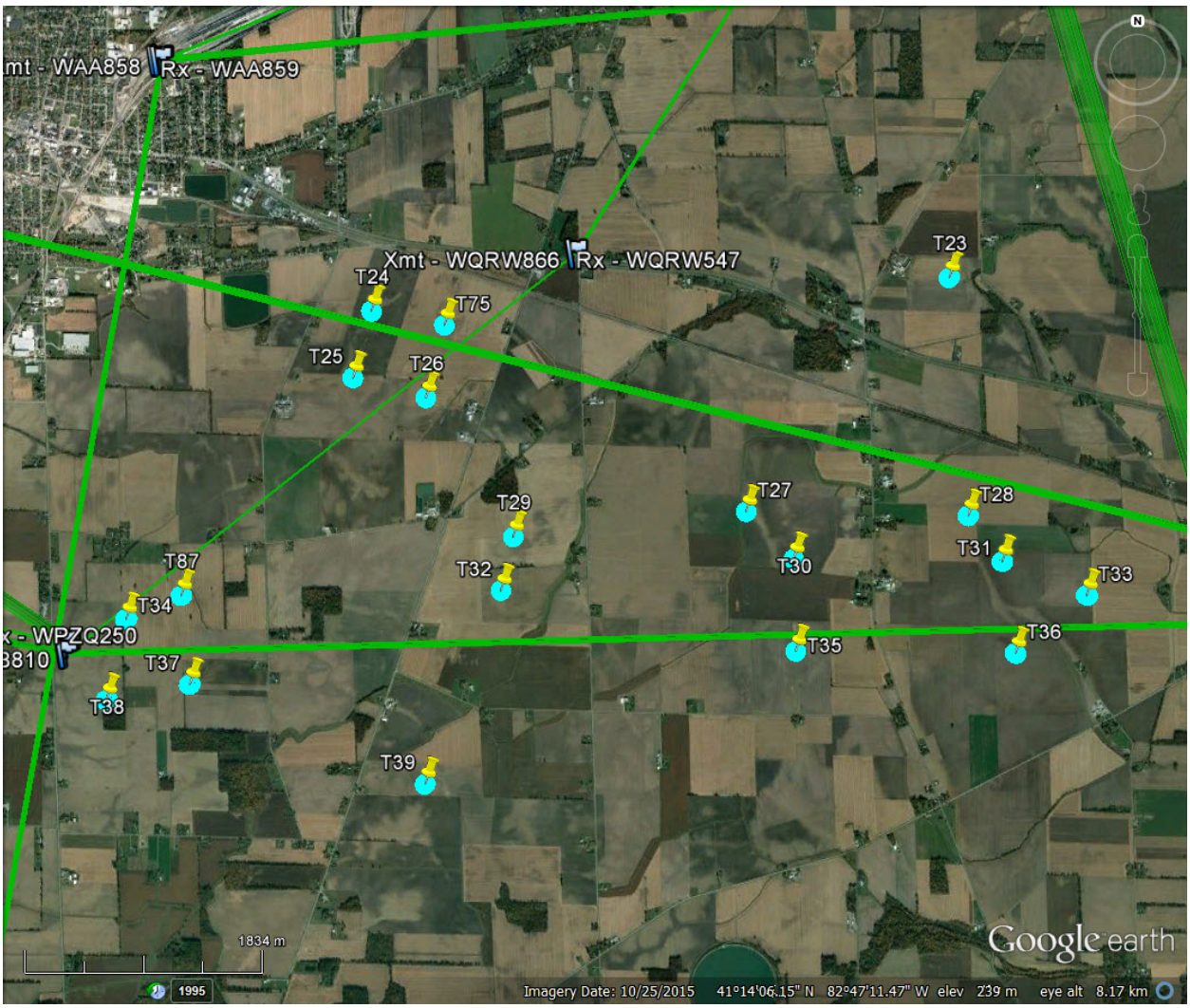

Figure 9 – Turbines 24 through 38, 75 and 87 near Microwave Paths

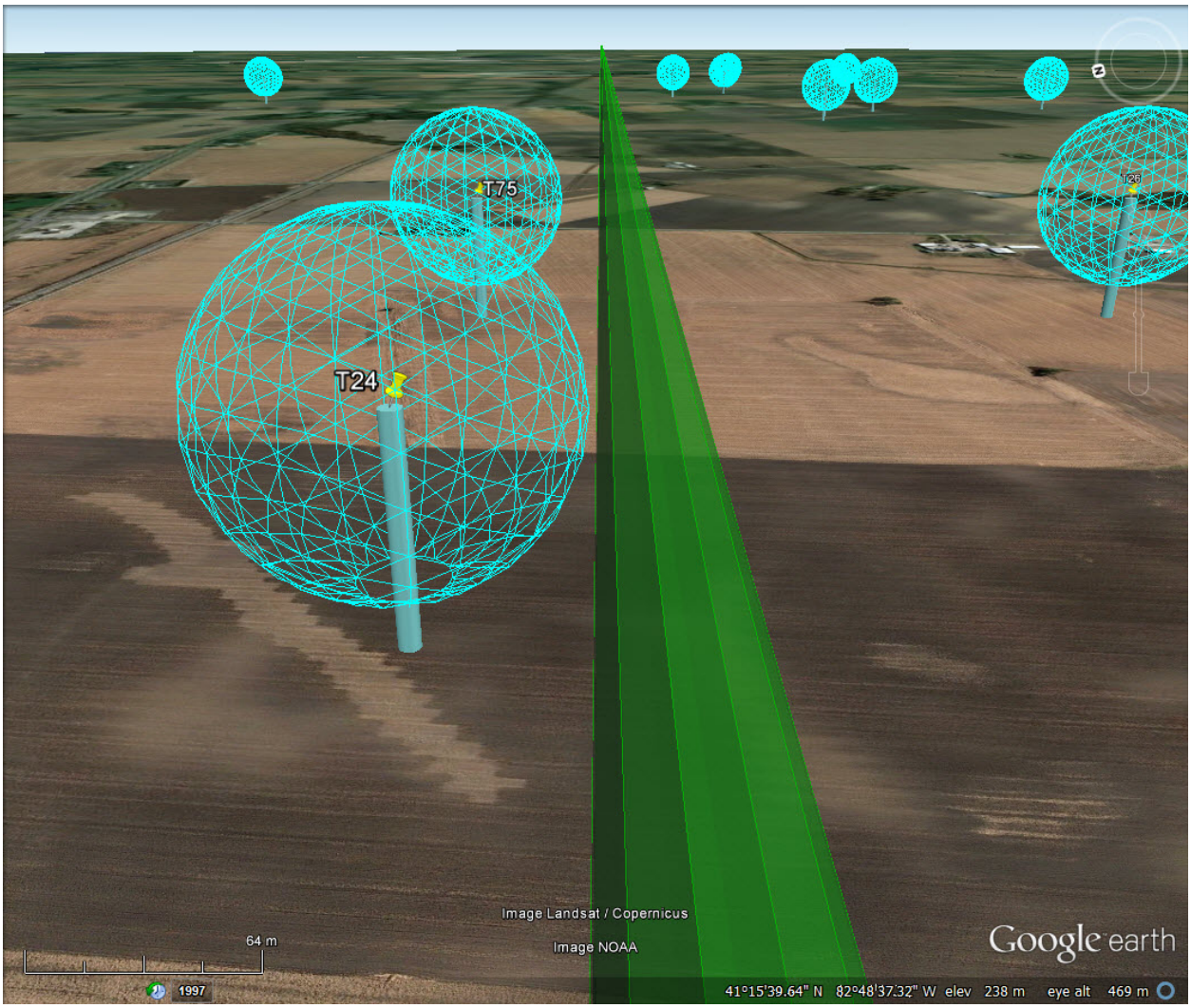

Figure 10 – Turbines 24 and 75 close to Microwave Path WQTQ663/WQTZ737

As can be seen in the image above, Turbines 24 and 75 would not penetrate the WCFZ of the microwave link.

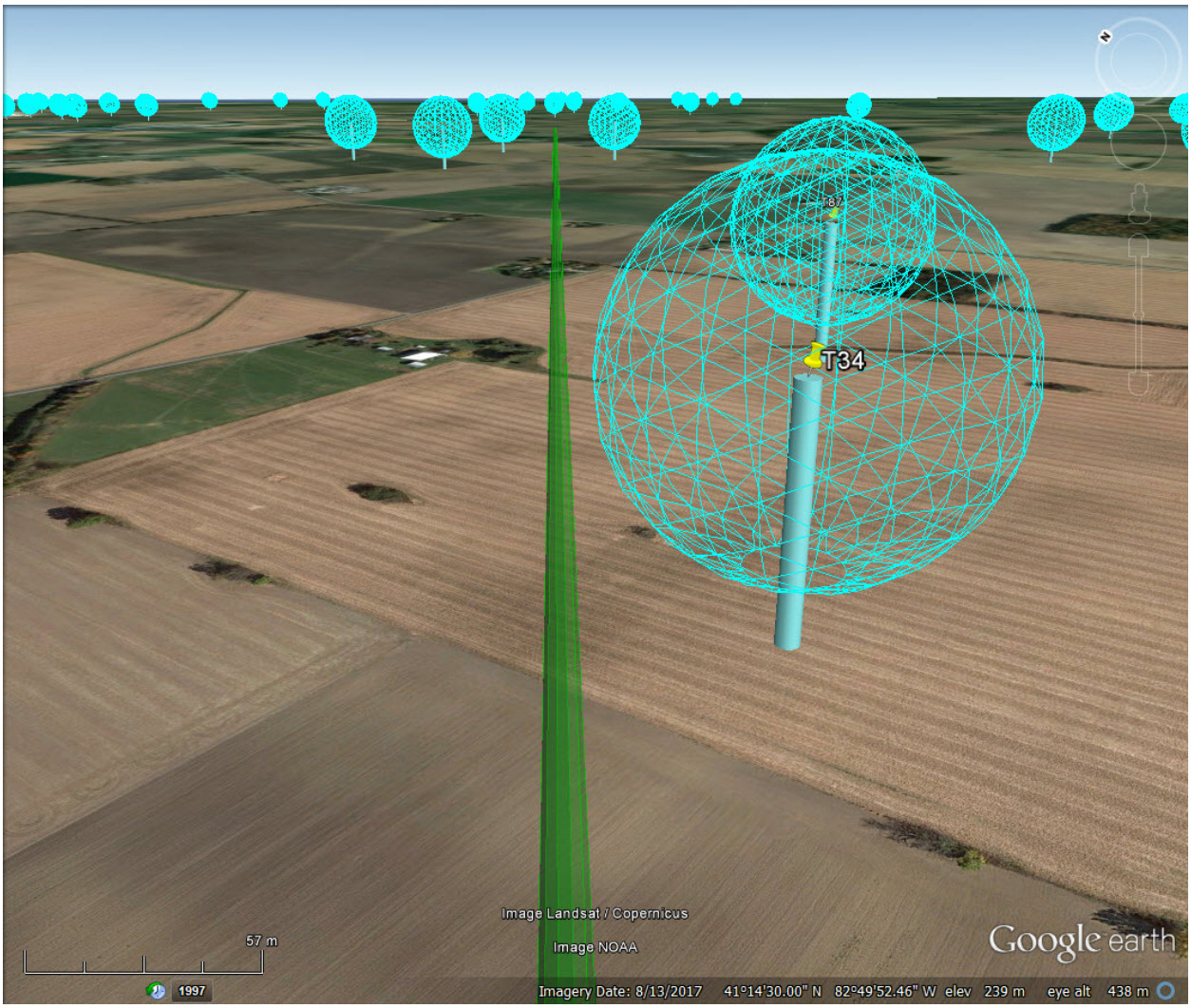

Figure 11 – Turbine 34 close to Microwave Path WPOQ355/WQVW473

As can be seen in the image above, Turbine 34 would not penetrate the WCFZ of the microwave link.

Figure 12 – Turbine 35 close to Microwave Path WQPB813/WQPB814

As can be seen in the image above, Turbine 35 would not penetrate the WCFZ of the microwave link.

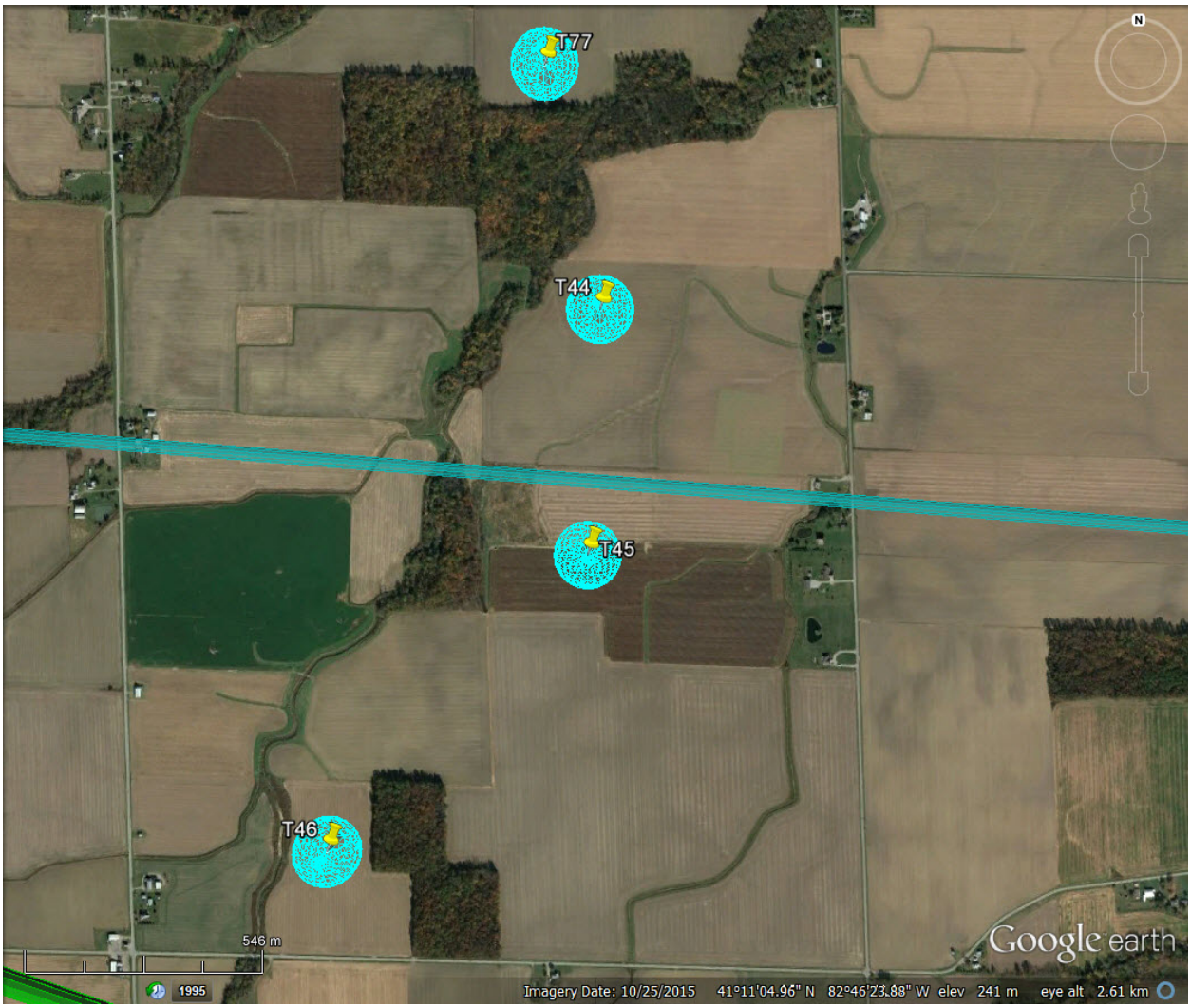

Figure 13 – Turbine 45 close to Microwave Path WESTLODI

As can be seen in the image above, Turbine 45 would not penetrate the WCFZ of the microwave link.

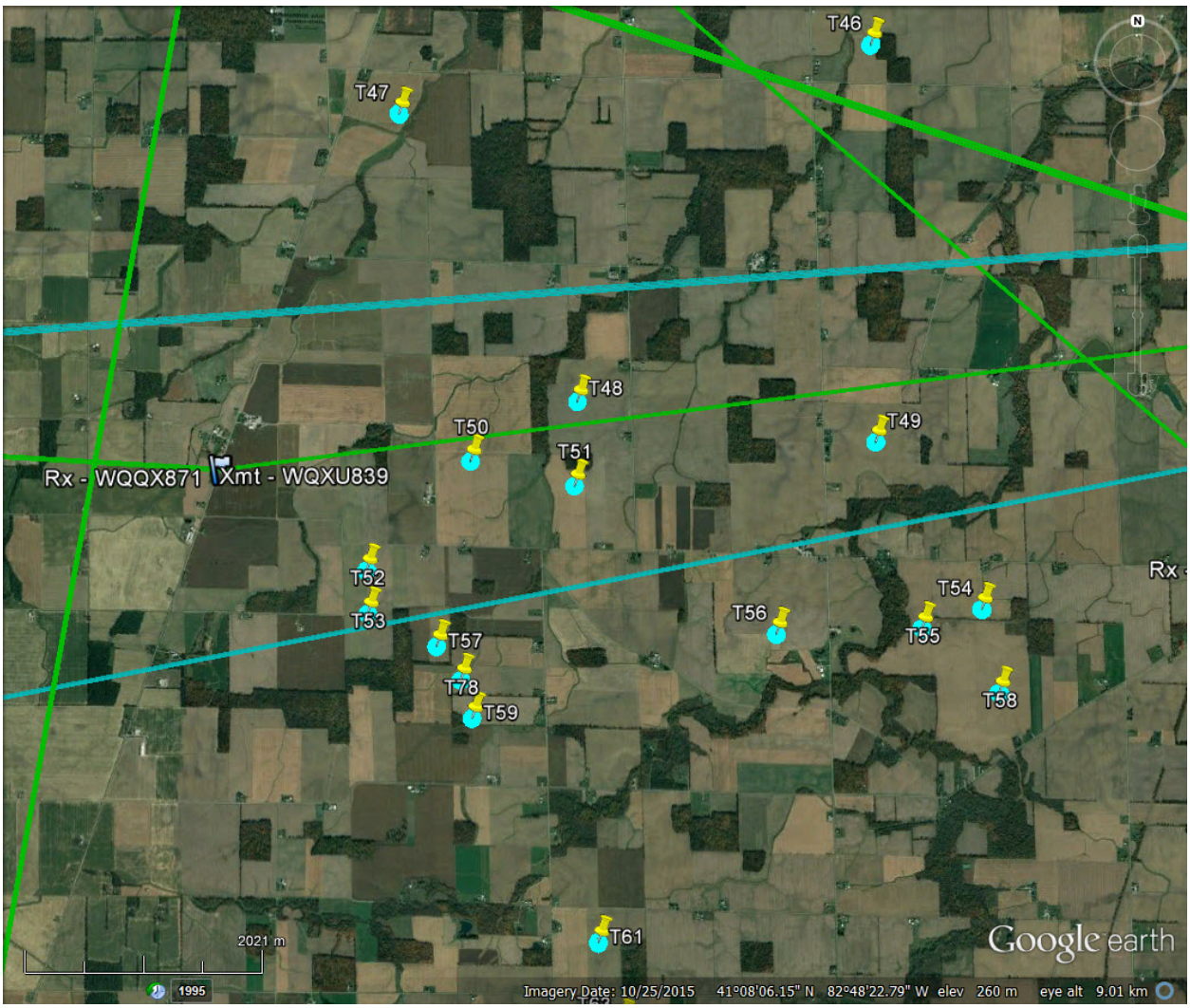

Figure 14 – Turbines 48 through 59 and 78 near Microwave Paths

Figure 15 – Turbine 53 close to Proposed Microwave Path WQQX778 (ASR1234443 to Republic ATC)

As can be seen in the image above, Turbine 53 would not penetrate the WCFZ of the microwave link.

III. ANALYSIS OF FIXED RADIO FACILITIES

3.1 Land Mobile & Public Safety Facilities

A search of the FCC's land mobile/public safety radio database revealed 158 land mobile transmitter stations that fall within the search area (0.5 mile beyond the project area boundary). These land mobile stations are listed in Table 2 and mapped in Figure 16. The specifications on the land mobile stations can be found in the associated land mobile (LM) spreadsheet file.

Multi-directional transmitting facilities, including land mobile stations, which are within 425 meters of a turbine site customarily should be further evaluated for the possibility of transmitter interference caused by wind turbines. It appears from Figures 17 through 22 that none of the land mobile stations in or near the project area are less than 425 meters from the nearest planned turbine.

Based on the current project layout, and assuming that the land mobile stations in and near the project area are actually located at their licensed locations, or located farther away from turbines, no adverse impact is expected to be caused to the transmissions of land mobile stations that are licensed by the FCC. If any of the turbines are to be re-sited, it is recommended that no turbines be closer than the following distances from the land mobile sites listed below.

Land Mobile Site	Distance (meters)
WPTI993	409
WPYT619	138
WQAU207	138
WQBZ733	425
WQJN475 (Loc 2) WQMK479 (Loc 2)	250
WQMK479 (Loc 1)	250
WQMK612 (Loc 1)	250
WQTK863 (Loc 2)	138
WQZH674	138
WQZZ917	138

Call Sign	Location	Latitude (NAD-83)	Longitude (NAD-83)	Ant. Ht. (m AGL)	Highest Freq. (MHz)	Licensee
KDN490	1	41.049444	-82.725833	23	154.295	Willard, City of
KDN490	1	41.049444	-82.725833	30	154.295	Willard, City of
KDN490	2	41.058944	-82.726556	20	46.06	Willard, City of
KDN490	4	41.056333	-82.7125	57.9	154.295	Willard, City of
KDS698	2	41.267	-82.841861	18	46.06	City of Bellevue
KGN406	2	41.288111	-82.803833	27	160.62	Norfolk Southern Railway Company
KGN406	3	41.292194	-82.786667	25.9	161.25	Norfolk Southern Railway Company
KIB579	1	41.0385	-82.710639	20	163.25	Mercy Hospital Willard
KJF738	2	41.292667	-82.786028	20	161.34	Norfolk Southern Railway Company
KJG983	2	41.042556	-82.722667	30	150.815	Wilcox, Roger
KJH294	1	41.292361	-82.7865	18	160.44	Norfolk Southern Railway Company
KJH294	3	41.285833	-82.810556	3	161.25	Norfolk Southern Railway Company
KJH294	5	41.288889	-82.802778	18.9	161.19	Norfolk Southern Railway Company
KJH294	6	41.289222	-82.802778	20	161.565	Norfolk Southern Railway Company
KJH296	2	41.289222	-82.801306	20	161.565	Norfolk Southern Railway Company
KJO898	1	41.066167	-82.742389	35	153.005	William Dauch Concrete Co., Inc.
KNAD898	1	41.0495	-82.725722	17/24	155.9325	Willard, City of
KNAJ325	1	41.291167	-82.794917	16	161.0025	Norfolk Southern Railway Company
KNBI612	1	41.280056	-82.870556	24	155.49	City of Bellevue
KNJT851	1	41.247556	-82.646556	91	464.225	Futronics Inc.
KQA234	1	41.065889	-82.749917	5	161.28	CSX Transportation, Inc.
KQA234	2	41.064778	-82.754361	40	161.28	CSX Transportation, Inc.
KQA234	4	41.059222	-82.728778	46	161.28	CSX Transportation, Inc.
KQA234	5	41.064778	-82.754361	40	160.5	CSX Transportation, Inc.
KQA234	6	41.059222	-82.727111	6	161.28	CSX Transportation, Inc.
KQA455	1	41.0495	-82.725722	30	151.235	City of Willard
KQA455	2	41.058944	-82.726556	23	39.58	City of Willard
KQA884	3	41.345417	-82.777222	21.4	158.25	East Ohio Gas Company
KQB724	1	41.245611	-82.701583	23	155.37	Monroeville, Village of
KQB724	4	41.245056	-82.698333	46.6	155.7075	Monroeville, Village of
KQD357	6	41.278972	-82.82925	13/31	161.25	Norfolk Southern Railway Company
KQE658	1	41.14	-82.670556	91.4	155.49	Huron, County of
KQI932	2	41.247556	-82.646556	91	463.375	Futronics Inc.
KSM916	2	41.308389	-82.866583	23	155.115	City of Bellevue
KTN465	2	41.245611	-82.701583	18	158.805	Monroeville, Village of
KVG797	1	41.292556	-82.788889	21	452.925	Norfolk Southern Railway Company
WNAH895	1	41.047278	-82.729056	24.4	461.075	Willard City Schools
WNCH537	1	41.064778	-82.754361	12	161.28	CSX Transportation, Inc.
WNCH537	2	41.065889	-82.751306	12	161.16	CSX Transportation, Inc.
WNCH537	3	41.070333	-82.782417	6	161.4	CSX Transportation, Inc.
WNCH537	4	41.061111	-82.728889	12	161.28	CSX Transportation, Inc.
WNCH537	5	41.060306	-82.72725	21.3	160.905	CSX Transportation, Inc.
WNCS800	1	41.289222	-82.802139	23	161.115	Norfolk Southern Railway Company

Call Sign	Location	Latitude (NAD-83)	Longitude (NAD-83)	Ant. Ht. (m AGL)	Highest Freq. (MHz)	Licensee
WNFY554	2	41.278972	-82.82925	16-37	161.565	Norfolk Southern Railway Company
WNJD866	1	41.037639	-82.731	10.6	151.835	K & P Trucking Co.
WNJD866	3	41.054972	-82.710056	3	151.835	K & P Trucking Co.
WNJD866	5	41.046139	-82.70525	3	151.835	K & P Trucking Co.
WNQK845	1	41.333667	-82.701306	17	151.655	Wensink, Robert
WNQS527	1	41.242	-82.709639	23	154.28	Huron River Joint Fire District
WNVX708	2	41.260889	-82.841028	13	464.925	A O Smith, Inc.
WNWP443	5	41.272639	-82.835167	3	918.5	Norfolk Southern Railway Company
WNWP443	6	41.293861	-82.793611	3	918.5	Norfolk Southern Railway Company
WNWP926	1	41.295361	-82.819194	3	918.5	Norfolk Southern Railway Company
WNWP926	3	41.153111	-82.87075	3	918.5	Norfolk Southern Railway Company
WNYH852	1	41.292278	-82.788889	21	161.385	Norfolk Southern Railway Company
WPAA487	2	41.051667	-82.674722	116	463.875	Futronics Inc.
WPHF830	1	41.233944	-82.655722	9	151.685	Oglesby Construction
WPOF427	1	41.270944	-82.766083	80	865.9875	Nextel West Corp.
WPPF560	1	41.069778	-82.779083	15	161.52	CSX Transportation, Inc.
WPPF560	2	41.0645	-82.742389	15	161.52	CSX Transportation, Inc.
WPPF560	3	41.063667	-82.742944	15	161.52	CSX Transportation, Inc.
WPPF560	4	41.055611	-82.687389	15	161.52	CSX Transportation, Inc.
WPPF560	5	41.068194	-82.7705	14/30.5	161.52	CSX Transportation, Inc.
WPPF560	6	41.070611	-82.779083	15	161.52	CSX Transportation, Inc.
WPPG239	3	41.055611	-82.687389	15	161.52	CSX Transportation, Inc.
WPPG239	4	41.059222	-82.721278	15	161.52	CSX Transportation, Inc.
WPPG239	5	41.061167	-82.727389	15	161.52	CSX Transportation, Inc.
WPPG239	6	41.062833	-82.731	15	161.52	CSX Transportation, Inc.
WPPH279	4	41.069778	-82.779917	15	161.52	CSX Transportation, Inc.
WPPH279	5	41.069778	-82.780472	15	161.52	CSX Transportation, Inc.
WPPH279	6	41.073111	-82.798806	15	161.52	CSX Transportation, Inc.
WPPL357	1	41.270944	-82.766083	80	865.0375	Nextel West Corp.
WPQY220	3	41.0495	-82.725722	24	155.805	Huron, County of
WPQY220	5	41.280056	-82.870472	43	155.805	Huron, County of
WPTI685	1	41.344833	-82.777222	46.3	865.9875	Nextel West Corp.
WPTI993	1	41.3075	-82.689778	61	865.9875	Nextel West Corp.
WPUX406	1	41.292722	-82.785861	28.7	452.9125	Norfolk Southern Railway Company
WPUX406	3	41.278972	-82.829222	29	452.9125	Norfolk Southern Railway Company
WPWC590	1	41.361722	-82.775417	3.1	161.19	Norfolk Southern Railway Company
WPWJ795	4	41.345472	-82.777222	20.1	451.2625	East Ohio Gas Company
WPWV978	4	41.270222	-82.837278	3.1	161.25	Norfolk Southern Railway Company
WPXD494	1	41.065	-82.754167	11/33.5	452.9125	CSX Transportation, Inc.
WPXD494	7	41.061861	-82.734	20.1	452.9125	CSX Transportation, Inc.
WPYL665	4	41.226417	-82.867083	3.1	161.19	Norfolk Southern Railway Company
WPYL665	5	41.237833	-82.859444	3.1	161.19	Norfolk Southern Railway Company
WPYL665	6	41.240889	-82.856528	3.1	161.19	Norfolk Southern Railway Company

Call Sign	Location	Latitude (NAD-83)	Longitude (NAD-83)	Ant. Ht. (m AGL)	Highest Freq. (MHz)	Licensee
WPYR728	4	41.272833	-82.839028	3.1	161.25	Norfolk Southern Railway Company
WPYT619	5	41.325583	-82.798722	3.1	161.19	Norfolk Southern Railway Company
WQAD781	5	41.2475	-82.646667	85	152.48	Futronics, Inc.
WQAU207	2	41.303639	-82.736361	3.1	161.25	Norfolk Southern Railway Company
WQBC811	1	41.0385	-82.710639	20	462.95	Mercy Hospital of Willard
WQBU261	5	41.338639	-82.647361	3.1	161.25	Norfolk Southern Railway Company
WQBU261	6	41.262528	-82.848472	3.1	161.25	Norfolk Southern Railway Company
WQBY632	7	41.243056	-82.711111	23	463.7375	Futronics, Inc.
WQBZ733	3	41.311444	-82.699333	3	921.5	Norfolk Southern Railway Company
WQCV640	2	41.14	-82.670556	91.4	155.0475	Huron, County of
WQDU781	3	41.243306	-82.711056	15	464.025	Berry Plastics
WQEW710	1	41.274778	-82.838139	3.2	921.5	Norfolk Southern Railway Company
WQEY247	1	41.281361	-82.869583	6	464.525	Amcor Rigid Plastics
WQFQ339	1	41.343389	-82.785194	51	452.075	Hanson Aggregates Midwest, Inc.
WQGP980	1	41.065028	-82.753917	15.2-21.3	161.52	CSX Transportation, Inc.
WQGP980	2	41.054417	-82.664694	21.3	160.23	CSX Transportation, Inc.
WQHA408	1	41.268889	-82.8225	14	159.7575	Quality Welding Inc.
WQHK910	1	41.068333	-82.648333	23	152.39	Bauer Farms
WQII220	5	41.175278	-82.870278	3.1	161.475	Norfolk Southern Railway Company
WQIL377	4	41.240667	-82.868444	9	173.275	North Central Electric Co-Op
WQJA686	3	41.283056	-82.8325	10	452.8125	Precision Automotive Plastics
WQJN475	1	41.165583	-82.836583	30	173.39	Northern Ohio Rural Water
WQJN475	2	41.106111	-82.735556	30	173.39	Northern Ohio Rural Water
WQJN477	1	41.283972	-82.785417	10	451.675	Northern Ohio Rural Water
WQJN477	2	41.165583	-82.836583	30	451.675	Northern Ohio Rural Water
WQJN477	3	41.138889	-82.852694	10	451.675	Northern Ohio Rural Water
WQJW666	1	41.165583	-82.836583	30	173.35	Northern Ohio Rural Water
WQJW667	1	41.283972	-82.785417	11	456.0875	Northern Ohio Rural Water
WQJW667	2	41.165583	-82.836583	30	456.0875	Northern Ohio Rural Water
WQLJ404	1	41.230722	-82.86425	3/6.1	161.565	Norfolk Southern Railway Company
WQLS706	2	41.351917	-82.783667	2	464.75	Galloway & Sons LLC
WQMH833	3	41.048083	-82.681167	115	152.3075	Futronics, Inc.
WQMH834	3	41.048083	-82.681167	115	152.3675	Futronics, Inc.
WQMK479	1	41.131528	-82.785556	30	451.2125	Northern Ohio Rural Water
WQMK479	2	41.106111	-82.735556	30	451.2125	Northern Ohio Rural Water
WQMK479	3	41.074722	-82.738333	13	451.2125	Northern Ohio Rural Water
WQMK612	1	41.247806	-82.803694	24	451.5	Shearer Farm Inc.
WQMK612	5	41.164722	-82.807833	39.6	452.275	Shearer Farm Inc.
WQMN426	1	41.288889	-82.802778	18.9	161.19	Norfolk Southern Railway Company
WQMR471	2	41.211667	-82.869722	3.1	161.475	Norfolk Southern Railway Company
WQNW560	6	41.295	-82.819444	3.1	161.475	Norfolk Southern Railway Company
WQOJ908	5	41.153333	-82.870833	3.1	161.475	Norfolk Southern Railway Company
WQOU492	4	41.346111	-82.785556	3.1	161.475	Norfolk Southern Railway Company

Call Sign	Location	Latitude (NAD-83)	Longitude (NAD-83)	Ant. Ht. (m AGL)	Highest Freq. (MHz)	Licensee
WQOX824	1	41.0385	-82.710639	18	464.325	Mercy Hospital of Willard
WQOY551	1	41.066972	-82.762361	10.7	160.5	CSX Transportation, Inc.
WQOY551	2	41.065111	-82.754028	33.5	161.28	CSX Transportation, Inc.
WQRK602	5	41.22475	-82.814	9	173.275	North Central Electric Co-Op
WQRR308	1	41.278528	-82.833583	16	461.225	Mitsubishi Chemical Performance Polymers, Inc.
WQSC373	2	41.160833	-82.870556	3.1	161.475	Norfolk Southern Railway Company
WQTB382	5	41.067528	-82.755667	12.8	160.785	CSX Transportation, Inc.
WQTK863	2	41.266083	-82.808167	15.5	161.025	Wheeling & Lake Erie Railway Co.
WQTK863	3	41.259972	-82.782972	15.5	161.025	Wheeling & Lake Erie Railway Co.
WQTK863	4	41.248861	-82.735972	15.5	161.025	Wheeling & Lake Erie Railway Co.
WQTK863	5	41.240722	-82.665833	15.5	161.025	Wheeling & Lake Erie Railway Co.
WQTT977	1	41.332056	-82.700861	33.5	464.95	Wensink Seed Farms Inc
WQUC399	2	41.065111	-82.754028	33.5	161.16	CSX Transportation Inc
WQUE232	1	41.045556	-82.730917	13.8	72.28	Willard City School District
WQUL470	1	41.292417	-82.786611	11.6	160.7325	Norfolk Southern Railway Company
WQVK640	1	41.285833	-82.819972	64	464.4375	Bunge North America, Inc.
WQVK929	4	41.240833	-82.869139	9	173.275	North Central Electric Co-Op
WQVM543	13	41.17775	-82.672278	2	464.2875	National Hot Rod Association
WQWJ832	3	41.038611	-82.709722	15.2	463.75	St. Vincent Medical Center
WQWJ872	5	41.160194	-82.861278	9	173.275	North Central Electric Co-Op
WQWM845	3	41.138889	-82.870833	7.9	161.475	Norfolk Southern Railway Company
WQWZ858	1	41.038667	-82.709722	15.2	464.9	St. Vincent Medical Center
WQXN431	1	41.259278	-82.842667	7.6	463.85	Tower Automotive
WQYJ401	1	41.064583	-82.754861	5.4	462.825	CSX Transportation, Inc.
WQYW485	4	41.065111	-82.754028	33.5	161.52	CSX Transportation, Inc.
WQZH674	6	41.303389	-82.73675	6.1	161.475	Norfolk Southern Railway Company
WQZZ917	6	41.333889	-82.793889	3.1	161.475	Norfolk Southern Railway Company
WRBX352	1	41.105306	-82.684083	2	462.2375	Smith, Hiram B.
WSY981	2	41.292278	-82.788889	18	160.665	Norfolk Southern Railway Company

Table 2 – Land Mobiles Stations within 0.5 mile of Project Area Boundary

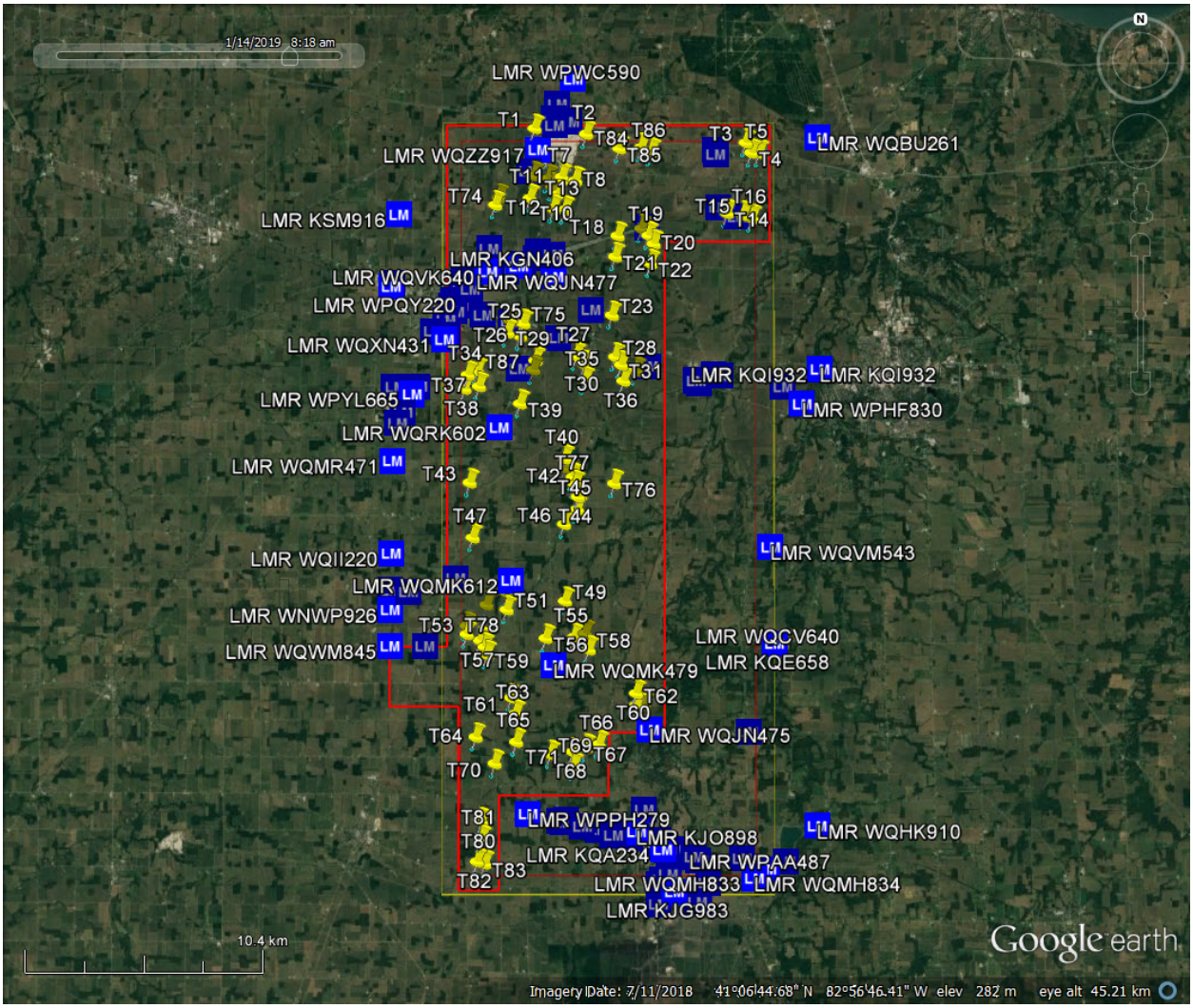

Figure 16 – Land Mobile Stations in or near Emerson Creek Project Area

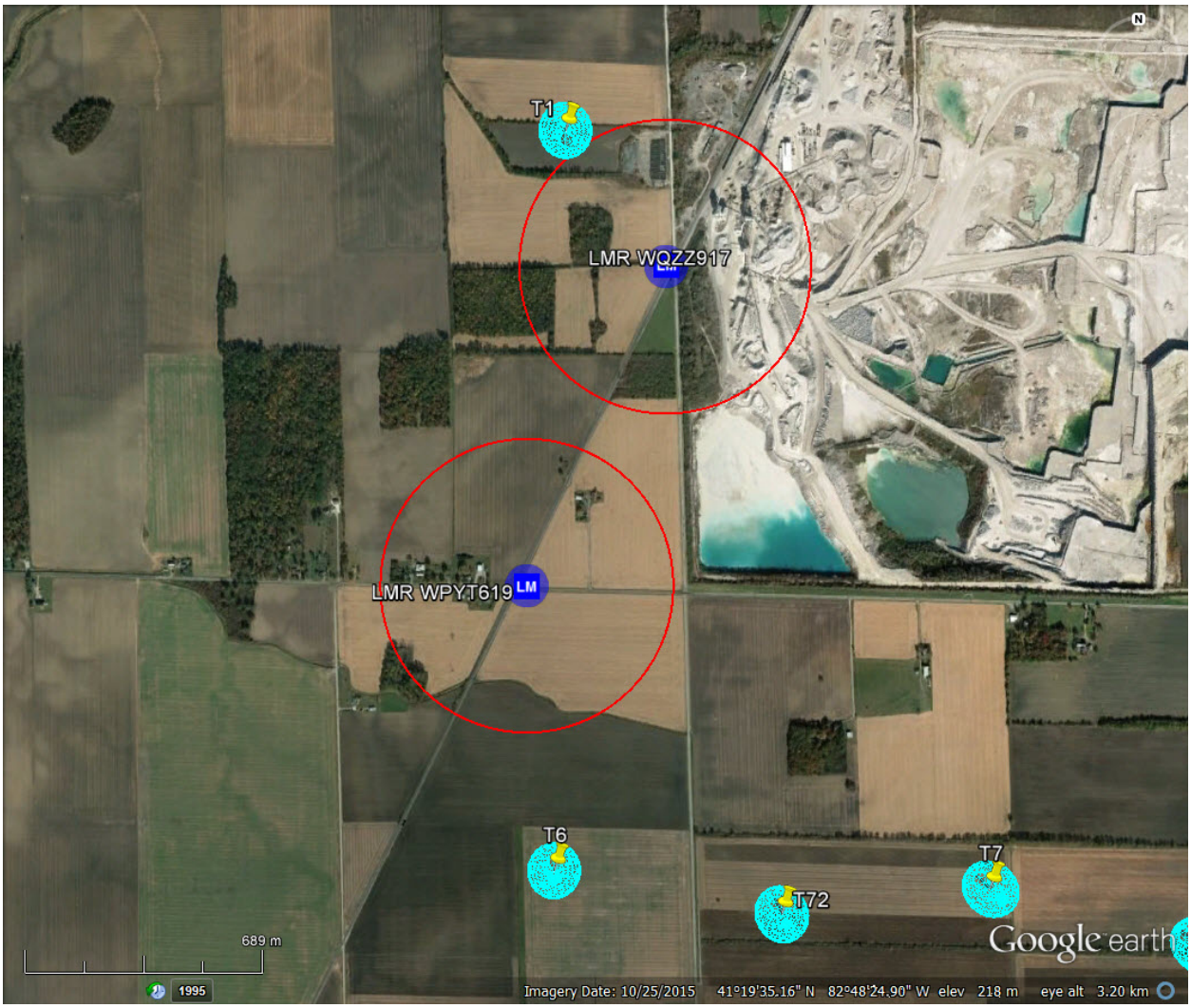

Figure 17 – Planned Turbines near Land Mobile Stations WQZZ917 & WPYT619

(Red Circle represents a worst-case setback of 425 meters.)

As can be see, the planned turbines in the image above are no closer than the worst-case recommended setback of 425 meters to the land mobile site(s).

Figure 18 – Planned Turbines near Land Mobile Stations WQBZ733 & WPTI993

(Red Circle represents a worst-case setback of 425 meters.)

As can be see, the planned turbines in the image above are no closer than the worst-case recommended setback of 425 meters to the land mobile site(s).

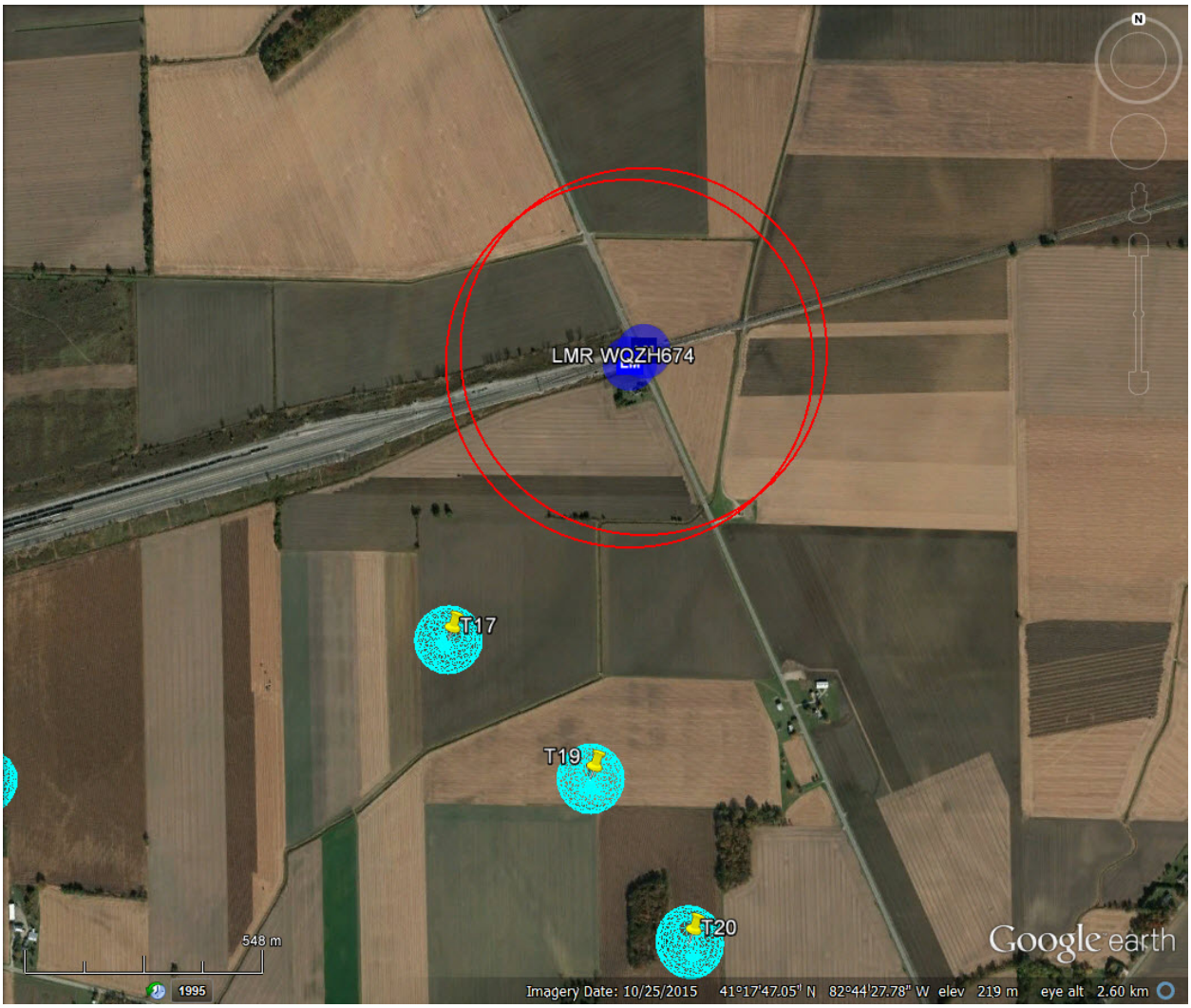

Figure 19 – Planned Turbines near Land Mobile Stations WQAU207 & WQZH674

(Red Circle represents a worst-case setback of 425 meters.)

As can be see, the planned turbines in the image above are no closer than the worst-case recommended setback of 425 meters to the land mobile site(s).

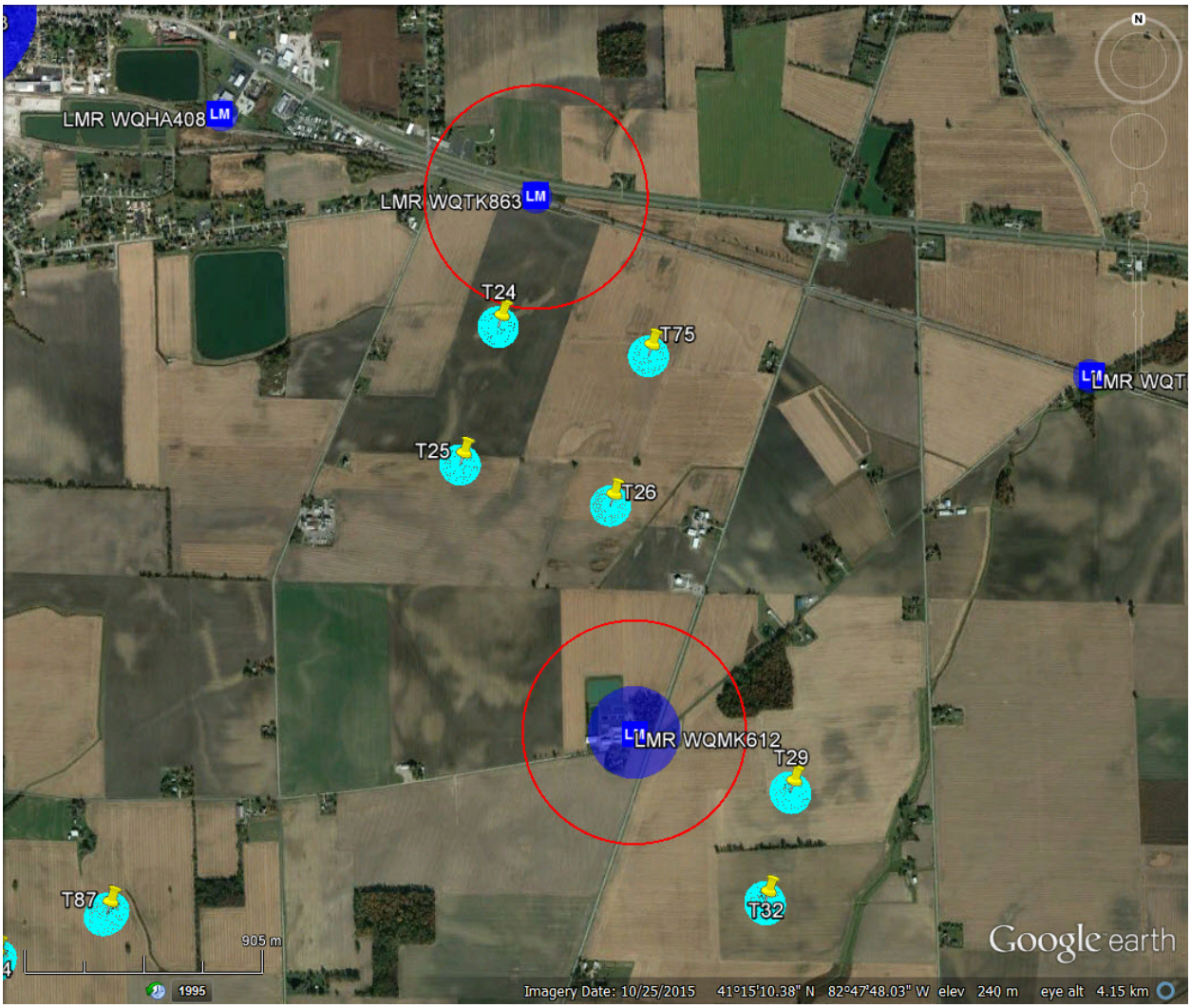

Figure 20 – Planned Turbines near Land Mobile Stations
WQTK863 Location 2 & WQMK612 Location 1

(Red Circle represents a worst-case setback of 425 meters.)

As can be see, the planned turbines in the image above are no closer than the worst-case recommended setback of 425 meters to the land mobile site(s).

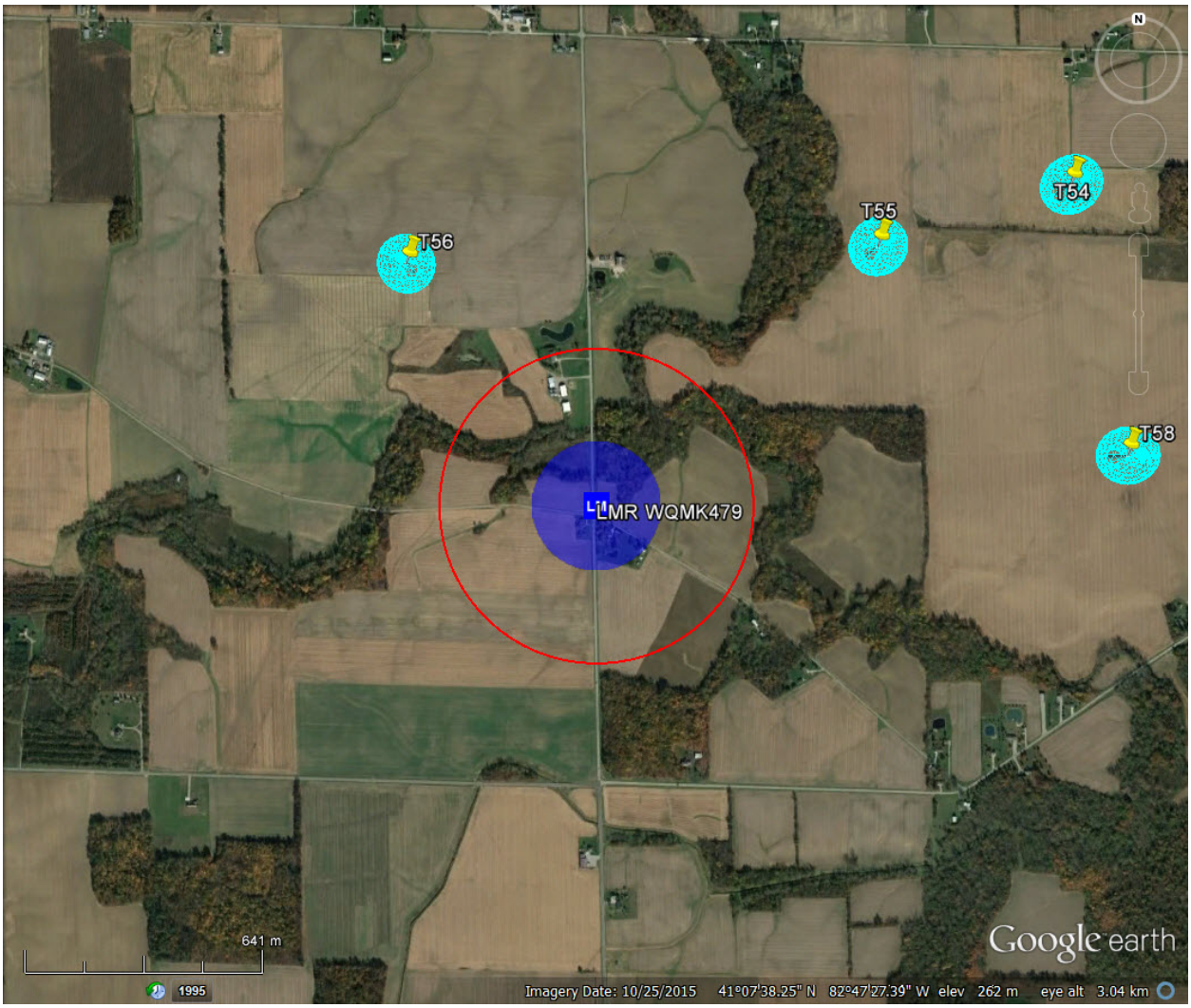

Figure 21 – Planned Turbines near Land Mobile Station WQMK479 Location 1

(Red Circle represents a worst-case setback of 425 meters.)

As can be see, the planned turbines in the image above are no closer than the worst-case recommended setback of 425 meters to the land mobile site(s).

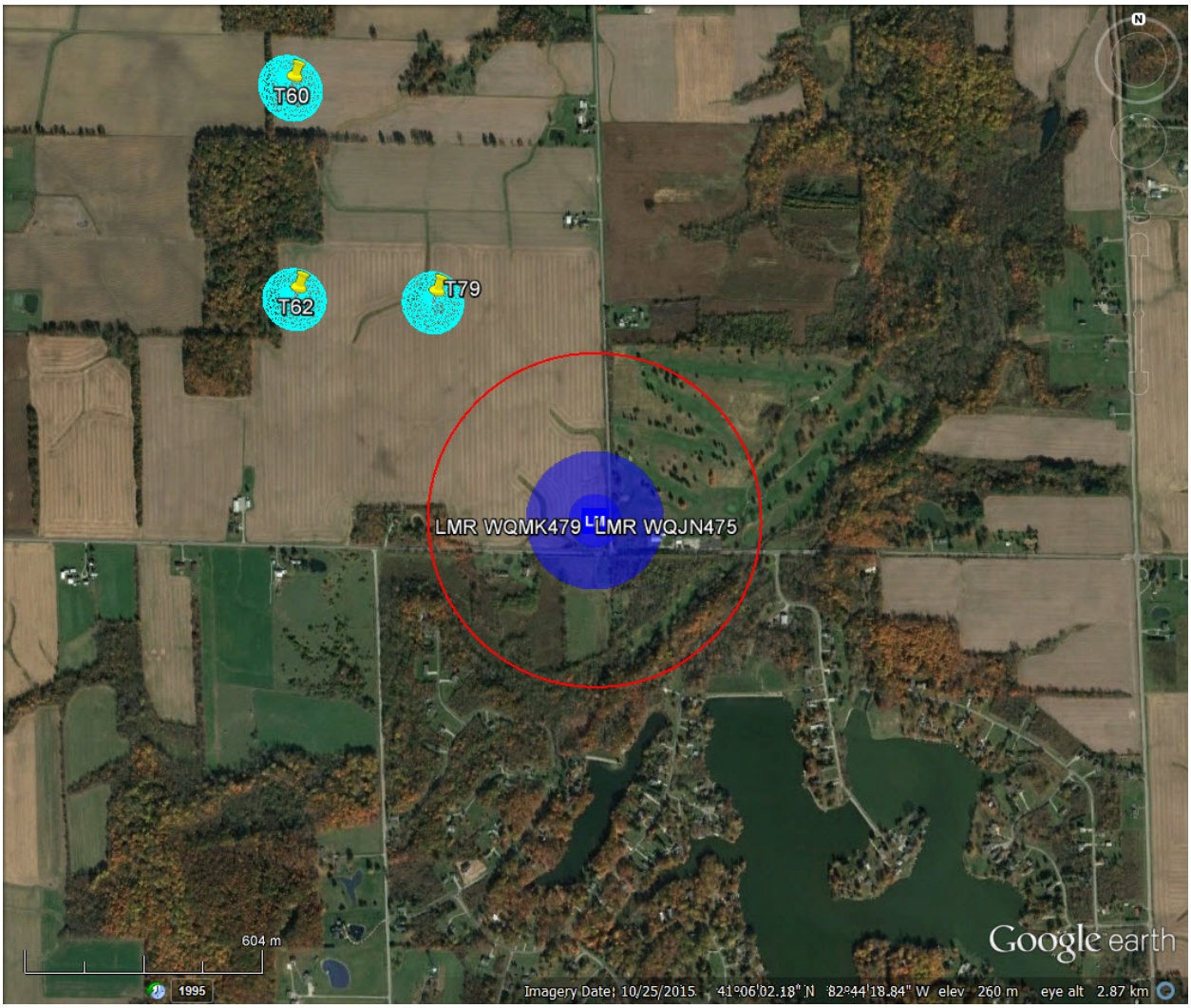

Figure 22 – Planned Turbines near Land Mobile Stations
WQJN475 Location 2 & WQMK479 Location 2 (Common Site)

(Red Circle represents a worst-case setback of 425 meters.)

As can be see, the planned turbines in the image above are no closer than the worst-case recommended setback of 425 meters to the land mobile site(s).

3.2 Other Communications Sites

A search through the FCC registered antenna structures database reveals other communications towers located within 10 kilometers beyond the turbine area, which are listed in Table 3 and mapped in Figures 23 and 24. The antenna structure locations closest to planned turbines are shown in Figures 25 through 28. Many of these structures appear to be cellular base station towers. It is suggested, though not required, that these sites be investigated for microwave operations that are not in the FCC database, including unlicensed microwave facilities.

Figure 24 is a closer view of the registered antenna towers in and near the turbine area. As mentioned previously, multi-directional transmitting facilities within 425 meters of a planned turbine customarily should be further evaluated for the possibility of turbine-related transmitter interference. Based on the current turbine layout, and as demonstrated in Figures 24 through 28, the Emerson Creek project is not expected to cause any turbine-related signal transmission problems to multi-directional transmitting facilities located at any of the tower sites listed in Table 3.

Table 3 should not be considered a complete list of antenna structures in the area, since most towers under 200 feet (61 meters) in height are not required to be registered with the FCC. An on-site visual survey is suggested to identify such towers.

FCC Registr. #	Owner	Location	Latitude	Longitude	Height AGL (m)
1003889	American Towers LLC	Willard, OH	41-03-34.8N	082-43-43.0W	83.8
1010022	Futronics Inc.	West Lodi, OH	41-11-55.0N	082-56-11.0W	103.0
1011065	Futronics Paging, Inc.	Norwalk, OH	41-14-50.9N	082-38-46.6W	96.9
1011067	Spectrum Mid-America, LLC	Willard, OH	41-09-10.0N	082-42-07.0W	88.3
1011074	Sound Systems, Inc.	Bellevue, OH	41-16-48.0N	082-54-20.0W	91.4
1012238	Erie Co. Cablevision, Inc.	Sandusky, OH	41-24-26.0N	082-42-51.0W	123.0
1013134	Ohio, State of	Castalia, OH	41-24-11.0N	082-49-05.0W	111.9
1013581	FELHC	York Township, OH	41-16-40.0N	082-55-15.0W	61.0
1013843	Buckeye Power, Inc.	Attica, OH	41-04-02.0N	082-53-59.0W	67.7
1014173	Ohio RSA 2 LP dba AllTel	Castalia, OH	41-24-20.6N	082-47-02.8W	125.8
1014175	Ohio RSA 2 LP dba AllTel	North Fairfield, OH	41-08-04.8N	082-36-59.8W	127.4
1014177	Ohio RSA 2 LP	Monroeville, OH	41-20-10.0N	082-41-39.0W	81.7
1014183	Ohio RSA 2 LP dba AllTel	Attica, OH	41-04-32.1N	082-54-49.6W	125.6
1014962	Futronics, Inc.	Castalia, OH	41-22-38.0N	082-48-52.0W	106.0
1015080	American Towers LLC	Townsend, OH	41-21-34.8N	082-52-28.9W	88.1
1015081	American Towers LLC	Bellevue, OH	41-16-15.3N	082-45-57.7W	77.7
1015082	American Towers LLC	Milan, OH	41-18-14.0N	082-34-04.0W	91.1
1015616	Ohio, State of	Norwalk, OH	41-13-18.0N	082-36-01.0W	60.9
1015738	Wayside Temple	Castalia, OH	41-23-48.0N	082-47-31.0W	224.6
1019432	Cellco Partnership	Monroeville, OH	41-20-14.0N	082-41-34.0W	88.4
1023032	Norfolk Southern Corp.	Attica, OH	41-05-09.0N	082-52-32.0W	105.2
1204575	City of Willard, Ohio	Willard, OH	41-02-58.0N	082-43-33.0W	30.5
1024609	Ohio RSA 2 LP dba AllTel	Huron, OH	41-24-01.5N	082-35-13.6W	36.3
1026342	Wayside Temple	Castalia, OH	41-23-48.2N	082-47-28.7W	78.9
1027715	BAS Broadcasting, Inc.	Bellevue, OH	41-14-55.8N	082-54-45.9W	91.1
1047453	Elyria-Lorain Broadcasting Corp.	Norwalk, OH	41-16-49.0N	082-39-26.0W	106.8
1053044	Ohio RSA 2 LP dba AllTel	Bellevue, OH	41-14-16.8N	082-50-15.9W	82.9
1058492*	Bible Broadcasting Network, Inc.	Sandusky, OH	41-24-14.0N	082-40-56.0W	30.5
1059100	STC Two LLC	Sandusky, OH	41-22-19.0N	082-42-05.0W	79.3
1060431	Perkins, Township of	Sandusky, OH	41-23-58.0N	082-39-07.0W	83.5
1061886	CCATT LLC	Bellevue, OH	41-20-23.1N	082-47-24.2W	79.2
1063450*	GRH & Associates	Sandusky, OH	41-24-12.0N	082-38-52.0W	46.3
1202119	SBC Tower Holdings LLC	Milan, OH	41-19-50.1N	082-36-04.8W	89.3
1202366	Crown Communications LLC	Bellevue, OH	41-16-23.0N	082-52-36.0W	93.6
1205025	City of Huron	Huron, OH	41-23-20.1N	082-35-51.6W	42.7
1205495	City of Huron	Huron, OH	41-23-20.0N	082-35-52.0W	42.7
1205981	STC Two LLC	Bellevue, OH	41-15-55.8N	082-47-27.9W	80.8
1207491	STC Five LLC	Bellevue, OH	41-20-58.9N	082-52-34.0W	80.7
1208463	American Towers LLC	Groten Township, OH	41-20-41.4N	082-46-38.0W	79.5

FCC Registr. #	Owner	Location	Latitude	Longitude	Height AGL (m)
1208759	Willard Christian Radio, Inc.	Celeryville, OH	41-02-07.2N	082-42-31.6W	33.5
1209387	Crown Communications LLC	Huron, OH	41-23-56.0N	082-34-46.0W	48.5
1209576	New Generation Land Co.	Willard, OH	41-01-29.0N	082-43-57.0W	16.2
1210801	American Towers LLC	Monroeville, OH	41-18-27.1N	082-41-23.4W	60.9
1211641	STC Two LLC	Norwalk, OH	41-14-35.2N	082-38-11.0W	79.2
1214960	American Towers LLC	Vickery, OH	41-23-11.2N	082-55-33.8W	95.1
1215369	American Towers LL	Milan, OH	41-20-05.4N	082-38-29.2W	78.3
1215837	American Towers LLC	Clyde, OH	41-18-16.6N	082-55-55.6W	80.4
1216152	American Towers LLC	Norwalk, OH	41-13-05.8N	082-35-46.8W	59.4
1218164	Ohio, State of	Castalia, OH	41-24-11.0N	082-49-04.0W	113.7
1218393	American Towers LLC	Vickery, OH	41-25-38.7N	082-51-24.1W	85.6
1218396	American Towers LLC	Sandusky, OH	41-24-28.2N	082-43-58.7W	75.6
1219345	Ohio Turnpike Commission	Bellevue, OH	41-20-59.0N	082-49-56.4W	55.8
1219809	American Towers LLC	Sandusky, OH	41-22-48.6N	082-45-32.8W	60.6
1220458	American Towers LLC	Castalia, OH	41-24-13.4N	082-48-49.7W	79.5
1221702	SBA 2012 TC Assets, LLC	Sandusky, OH	41-24-16.8N	082-43-39.0W	85.0
1224207	STC Two LLC	Sandusky, OH	41-24-31.0N	082-39-37.5W	57.9
1226188	Crown Communication LLC	Attica, OH	41-03-16.0N	082-51-38.0W	97.5
1226357	American Towers LLC	Bellevue, OH	41-20-12.7N	082-49-53.9W	60.7
1226358	American Towers LLC	Vickery, OH	41-24-37.0N	082-54-53.9W	51.2
1230775	Comwavz	Sandusky, OH	41-18-43.2N	082-41-54.5W	91.4
1234280	STC Five LLC	Clyde, OH	41-18-02.1N	082-56-45.4W	60.0
1239981	BAS Broadcasting, Inc.	Bellevue, OH	41-14-19.2N	082-50-15.6W	101.5
1241031	SBA 2012 TC Assets, LLC	Norwalk, OH	41-15-02.5N	082-38-16.7W	112.5
1241042	Crown Communication LLC	Huron, OH	41-23-55.7N	082-34-47.1W	48.2
1243264	SBA Towers II LLC	Huron, OH	41-24-22.1N	082-35-49.6W	46.9
1243968	SBA 2012 TC Assets, LLC	Willard, OH	41-04-07.3N	082-42-51.4W	78.3
1251687	SBA 2012 TC Assets, LLC	Attica, OH	41-04-49.0N	082-53-16.0W	106.6
1260473	SBA Monarch Towers II, LLC	Bellevue, OH	41-17-35.8N	082-50-06.9W	59.4
1262601	New Par	Sandusky, OH	41-25-26.5N	082-40-29.9W	36.6
1263190	New Par	Monroeville, OH	41-15-02.7N	082-42-37.3W	91.4
1263325	Futronics, Inc.	Bellevue, OH	41-17-33.1N	082-53-17.5W	60.9
1263961	SBA Monarch Towers II, LLC	Milan, OH	41-17-06.7N	082-35-06.5W	60.7
1264158	Seneca Co. Dept. of Public Safety	Attica, OH	41-03-26.6N	082-53-11.9W	60.7
1265260	American Towers LLC	Republic, OH	41-07-46.9N	082-56-20.7W	60.7
1265977	Futronics, Inc.	New Haven, OH	41-02-53.1N	082-40-52.2W	115.8
1268540	New Par	Milan, OH	41-18-15.2N	082-34-03.0W	82.2
1270898	SBA 2012 TC Assets, LLC	Bellevue, OH	41-16-53.4N	082-51-51.6W	58.8
1282842	American Towers LLC	Attica, OH	41-08-58.8N	082-50-51.3W	88.4

FCC Registr. #	Owner	Location	Latitude	Longitude	Height AGL (m)
1283655	American Towers LLC	Willard, OH	41-03-51.7N	082-43-02.6W	87.5
1284508	New Par	Vickery, OH	41-24-27.8N	082-55-20.4W	89.9
1285262	New Par	Castilia, OH	41-23-47.9N	082-48-08.1W	89.9
1285271	New Par	North Fairfield, OH	41-07-09.1N	082-36-51.7W	89.9
1293935	STC Towers Acquisition 2015, LLC	Huron, OH	41-24-39.6N	082-36-47.6W	44.2
1294227	BAS Broadcasting, Inc.	Milan, OH	41-19-51.5N	082-35-56.5W	152.1
1294467	Skyway Towers, LLC	Bellevue, OH	41-12-39.8N	082-50-29.9W	88.3
1295586	Huron County EMA	Willard, OH	41-08-24.0N	082-40-14.0W	97.0
1296851	SBA Towers VI, LLC	Sandusky, OH	41-24-50.1N	082-42-00.6W	41.1
1296896	Norfolk Southern Railway Co.	Huron, OH	41-25-28.9N	082-38-35.0W	19.2
1296902	Norfolk Southern Railway Co.	Huron, OH	41-24-06.8N	082-35-39.2W	13.1
1297669	Capital Telecom Holdings LLC	Monroeville, OH	41-08-33.7N	082-44-10.2W	79.2
1300038	Arcadia Towers II, LLC	Sandusky, OH	41-23-50.7N	082-42-27.0W	60.7
1301743	STC Towers, LLC	Sandusky, OH	41-25-18.1N	082-45-39.6W	60.6
1301744	STC Towers, LLC	Norwalk, OH	41-15-57.2N	082-36-47.0W	60.6
1303456	OH Exchange Facilities Networks	Willard, OH	41-01-54.8N	082-43-04.8W	38.1
1304591	Tillman Infrastructure, LLC	Bellevue, OH	41-21-22.7N	082-52-26.9W	80.7
1305829	Tillman Infrastructure, LLC	Sandusky, OH	41-25-29.4N	082-40-23.7W	38.1

The listed coordinates for the above structures are from documents filed with the FCC and have not been verified by this consultant. Green-shaded records indicate towers containing microwave facilities documented in Section II of this report. Blue-shaded tower records indicate sites of land mobile stations listed in this section. Cyan-shaded records indicate sites of both microwave and land mobile facilities listed in this report.

* The indicated towers, although registered with the FCC, have not been verified to have been constructed.

Table 3 – Registered Communications Towers within 10 KM beyond Turbine Area Boundary

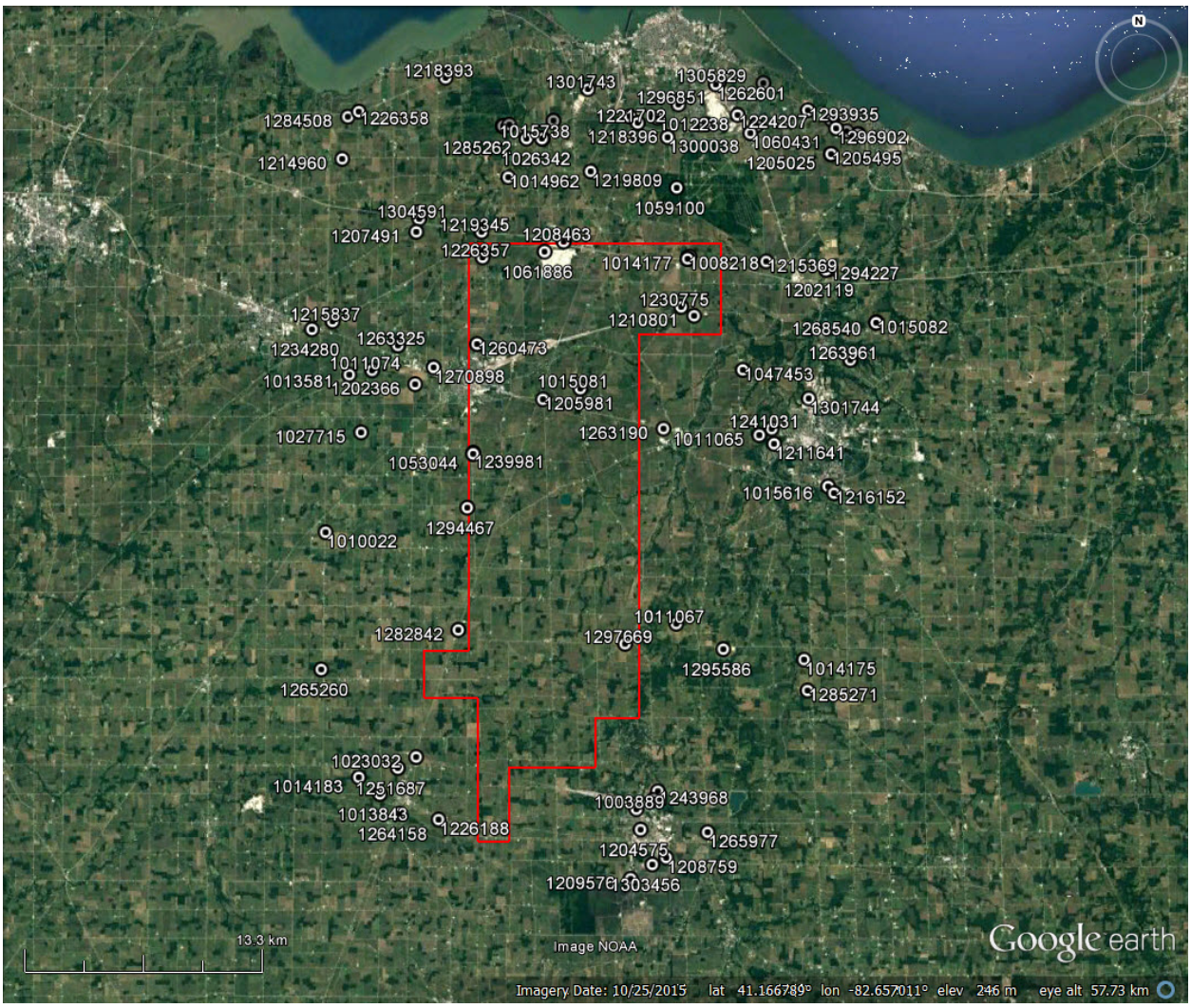

Figure 23 – Registered Communications Towers within 10 KM beyond Turbine Area Boundary

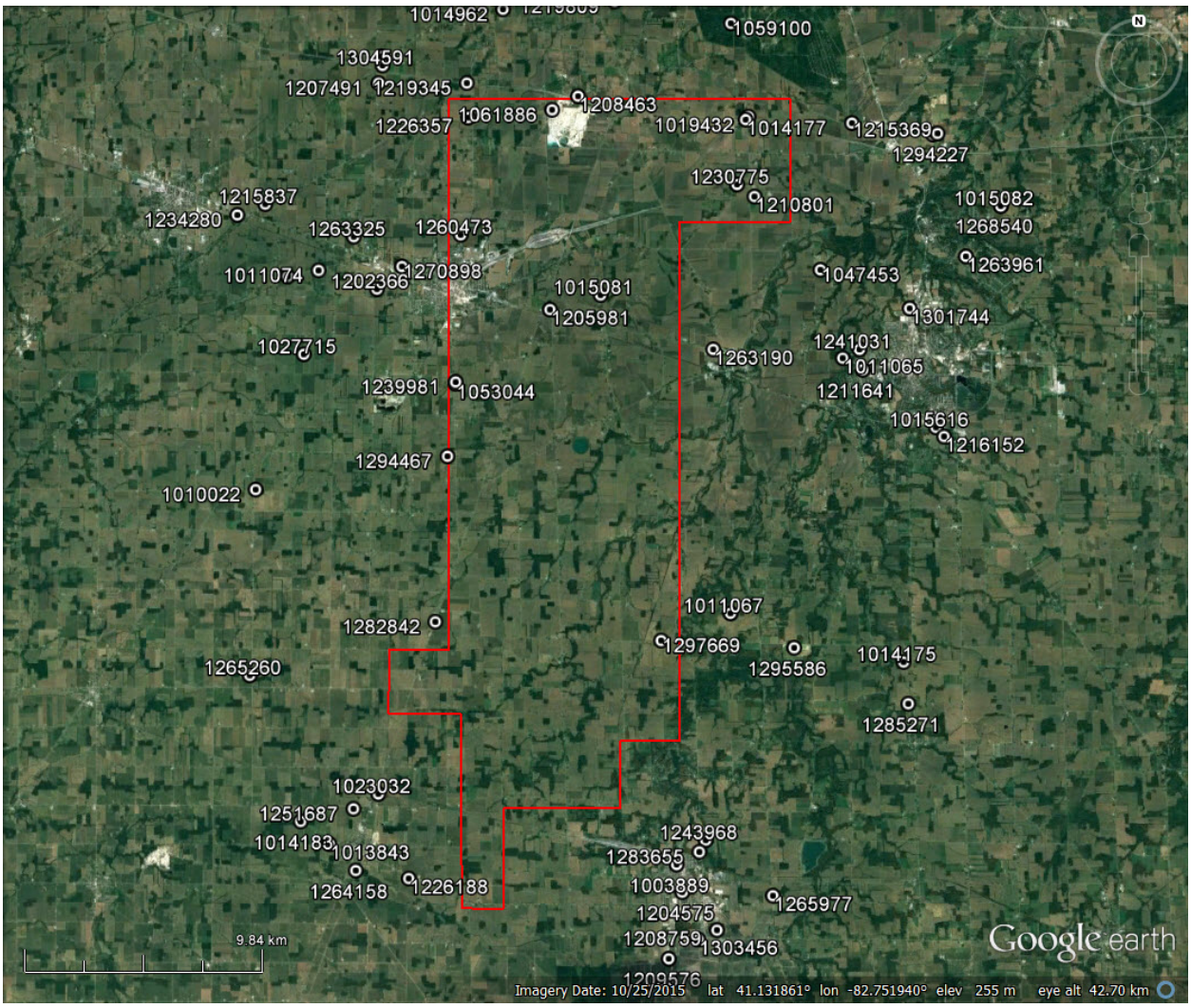

Figure 24 – Closer View of Registered Communications Towers in and near Turbine Area

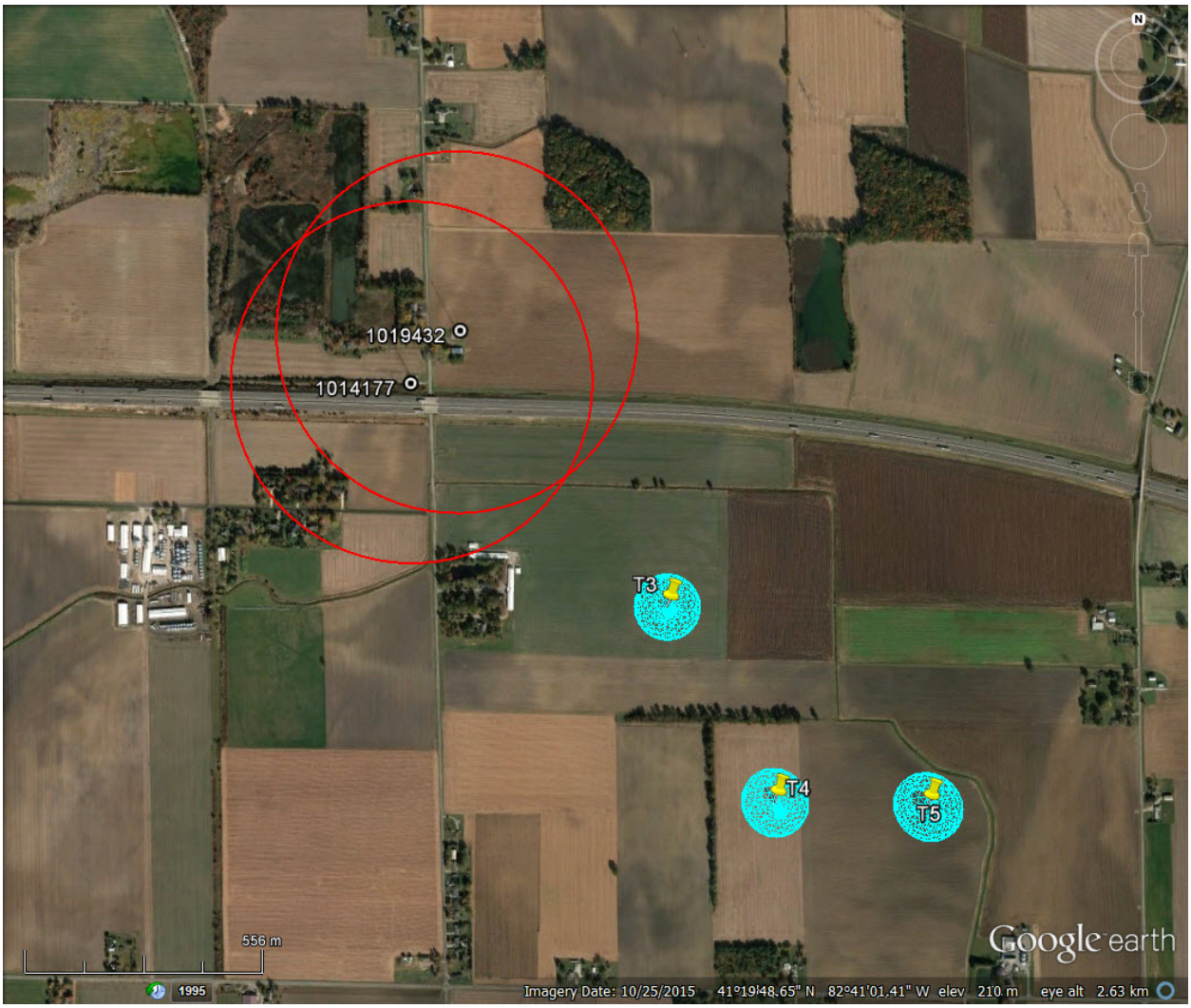

Figure 25 – Planned Turbines near FCC-Registered Towers 1014177 & 1019432

(Red Circle represents a worst-case setback of 425 meters.)

As can be see, the planned turbines in the image above are no closer than the worst-case recommended setback of 425 meters to the FCC-registered tower site(s).

Figure 26 – Planned Turbine 1 near FCC-Registered Tower 1061886

(Red Circle represents a worst-case setback of 425 meters.)

As can be see, the planned turbine in the image above is no closer than the worst-case recommended setback of 425 meters to the FCC-registered tower site.

Figure 27 – Planned Turbines near FCC-Registered Towers 1210801 & 1230775

(Red Circles represent a worst-case setback of 425 meters.)

As can be see, the planned turbines in the image above are no closer than the worst-case recommended setback of 425 meters to the FCC-registered tower site(s).

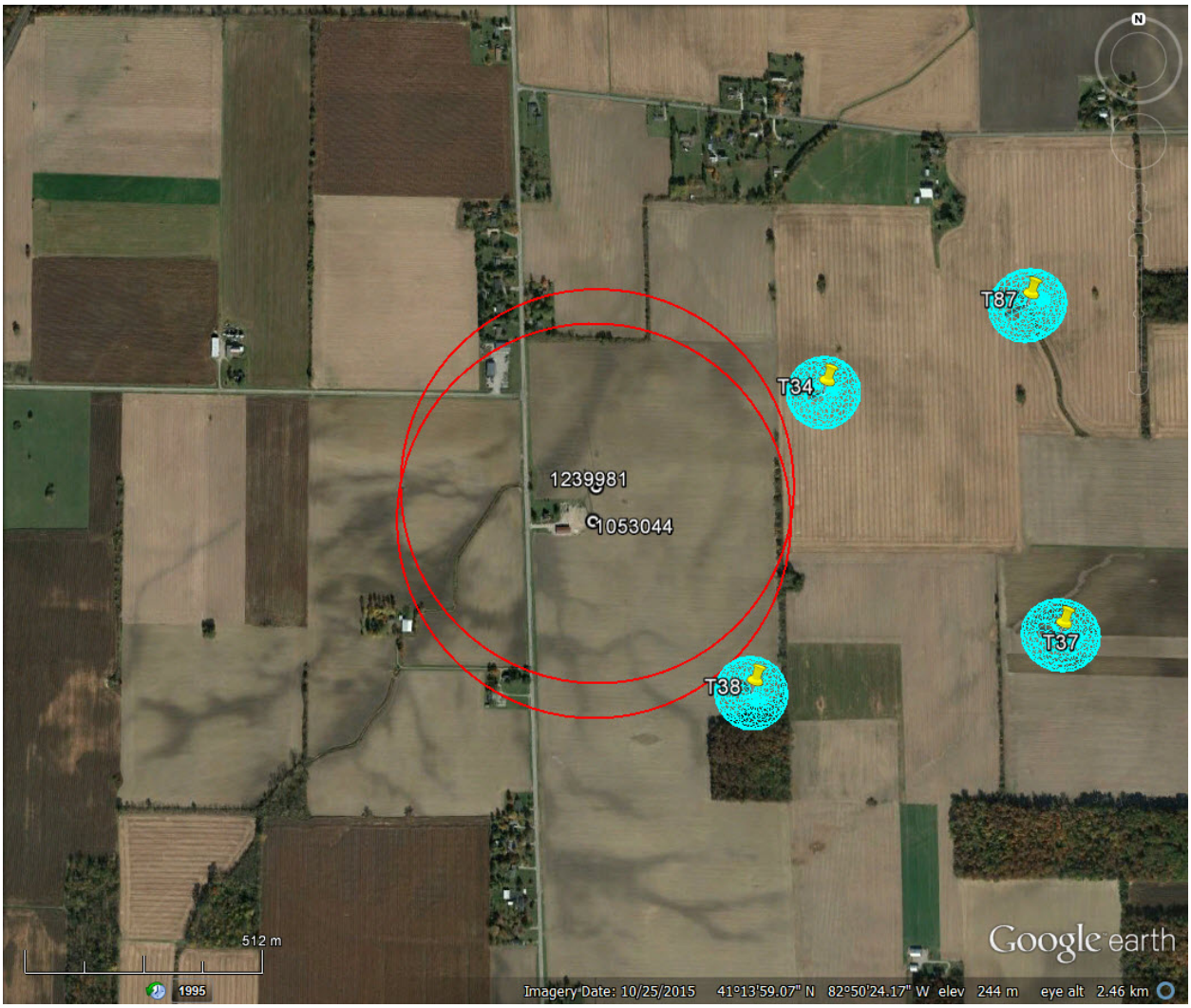

Figure 28 – Planned Turbines near FCC-Registered Towers 1053044 & 1239981

(Red Circle represents a worst-case setback of 425 meters.)

As can be see, the planned turbines in the image above are no closer than the worst-case recommended setback of 425 meters to the FCC-registered tower sites, as measured to the turbine tower.

IV. ANALYSIS OF BROADCAST FACILITIES

4.1 TV Broadcast Facilities

The rotating blades of a wind turbine have the potential to disrupt over-the-air broadcast TV reception within a few miles of the turbine, especially when the direct path from the viewer's residence is obstructed by terrain. Interference is caused when signals reflected by the blades arrive at the viewer's TV antenna along with the direct signal. This is known as "multipath interference." However, as turbine manufacturers have replaced all-metal blades with blades constructed of mostly nonmetallic materials[8], this effect has been reduced. Also, the new generation of HDTV receivers is better equipped to deal with minor multipath interference (which is manifested by "pixilating" or "freezing" of the digital picture) than analog TV sets, as special circuitry is employed to suppress the weaker reflected signal. Occasionally, however, multipath interference from one or more turbines can cause video failure in HDTV receivers, especially if the receiver location is in a valley or other place of low elevation.

There is some possibility of signal disruption for residences that have to point their outdoor antennas through the turbine area, or that utilize "rabbit ear" antennas and/or older HDTV receivers. Most of this effect should be dissipated for locations three or more miles from a turbine, but some residual problems could be noted for HDTV receivers that are located below the grade level at the turbine base. Usually, a rule of thumb is that approximately 10% of the receiver locations are affected to some extent within three miles of a large turbine when the turbine is between the TV station and the receiver. The usual effect is intermittent "pixilation" or freezing of the digital TV picture. This estimate is based upon Evans Engineering's experience with similar wind energy projects.

The proposed wind project area is along the border between the Toledo TV Designated Market Area and the Cleveland-Akron TV Designated Market Areas (DMA). Erie and Huron Counties are in the Cleveland-Akron DMA and Seneca County is in the Toledo DMA. TV stations from both DMAs are predicted to serve all or a portion of the wind project area and adjacent areas with a satisfactory over-the-air signal. The TV stations that have been determined to place a predicted FCC primary off-the-air service signal over at least a portion of the project area or its immediate environs are listed in Table 4. The TV stations' service area boundaries are mapped in Figure 29.

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[8] Modern turbine blades are usually constructed from glass-reinforced plastic (GRP), although they usually contain some metal for strengthening, balance and grounding.

Call Sign	Network Affiliate	Virtual Channel	RF Channel	City of License	Power (KW)	Ant. Height (m HAAT)	Dist. (km)	Azimuth (°T)
WJW	Fox	8	8	Cleveland, OH	11	342	87.6	83.8
WOIO	CBS	19	10	Shaker Heights, OH	9.5	304	89.7	82.2
WTOL	CBS	11	11	Toledo, OH	16.9	305	67.7	310.0
WMFD-TV	Independent	68	12	Mansfield, OH	14	180	58.8	168.4
WTVG	ABC	13	13	Toledo, OH	16.7	305	70.6	309.3
WEWS-TV	ABC	5	15	Cleveland, OH	1000	301	87.6	83.0
WKYC*	NBC	3	19	Cleveland, OH	1000	307	90.1	82.3
WVPX-TV*	ION	23	22	Akron, OH	950	290	100.8	104.1
WVIZ*	PBS	25	35	Cleveland, OH	280	330	90.1	82.3
WBGU-TV*	PBS	27	22	Bowling Green, OH	137	320	97.8	260.8
WUAB*	CW	43	10	Lorain, OH	9.5	304	89.7	82.2
WGTE-TV	PBS	30	29	Toledo, OH	49.5	314	70.1	306.7
WBNX-TV*	Independent	55	17	Akron, OH	505	357	89.6	82.4
WQHS*	Univision	61	36	Cleveland, OH	780	353	89.0	82.5
WOSU-TV*	PBS	34	16	Columbus, OH	1000	329	125.5	186.5
WOHZ-CA*	*Unknown*	41	20	Mansfield, OH	9.2	153	58.8	168.4
WGGN-TV*	Religious	52	3	Sandusky, OH	10	283	34.5	131.8
WUPW*	Fox	36	26	Toledo, OH	65	370	70.8	306.1
WDLI-TV*[9]	ION	17	22	Canton, OH	950	290	100.8	104.1
WNWO-TV*	NBC	24	23	Toledo, OH	275	424	65.8	310.7
WEAO*	PBS	49	24	Akron, OH	191	294	96.8	102.9
New (Permit)	*Unknown*	-	33	Stevenson, ON, CA	62.1	109	89.4	14.6
New (Permit)	*Unknown*	-	9	Windsor, ON, CA	26	184	98.1	350.5

Table 4 - TV Stations Serving Emerson Creek Wind Project Area

The TV stations marked with an asterisk (*) will soon be moving to the RF channels that are specified above as per the Federal Communications Commission's "TV repacking" initiative[10]. This may involve one or more of the affected stations moving to a different site and/or operating at different power levels or antenna heights.

[9] WDLI-TV will share RF channel and transmitter with WVPX-TV.

[10] "TV repacking" is the nationwide initiative to vacate the upper UHF TV band (Channels 38 through 51) that has recently been repurposed for future wireless and LTE cellular services. In some markets, certain stations on the lower portion of the band had to be moved to other lower-band channels in order to make room for stations moving from the upper UHF band. The transition is scheduled to be completed by July 2020.

If the Emerson Creek wind project should cause disruptions to over-the-air TV viewing, methods to resolve them are available, and are as follows:

1. Relocation of the household antenna to receive a better signal
2. Installation of a better outside antenna, or one with a higher gain
3. Installation of satellite or cable TV

According to this engineer's calculations, there are approximately 7,780 households within an area most likely to be affected (approximately 228 square miles). It is conservatively estimated that 70%, or 5,446, of the households receive TV programming primarily by satellite dish or cable. This leaves an estimated 2,334 households relying on transmitted off-the-air TV signals. Based on the 10% criteria described previously, up to 233 TV receiving locations may be affected to varying degrees in the worst-case. Mitigation costs would be approximately $200 per location for an upgraded outdoor antenna, or $450 per year per location for a satellite or cable subscription.

It is the opinion of this consultant that any disruptions to over-the-air TV broadcast signals, if they occur, can be resolved satisfactorily.

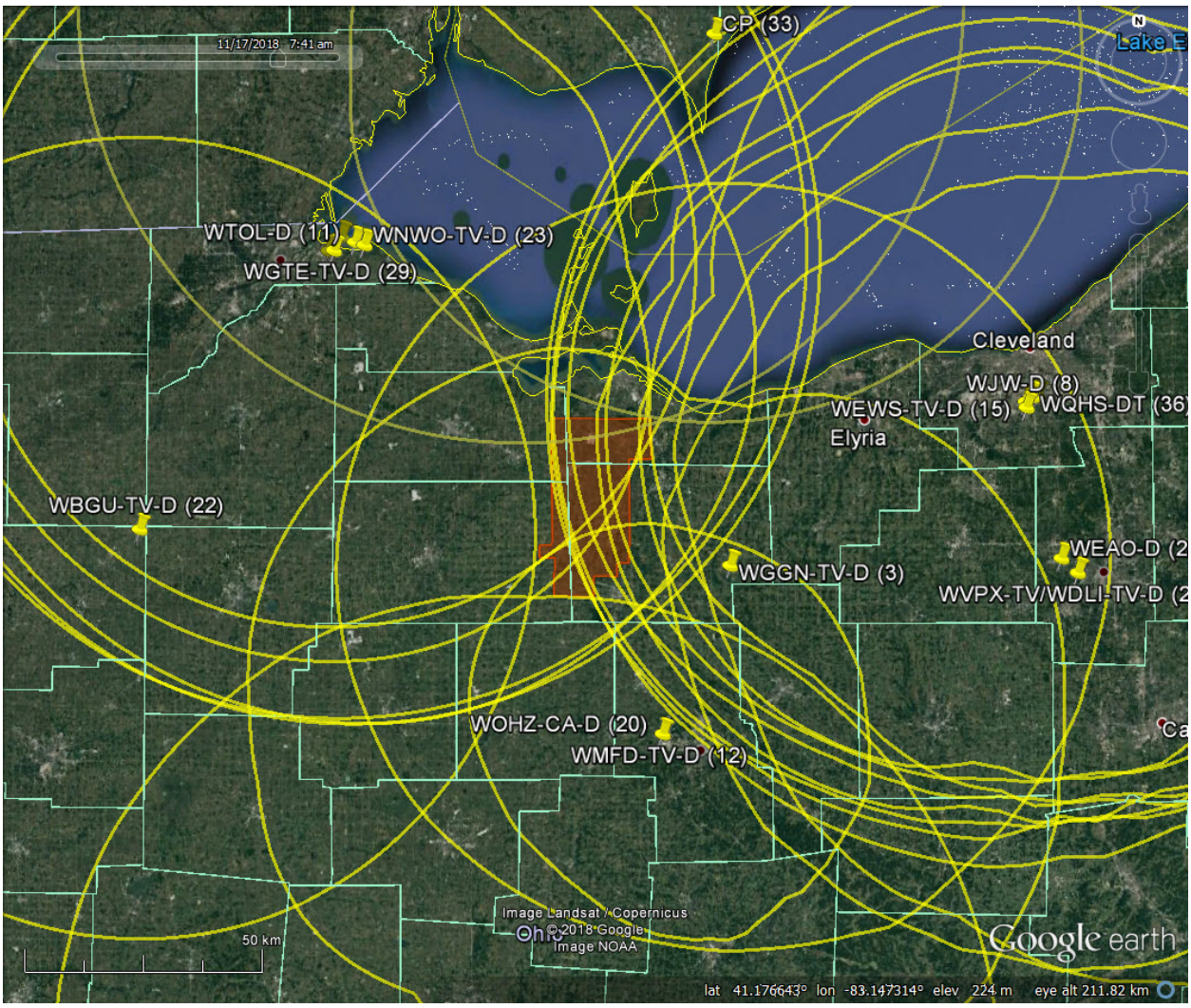

Figure 29 – Predicted Over-the-Air Television Coverage into Emerson Creek Project Area

4.2 FM Facilities

The full-service FM stations that place a predicted primary signal over at least part of the project area are listed in the following Table 5. The FM stations' service area boundaries are mapped in Figure 30.

Call Sign	Freq. (MHz)	City of License	Power (KW)	Ant. Height (m HAAT)	Dist. (km)	Azimuth (° True)
WHRQ	88.1	Sandusky, OH	0.38	102	11.5	335.4
WYOR[11]	88.5	Republic, OH	0.1	32	28.2	227.0
WNZN	89.1	Lorain, OH	2.2	114	26.6	83.5
WVMS	89.5	Sandusky, OH	5.5	30	18.1	347.1
WXML	90.1	Upper Sandusky, OH	15	158	51.3	217.3
WHVT	90.5	Clyde, OH	2.7	47	18.2	274.7
WNRK	90.7	Norwalk, OH	4.0	124	32.9	110.0
WSHB	90.9	Willard, OH	0.45	72	26.8	166.2
WGTE-FM	91.3	Toledo, OH	13.5	289	70.1	306.7
WOHF	92.1	Bellevue, OH	5.8	103	8.3	234.1
WVKS	92.5	Toledo, OH	50	146	75.2	291.9
WXKR	94.5	Port Clinton, OH	30	188	49.3	299.6
WLKR-FM	95.3	Norwalk, OH	3.3	91	8.4	91.7
WKFM	96.1	Huron, OH	3.4	133	22.7	84.6
WLRD	96.9	Willard, OH	6.0	100	37.6	162.3
WGGN	97.7	Castalia, OH	0.64	221	13.0	347.1
WNCX	98.5	Cleveland, OH	16	293	85.4	85.3
WYKL	98.7	Crestline, OH	1.8	122	56.9	179.9
WFRO-FM	99.1	Fremont, OH	11.5	111	29.3	288.6
WKKO	99.9	Toledo, OH	50	152	72.2	306.6
WSWR	100.1	Shelby, OH	3.0	91	38.3	167.9
WMJK	100.9	Clyde, OH	3.0	91	13.6	254.2
WNCO-FM	101.3	Ashland, OH	50	152	59.5	145.5
WRVF	101.5	Toledo, OH	33	164	70.7	308.1
WFXN-FM	102.3	Galion, OH	3.5	131	58.4	182.7
WCPZ	102.7	Sandusky, OH	50	135	14.3	67.9
WCKY-FM	103.7	Pemberville, OH	50	131	44.0	248.9
WQAL	104.1	Cleveland, OH	12	293	85.4	85.3
WIOT	104.7	Toledo, OH	50	165	70.7	308.1
WYHT	105.3	Mansfield, OH	50	113	59.9	162.1
WMJI	105.7	Cleveland, OH	16	344	89.6	82.4
WVNO-FM	106.1	Mansfield, OH	40	166	58.8	168.4
WNWV	107.3	Elyria, OH	20	238	63.1	91.1

Table 5 – FM Stations Serving Emerson Creek Project Area

[11] WYOR holds an FCC construction permit to increase power to 20 KW and move its transmitter to another site.

Real-world experience with wind farms has shown that FM broadcast station signals (88 to 108 MHz) are fairly insensitive to wind turbines, even in cases where the FM transmitting antenna is surrounded by turbines that are higher than the FM antenna. Because of the "capture effect" supported by the "discriminator" in FM receivers, significant disruptions to the above facilities are not expected. Although the received signal may vary with the blade rotation at some receiver locations in the immediate area, good quality FM radios should factor out such time-varying signals.

There is one FM broadcast transmitter site on the west boundary of the wind project area. It is at FCC-registered tower 1239981 (see Figure 28). This tower supports the transmitting antenna of WOHF in Bellevue, which is listed in Table 5. The nearest planned turbine from this FM site is Turbine 34, which is 503 meters away. However, for the reasons given above, WOHF's signals are not expected to be adversely affected.

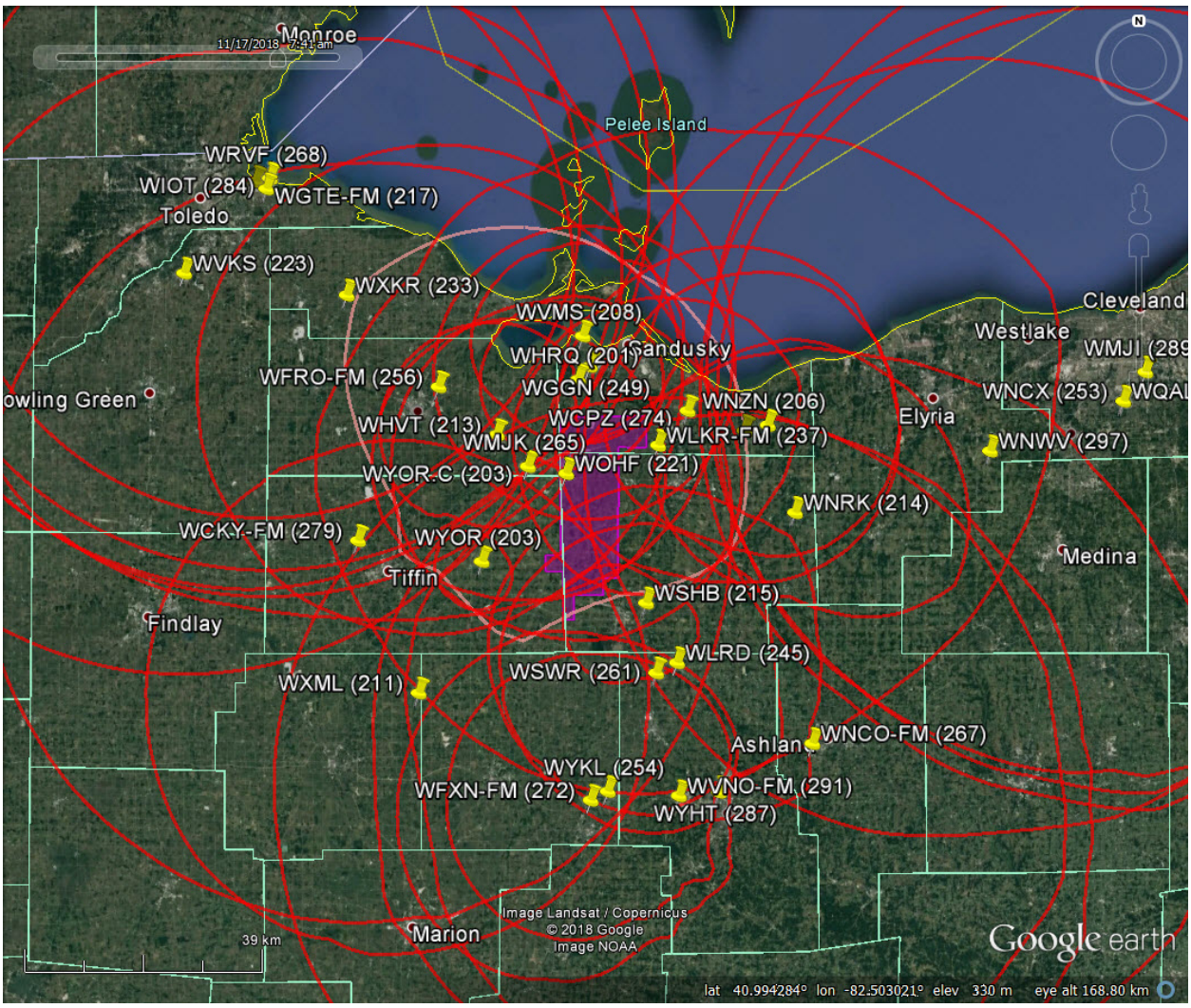

Figure 30 – Predicted FM Radio Coverage into Emerson Creek Project Area

4.3 AM Facilities

Large metallic structures such as wind turbines can adversely affect the transmitted signals of AM broadcast stations up to three kilometers away or further. A search of the FCC's database revealed one AM directional[12] transmitter within a distance of 5.6 kilometers from any planned turbine – that of AM station WLKR in Norwalk, which operates on 1510 KHz on the AM broadcast band. The location of WLKR relative to the wind turbine area is shown in Figure 31. According to broadcast engineering practice, metal vertical structures more than 30 meters tall (such as communications towers and wind turbines) that are within 10 wavelengths distant from a directional AM station transmitter should be considered to have the potential for disrupting the technical operation of the AM station.

The distance of 10 wavelengths at WLKR's frequency of 1510 KHz is 1.99 kilometers. Based on the current layout, the nearest planned turbine in the Emerson Creek project – Turbine 16 – would be 3.37 kilometers. As long as no turbine is less than 1.99 kilometers from the WLKR transmitter, the Emerson Creek project would not be considered a disturbance to the technical operation of the station.

There should therefore be no reasonable expectations of disruptions in transmitted signals on the AM band due to the presence of the turbines. Occasionally, depending upon ground conditions, local AM receivers may experience slight signal changes due to local effects, but such anomalies are not recognized by the FCC or the standards of good engineering practice as having an unduly adverse effect.

[12] An AM directional transmitter is one that consists of an antenna system of two or more RF energy-radiating towers placed close together (either in a line or in some geometric pattern), and whose RF current magnitudes and phases are controlled in such a way as to achieve desired levels of radiated signal intensity, or field strength, in certain directions. This "directional radiation pattern", as it is known in the industry, is characterized by high levels of field strength in one or more directions, and lower levels of field strength in other directions.

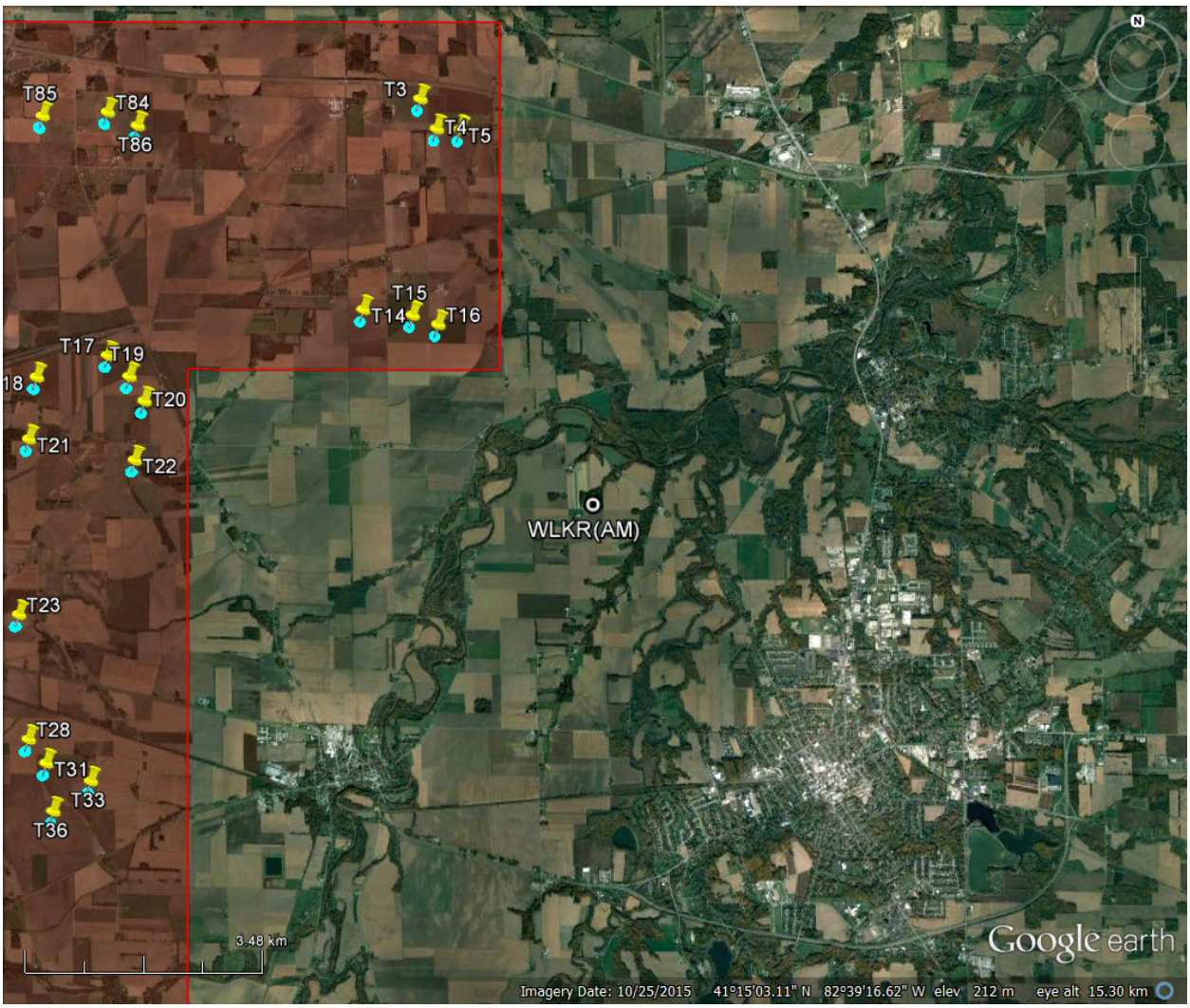

Figure 31 – AM Station WLKR near Wind Turbine Area

V. CONCLUSIONS AND RECOMMENDATIONS

1. Based on the current turbine layout, no turbine would conflict with any FCC-licensed or known planned microwave link.

2. If an excessive amount of time goes by before the turbines are to be constructed (six months or more), it is recommended that the microwave study be updated in case new paths have been added to the FCC's database.

3. No land mobile or public safety or other omnidirectional transmitting stations are expected to be adversely affected, assuming that their transmitting sites are located exactly as per their FCC licenses.

4. Over-the-air TV interference due to operating wind turbines may occur but is not expected to be an intractable problem. Effective mitigation methods to resolve any interference that may occur are available, with satellite or cable service installation providing the worst-case solution. No AM or FM radio broadcast facilities are likely to be affected.

Respectfully Submitted,

B. Benjamin Evans
RF Impact Consultant

January 14, 2018

Exhibit R
Raptor Nest Survey and Monitoring Reports

1. **Emerson Creek 2018 Raptor Nest Surveys dated May 17, 2018**
2. **Eagle Nest Monitoring Surveys for the Emerson North Wind Project in Erie, Huron and Seneca Counties, Ohio dated September 27, 2018**
3. **Emerson Creek 2018 Raptor Nest Surveys dated June 13, 2018**
4. **Raptor Nest Surveys for the Emerson Creek Wind Project Huron County, Ohio Spring 2014, dated October 2, 2015**
5. **Stage 2-Site Specific Bald Eagle Survey Report; 2013 Nest Productivity Update dated November 6, 2013**
6. **Spring 2012 Raptor Nest Survey Results dated May 9, 2012**
7. **Spring 2011 Raptor Nest Survey Results dated May 6, 2011**
8. **Bald Eagle Monitoring Report for the Proposed Firelands Wind Farm Project dated September 20, 2010**
9. **Raptor Nest Survey & Monitoring dated June 2009**

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Case No. 18-1607-EL-BGN

Exhibit R
Raptor Nest Survey and Monitoring Reports

1. Emerson Creek 2018 Raptor Nest Surveys dated May 17, 2018

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TECHNICAL MEMORANDUM

Date: May 17, 2018

To: Jennie Geiger, Apex Clean Energy Management, LLC

From: Goniela Iskali and Wes Conway, Western EcoSystems Technology, Inc.

Subject: Emerson Creek Wind Project – Raptor Nest Survey Memo

INTRODUCTION

Apex Clean Energy is developing the Emerson Creek Wind Project (Project) in Huron, Erie, and Seneca counties, Ohio. Western EcoSystems Technology, Inc. (WEST) completed a survey to detect raptor nests in and near the area proposed for development. The purpose of the survey was to document the presence of bald eagle nests within 2 miles (mi; 3.2 kilometers [km]) of the Project, and other large raptor nests within one mi (1.6 km) of the Project. Surveys were completed in accordance with the Ohio Department of Natural Resources (ODNR) *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio* (ODNR 2009) and agency recommendations.

PROJECT AREA

The Project is located in three different Level III Ecoregions: Eastern Corn Belt Plains, Huron/Erie Lake Plains, and Erie/Ontario Drift and Lake Plain. The predominant land cover types within the Project are cultivated crops (89.4%), developed areas (4.2%), and deciduous forest (4.1%; Figure 1). The remaining land cover types (open water, barren land, evergreen forest, shrub/scrub, herbaceous, hay/pasture and wetlands) make up approximately 2.3% of the Project (US Geological Survey National Land Cover Database 2011, Homer et al. 2015).

Today, most of the area has been artificially drained and cleared for farms producing corn (*Zea mays*), soybeans (*Glycine max*), and livestock (USEPA 2016). Small tributaries, such as Seymour Creek, Megginson Creek, and Frink Run, flow through the central and southern portions of the Project and likely provide the most suitable raptor nesting habitat within the Project. The West Branch of the Huron River is located just outside the eastern Project boundary and provides a large amount of nesting habitat as well.

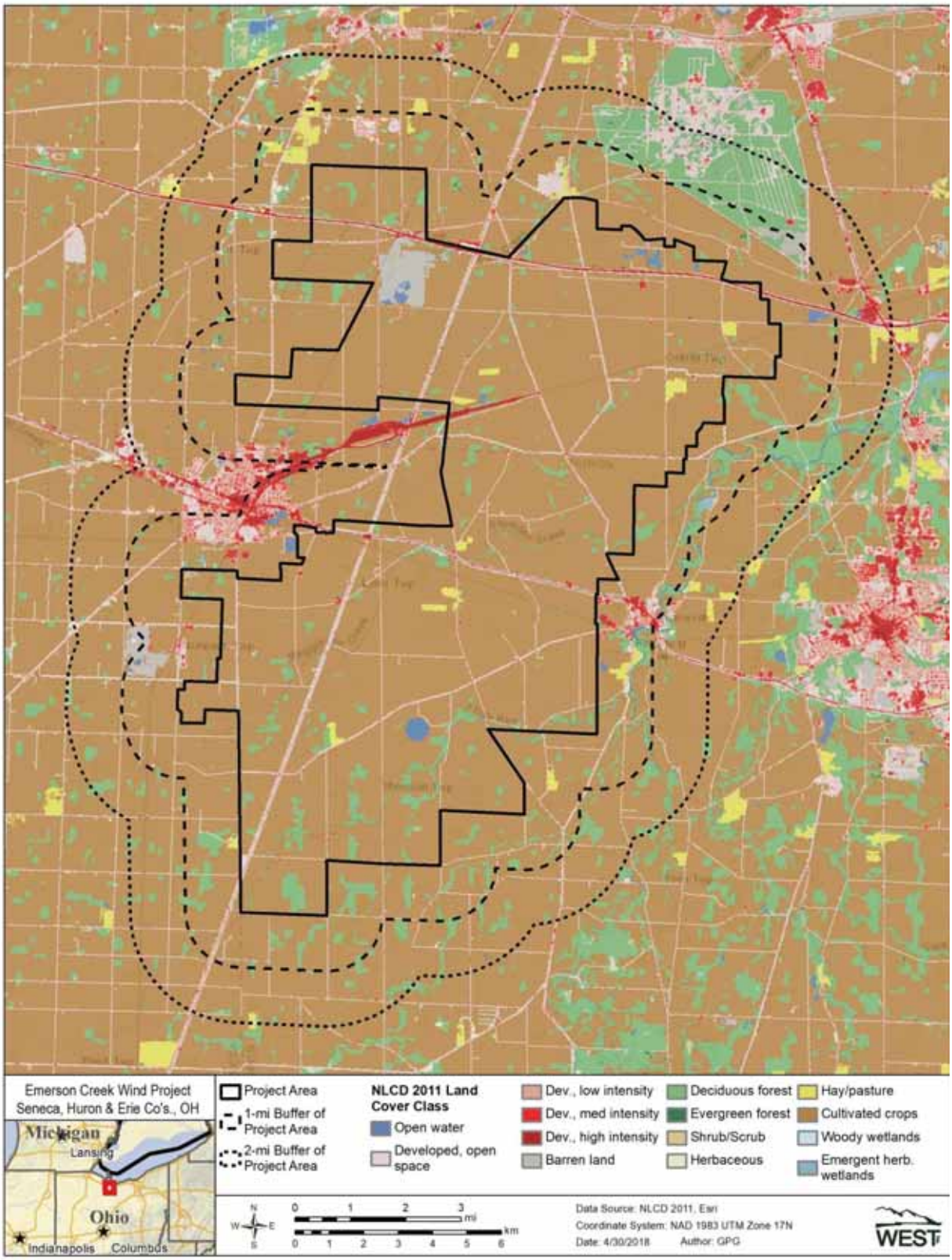

Figure 1. Land cover types within Emerson Creek Wind Project in Huron, Erie, and Seneca counties, Ohio and 1- and 2-mile buffers (US Geological Survey National Land Cover Database 2011, Homer et al. 2015).

METHODS

Ground-based raptor nest surveys were completed March 12-15, 2018, for all raptors within the Project and a 1-mi (1.6-km) buffer, and for eagles within a 2-mi (3.2-km) buffer (Figure 1). Surveys were completed prior to leaf-out and entailed driving along public roads and surveying all areas containing potentially suitable raptor nest habitat (e.g., riparian forested areas, shelterbelts, woodlots, and artificial nest structures) for potential raptor nests (defined here as stick nest structures large enough to accommodate a Buteo-sized raptor or larger).

All potential nest sites were classified to species, or as unknown species if undeterminable. Locations of each nest were recorded on aerial photographs, and locations digitized into Geographical Information Systems (North American Datum 83, Universal Transverse Mercator Zone 17). Species, nest status, nest condition, nest height, aspect, size, and substrate of each nest were recorded. Status was classified as Occupied, Unoccupied, or Unknown and nest condition was categorized as Good, Fair, or Poor. Nests were classified as occupied if any of the following were observed at the nest structure: (1) an adult in an incubating position, (2) eggs, (3) nestlings or fledglings, (4) occurrence of a pair of adults (or sometimes sub-adults), (5) freshly molted feathers or plucked down or current year's mutes. Occupied nests were further classified as active if any eggs or nestlings were observed or inactive if no eggs or chicks were present. A nest that did not meet the above criteria for occupied was classified as unoccupied.

Additional follow-up visits were completed to confirm the status of potential eagle nests that were documented as unoccupied during the initial raptor nest surveys. Unoccupied nests were monitored for a total of four hours over two separate days, April 4 and April 11, 2018 in order to determine occupancy status in accordance with the USFWS Eagle Conservation Plan Guidance (USFWS 2013).

RESULTS

Eagles

Five occupied and one unoccupied bald eagle nests were recorded within two miles of the Project (Table 1, Figure 2). Two of the occupied eagle nests were located within the Project (Nest ID #4 and #12) and the other three occupied nests were located 0.78 miles (1.25 km), 1.73 miles (2.78 km), and 1.95 miles (3.14 km) from the Project. The unoccupied nest was located 0.8 mi south of the Project and although occupied in 2017, was confirmed unoccupied this year after two rounds of follow-up surveys.

Other Raptors

Eleven active red-tailed hawk (*Buteo jamaicensis*) nests, one active great horned owl (*Bubo virginianus*) nest, and 21 unoccupied, non-eagle stick nests were observed within the Project and 1-mile buffer (Table 1, Figure 2). The unoccupied nests were determined to be non-eagle nests based on their size.

Table 1. Raptor nests documented during surveys completed March 12 – 15, 2018 within the Emerson Creek Wind Project and associated buffers in Huron, Erie, and Seneca counties, Ohio.

Nest ID	Species	Status	Condition	Distance to Project (miles)	UTM X	UTM Y
1	Bald Eagle	Occupied, Active	Good	0.78	346148	4576135
4	Bald Eagle	Occupied, Active	Good	0.00	349142	4579842
11	Bald Eagle	Occupied, Active	Good	1.73	363847	4572785
12	Bald Eagle	Occupied, Active	Good	0.00	355220	4578462
31	Bald Eagle	Occupied, Active	Good	1.95	342755	4562640
41	Bald Eagle	Unoccupied, Inactive	Good	0.75	352974	4560276
28	Great Horned Owl	Occupied, Active	Good	0.00	353882	4571799
13	Red-tailed Hawk	Occupied, Active	Good	0.00	355398	4576827
14	Red-tailed Hawk	Occupied, Active	Good	0.00	350324	4575987
15	Red-tailed Hawk	Occupied, Active	Good	0.00	354876	4575861
17	Red-tailed Hawk	Occupied, Active	Good	0.00	359558	4575229
19	Red-tailed Hawk	Occupied, Active	Good	0.00	353495	4574370
24	Red-tailed Hawk	Occupied, Active	Good	0.24	351404	4571507
27	Red-tailed Hawk	Occupied, Active	Good	0.00	353392	4572230
33	Red-tailed Hawk	Occupied, Active	Good	0.00	349316	4567913
36	Red-tailed Hawk	Occupied, Active	Good	0.00	354917	4566893
38	Red-tailed Hawk	Occupied, Active	Good	0.94	357779	4563620
42	Red-tailed Hawk	Occupied, Active	Good	0.30	352230	4560904
2	Unknown Raptor (Non-eagle)	Unoccupied	Good	0.00	347887	4573792
3	Unknown Raptor (Non-eagle)	Unoccupied	Good	0.00	350716	4573847
5	Unknown Raptor (Non-eagle)	Unoccupied	Good	0.20	351119	4579623
6	Unknown Raptor (Non-eagle)	Unoccupied	Fair	0.33	350252	4580772
7	Unknown Raptor (Non-eagle)	Unoccupied	Good	0.43	350199	4580981
16	Unknown Raptor (Non-eagle)	Unoccupied	Fair	0.00	358921	4575596
18	Unknown Raptor (Non-eagle)	Unoccupied	Fair	0.00	356508	4573391
20	Unknown Raptor (Non-eagle)	Unoccupied	Good	0.51	360646	4572482
21	Unknown Raptor (Non-eagle)	Unoccupied	Good	0.02	360041	4573696
22	Unknown Raptor (Non-eagle)	Unoccupied	Poor	0.00	355414	4571263
23	Unknown Raptor (Non-eagle)	Unoccupied	Fair	0.00	354651	4572642
25	Unknown Raptor (Non-eagle)	Unoccupied	Good	0.00	352430	4570121
26	Unknown Raptor (Non-eagle)	Unoccupied	Fair	0.00	356033	4570815
29	Unknown Raptor (Non-eagle)	Unoccupied	Fair	0.40	351191	4571993
30	Unknown Raptor (Non-eagle)	Unoccupied	Poor	0.00	345436	4568372
32	Unknown Raptor (Non-eagle)	Unoccupied	Poor	0.67	344223	4566859
34	Unknown Raptor (Non-eagle)	Unoccupied	Good	0.00	350328	4568657
35	Unknown Raptor (Non-eagle)	Unoccupied	Fair	0.00	352385	4568181
37	Unknown Raptor (Non-eagle)	Unoccupied	Poor	0.00	353761	4569108
39	Unknown Raptor (Non-eagle)	Unoccupied	Poor	0.00	353778	4564547
40	Unknown Raptor (Non-eagle)	Unoccupied	Fair	0.22	354555	4561719

UTM = Universal Transverse Mercator

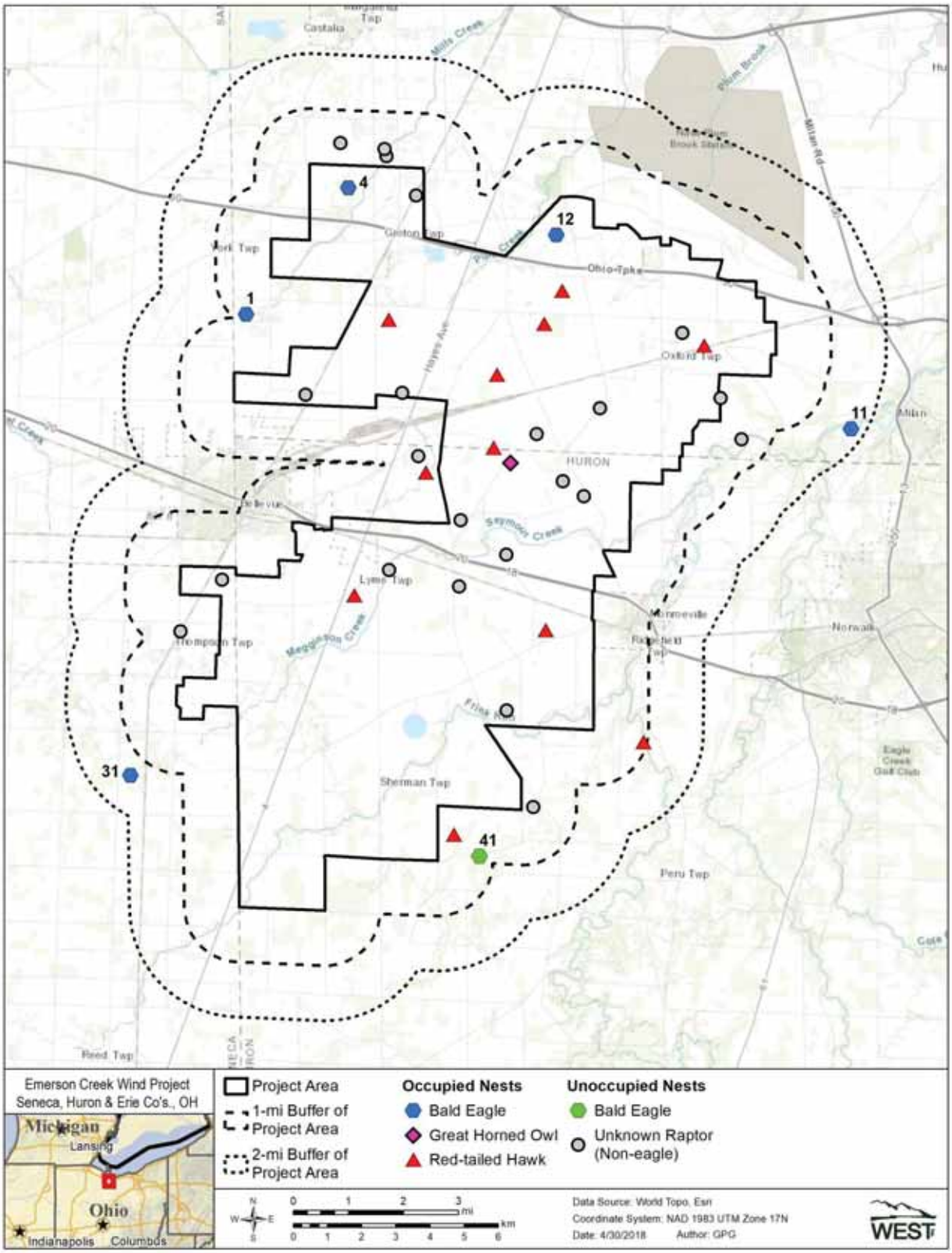

Figure 2. Raptor nests observed within the Emerson Creek Wind Project raptor nest survey area during March 12 – 15, 2018.

CONCLUSION

The majority of the nests found in or near the Project area were unoccupied. Those that were occupied were mostly of red-tailed hawk, which is a common raptor species that breeds in relatively high densities in Ohio. The two occupied bald eagle nests located in the Project may warrant siting consideration to avoid risk of disturbance during construction or operations. The three occupied bald eagle nests located outside the Project area are not likely to be affected by construction of the Project; however, individuals from these nests may utilize area in or near the Project.

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Exhibit R
Raptor Nest Survey and Monitoring Reports

2. Eagle Nest Monitoring Surveys for the Emerson North Wind Project in Erie, Huron and Seneca Counties, Ohio dated September 27, 2018

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Eagle Nest Monitoring Surveys for the Emerson North Wind Project in Erie, Huron and Seneca Counties, Ohio

Prepared by:

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Western EcoSystems Technology, Inc.
408 West 6th Street
Bloomington, Indiana 47404

September 27, 2018

Privileged and Confidential – Not for Distribution

EXECUTIVE SUMMARY

Western EcoSystems Technology, Inc. completed eagle nest monitoring surveys for the proposed Emerson North Wind Project (Project) located in Erie, Huron and Seneca counties, Ohio. Surveys were completed at two known active bald eagle nests within the northern portion of the Project area to understand how the birds utilized the area around the nests and inform siting of turbines in this area.

Eagle nest monitoring consisted of 60-min point-count surveys completed twice a week at four points per nest, totaling eight fixed-point locations per nest per week. Nest #1 was monitored between April 17 and June 27, 2018, and Nest #2 was monitored from May 2 to June 28, 2018 for a total of 160 point-count surveys (160 survey hours). Eagle activity was concentrated within 0.51 mi of each nest location, with nearly half (46%) of the eagle flight paths directed towards the north and outside of the Project boundary. Both eagle nests are located near the northern boundary of the Project and nearly half of the eagle flight paths were directed to or from the north and outside of the Project. The majority of activity was concentrated around the nests and therefore avoidance of turbine siting within 0.25-0.4 mi of the nests may be appropriate to avoid areas of concentrated high eagle activity and minimize risk.

STUDY PARTICIPANTS

Western EcoSystems Technology, Inc.

Goniela Iskali	Project Manager
Chad LeBeau	Senior Reviewer
Karl DuBridge	Field Supervisor
Mandy Kauffman	Statistician
Wes Conway	Report Compiler
Kelly Borgmann	Report Compiler
Jeff Fruhwirth	GIS Technician
Katie Wynne	Technical Editor
Dan Kramer	Field Technician

REPORT REFERENCE

Iskali, G. and C. LeBeau. 2018. Eagle Nest Monitoring Surveys for the Emerson North Wind Project in Erie, Huron and Seneca Counties, Ohio. Final Report. Prepared for Emerson North, LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. September 27, 2018.

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INTRODUCTION

Western EcoSystems Technology, Inc. (WEST) completed eagle nest monitoring surveys for the proposed Emerson North Wind Project (Project) located in Erie, Huron and Seneca counties, Ohio in 2018. The eagle nest monitoring surveys were completed at two known active bald eagle (*Haliaeetus leucocephalus*) nests within the Project area to gain additional information about how the eagles approached and left the nest locations and how they utilized the area around the nests to inform Project design and minimize potential risk to eagles using these nests.

PROJECT AREA

The Project is located within the Huron/Erie Lake Plain ecoregion, which is a broad, flat, fertile plain with some relic sand dunes, beach ridges, and end moraines. Today, most of the forests in the area have been cleared and the swamps artificially drained to make way for highly productive farms which produce corn (*Zea mays*), soybean (*Glycine max*), and livestock (US Environmental Protection Agency 2017).

Approximately 87.1% of the nearly 191 square kilometers (47,194 acres) in the Project area is composed of cultivated cropland (US Geological Survey National Land Cover Database 2011, Homer et al. 2015). Developed areas are the next most common land cover type (6.5%), followed by deciduous forest (4.1%) that consists primarily of shelterbelts and woodlots associated with homesteads, and barren land (1.2%). All other land cover types compose less than 1.0% of the Project, individually (Table 1 and Figure 1).

The habitat surrounding Nest #1 and #2 is representative of the Project area. Suitable nesting habitat (deciduous forest and woody wetlands) is distributed throughout the Project, but only constitutes ~4.2% of the total area. However, the habitat increases in quality immediately to the east and north. The Huron River passes within 0.7 miles (mi; 1.1 kilometers [km]) of the eastern Project boundary and contains suitable nesting habitat along its entire length. Nasa's Plum Brook Station and the Resthaven Wildlife Area are located 0.7 mi (1.1 km) and 2.2 mi (3.5 km), respectively, from the northern Project boundary. These two areas total ~8672 ac and are composed primarily of deciduous forest. The coast of Lake Erie, which includes bald eagle wintering habitat is located less than 6 mi (9.7 km) north of the Project.

Table 1. Land cover types and composition at the Emerson North Wind Project.

Habitat	Acres	Percent Composition
Cultivated Crops	41,122	87.1
Developed	3,067	6.5
Deciduous Forest	1,919	4.1
Barren Land	565	1.2
Hay/Pasture	286	0.6
Open Water	221	0.5
Woody Wetlands	5	<0.1
Shrub/Scrub	3	<0.1
Evergreen Forest	3	<0.1
Herbaceous	2	<0.1
Emergent Herbaceous Wetlands	1	<0.1
Total	**47,194**	**100**

Data from US Geological Survey National Land Cover Database 2011, Homer et al. 2015

Sums may not add up due to rounding.

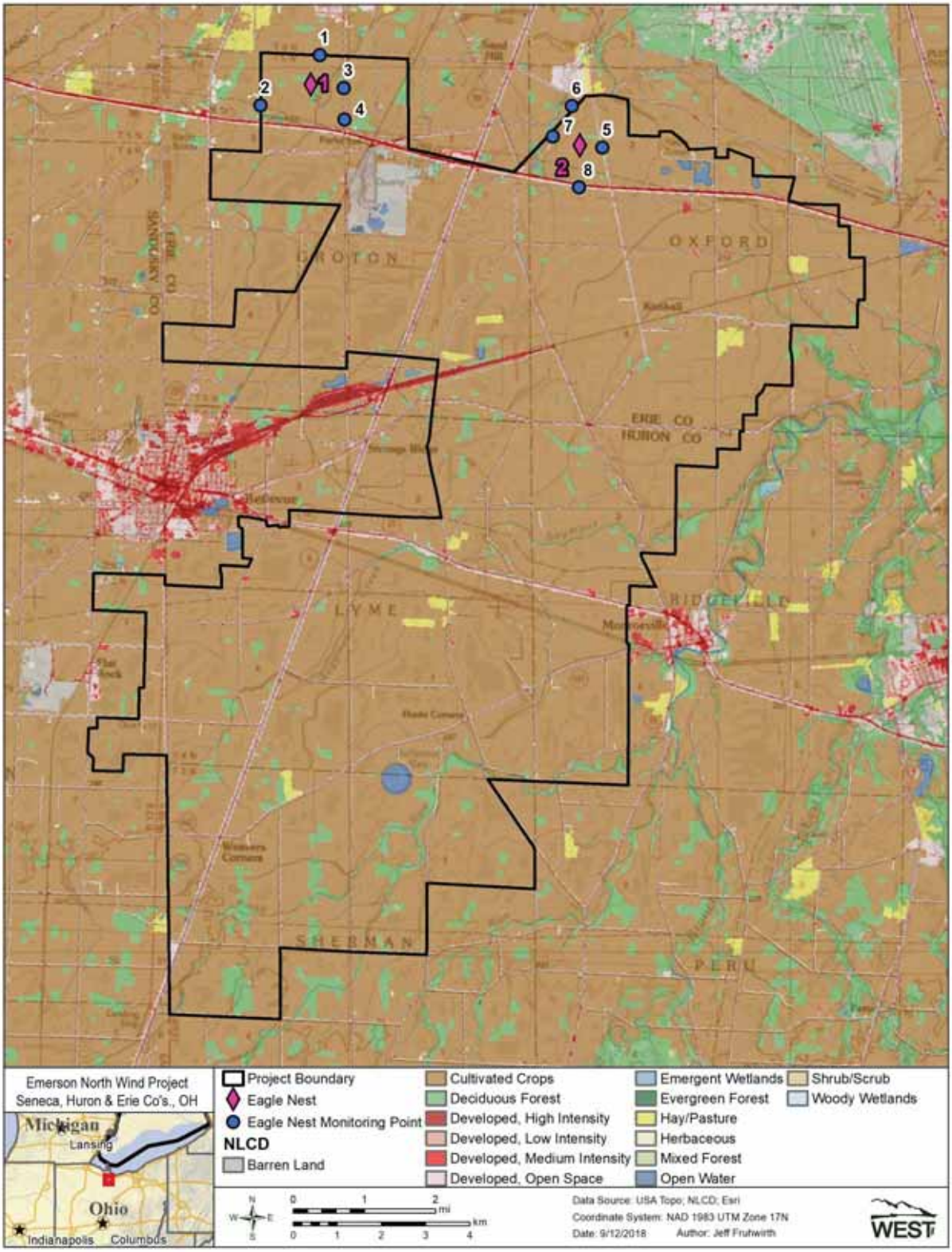

Figure 1. Land cover, eagle nest locations, and nest survey locations at the Emerson North Wind Project.

METHODS

Eagle nest monitoring surveys were completed at two active bald eagle nests identified within the northern portion of the Project boundary during the 2018 raptor nest surveys (WEST 2018). In accordance with recommendations within the Ohio Department of Natural Resources (ODNR) *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio* (ODNR 2009), four fixed-point count locations were placed at each of the two nests (eight point locations total; Figure 1). Surveys were completed between April 17 and June 27, 2018 at Nest #1, and between May 2 and June 28, 2018 at Nest #2. Each survey was completed for 60 minutes twice per week, for a total of 16 hours of total survey effort per week. Each point count survey consisted of an unlimited viewshed for eagles, with the following data recorded for each survey:

- Date
- Time (start and end)
- Point number
- Observer
- Weather (temperature, wind speed and direction, precipitation, and cloud cover)

For each eagle observed during a point-count survey, the following information was recorded:

- Species or best possible identification
- Number of individuals
- Distance of bird/flock to observer (initial, and nearest)
- Sex and age class
- Height above ground (if flying)
- Behavior
- Habitat

For each eagle observed during a point-count survey, the flight path was hand-drawn by the observer on a map figure printed on a field data sheet, and subsequently digitized for analysis of movement patterns. Federally and state-listed species were also to be recorded and mapped if observed.

RESULTS

No federally or state-listed species were observed during the surveys. A total of 235 eagle observations were recorded during 160 hours of the fixed-point eagle nest monitoring surveys. The majority of the observations recorded were of adults (n=185), followed by sub-adults (n=32) and juveniles (n=18; Table 2). Of the 235 observations, 160 of the eagles were observed flying and the majority of these (73.8%) were observed flying between 25 and 200 meters above ground level (Table 3). Eagles from both nests were most commonly observed in cropland habitat (n=150), followed by forest habitat (n=65).

Eagle activity observed during the surveys was concentrated within 0.5-1 mi (0.8-1.6 km) of the nests (Figures 2 and 3). The breeding pair from Nest #1 was most commonly observed approaching and leaving the nest to/from the north or northeast (Figure 2), and the breeding pair from Nest #2 were most commonly observed approaching and leaving the nest to/from the north and northwest (Figure 3). Both of the nests successfully fledged chicks, two chicks fledged from Nest #1 by June 11 and three chicks from Nest #2 after June 25.

The highest densities of eagle flight paths for both nests were recorded near and around the nests, and to the north of the nests (Figure 4). The mean distance from areas with the highest density of flight paths (more than 3 flights) to each nest was calculated to determine the mean distance from each nest to "high risk areas". This mean distance was 0.4 mi (0.7 km) for Nest #1 and 0.25 mi (0.4 km) for Nest #2.

Table 2. Summary of bald eagle sightings by age group at the Emerson North Wind Project during eagle nest monitoring surveys from April 17 to June 27, 2018.

Nest ID	Number of Individuals	Number of Groups	Number of Adults	Number of Sub-Adults	Number of Juveniles	Number of Unknown Age
Nest 1	154	154	115	25	14	0
Nest 2	81	81	70	7	4	0
Total	**235**	**235**	**185**	**32**	**18**	**0**

Table 3. Summary of bald eagle activity at the Emerson North Wind Project during eagle nest monitoring surveys from April 17 to June 27, 2018.

Nest ID	Number of Eagles Observed Perched*	Number of Eagles Observed Flying[a]*	% within Flight Height Categories		
			0 - 25 m	25 - 200 m[b]	> 200 m
Nest 1	32	122	9.0	76.2	14.8
Nest 2	43	38	21.1	65.8	13.2
Total	**75**	**160**	**11.9**	**73.8**	**14.4**

*Results based on first activity observed

[a] Activities summarized as "flying" also include soaring and stooping or diving antagonistically.

[b] The likely rotor-swept area for potential collision with a turbine blade, or 25 to 200 meters (82 to 652 feet) above ground level. These observations are based on first flight height records of all flying eagle observations.

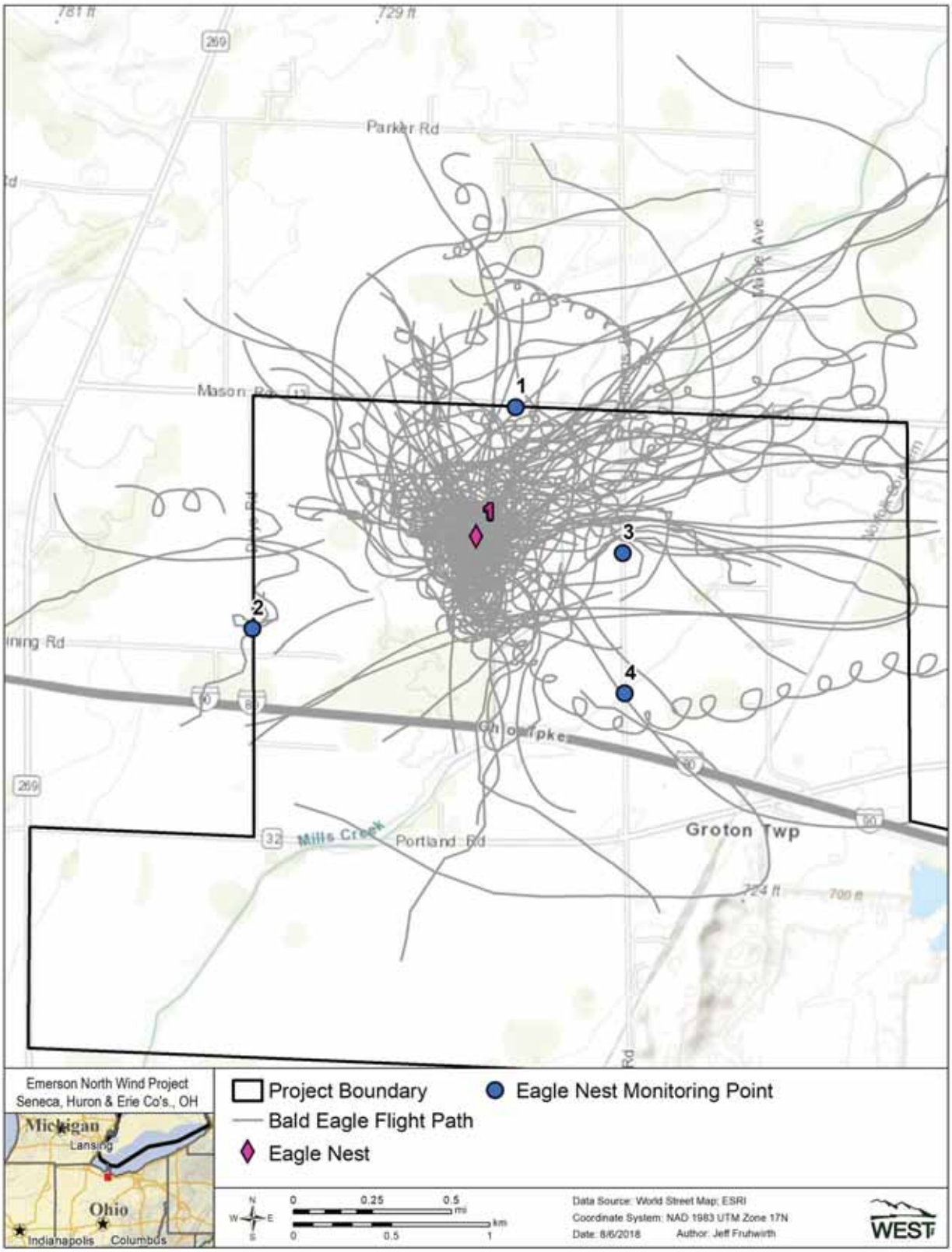

Figure 2. Eagle nest activity near Nest 1 during eagle nest monitoring surveys at the Emerson North Wind Project.

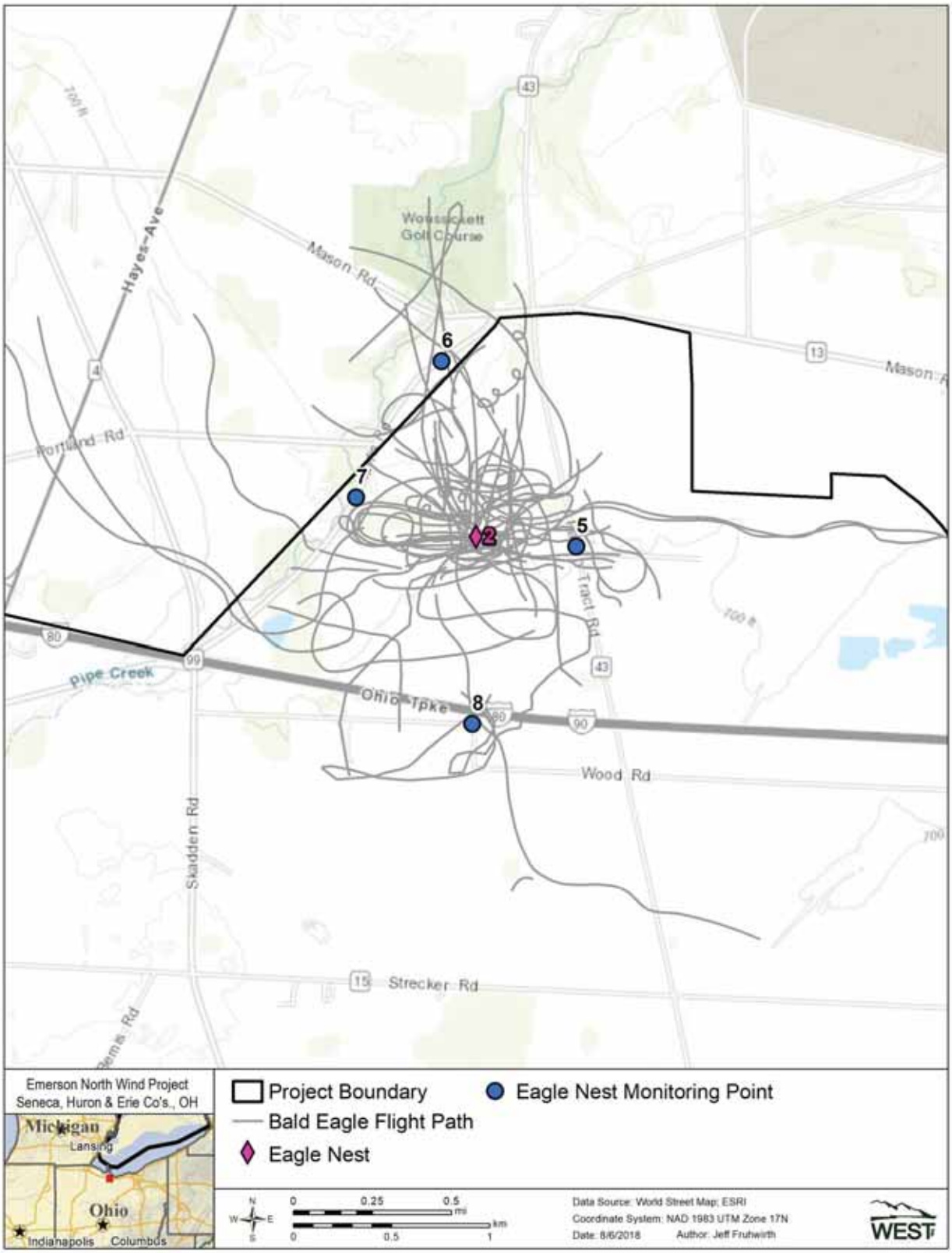

Figure 3. Eagle nest activity near Nest 2 during eagle nest monitoring surveys at the Emerson North Wind Project.

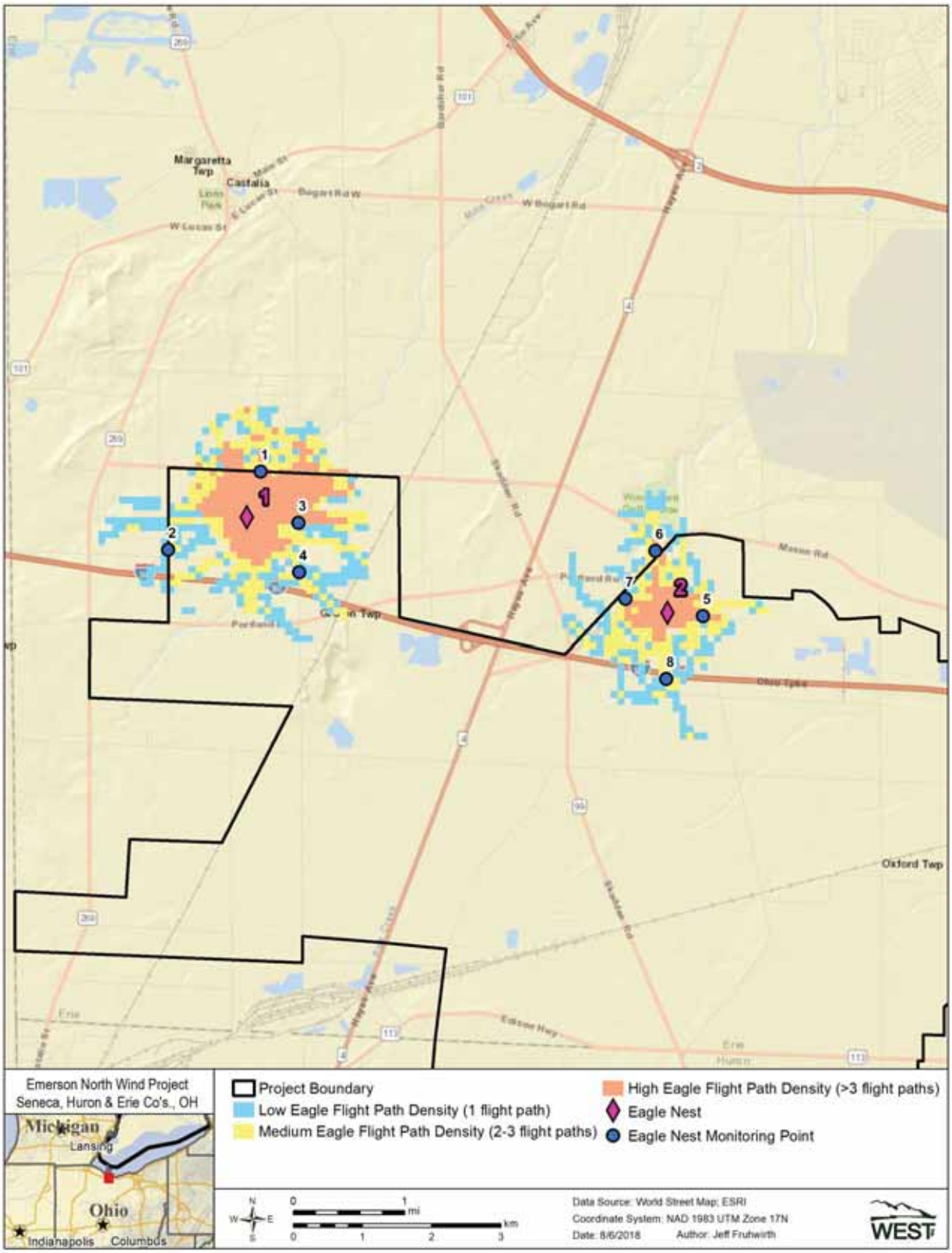

Figure 4. Density of eagle nest flight paths near Nest 1 and Nest 2 during eagle nest monitoring surveys at the Emerson North Wind Project.

CONCLUSIONS

Eagle activity observed during the eagle nest monitoring surveys was concentrated within 0.5 mi of the nests and to the north of the nests. Very few eagle detections were recorded greater than 1 mi south, east or west of each nest. Both eagle nests are located near the northern boundary of the Project and nearly half of the eagle flight paths were directed to or from the north and outside of the Project. Given the higher use of the area around the nests by eagles, avoidance of siting turbines within 0.25 mi of Nest #2 and 0.4 mi of Nest #1 may be appropriate to avoid areas of concentrated eagle activity and minimize risk.

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Exhibit R
Raptor Nest Survey and Monitoring Reports

3. Emerson Creek 2018 Raptor Nest Surveys dated June 13, 2018

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TECHNICAL MEMORANDUM

Date: June 13, 2018

To: Jennie Geiger, Apex Clean Energy

From: Goniela Iskali and Wes Conway, Western EcoSystems Technology, Inc.

Subject: Emerson Creek Wind Project – Raptor Nest Survey Memo

INTRODUCTION

Western EcoSystems Technology, Inc. (WEST) completed a raptor nest survey for the Emerson Creek Wind Project (Project) in Huron County, Ohio. The purpose of the survey was to document the presence of eagle and any other large raptor nests within one mile (mi) and to confirm the status of historical bald eagle nests within 2 mi of the Project. Surveys were completed in accordance with the Ohio Department of Natural Resources (ODNR) *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio* (ODNR 2009) and agency recommendations.

PROJECT AREA

The Project is located in the Eastern Corn Belt Plains Level III Ecoregion. The predominant land cover types within the Project are cultivated crops (80.0%), deciduous forest (13.5%), and developed areas (4.9%; Figure 1). The remaining land cover types (open water, barren land, evergreen forest, shrub/scrub, herbaceous, hay/pasture and wetlands) make up approximately 1.6% of the Project (US Geological Survey National Land Cover Database 2011, Homer et al. 2015).

Today, most of the area has been artificially drained and cleared for farms producing corn (*Zea mays*), soybeans (*Glycine max*), and livestock (USEPA 2016). Small tributaries, such as Slate Run and Frink Run, flow through the central and northern portions of the Project and likely provide the most suitable raptor nesting habitat within the Project. The West Branch of the Huron River is located just outside the eastern Project boundary and provides a large amount of nesting habitat as well.

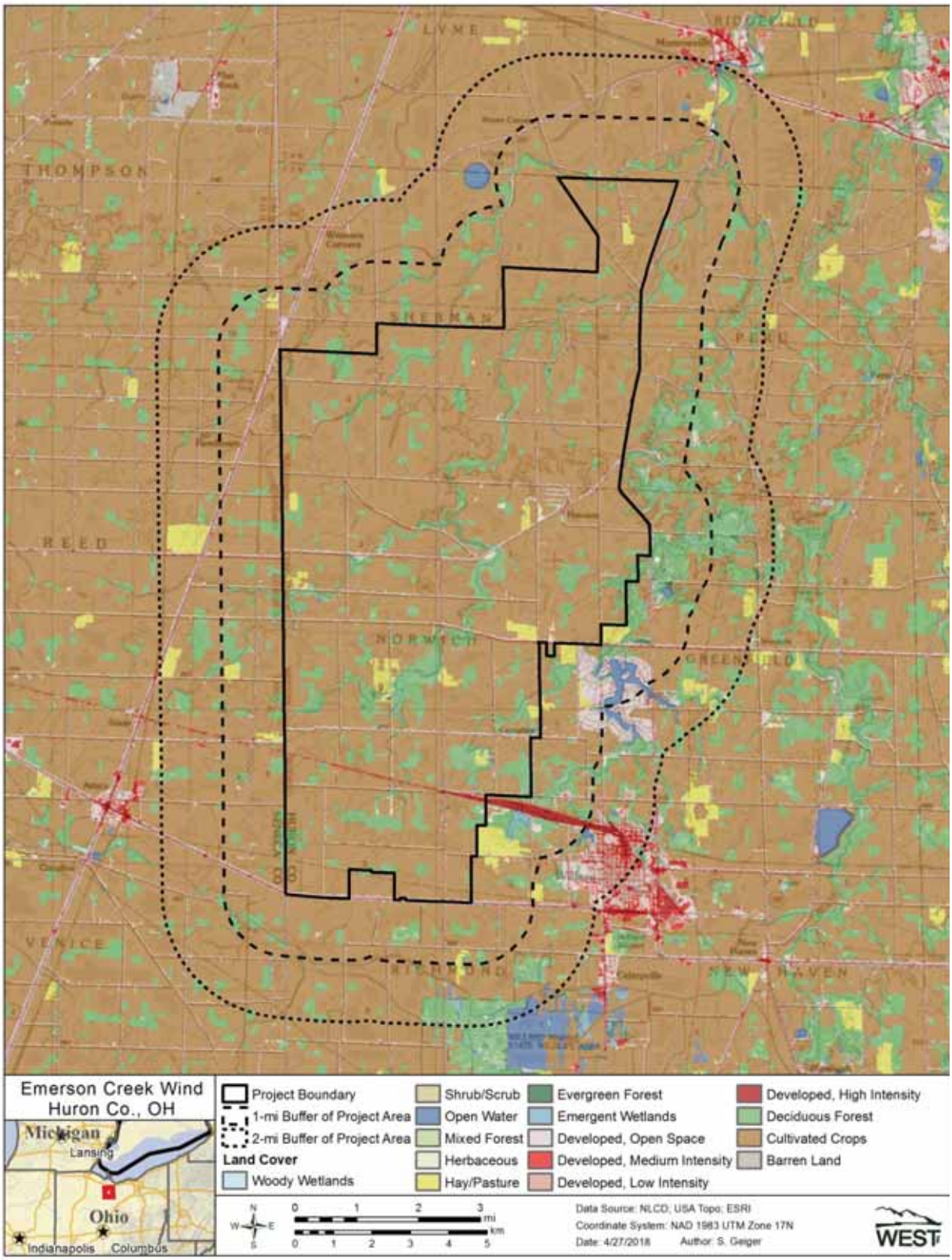

Figure 1. Land cover types within Emerson Creek Wind Project in Huron County, Ohio and 1- and 2-mile buffers (US Geological Survey National Land Cover Database 2011, Homer et al. 2015).

METHODS

Ground-based raptor nest surveys were completed April 9-10, 2018, for all raptors (including eagles) within the Project and a 1-mi buffer. Surveys were completed prior to leaf-out and entailed driving along public roads and surveying all areas containing potentially suitable raptor nest habitat (e.g., riparian forested areas, shelterbelts, woodlots, and artificial nest structures) for potential raptor nests (defined here as stick nest structures large enough to accommodate a Buteo-sized raptor or larger). In addition, any known historical eagle nests within a 2-mi buffer were checked to verify presence and status (Figure 1).

All potential nest sites were classified to species, or as unknown species if undeterminable. Locations of each nest were recorded on aerial photographs, and locations digitized into Geographical Information Systems (North American Datum 83, Universal Transverse Mercator Zone 17). Species, nest status, nest condition, nest height, aspect, size, and substrate of each nest were recorded. Status was classified as Occupied, Unoccupied, or Unknown and nest condition was categorized as Good, Fair, or Poor. Nests were classified as occupied if any of the following were observed at the nest structure: (1) an adult in an incubating position, (2) eggs, (3) nestlings or fledglings, (4) occurrence of a pair of adults (or sometimes sub-adults), (5) freshly molted feathers or plucked down or current year's mutes. Occupied nests were further classified as active if any eggs or nestlings were observed or inactive if no eggs or chicks were present. A nest that did not meet the above criteria for occupied was classified as unoccupied.

Additional follow-up visits were completed to confirm the status of potential eagle nests that were documented as unoccupied during the initial raptor nest surveys. One unoccupied nest was monitored for a total of four hours on April 19, 2018 in order to determine occupancy status in accordance with the USFWS Eagle Conservation Plan Guidance (USFWS 2013).

RESULTS

Eagles

Two occupied bald eagle nests and one unoccupied bald eagle nest were recorded within two mi of the Project (Table 1, Figure 2). Of the occupied eagle nests, one was known (Nest ID #18) and one was new or previously undocumented (Nest ID #2). The unoccupied nest was occupied in 2017, but was confirmed as unoccupied this year as confirmed through additional nest monitoring. Two of the nests, the newly discovered occupied one and the historic unoccupied one, are located within the Project area.

Other Raptors

Six active red-tailed hawk (*Buteo jamaicensis*) nests, two active great horned owl (*Bubo virginianus*) nests, and 12 unoccupied, non-eagle stick nests were observed within the Project and 1-mi buffer (Table 1, Figure 2). The unoccupied nests were determined to be non-eagle nests based on their size.

Table 1. Raptor nests identified in trees during surveys conducted April 9 - 10, 2018 within the Emerson Creek Wind Project and associated buffers in Huron County, Ohio.

Nest ID	Species	Status	Condition	Distance to Project (miles)	UTM X	UTM Y
2	Bald Eagle	Occupied, Active	Good	0	349258	4548535
18	Bald Eagle	Unoccupied, Inactive	Good	0	352974	4560276
23	Bald Eagle	Occupied, Active	Good	1.5	346859	4542908
1	Great Horned Owl	Occupied, Active	Good	0.6	349077	4544205
7	Great Horned Owl	Occupied, Active	Good	0	350930	4550010
5	Red-tailed Hawk	Occupied, Active	Good	0	348275	4549559
11	Red-tailed Hawk	Occupied, Active	Good	0	348380	4552610
12	Red-tailed Hawk	Occupied, Active	Good	0	348140	4550951
14	Red-tailed Hawk	Occupied, Active	Good	0.4	353279	4550464
15	Red-tailed Hawk	Occupied, Active	Good	0.1	345819	4550096
20	Red-tailed Hawk	Occupied, Active	Good	0.9	357779	4563620
3	Unknown Raptor (Non-eagle)	Unoccupied	Fair	0	349566	4549394
4	Unknown Raptor (Non-eagle)	Unoccupied	Good	0	349126	4548709
6	Unknown Raptor (Non-eagle)	Unoccupied	Poor	0	347896	4551504
8	Unknown Raptor (Non-eagle)	Unoccupied	Fair	0	352336	4548525
9	Unknown Raptor (Non-eagle)	Unoccupied	Poor	0	350985	4548384
10	Unknown Raptor (Non-eagle)	Unoccupied	Fair	0.4	355057	4551699
13	Unknown Raptor (Non-eagle)	Unoccupied	Fair	0.6	354433	4550910
16	Unknown Raptor (Non-eagle)	Unoccupied	Fair	0	349431	4553635
19	Unknown Raptor (Non-eagle)	Unoccupied	Good	0	352230	4560904
17	Unknown Raptor (Non-eagle)	Unoccupied	Poor	0	350211	4554265
21	Unknown Raptor (Non-eagle)	Unoccupied	Fair	0	354555	4561719
22	Unknown Raptor (Non-eagle)	Unoccupied	Poor	0.3	353778	4564547

UTM = Universal Transverse Mercator Zone 17

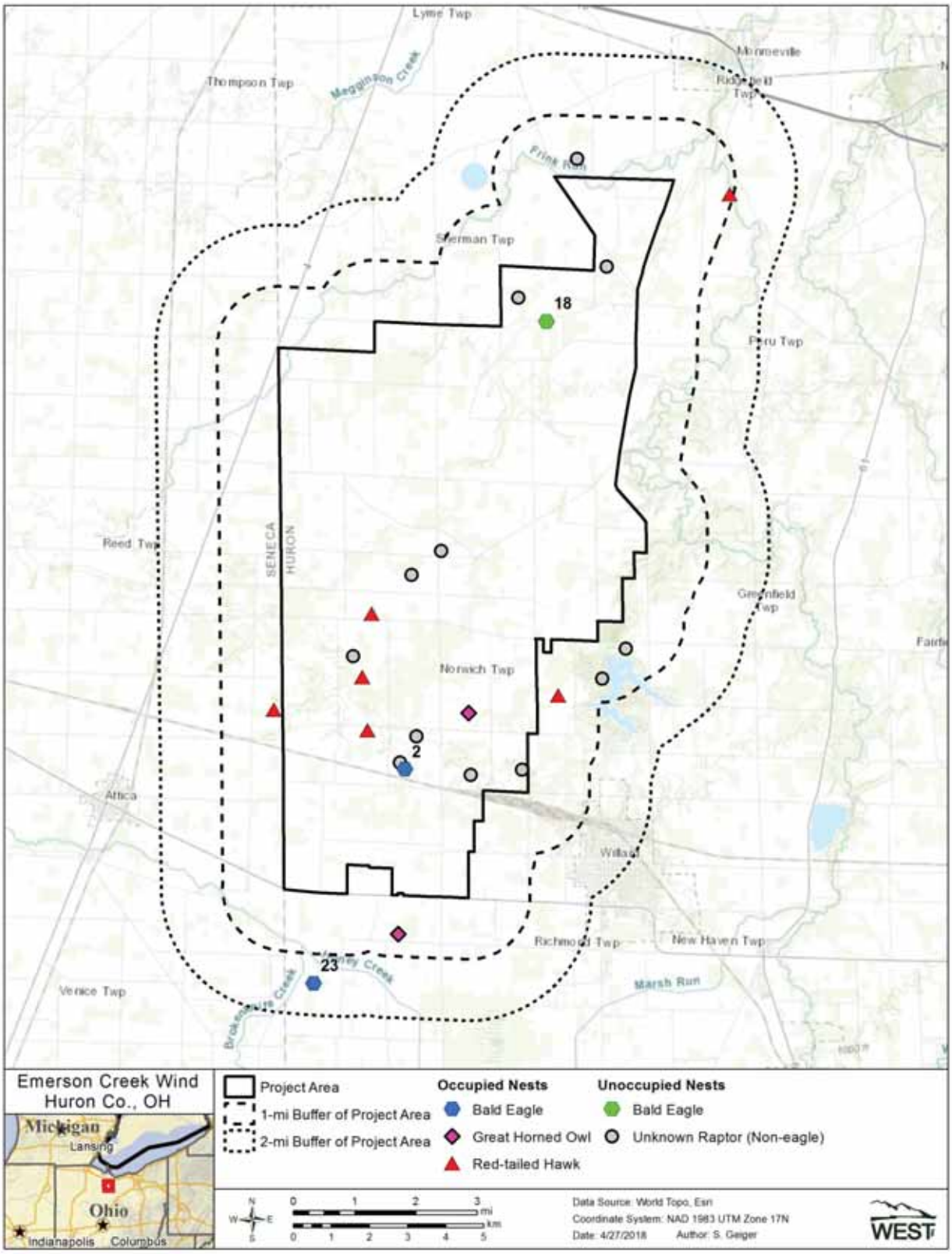

Figure 2. Raptor nests observed within the Emerson Creek Wind Project raptor nest survey area during April 9-10, 2018.

CONCLUSION

The majority of the nests found in or near the Project area were unoccupied. Those that were occupied were mostly of red-tailed hawk, which is a common raptor species that breeds in relatively high densities in Ohio. The bald eagle nests located in the Project may warrant siting consideration to avoid risk of disturbance during construction or operations. The occupied bald eagle nest located outside the Project area is not likely to be affected by construction of the Project; however, individuals from these nests may utilize area in or near the Project.

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Exhibit R
Raptor Nest Survey and Monitoring Reports

4. Raptor Nest Surveys for the Emerson Creek Wind Project Huron County, Ohio Spring 2014, dated October 2, 2015

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Raptor Nest Surveys for the Emerson Creek Wind Project Huron County, Ohio

Report
Spring 2014

Prepared for:

Apex Clean Energy, Inc.

Prepared by:

Rhett E. Good and Goniela Iskali

Western EcoSystems Technology, Inc.
408 W. 6th Street
Bloomington, IN 47404

October 2, 2015

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Figure 1. Bald eagle and other raptor nest survey areas and results for the Emerson Wind Project – April 29-May 1, 2014. 2

INTRODUCTION

Apex Clean Energy, Inc. (Apex) is considering the development of a wind-energy facility in Huron County, Ohio known as the Emerson Creek Wind Project (ECWP; Figure 1). ECWP was previously surveyed by TTech in 2011, 12 and 13. Apex requested that Western Ecosystems Technology, Inc. (WEST) conduct raptor nest surveys outside of the area surveyed by TTech and determine if there were any nesting bald eagles (*Haliaeetus leucocephalus*) within three miles and any raptor nests within 1 mile of the project addition to the south of the project boundaries (Figure 1). In addition, six previously recorded eagle nests were monitored for activity.

METHODS

A survey for eagle nests was completed within an area selected by Apex to augment existing nest data (Figure 1). This included areas outside of what was previously surveyed for an adjacent project (Firelands) in 2011, 12 and 13, and within 3 miles of the current Emerson boundary. Additionally, six known eagle nests were assessed for 2014 activity status. The survey consisted of searching suitable nesting areas from public roads. One ground survey was conducted on April 29-May 1, 2014. The survey was completed just prior to leaf out, and observers were able to adequately survey for raptor nests that were visible from public roads. Six known eagle nests were also visited per APEX's request, to determine if nests were active (Figure 1).

Surveys were completed by driving along public roads while looking for raptor nest structures within areas of suitable habitat, such as riparian forested areas, shelterbelts, woodlots and artificial nest structures. Raptor nest structures were defined as stick nest structures large enough to accommodate a *Buteo*-sized raptors or larger. Other species that nest on the ground or species that nest in cavities were recorded if observed, but were not the focus of surveys. Areas with potentially suitable habitat were viewed with binoculars and spotting scopes, and searched for potential raptor or owl nest structures. Nest locations were mapped on recent aerial photographs and digitized in to ArcGIS; therefore, locations are estimated to be accurate to within 10 – 30 m of the coordinate.

Data recorded for each nest site included nest status (active or inactive), the number of adults and young present, species occupying nest site, behavior of adults at the nest, nest condition (poor, fair, good), observation location and nest substrate. Efforts were made to minimize disturbance to breeding raptors; the greatest possible distance at which the species could be identified was maintained, with distances varying depending upon nest location and wind conditions.

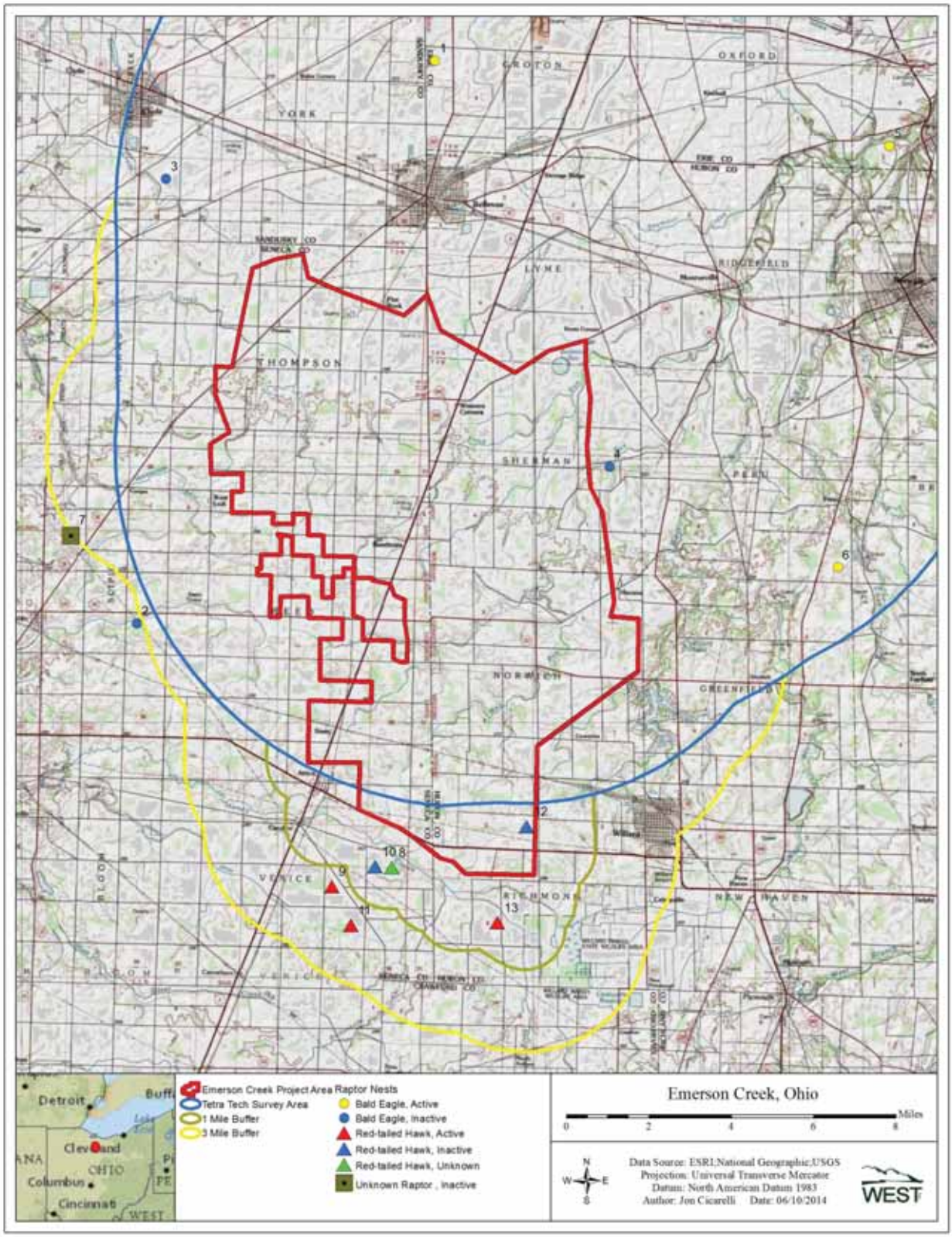

Figure 1. Bald eagle and other raptor nest survey areas and results for the Emerson Wind Project – April 29-May 1, 2014.

RESULTS

Eagles

Three of the previously known eagle nest locations were active. Adult bald eagles were observed sitting on nests or hunting around nest, and one young was observed at each of the active nests. The other 3 known eagle nests were inactive (Figure 1; Table 2).

Other Raptors

Six red-tailed hawk nests were observed within or adjacent to the the 1-mi buffer zone (Nests 8-13 on Figure 3 and Table 3). Three of the nests were active with adults observed in or around the nest. Two were inactive and one was unknown whether it was active. No red-tailed hawks were observed around the inactive and unknown nests but the nests were most likely constructed by red-tailed hawks, based on the relative abundance of this species in the ECWP, the size of the nests, and the habitat surrounding each nest; however, the nests could also be used by other raptor species, such as Cooper's hawk (*Accipiter cooperii*) or great horned owl (*Bubo virginianus*).

One large, empty stick nest was found along the edge of the survey area, approximately 3 miles from the western edge of the project area (depicted as Nest 7 on Figure 3 and Table 3). No birds were present during the survey; thus the species associated with the nest is unknown. The nest was large enough to potentially have been constructed by a bald eagle; however the nest was not located adjacent to any large, fish bearing waters, suggesting that the nest could have been constructed by a buteo species.

Table 2. Description of previously known eagle nest during nest surveys at the Emerson Creek Wind Project from April 29-May 4, 2014.

Nest ID #	Species	Nest Status	Nest condition	Nest Substrate	Substrate Height (ft)	Nest Height (ft)
1	Bald Eagle	Active	Good	Tree	110	90
2	Bald Eagle	Not active	Good	Tree	35	25
3	Bald Eagle	Not active	Good	Tree	30	25
4	Bald Eagle	Not active	Good	Tree	110	80
5	Bald Eagle	Active	Good	Tree	100	80
6	Bald Eagle	Active	Good	Tree	110	80

Table 3. Description of observed raptor nest during nest surveys at the Emerson Creek Wind Project from April 29-May 1, 2014.

Nest ID #	Species	Nest Status	Nest condition	Nest Substrate	Substrate Height (ft)	Nest Height (ft)
7	Unknown Raptor	Not active	Looks unused	Tree	25	15
8	Red tailed hawk	Unknown	Good to fair	Tree	30	25
9	Red tailed hawk	Active	Good	Tree	30	25
10	Red tailed hawk	Not active	Fair	Tree	35	30
11	Red tailed hawk	Active	Good	Tree	35	30
12	Red tailed hawk	Not active	Fair	Tree	25	20
13	Red tailed hawk	Active	Good	Tree	25	17

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Exhibit R
Raptor Nest Survey and Monitoring Reports

5. Stage 2-Site Specific Bald Eagle Survey Report; 2013 Nest Productivity Update dated November 6, 2013

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STAGE 2-SITE SPECIFIC BALD EAGLE SURVEY REPORT

2013 NEST PRODUCTIVITY UPDATE

FIRELANDS WIND FARM

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Tetra Tech Project #: 103P178401

November 6, 2013

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1.0 INTRODUCTION

Firelands Wind Farm, LLC (Firelands) are proposing to construct a wind energy facility in Erie and Huron Counties, Ohio (see Figure 1 – Site Location Map). Firelands contracted Tetra Tech, Inc. (Tetra Tech) to conduct various surveys and studies required for successful permitting and development of the proposed project. Tetra Tech prepared this report to document the site specific Bald Eagle (*Haliaeetus leucocephalus*) Nest Productivity Surveys conducted in 2013 and includes a description of the survey methodology, results, and discussion.

1.1 Purpose

As specified in the United States Fish and Wildlife Service (USFWS) Draft Eagle Conservation Plan Guidance (Draft ECPG) dated January 2011 and Final Eagle Conservation Plan Guidance (ECPG) issued April 2013, the purpose of the Stage 2 site specific Bald Eagle surveys is to report Bald Eagle activity and quantify Bald Eagle use (i.e. exposure) in the Project Area. Then this data, along with turbine specifications, siting and operational details, can be used by Firelands to determine the risk to Bald Eagles during the subsequent Stage 3 risk analysis for the proposed wind energy facility. Additionally, the Firelands was classified by the Ohio Department of Natural Resources (ODNR) as a "moderate effort" site in a letter dated May 21, 2011, and specific avian surveys required by ODNR under this classification included raptor nest searching and monitoring, diurnal raptor/bird migration surveys, breeding bird surveys, and site specific Bald Eagle nest monitoring and surveys. The purpose of this report is to provide an update of the ongoing Stage 2 site specific research at Firelands for the year 2013.

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The scope of work was conducted in accordance with the *Avian and Bat Study Plan* dated March 23, 2011 (Study Plan), which was submitted to Ms. Melanie Cota of the USFWS Columbus, Ohio Field Office and Ms. Jennifer Norris of the ODNR. Approval of the *Avian and Bat Study Plan* was received from the USFWS in an electronic mail dated April 27, 2011 and ODNR on May 21, 2011. Additionally, the Bald Eagle surveys followed the ODNR *On-shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in OH* (2009), the 2011 *USFWS Draft Land-Based Wind Energy Guidelines* (ODNR/USFWS wind guidelines), and the survey recommendations outlined in correspondence received by Tetra Tech on May 21, 2011 from ODNR Wind Energy Lead, Jennifer Norris.

The potential impacts to birds are regulated under several federal and state laws. Therefore the approved Study Plan was designed and conducted in accordance with the following state and federal laws and/or guidelines including:

- The Endangered Species Act (ESA) of 1973 (7 U.S.C. § 136, 16 U.S.C. § 1531 et seq.)
- The Migratory Bird Treaty Act (MTBA) of 1918 (16 U.S.C. 703-712; Ch. 128; July 13, 1918; 40 Stat. 755)
- The National Environmental Policy Act (NEPA) of 1969 (42 USC 4321)

- The Bald and Golden Eagle Protection Act (BGEPA) of 1940 (16 U.S.C. 668-668d, 54 Stat. 250)
- Ohio Revised Code Title 15 Conservation of Natural Resources (Chapter 1531.01 - 1531.25)
- The USFWS Draft Eagle Conservation Plan Guidance, January 2011
- The USFWS Final Eagle Conservation Plan Guidance, April 2013

1.2 Prior Bald Eagle Survey Activities

As part of preconstruction activities for the proposed project, Tetra Tech completed over one year of site specific surveys for the federally protected and state of Ohio listed species, the Bald Eagle, within and surrounding the Project Area. As outlined in the Study Plan, surveys were conducted to support protocols identified in Stage 2 of the Draft ECPG and fulfill the requirements for "moderate effort" classification Bald Eagle surveys found in the ODNR Wind Guidelines. The Bald Eagle surveys required by the Draft and Final ECPG, included site specific Bald Eagle surveys within the Project Area, Bald Eagle nest searching and monitoring, and diurnal raptor/bird migration surveys.

Tetra Tech initiated field efforts and surveys in the Project Area on March 2, 2011. Specific Bald Eagle surveys that were conducted included the following:

- Two years of Bald Eagle nest and productivity surveys conducted during the 2011 and 2012 breeding seasons;
- One year of diurnal raptor/bird migration surveys; and
- 13 months of fixed radius point counts at forty (40) locations within and surrounding the Firelands Project Area.

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A complete report of the diurnal raptor/bird migration surveys and the 13 months of fixed point counts, as well as the 2011 and 2012 Bald Eagle nest productivity monitoring are found in the Tetra Tech *Stage 2-site specific Bald Eagle Survey Report* dated July 2012.

The following sections of the report provide an overview of existing site conditions, survey methods, and results for each of the 2011, 2012 and 2013 Bald Eagle nest productivity monitoring collection efforts conducted for the Firelands project. The results of the 2013 breeding season, along with the July 2012 *Stage 2-site specific Bald Eagle Survey Report* will provide Firelands and agency staff with the necessary quantitative data for the subsequent Stage 3 risk analysis of the ECPG.

2.0 EXISTING SITE CONDITIONS

This section of the report will present the existing site conditions from both a regional and Project Area perspective.

2.1 Region

The Firelands Project Area is located in the Maumee and Erie Lake Plain physiographic provinces of north central Ohio (see Figures 1, 2, & 3). This area is characterized by level to gently rolling terrain and clay and loamy clay lakebed soils. Prior to settlement, much of this region was covered by various mixed hardwood forest types; however, due to the fertile soil the area is now predominantly agricultural (crop) land with only scattered forest remnants or woodlots remaining, primarily along stream channels or in isolated stands. Two large waterways, the Sandusky and Huron Rivers are found in the two counties within this region. These rivers flow from south to north through farm country from interior Ohio to Lake Erie. A band of natural habitat, including upland and floodplain forest and wetlands occurs along these river channels. In addition, Lake Erie, including Sandusky Bay, is located approximately 5 to 10 miles to the north of the Project Area and harbors shoreline and open water habitats. Most of the wetlands in the agricultural portion of this region have been greatly reduced in size and extent; however, small areas of emergent marsh/meadow, farm ponds, and floodplain/bottomland forest still occur in isolated patches or along riparian stream corridors.

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Given the large scale conversion of much of the regional landscape to agriculture, habitat for Bald Eagle has likely been diminished, especially in the Project Area. While Lake Erie and the Sandusky River and Huron River corridors provide quality habitat, the agricultural portion of this region generally contains relatively low levels of biological diversity. This is evidenced by a lack of Audubon Society designated Important Bird Areas (IBA), wildlife management areas, and rare species element occurrences in the agricultural portion of the region when compared with the Sandusky and Huron River corridors and Lake Erie.

The Sandusky River corridor (approximately 14 miles west of the Project Area) is designated by the Audubon Society as the Sandusky IBA, while a large portion of Lake Erie including Sandusky Bay is designated as the Lake Erie Western Basin IBA. The Sandusky IBA is known as a Bald Eagle migration corridor and is important to a number of other bird species. The Lake Erie Western Basin IBA is known to be an important wintering and nesting area for Bald Eagles as well as numerous waterfowl and water bird species.

2.2 Project Area

The vast majority (over 98%) of the Project Area has been converted to cropland or other high intensity development. Forest stands and other natural habitats are generally small, scattered and highly fragmented. Forest fragments, National Wetland Inventory identified wetlands, and the National Hydrography Dataset are displayed on Figure 2.

Small tributary streams, which comprise approximately 257,000 linear meters, traverse the Project Area, some of which flow through or are adjacent to scattered wooded areas or woodlots (see Figure 2). Many of the stream channels have been modified through

agricultural practices; however, some of these drainages contain small forested wetlands or floodplain areas. No larger rivers or water bodies occur within the Project Area. The Project Area is approximately 14 miles east of the Sandusky River corridor, 1-2 miles west of the Huron River corridor, and 6-8 miles south of Lake Erie. However, a few quarries containing ponded water do occur within the Project Area and one artificial reservoir (Bellevue Reservoir) is located adjacent to the southern boundary of the Project Area. Scattered wetlands (approximately 800 acres), such as forested bottoms/floodplains, emergent, and scrub-shrub wetlands occur in the Project Area; however, most of these have been affected by farming and draining activities (see Figure 2).

There are no known Audubon Society designated IBAs, wildlife management areas, or rare species element occurrences in the Project Area.

During pre-permit meetings with ODNR, USFWS and OPSB; Firelands took into consideration the recommendations by all parties to eliminate the portions of the Project Area within Seneca County and west of Route 4 (see Figures 1 and 5). The purpose of eliminating the Seneca County area was to avoid the 5-mile buffer radius of an Indiana bat capture reported to ODNR and USFWS by another agency. The section of the project boundary west of Route 4 is the location of a historic Bald Eagle nest #1 and #2 (two nest locations occupied by the same breeding pair).

The modified Project Area for 2013 is now approximately 43,000 acres, however the characteristics and condition of the landscape have not changed significantly (Figure 2).

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3.0 SURVEY METHODOLOGY

Methods for the Stage 2 site specific Bald Eagle surveys followed the recommended components of Appendix C in the ECPG. The protocols found in the approved Study Plan for the Firelands Project Area were designed to be in accordance with the Draft ECPG and ODNR wind guidelines for a moderate level site. The Bald Eagle nest and productivity survey was conducted in accordance with the protocol identified in Appendix C of the Draft ECPG for evaluating eagle nest productivity within 10 miles of the Project Area and ODNR wind guidelines for evaluating protected raptor (including Bald Eagle) nest activity within 2 miles of the project boundary.

3.1 Bald Eagle Nest & Productivity Surveys

In accordance with the approved Study Plan and for two breeding seasons (2011 and 2012) Tetra Tech wildlife biologists conducted a vehicular reconnaissance within Firelands Project Area and a 10-mile buffer (see Figure 3) in order to identify Bald Eagle nests. Nest searches were conducted as outlined in the Draft ECPG (10-mile Draft ECPG buffer) during March 2011 and March 2012, which also covered the 2-mile buffer indicated in the ODNR wind guidelines. Each observed nest was identified to species by nest size, material and/or bird activity at the nest. Global Positioning Satellite (GPS) locations of each confirmed nest was recorded using a handheld Trimble GeoX.

Once Bald Eagle nests were positively identified (species present, nest size, nest materials, and/or bird activity at the nest) and their territories established, Tetra Tech biologists generated field forms and figures depicting all identified Bald Eagle nests and then utilized them during the spring months of 2011 and 2012 nest productivity survey efforts to document the behavioral patterns of the adults and eaglets. Additionally, Tetra Tech developed a nest productivity field form which captured activity in and around each Bald Eagle nest during each of the three nest productivity surveys conducted in over three breeding seasons (April, May and June of 2011, 2012 and 2013).

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As mentioned in Section 2.2, upon completion of the *Stage 2-site Specific Bald Eagle Survey Report* and subsequent discussions of the report with ODNR, USFWS, and OPSB; Firelands concluded that a reduction in the project boundary would fulfill the recommended Bald Eagle conservation criteria of the Draft ECPG and requests for Indiana bat conservation by USFWS. Tetra Tech utilized this revised boundary for the purposes of the 2013 raptor nest search.

Also upon request in 2013, Tetra Tech received via electronic facsimile a GIS shapefile of Bald Eagle nest locations within the Firelands 10-mile buffer from Dr. Keith Lott of the USFWS Columbus Field Office on April 16, 2013 (Figure 4). Tetra Tech biologists confirmed the presence/absence of Bald Eagle nests at those given locations during the April raptor nest search (Table 4 and Figure 4).

Nest productivity surveys were conducted at each identified Bald Eagle nest three (3) times (once in April, May and June) for four (4) hours each. During the nest productivity surveys Tetra Tech biologists recorded all activity of Bald Eagles (incubation, feeding young, nest maintenance, flight height and direction, etc…) in order to report; the number, occupancy status and productivity of nesting Bald Eagles.

4.0 SURVEY RESULTS

Tetra Tech biologists completed Bald Eagle nest productivity surveys in accordance with the approved Study Plan, within the original Firelands Project Area and 10-mile Draft ECPG buffer between March 2011 and June 2012, and the approximately 43,000 acre modified Project Area and 10-mile buffer in 2013. The results of the Bald Eagle nest searching and productivity monitoring within the 2-mile ODNR wind guidelines and 10-mile ECPG buffer are summarized in the sections below.

4.1 Bald Eagle Nest & Productivity Survey

A vehicular reconnaissance survey was conducted over the period of three breeding seasons (March 2011, March 2012 and April 2013) to identify all Bald Eagle nests within the 10-mile Draft ECPG buffer. Bald Eagle nests were identified by Tetra Tech biologists as over 5-feet wide and at least 3-feet tall piles of dry tree limbs and by observed activity at the nest. Tetra Tech biologists confirmed individual raptor species activity at the nest by observing Bald Eagle(s) approaching the nest, performing breeding activity at the nest (nest building, incubation, etc…) perched on and/or within 800 m of the nest. Following identification of Bald Eagle nest locations, Tetra Tech wildlife biologists recorded the following: Bald Eagle nest location (GPS coordinates), activity status, productivity, and mean internest distance/territory size.

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During the 2011 vehicular reconnaissance eight Bald Eagle nests were identified and observed on private properties within and surrounding the Project Area (see Figure 3). The identified Bald Eagle nests are primarily located north of the Project Area, near Lake Erie, and along the Huron River corridor. Two Bald Eagle nests were identified in the northwest portion of the Project Area (see Figure 3).

Tetra Tech wildlife biologists determined the spatial extent of all Bald Eagle territories found within the 2-mile ODNR wind guidelines buffer for the original Project Area. The size of each Bald Eagle territory was based on ½ the mean internest distance between all known Bald Eagle nests in the vicinity. This value was determined to be 0.85 miles and was provided by the USFWS and ODNR. The total acreage of Bald Eagle territory within the Project Area is approximately 2,288 acres. The proportion of the Project Area containing Bald Eagle territory is approximately 5% of the total Project Area (~43,000 acres). Also, the two Bald Eagle territories in the Project Area are located in the extreme northwest portion of the Project Area (Figure 3).

In 2013, visually confirmed the presence/absence of nest locations provided by the USFWS (Figure 4) and conducted nest monitoring activities at those locations identified on Figure 5. Tetra Tech wildlife biologists determined the spatial extent of territories for the eleven (11) Bald Eagle nests within the modified Project Area and 10-mile buffer. As in previous years, the size of Bald Eagle territories was determined by the ½ mean internest distance; which for the modified 2103 Project Area was calculated to be 1.9 miles. The modified Project Area has no Bald Eagle territories within it (see Figure 6).

The attached Table 1 includes a summary Bald Eagle nest observations and productivity data during spring/summer 2011. Table 1 provides the 2011 observed nest status and number of fledglings, if applicable. As can be seen in Table 1, seven nests (#1, #3, #4, #5, #6, #7, and #8) were found to be occupied by Bald Eagles. Nest #2 was observed to

be occupied by a Red-tailed hawk. Tetra Tech biologists did not observe Bald Eagle fledglings for nests #5 and #6, therefore they were unproductive. Tetra Tech determined that the two nests (#1 and #2) in the Project Area were from the same pair of Bald Eagles that abandoned one nest (#2) and constructed another (#1).

The attached Table 2 summarizes the results of the 2012 vehicular reconnaissance. Tetra tech biologists observed 11 nest locations, which included three new Bald Eagle nests (#7_2012, #8_2012, and #9) (see Figures 3 and 4). Nest #2 was observed to be unoccupied by any birds. Tetra Tech biologists determined that the two nests (#7 and #8) observed in 2011 were destroyed and no longer present. Tetra Tech biologists determined that due to the proximity to the old nest locations (see Figure 3) that the new nests (#7_2012 and #8_2012) were re-nests by breeding pairs from the previous year nests #7 and #8. Thus, a total of nine nest locations were monitored in 2012, eight were occupied by Bald Eagles, and four occupied nests were productive (see Table 2). The Bald Eagle nests within the 2-mile ODNR wind guidelines buffer did not change locations or activity status in 2012, therefore the amount of Bald Eagle territory remained approximately 5% of the total Project Area. It should also be noted that Tetra Tech biologists periodically observed the locations of the original Bald Eagle nests at locations #7 and #8 (Figure 3) through the end of productivity monitoring in 2012 to ensure no other replacement nests were constructed.

In 2013 (see Table 3), the modified Project Area eliminated three (3) Bald Eagle nest locations, monitored previously in 2011 and 2012 from the 10-mile buffer (#6, #7_2013 and #8) and one (1) breeding pair from the Project Area boundary (nest locations #1 and #2, see Figure 4). As in 2011, nest locations #1 and #2 were occupied by the same breeding pair and no nest was observed at location #2. However, six (6) new nests were located within the 10-mile buffer from the information provided by USFWS in April 2013 and our visual reconnaissance. As depicted in Figure 4, Bald Eagle nests #10_2013, #11_2013, #12_2013, #13_2013, #14_2013 and #15_2013, were added to the Bald Eagle productivity monitoring efforts (Table 3).

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5.0 DISCUSSION

Tetra Tech successfully completed the Stage 2 components outlined in Appendix C of the Draft ECPG and provides this 2013 Bald Eagle Nest Productivity Update report. Tetra Tech also understands that additional data from the Stage 2 surveys may be used as part of both the fatality prediction model and overall risk analysis for Bald Eagles as considered by the USFWS. As a result of the Bald Eagle site specific surveys, Firelands and consulting agencies are provided with the information that can satisfy the adaptive Bald Eagle management requirements and the regulatory monitoring requirements of the USFWS and ODNR.

5.1 Bald Eagle Nest Monitoring & Productivity

Characterization of the Firelands local-area nesting population of Bald Eagles is summarized in Tables 1, 2 and 3 for 2011, 2012 and 2013. A total of seven (7) Bald Eagle breeding pairs occupied nests within the 10-mile ECPG buffer of the Project Area during 2011 and an eight breeding pair occurred in 2012 (Figure 3). However, of those eight (8) breeding pairs of Bald Eagles, only five (5) pairs produced a total of nine (9) fledglings in 2011, and four (4) pairs produced ten (10) fledglings in 2012.

In 2013, a total of eleven (11) nests were observed with nine (9) actively breeding pairs. The nine (9) actively breeding pairs produced a total of sixteen (16) fledglings within the 10-mile buffer of the Project Area. The Bald Eagle nesting pair (at nest locations #1 and #2) that was originally located within the Project Area, is now located over 2 miles west-northwest of the project boundary due to the modification.

As expected and due to the project boundary modification, the Bald Eagle Nest territories associated with nest locations #1 and #2 are now outside of the Project Area.

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FIGURES

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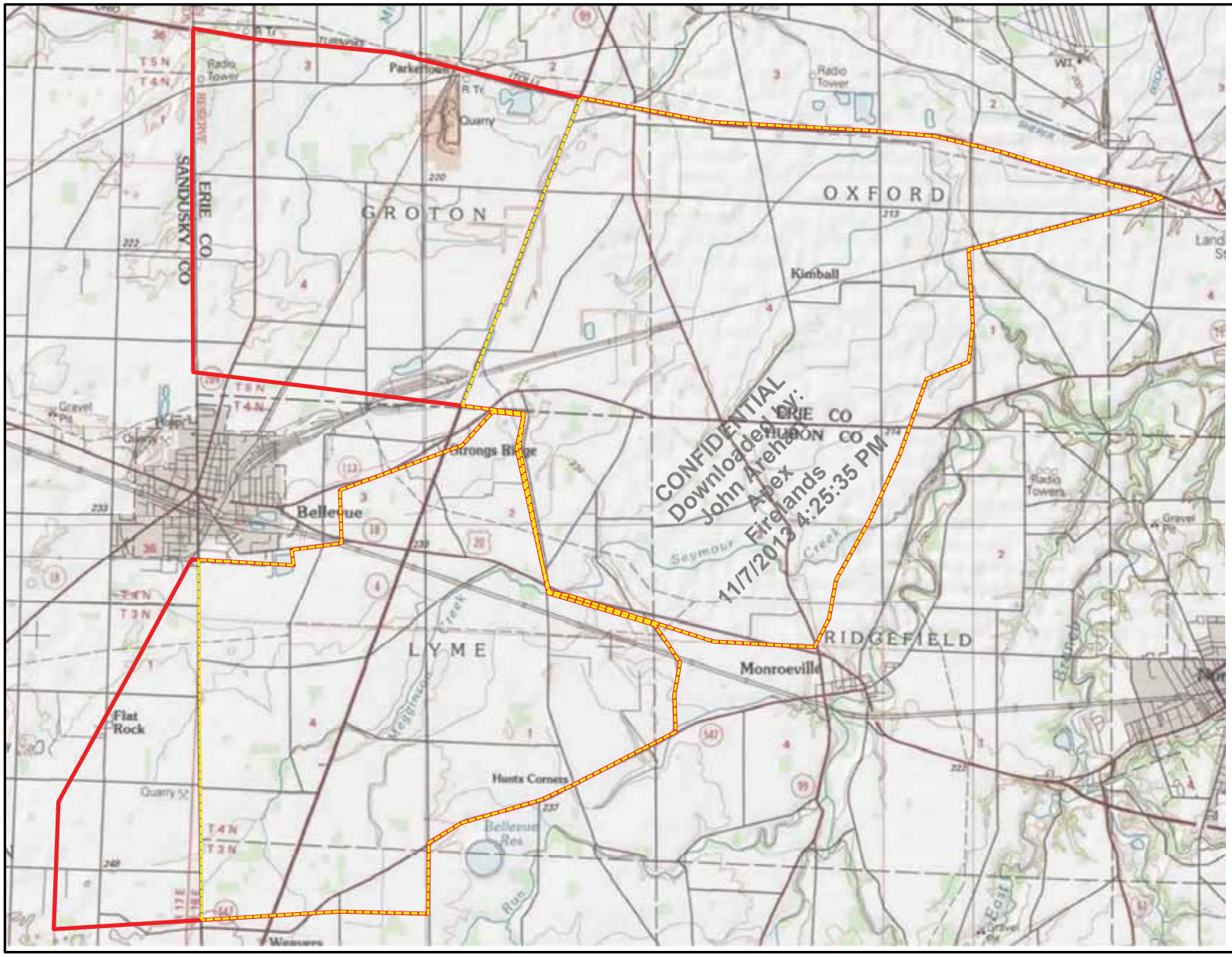

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LEGEND

- Modified Firelands Project Area
- Lyme Project Boundary
- Firelands Project Boundary

0 0.75 1.5 Miles

FIGURE1
SITE LOCATION MAP

JUWI WIND
FIRELANDS AND LYME PROJECT
ERIE, HURON AND SENECA COUNTIES, OHIO

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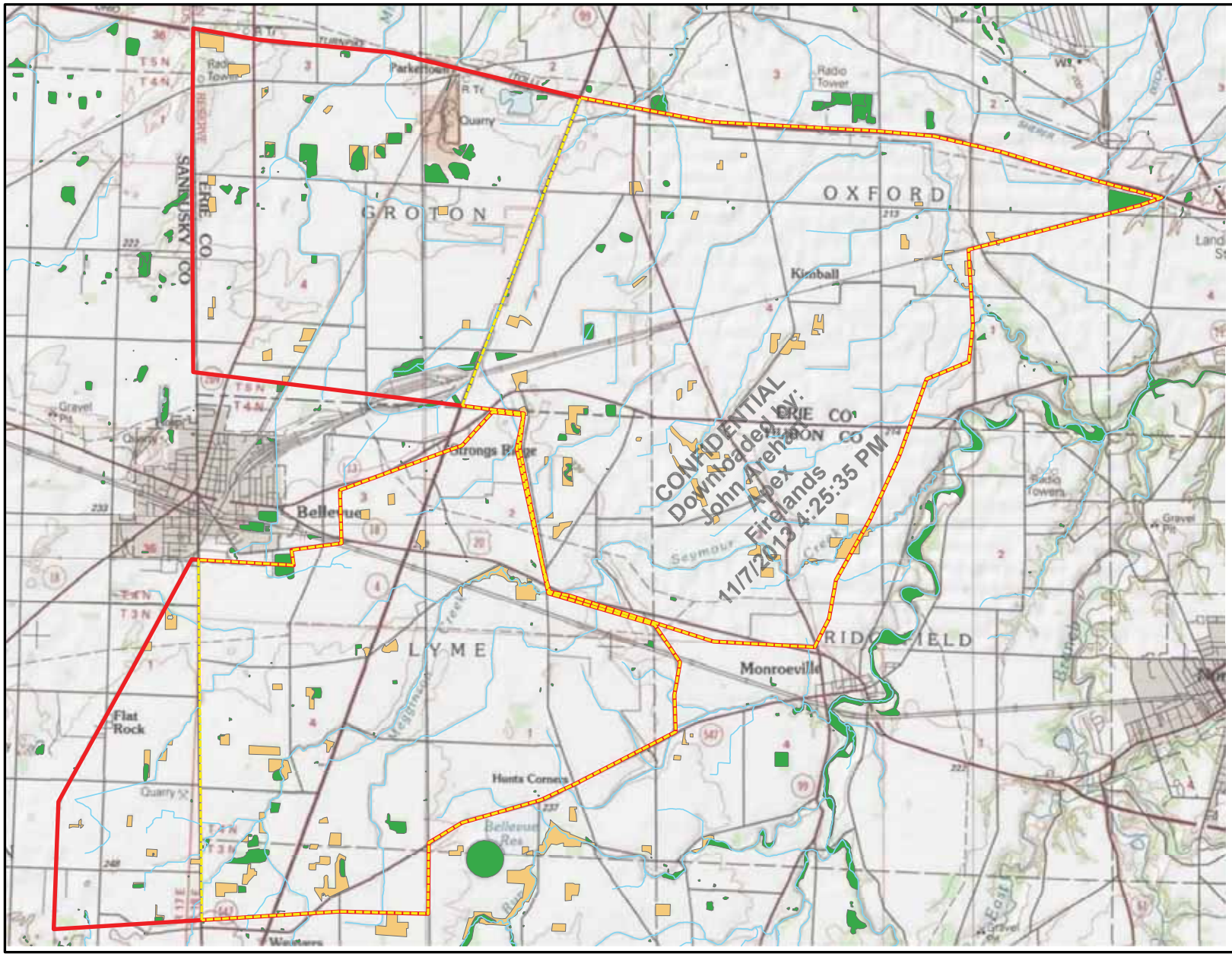

LEGEND

- Modified Firelands Project Boundary
- Lyme Project Boundary
- Firelands Project Boundary
- National Hyrdrography Dataset
- National Wetland Inventory
- Forested Habitat

0 0.75 1.5 Miles

FIGURE 2
PROJECT AREA EXISTING CONDITIONS

JUWI WIND
FIRELANDS AND LYME PROJECT
ERIE, HURON, AND SENECA COUNTIES, OHIO

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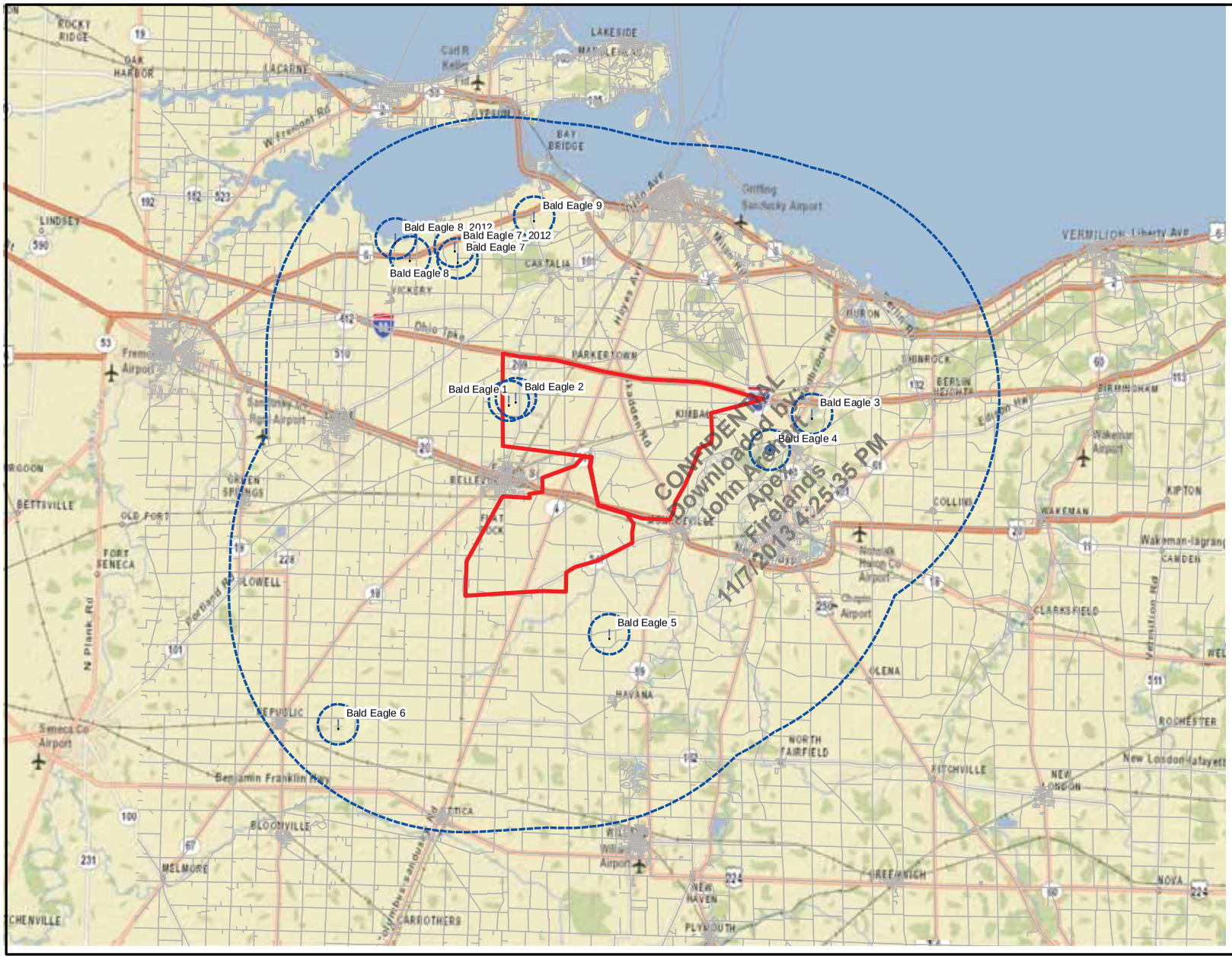

Figure 3
2011 and 2012 Bald Eagle Nest Locations

JUWI WIND
FIRELANDS AND LYME PROJECT
ERIE, HURON, AND SENECA COUNTIES, OHIO

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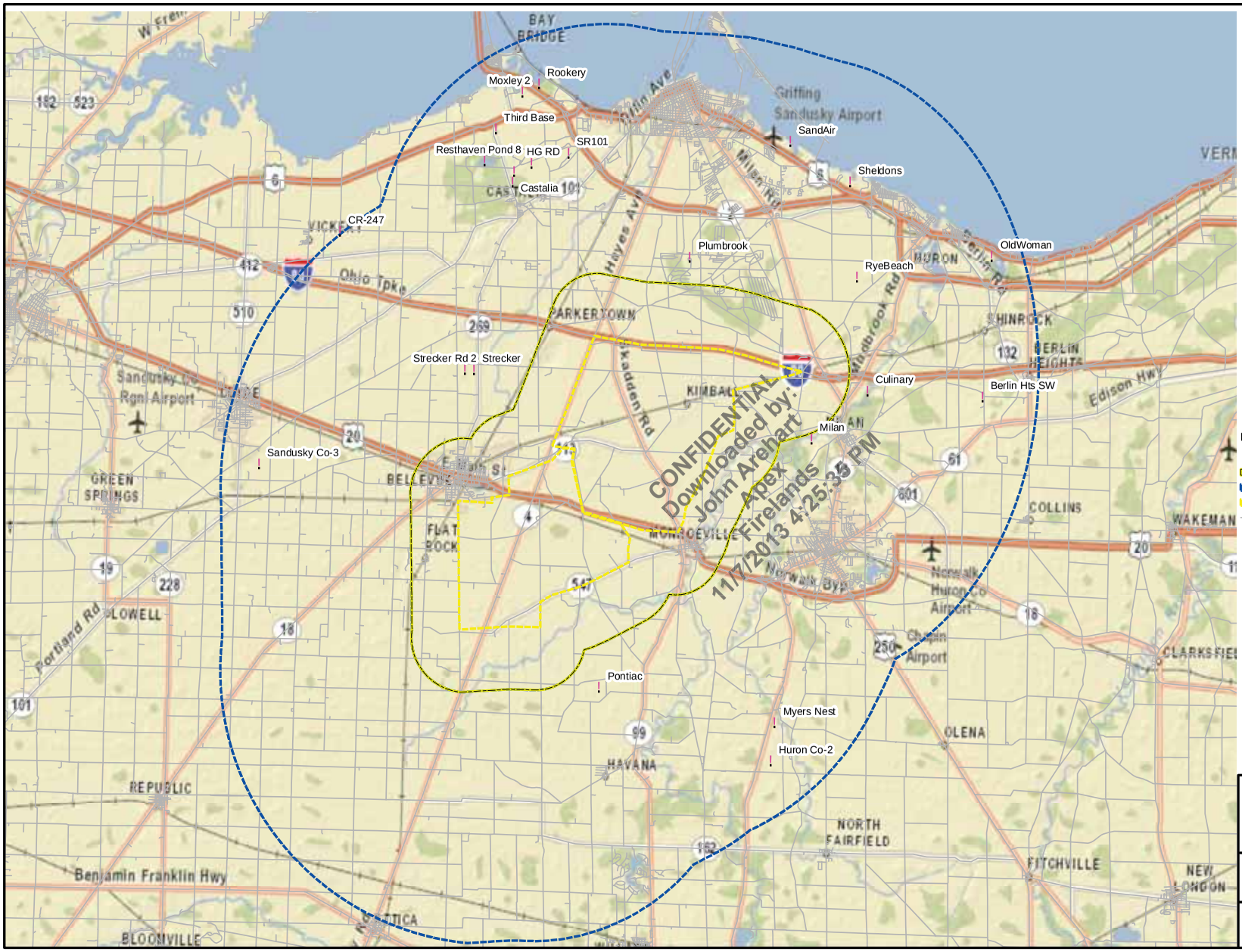

Legend

- Bald Eagle Nest Locations provided by USFWS
- 2-Mile ODNR Wind Guidelines Buffer
- 10-Mile ECPG Buffer
- Firelands Project Area
- Roads

0 2 4 Miles

Figure 4
Bald Eagle Nest Locations
provided by USFWS

Firelands Wind Energy Project
10-mile Buffer
with 2013 Bald Eagle Nest Locations

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Figure 5
2013 Bald Eagle Nest Locations

Firelands Wind Energy Project
10-mile Buffer
with 2013 Bald Eagle Nest Locations

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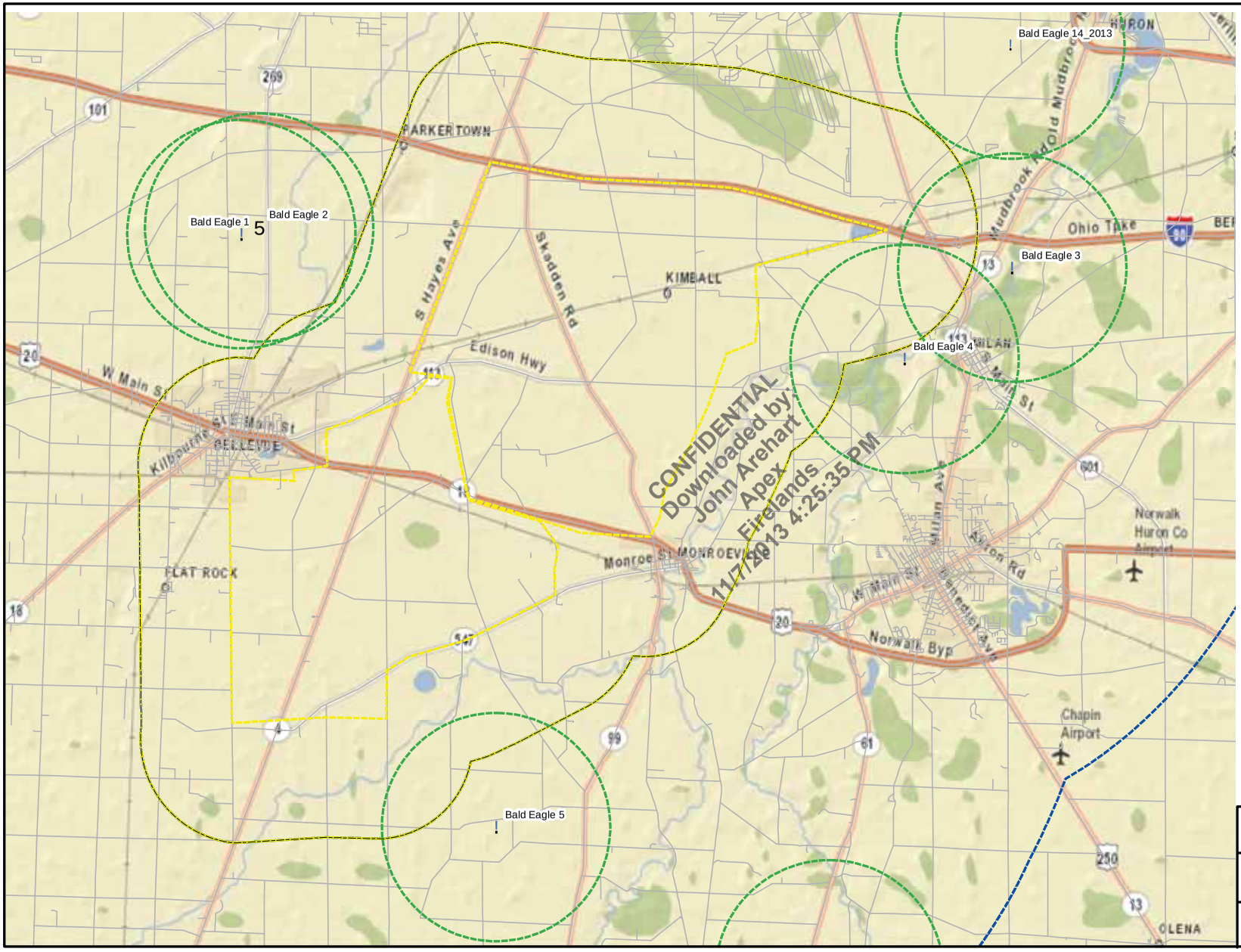

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Legend

- 5 Inactive Bald Eagle nest location
- Active Bald Eagle nest
- 2-Mile ODNR Wind Guidelines Buffer
- 10-Mile ECPG Buffer
- Firelands Project Area
- Roads
- 1.9 mile Bald Eagle Nest Territory Buffer

0 2 4 Miles

Figure 6
2013 Bald Eagle Nest Terrtories

Firelands Wind Energy Project
2-mile Buffer
with 2013 Bald Eagle Nest Terrtories

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TABLES

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Table 1 – 2011 Bald Eagle Nest Productivity Monitoring

Nest Identification	Located Within Project Boundary	Productive	# of Fledglings Observed	Comments
Bald Eagle 1	Yes	Yes	2	-
Bald Eagle 2	Yes	No	N/A	Red-tailed hawk observed occupying nest.
Bald Eagle 3	No	Yes	1	-
Bald Eagle 4	No	Yes	1	This nest was only visible in April until leaf out obscured visibility.
Bald Eagle 5	No	No	0	Adults were incidentally observed in the vicinity in the early portions of the breeding season, and on one occasion an adult was observed in an incubation position.
Bald Eagle 6	No	No	0	Adults were observed nesting and in vicinity early in the breeding season. Following a strong wind storm the nest was damaged and portions of it were blown down.
Bald Eagle 7	No	Yes	2	-
Bald Eagle 8	No	Yes	3	-

See Figure 3 for 2011 & 2012 Bald Eagle nest locations

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Table 2 – 2012 Bald Eagle Nest Productivity Monitoring

Nest Identification	Located Within Project Boundary	Productive	# of Fledglings Observed	Comments
Bald Eagle 1	Yes	Yes	2	-
Bald Eagle 2	Yes	No	N/A	Unoccupied, no activity at nest.
Bald Eagle 3	No	No	0	3 adults observed feeding 2 eaglets (<52 days old) in April; no fledglings observed in June.
Bald Eagle 4	No	No	0	Adults observed incubating in March and April; nest not visible in June due to leaf out, no eaglets or fledglings observed.
Bald Eagle 5	No	Yes	2	
Bald Eagle 6	No	No	0	Adults observed in March incubating and feeding young in April, unoccupied and appears abandoned in June; no fledglings observed.
Bald Eagle 7	No	No	N/A	Nest destroyed by natural causes.
Bald Eagle 7_2012	No	Yes	3	Re-nest by breeding pair from nest #7 that was destroyed.
Bald Eagle 8	No	No	N/A	Nest and tree destroyed by natural causes.
Bald Eagle 8_2012	No	Yes	3	Re-nest by breeding pair from nest #8 that was destroyed.
Bald Eagle 9	No	No	0	Adults observed incubating in April, nest unoccupied in May and June.

See Figure 3 for 2011 & 2012 Bald Eagle nest locations

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Table 3 – 2013 Bald Eagle Nest Productivity Monitoring

Nest Identification	Located Within Project Boundary	Productive	# of Fledglings Observed	Comments
Bald Eagle 1	No	Yes	Unknown	One eaglet of less than 65 days of age was observed during final nest productivity survey in June.
Bald Eagle 2	No	No	N/A	Unoccupied, no activity and no nest present at location.
Bald Eagle 3	No	Yes	2	3 adults observed feeding 2 eaglets, fledglings observed in June.
Bald Eagle 4	No	Yes	1	Eaglet observed in April and fledgling observed in June.
Bald Eagle 5	No	Yes	2	-
Bald Eagle 6	No	-	-	Nest no longer located within modified Firelands 10-mile buffer; no longer included in monitoring survey efforts.
Bald Eagle 7	No	No	N/A	Nest destroyed by natural causes in 2011.
Bald Eagle 7_2012	No	No	-	Re-nest in 2012 by breeding pair from nest #7 that was destroyed in 2011.
Bald Eagle 8	No	No	N/A	Nest and tree destroyed by natural causes in 2011.
Bald Eagle 8_2012	No	Unknown	Unknown	Re-nest by breeding pair from nest #8 that was destroyed in 2011. Nest is no longer within the modified 2013 project area 10-mile buffer; no longer included in monitoring survey.
Bald Eagle 8_2013	No	Unknown	Unknown	Re-nest by breeding pair from nest #8_2012. Nest is no longer within the modified 2013 project area 10-mile buffer and no longer included in monitoring survey.
Bald Eagle 9	No	Yes	1	-

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Nest Identification	Located Within Project Boundary	Productive	# of Fledglings Observed	Comments
Bald Eagle 10_2013	No	No	0	No activity at nest and little activity observed in territory, either an unoccupied territory or a part of Bald Eagle 11_2013 territory.
Bald Eagle 11_2013	No	Yes	3	-
Bald Eagle 12_2013	No	Yes	3	-
Bald Eagle 13_2013	No	Yes	2	-
Bald Eagle 14_2013	No	No	0	Bald Eagles observed occupying territory and maintaining nest, but no incubation or eaglets observed.
Bald Eagle 15_2013	No	Yes	2	-

See Figure 5 for 2013 Bald Eagle nest locations.

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Exhibit R
Raptor Nest Survey and Monitoring Reports

6. Spring 2012 Raptor Nest Survey Results dated May 9, 2012

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TECHNICAL MEMORANDUM

Date: May 9, 2012

To: Apex Wind Energy

From: Michelle L. Ritzert and Matt Clement, WEST Inc.

RE: Spring 2012 Raptor Nest Survey Results, Emerson Creek Wind Resource Area

---

Apex Wind Energy (Apex) is considering the development of a wind energy facility in Van Wert County, Ohio, known as the Emerson Creek Wind Resource Area (ECWRA). Apex requested that Western EcoSystems Technology, Inc (WEST) conduct ground-based raptor nest surveys at the proposed ECWRA to locate raptor nests in and within one mile (1.6 kilometers [km]) of the project boundary, per ODNR guidelines.

Suitable raptor nesting habitat is present in the ECWRA in the form of deciduous trees, shelterbelts, grasslands, and man-made structures such as power poles. One survey for raptor nests, including potential northern harrier (*Circus cyaneus*) nesting habitat, was conducted from March 29 to 31, 2012. The survey consisted of searching suitable nesting areas from public roads and leased areas within the ECWRA and a one mile buffer.

The survey effort focused on species that build large nest structures, such as red-tailed hawks (*Buteo jamaicensis*), as well as suitable breeding habitat for northern harriers (i.e. grasslands larger than 0.5 acres). Other species that nest on the ground or species that nest in cavities were recorded if observed, but were not the focus of surveys. Areas with potentially suitable habitat were viewed with binoculars and spotting scopes, and searched for potential raptor or owl nest structures. Private, leased lands were accessed on foot when closer views of potential nesting habitat were needed. Potential nest locations were recorded on recent aerial photographs, and digitized in a geographical information system (GIS), ArcGIS 10.

Data recorded for each nest site included nest status (active or inactive), the number of adults and young present, species occupying nest site, behavior of adults at the nest, nest condition (poor, fair, good), nest location (global positioning system [GPS] coordinates) and nest substrate.

During the survey, one active red-tailed hawk nest and two inactive unknown raptor species nests were observed within the ECWRA (Figure 1). An additional five active red-tailed hawk nests, two active bald eagle nests (*Haliaeetus leucocephalus*), and two inactive unknown raptor species nests were observed within one mile of the project boundary. The inactive unknown raptor species nests were likely constructed by red-tailed hawks, based on their size and the habitats surrounding the nests; however, the nests could also be used by other raptor species, such as Cooper's hawk (*Accipiter cooperii*) or great horned owl (*Bubo virginianus*). Ten grasslands with potentially suitable northern harrier breeding habitat were observed during

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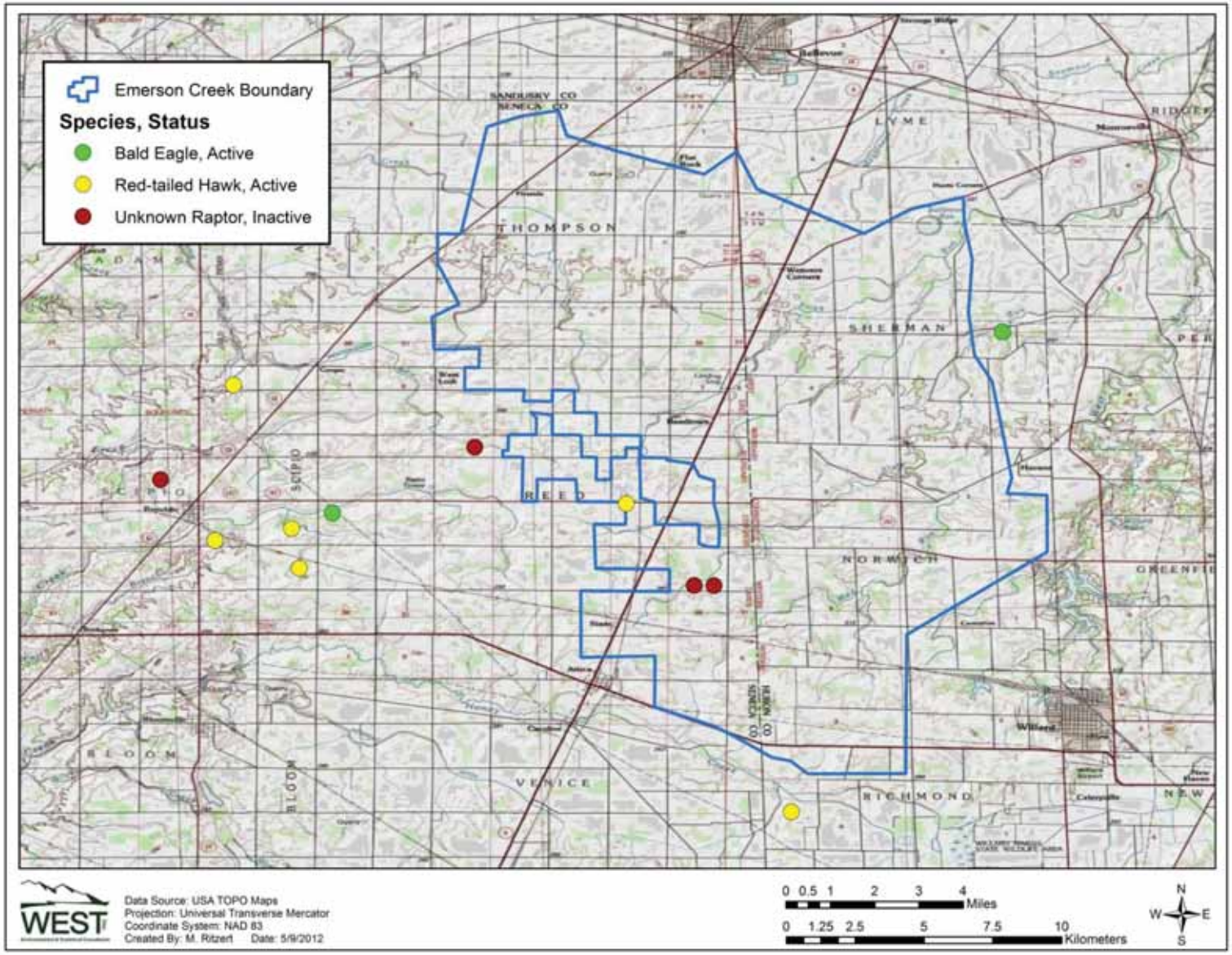

Figure 1. Raptor Nest Locations at the Emerson Creek Wind Resource Area.

surveys. The northern harrier breeding season begins in late April in Ohio and courtship displays can occur as early as March (The Ohio Ornithological Society 2012). Observations of northern harriers were made at eight of the grassland areas; however, observations were of female harriers only and no courtship displays were observed.

It is important to note that raptor nest locations were mapped on recent aerial photographs, and digitized in to ArcGIS. The locations were not recorded with a sub-meter GPS, and some error is associated with each location. Locations are estimated to be accurate to within 50 – 100 m (164 – 328 ft) of the coordinate.

The Ohio Ornithological Society. Ohio's Birding Network. 2012. Available at: http://www.ohiobirds.org/obba2/pdfs/species/NorthernHarrier.pdf

Exhibit R
Raptor Nest Survey and Monitoring Reports

7. Spring 2011 Raptor Nest Survey Results dated May 6, 2011

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Attorneys for Firelands Wind, LLC

Memorandum

Date: May 6, 2011

To: Apex Wind Energy

From: Michelle L. Ritzert, WEST Inc.

RE: Spring 2011 Raptor Nest Survey Results, Emerson Creek Wind Resource Area

---

Apex Wind Energy (APEX) is considering the development of a wind energy facility in Van Wert County, Ohio, known as the Emerson Creek Wind Resource Area (ECWRA). APEX requested that Western EcoSystems Technology, Inc (WEST) conduct ground-based raptor nest surveys at the proposed ECWRA to locate raptor nests in and within one mile (1.6 kilometers [km]) of the project boundary that may be subject to disturbance and/or displacement effects from the wind energy facility construction and/or operation.

Suitable raptor nesting habitat is present in the ECWRA in the form of deciduous trees, shelterbelts, grasslands, and man-made structures such as power poles. One survey for raptor nests, including potential northern harrier (*Circus cyaneus*) nesting habitat, was conducted from April 1 to 9, 2011. The survey consisted of searching suitable nesting areas from public roads and leased areas within the ECWRA and a one mile buffer.

The survey effort focused on species that build large nest structures, such as red-tailed hawk (*Buteo jamaicensis*). However, surveys of suitable breeding habitat for northern harriers (i.e. grasslands larger than 0.5 acres) were also conducted. Other species that nest on the ground or species that nest in cavities were recorded if observed, but were not the focus of surveys. Areas with potentially suitable habitat were viewed with binoculars and spotting scopes, and searched for potential raptor or owl nest structures. Private, leased lands were accessed on foot when closer views of potential nesting habitat were needed. Potential nest locations were recorded on recent aerial photographs, and digitized in a geographical information system (GIS), ArcGIS 10.

Data recorded for each nest site included nest status (active or inactive), the number of adults and young present, species occupying nest site, behavior of adults at the nest, nest condition (poor, fair, good), nest location (global positioning system [GPS] coordinates) and nest substrate.

During the survey, seven active red-tailed hawk nests and nine inactive unknown raptor species nests were observed within the ECWRA (Figure 1). An additional seven active red-tailed hawk nests, six inactive unknown raptor species nests, and one inactive bald eagle nest (*Haliaeetus leucocephalus*) were observed within one mile of the project boundary. The inactive unknown raptor species nests were likely constructed by red-tailed hawks, based on their size and the relative abundance of this species in the ECWRA; however, the nests could also be used by

other raptor species, such as Cooper's hawk (*Accipiter cooperii*) or great horned owl (*Bubo virginianus*).

It is important to note that raptor nest locations were mapped on recent aerial photographs, and digitized in to ArcGIS. The locations were not recorded with a sub-meter GPS, and some error is associated with each location. Locations are estimated to be accurate to within 50 – 100 m (164 – 328 ft) of the coordinate.

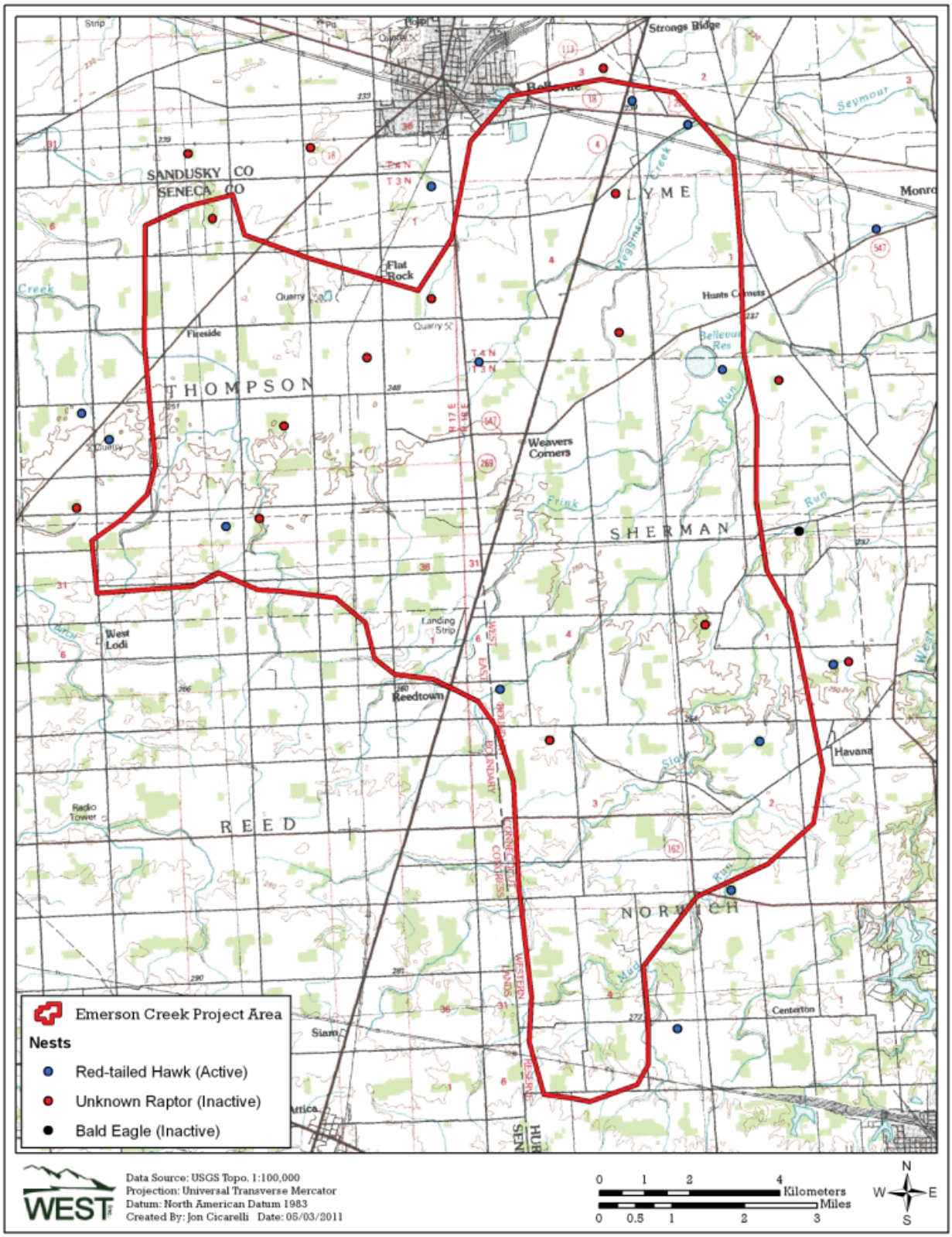

Figure 1. Raptor Nest Locations at the Emerson Creek Wind Resource Area.

Exhibit R
Raptor Nest Survey and Monitoring Reports

8. Bald Eagle Monitoring Report for the Proposed Firelands Wind Farm Project dated September 20, 2010

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Date:
September 20, 2010

Contact:
Fred Sellars

Phone:
978.937-9999 x317

Email:
frederick.sellars@
arcadis-us.com

Our ref:
CO001527.0001

Subject:
Bald Eagle Monitoring Report for the Proposed Firelands Wind Farm Project

Dear Mr. Lott and Ms. Seymour:

ARCADIS/Malcolm Pirnie was retained by Firelands Wind Farm, LLC to provide raptor nest searching and bald eagle (*Haliaeetus leucocephalus*) nest monitoring in support of the proposed Firelands Wind Farm Project near Bellevue, Ohio (previously titled "I-80 Wind Farm"). The bald eagle is listed as threatened in Ohio according to the Ohio Division of Wildlife (DOW) *List of Wildlife that are Considered to be Endangered, Threatened, Species of Concern, Special Interest, Extirpated, or Extinct in Ohio, January 2009;* and is listed as a Federal Species of Concern according to the United States Fish and Wildlife Service (USFWS) *List of Federal Species of Concern in Ohio, May 2010*. The information collected during this monitoring effort supplements the results of a previous survey conducted by juwi during 2009.

The approximately 30,000-acre proposed wind energy project site and a 2-mile radius from the site (hereafter "Study Area") are shown on Figure 1. The Study Area encompasses portions of Erie, Huron, and Sandusky Counties. As shown on Figure 2, one active bald eagle nest and several active and inactive red-tailed hawk (*Buteo jamaicensis*) nests were documented within the Study Area during the 2010 study. The active bald eagle nest is located

just south and west of the intersection of SR 269 and Strecker Road. Two bald eagles chicks were reared from this nest in 2009 according to the previous monitoring results. Photographs taken during the 2010 study are attached. Photograph locations and corresponding numbers are shown on Figure 2.

Prior to starting the 2010 study, a monitoring protocol was developed for this project following the *Ohio Department of Natural Resources On Shore Bird and Bat Pre- and Post- Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio, May 4, 2009*. The monitoring protocol included nest monitoring twice per week between mid-April and early May, 2010; and then once per week through late June, 2010 (13 total monitoring events). The protocol was submitted by email to the DOW and USFWS on April 13, 2010. The DOW approved the protocol by email on April 14, 2010. Subsequent to starting the monitoring, the USFWS provided additional guidance by email on April 28, 2010, which recommended 20 visits during the breeding season. Based on this guidance, juwi revised the monitoring scope to include an additional seven monitoring events to occur between late June, 2010 and mid-August, 2010.

The 2010 monitoring initiated on April 16 and was performed twice per week starting April 20 through May 7. Starting on May 12, monitoring was conducted once per week with the most recent monitoring event occurring on July 21. To date, a total of 18 monitoring events have been conducted. The objective of the monitoring was to document and establish behavior patterns of the adult birds, and to determine how frequently the birds enter the proposed wind facility site. Information gathered during the monitoring will assist juwi, in cooperation with the DOW and USFWS, in siting the wind turbines such that all practical measures are implemented to reduce any detrimental effects on eagles.

Field notes for each monitoring event are attached. The notes document weather conditions during each monitoring event; nesting, hunting, and feeding activities; flight directions and elevations; and any other raptor activity observed during the monitoring. The initial 2010 monitoring event did not occur until April 16; therefore, courting/mating behavior and egg laying was not documented during this study. The first time chicks (two) were observed in the nest was April 20, so it is likely the eggs were laid sometime around mid-March. Fledging (two juveniles) was documented on June 23. During

the most recent monitoring event on July 21, the juvenile birds appeared to be independent and hunting on their own. A summary of the monitoring is provided in Table 1.

Table 1: Bald Eagle Nest Monitoring Summary

Date of Monitoring Event	Flight Direction From Nest To/ # Times Documented								Flight Direction To Nest From/ # Times Documented								Comments
	N	NW	NE	W	S	SW	SE	E	N	NW	NE	W	S	SW	SE	E	
4/16/10	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	Active nest identified S of intersection Strecker Rd and SR 269, no chicks observed.
4/20/10	2	-	-	-	-	-	-	-	2	-	-	-	-	1	-	-	Two bald eagle chicks observed in nest.
4/21/10	-	-	-	1	-	1	-	2	2	-	-	1	-	-	-	-	
4/28/10	2	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	Immature bald eagle arrives on site from S, departs to S/SW.
4/30/10	1	1	-	2	-	1	-	-	1	-	-	1	-	1	-	-	Adult bald eagle (not of nesting pair) noted along northern tree line near nest.
5/6/10	1	-	-	1	-	-	-	-	1	-	1	-	-	-	-	-	
5/7/10	2	1	-	2	-	-	-		-	-	-	2	-	-	-	-	Adult male (of nesting pair) observed chasing another adult bald eagle (not of nesting pair) to N.
5/12/10	1	-	-	-	-	-	-	1	-	-	-	-	3	-	-	-	
5/19/10	2	-	-	1	-	-	-	-	-	-	-	1	-	1	-	-	
5/26/10	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	
6/2/10	-	-	-	-	2	-	-	-	-	-	-	-	2	-	-	1	
6/9/10	-	-	-	1	1	-	-	1	-	-	-	1	1	-	-	1	Osprey observed entering nest site from E. Adult male (of nesting pair) pursued osprey to W.
6/16/10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
6/23/10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Two juveniles fledge.
6/30/10	-	-	-	-	2	-	-	-	-	-	-	2	-	-	-	-	
7/7/10	-	-	-	1	-	-	-	-	-	-	-	1	1	-	-	-	Juvenile flies to nest with rabbit.
7/14/10	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	
7/21/10	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	Juvenile flies in to nest site from W/SW with small mammal.
Total # times documented	12	3	-	9	6	2	-	4	7	-	1	11	9	3	-	2	
% documented flights from nest to N, NW, W, S, or SW	89%																
% documented flights to nest from N, NW, W, S, or SW									91%								

As depicted in Table 1, flight directions (relative to the nest) have primarily been to and from the N, NW, W, S, or SW, away from the proposed wind facility. About 89 percent of the time the eagles flew from the nest to the N, NW, W, S, or SW; and 91 percent of the time the eagles returned to the nest from the N, NW, W, S, or SW. Very rarely have the birds been documented east of SR 269 in the direction of the proposed wind energy project. The flight patterns observed in 2010 are consistent with those observed during the 2009 monitoring effort.

During the 2010 monitoring, fish and small mammals (primarily rabbit) were observed to be the primary prey items. Other less frequent prey items included a snake, a small bird, and animal remains. The adults were commonly observed hunting in adjacent fields in the vicinity of the nest, west of SR 269. Based on documented flight patterns, it is likely that fish were being hunted from nearby farm ponds or other waterbodies/streams west of SR 269.

Other state-listed raptors observed in the vicinity of the nesting site during this monitoring effort include: 1) a single juvenile bald eagle (not of the nesting pair) during the April 28 monitoring event, 2) a single adult bald eagle (not one of the nesting pair) during the April 30 and May 7 monitoring events, and 3) a single osprey (*Pandion haliaetus*) during the June 9 monitoring event. The osprey is listed as threatened in Ohio according to the DOW list of *Wildlife that are Considered to be Endangered, Threatened, Species of Concern, Special Interest, Extirpated, or Extinct in Ohio, January 2009*. These sitings were isolated incidents, and no additional bald eagle, osprey, or other protected raptor nests were observed within the Study Area during the 2010 monitoring.

It is our opinion that the information collected during the 18 monitoring events this breeding season has sufficiently documented existing raptor nests, and consistent behavior patterns for the nesting pair of bald eagles within the Study Area. Flight directions (relative to the nest) have primarily been to and from the N, NW, W, S, or SW, away from the proposed wind energy project. During our last monitoring event on July 21, the only activity observed during the six hours we were on-site was a single juvenile that had returned to the nest briefly to feed on a small mammal. Due to the lack of significant or new activity in the vicinity of the nest, we propose to end the monitoring for this breeding season. As previously mentioned, the birds were rarely observed

east of SR 269 in the direction of the proposed wind energy project during the nest monitoring efforts in 2009 and 2010. This is likely due to the presence of suitable/preferred hunting grounds west of SR 269. Therefore, based on the documented behavior patterns, the potential for project-related impacts the breeding pair of eagles is lessened.

Please review this information and provide any further recommendations or guidance you may have moving forward. If you have any comments or questions, please call me at (978) 937-9999 or email me at frederick.sellars@arcadis-us.com.

Sincerely,

ARCADIS U.S., Inc

Frederick M. Sellars
Vice President

Attachments: as noted

cc: Matt Stuber, U.S. Fish and Wildlife Service, East Lansing Field Office
Peter Endres, juwi Wind, LLC
Matthew Krivos, juwi Wind, LLC
John Shady, Malcolm Pirnie, Inc.

Exhibit R
Raptor Nest Survey and Monitoring Reports

9. Raptor Nest Survey & Monitoring dated June 2009

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Attorneys for Firelands Wind, LLC

PN: 1865.003 June 2009

RAPTOR NEST SURVEY & MONITORING
FOR
PROPOSED I - 80 WIND FARM
ERIE COUNTY, OHIO

Prepared for:
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FIGURES

Figure 1. Proposed I-80 wind facility project area, Sandusky and Erie Counties, Ohio.

Figure 2. Bald eagle flight paths, I-80 wind facility project area, Sandusky and Erie Counties, Ohio.

APPENDICES

Appendix A. Photographs.

Appendix B. Nest Monitoring Results.

EXECUTIVE SUMMARY

BHE Environmental, Inc. was contracted by JW Great Lakes Wind, LLC to identify and subsequently monitor raptor nests within the proposed I-80 wind facility project area plus a two-mile perimeter, in accordance with the Ohio Department of Natural Resources' (ODNR) *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio.*

A total of twelve raptor nests (all approximately 3 feet diameter stick nests - probable Red-tailed Hawk [*Buteo jamaicensis*] nests) were identified within the survey area during February 10-12, 2009. Six nests were within the proposed project area and six were outside the project area but within the two-mile perimeter. Pairs of Red-tailed Hawks were observed performing courtship flights, perched in close proximity to each other near identified nests, and/or repairing nests and carrying nesting material. Such activity indicated that at least four of the identified nests are likely to be used during the 2009 breeding season. Only one of these potentially active nests is located within the project area, the remaining three are located within the two-mile perimeter. Red-tailed Hawks are a common species, and are not state or federally listed.

In addition, two Bald Eagle (*Haliaeetus leucocephalus*) nests were identified within the project area. Bald Eagles were observed flying over and perched within the proposed project area on each of the nest identification survey days. No Bald Eagle activity was observed at or near the existing nests during the nest identification survey.

Subsequent to the nest identification survey, nest monitoring was conducted at the Bald Eagle nests as the species is designated as protected by ODNR. Only the northwest nest was found to be active. At and near this nest, a pair of Bald Eagles was observed during courtship, incubation of eggs, and rearing of two eaglets. The majority of Bald Eagle activity observed occurred at, or west and north of, the nest. With little exception, Bald Eagles were not observed traveling into (east of the nest) the project area.

1.0 INTRODUCTION

JW Great Lakes Wind, LLC (JWGL) proposes construction of a wind farm near the town of Bellevue, Erie County, Ohio (Figure 1). The Ohio Department of Natural Resources' (ONDR) *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio* (Protocol) recommends monitoring be conducted to assess daily movement patterns during the incubation and rearing stages of protected raptor species. In accordance with this Protocol, JWGL contracted BHE Environmental, Inc. (BHE) to identify raptor nests within the project area and a two-mile perimeter, and subsequently to monitor potential nests of protected raptors, as described below in detail.

The project area is approximately 17,923 acres (7,253 hectares), the majority of which is dominated by intensive row crop agriculture production. A two-mile perimeter, surrounding the project area, was also surveyed (Figure 1). The area composing the project area and the two-mile perimeter is approximately 55,107 acres (22,301 hectares).

2.0 METHODS

2.1 RAPTOR NEST SURVEY

BHE completed raptor nest surveys February 10-12, 2009. These surveys were conducted with the aid of 10X binoculars and included periods of stationary observation and automobile surveys. Surveys consisted of driving all roads within the project area and a two-mile perimeter and searching for stick nests in mature trees. When a nest was identified, a 2 – 15 minute period of stationary observation was conducted. When raptors were observed perched in or near a known nest, or were observed performing courtship displays in the vicinity of a nest, the nest was considered active.

2.2 BALD EAGLE NEST MONITORING

Nest monitoring methods were consistent with the Protocol, Section 1.2.1, Raptor nest monitoring, shown below.

> Monitoring should be conducted to assess the daily movement patterns of any species of protected raptor whose nest is located within 2 miles of the proposed site. During the incubation and rearing stage the location of adult birds should be tracked for at least 4 hours twice per week until consistent activity patterns are established. Alternate monitoring strategies that assess the degree to which nesting raptors use the proposed turbine facility will be considered (contact ODNR Division of Wildlife). Information collected will be used to document how frequently the birds enter the proposed turbine facility and whether particular turbines may pose a more substantial risk.

Three monitoring events, each for a minimum of four hours per day for two consecutive days (including morning and afternoon periods) were completed. These events occurred on:

- March 4-5, 2009, to observe courtship and nest building;
- April 2-3, 2009, to observe incubation; and

2

Figure 1. Proposed I-80 wind facility project area, Sandusky and Erie Counties, Ohio.

Miles
1 0 1 2

June 2009

Basemap:
NAIP Aerial Imagery (2006)

BHE ENVIRONMENTAL

- May 4-5, 2009, to observe brooding.

Photographs were taken during nest identification and monitoring efforts, and are presented in Appendix A.

3.0 RESULTS

3.1 RAPTOR NEST SURVEY

A total of twelve raptor nests (all approximately 3 feet diameter stick nests - probable Red-tailed Hawk nests) were identified during the survey: six nests within the project area and six nests outside the project area but within the two-mile perimeter. Of these twelve nests, four were determined likely to be active during the 2009 breeding season. Only one of these four nests is located within the project area, the remaining three are located outside the project area but within the two-mile perimeter. Red-tailed Hawks are a common species, and are not state or federally listed.

In addition to the twelve Red-tailed Hawk nests, two Bald Eagle (*Haliaeetus leucocephalus*) nests were identified. Both of these nests are within the project area and were subject to monitoring, as the species is designated protected by ODNR.

3.2 BALD EAGLE NEST MONITORING

Of the two Bald Eagle nests identified, the nest located adjacent to the Strecker Road/Route 286 intersection was active (Figure 1), with a pair of Bald Eagles on and/or near the nest when the BHE biologist arrived on March 4 and during each subsequent monitoring event. The second nest was determined inactive after some monitoring. Based upon discussions with the landowner and observations made by the BHE biologist, it is likely that both the inactive and active nest were constructed by the same pair of birds.

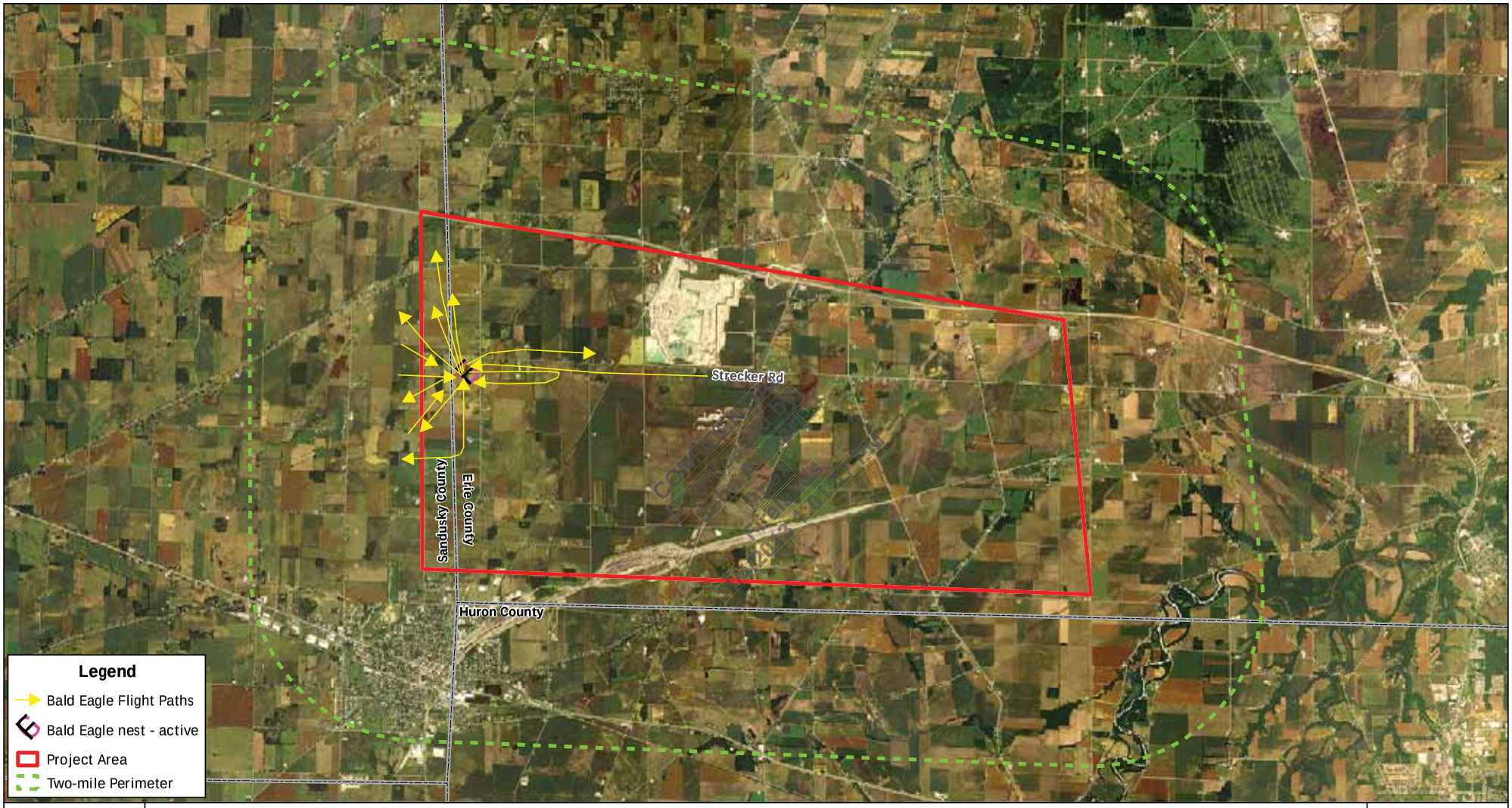
All activity, behavior, flight tracks, and flight directions were recorded during each monitoring event (Appendix B).

4.0 DISCUSSION

While twelve Red-tailed Hawk nests were identified during the search, only one active nest was identified within the project area. The nest is located in a windrow of mature trees in the southwest portion of the project area (Figure 1). A pair of mature Red-tailed Hawks was observed performing courtship display flights and perching together near this nest.

The potential for nesting American Kestrels (*Falco sparverius*) exists within the project area. American Kestrels were observed within the project area and within the two-mile perimeter. However, this species is a cavity nester and it was beyond the scope of this survey to search for potential nests.

Activity patterns of the nesting pair of Bald Eagles were established for the courtship/nest building, incubation, and brood rearing periods, and are detailed in Appendix B. The pair incubated two eggs, and currently is rearing two eaglets. Flights observed during monitoring events occurred to or from the west or north, with the exception of one flight (Figure 2). This was a brief flight made by the male on March 5, and occurred to and from the east along



2

Figure 2. Bald eagle flight paths, I-80 wind facility project area, Sandusky and Erie Counties, Ohio.

Miles
0.5 0 0.5 1

June 2009

Basemap:
NAIP Aerial Imagery (2006)

BHE ENVIRONMENTAL

Route 286. It is likely that most flights, which occurred to or from the west or north, were foraging trips to either the Sandusky River or Lake Erie. Aside from an initial (February) sighting of a Bald Eagle scavenging in the east-central portion of the project area, and the flight just described, Bald Eagles were not seen traveling into (beyond the active nest) the project area.

The eaglets will likely fledge near the end of June or early July. At that time, they will conduct short, initial (or "test") flights. The paths of these flights are unknown. It is likely that once they begin longer flights, the young will follow the flight paths of the adult Bald Eagles (to the west and north to forage along the Sandusky River or Lake Erie). Bald Eagles travel for approximately 3 years before settling into a territory, and can establish far from their rearing location. These young may settle along Lake Erie, or in another area (e.g., state) entirely.

5.0 LITERATURE CITED

Ohio Department of Natural Resources. *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio*.

APPENDIX A

Photographs

Photo 1. Bald Eagle feeding on carrion in east-central portion of project area (February 2009).

Photo 2. Male Bald Eagle perching near nest (April 2009).

Photo 3. Active Bald Eagle nest in the northwestern portion of the project area (March 2009).

Photo 4. Tundra swans in eastern portion of the project area (February 2009).

Photo 5. Herring Gulls and Tundra Swans in the eastern portion of the project area (February 2009).

APPENDIX B

Nest Monitoring Results

Date	Time (hrs)	Observation
March 4, 2009	1208	Adult BAEA perched in tree 50 meters northeast from nest. Additional adult BAEA sitting low in nest. Occasional vocalizations between the pair of birds.
	1245	Adult BAEA (presumed female) on nest flushed by surveyors. Flew west at approximate elevation of 25 meters.
	1250	Female BAEA returned, perched in tree 10 meters from nest. Male BAEA did not leave perch.
	1345	Birds in farthest tree flew to nest. Not sitting low in nest, appears to be rearranging nest materials.
	1425	Both birds flew to the north, circled, then returned. One bird sits on nest, other bird perching in tree 50 meters northwest of nest. Bird in nest standing on rim, not low as if incubating eggs.
	1432	Both birds in nest.
	1438	Male BAEA (smaller bird) flew to southwest, circling upwards.
	1442	Other BAEA (presumed female) flew to southwest, circling, gaining altitude, drifting northward.
	1448	Both birds circling together southwest of nest.
	1452	Both birds drift off to the west-south-west, high over 300 meters in elevation.
	1505	One BAEA returns to perch in tree 10 meters north of nest.
	1520	Other BAEA returns to nest from the northwest. Sits high in nest. Other bird still perched 10 meters from nest.
	1527	Both birds in nest.
	1538	One BAEA flies to perch in tree 50 meters north of nest. Frequent vocalizations.
	1549	BAEA in nest flies to northwest. Other BAEA still n perch.
	1559	BAEA perched in tree exhibits no reaction to a pair of Red-tailed hawks perching 100 meters from nest.
March 5, 2009	755	BAEA standing in nest.
	843	Second BAEA flies in from west and perches in tree 10 meters from nest.
	902	Both BAEA short flight, close together, perch in tree 50 meters from nest, very close together. One of the birds then flies to the nest.
	906	BAEA perched in tree 50 meters from nest flies off to the northwest, low in elevation.
	909	BAEA in nest flies in low circle around pond and returns to nest.
	911	Other BAEA returns from northwest, lands in nest.
	914	One BAEA (male?) flies to perch in tree 50 meters north of nest, then flies back to perch in tree 10 meters from nest.
	917	Perched BAEA joins mate in nest.
	921	BAEA flies off low to the west.
	1113	BAEA in nest flies to the east, across Route 286, approximately 500 meters, then circles back and perches in tree below nest.
	1119	Mate returns from the east and lands in nest.
	1126	BAEA in nest sitting low.
	1128	Bird in nest flies to perch in tree 30 meters southeast of nest.
	1206	BAEA perched 30 meters southeast of nest flies to perch in tree 50 meters north of nest.
	-	After the monitoring effort at the Streeker Rd. nest, BHE Biologist visits the other nest. During an hour and a half time period, no activity observed in or around the nest.
April 2, 2009	1230	Female sitting low in nest.
	1317	Male flew in from northwest. Perched in tree 20 m north of nest.
	1330	Male flew to south, circled slowly over flooded farm field approximately 75 – 100 m in elevation. There was a flock of approximately 50 ducks in the field. Male BAEA made unsuccessful dive on waterfowl, then drifted off to the southwest.
	1435	Male flew in from west. Perched in tree 10 m north of nest.
	1445	Male moved to perch in tree 50 m north of nest.
	1452	Male flew to the northeast, low, approximately 10 - 15 m AGL.
	1552	Pair of Great Blue Herons land in tree 10 m north of nest. No reaction from incubating female.
	1617	Male returns from west, perches in large tree 75 m northwest of nest.
	1627	Male flies off to northwest, low.
April 3, 2009	800	Female incubating, low in nest. Male perched in tree 10 m south of nest.
	822	Male moves to perch 15 m north of nest.
	855	Male moves back to perch 10 m south of nest.
	920	Male flies to nest, female stands and walks around rim of nest. After 2 minutes of close interaction, female flies to perch 150 m north of nest and male takes over incubation.
	945	Female flies to nest.
	948	Female flies off to west, low.
	1017	Female returns to nest, exchanges incubation duties with male, male flies to perch 150 m north of nest.
	1104	Males flies off to west, low.
	1143	Male returns to nest with a fish, approximately 25 cm in length. Male perches on rim of nest, tears off pieces of the fish and feeds female. Leaves remainder of carcass and flies to perch 50 m north of nest. Female continues feeding.
May 4, 2009	1220	Female on nest with 2 chicks.
	1315	Female feeding chicks from prey item in nest.
	1507	Male flies from northwest with fish approximately 12" long.
	1510	Male flies off to the north.
	1515	Female begins feeding chicks. Neither chick appears dominant. Chicks sit side by side and are given pieces of the fish alternately.
	1537	Feeding ceases.
	1718	Male returns from the west. No prey item. Perches in tree 20 meters to the north.

Date	Time (hrs)	Observation
May 5, 2009	730	Female on nest with chicks.
	929	Female standing on rim of nest vocalizing.
	933	Both chicks moving around in nest. Female begins feeding chicks. Chicks do not appear to be extremely hungry and turn down some of the offered food.
	959	Male flies to nest, low, from west. Perches on nest. Female stands between male and chicks, head bowed, low vocalizations.
	1001	Male flies off low to southwest.
	1004	Male circling slowly to the west, less than 200 meters in elevation.
	1008	Male drifting off to the west.
	1125	Male flies to nest from the west. Perches on rim of nest. Female mantling between male and chicks. Male stands erect, female bowed and vocalizing.
	1130	Male flies to perch 75 meters north of nest.
	1132	Male returns to nest. Female feeds chicks and feeds herself. Male watching intently.
	1135	Male begins feeding as female continues feeding chicks.
	1137	Male flies to the northwest.
	1153	Male returns low from the west.
	1155	Male perches on limb 1 meter from nest.
	1200	Male returns to nest, begins feeding.
	1208	Male flies to perch 10 meters north of nest.
	1225	Male flies off to southwest.

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Summary: Application - Part 7 of 17 electronically filed by Christine M.T. Pirik on behalf of Firelands Wind, LLC