

**DRAFT
LAKE TOWNSHIP ZONING ORDINANCE FOR WIND ENERGY SYSTEMS**

AUTHORITY

Michigan state law preserves local authority regarding zoning generally, including zoning of wind energy systems.

FINDINGS OF FACT

1. It is necessary and appropriate to protect and preserve the unique natural resources of Lake Township, specifically the Rush Lake Wildlife Area, which includes portions of Sections 21, 22, 23, 26, 26 and 28, the scenic views and viewsheds, aesthetics and tourism based economy.
2. It is necessary to protect the health, safety and welfare of the residents and property owners of Lake Township. In Section 6.2, Community Wide Goals, of the Master Plan of Lake Township, adopted in 1999, Goal No. 3 is “to preserve and promote the rights of individual property owners while maintaining the aesthetic character of the community” and Goal No. 4 states. “To relate land use primarily to the natural characteristics of the land and the long-term needs of the community, rather than to short-term economic gain.”
3. The U.S. Fish & Wildlife Service (USFWS) of the U.S. Department of Interior recommends that no turbines be located within three miles of a Great Lake’s Shoreline, within five miles of bald eagle nests or between the refuges and known feeding areas for migratory waterbirds and waterfowl. The USFWS also encourages the placement of turbines away from any large wetland, stream corridor or wooded areas and to avoid placing turbines between nearby habitat blocks. The USFWS strongly recommends that turbines be located as far away from any national/state wildlife refuge as possible. According to USWFS, Lake Township, with its six miles of Great Lakes shoreline, two significant river systems and the Rush Lake State Game Area, a state wildlife refuge, centrally located within the Township, has two bald eagle nests and is within the pathway of migratory birds including tundra swans and sandhill cranes, is a potential summer habitat range of the federally endangered Indiana bat and may also intercept potential migration pathways for the species, a potential spring and fall migratory pathway of the Kirtland warbler, a federally endangered bird that nests almost exclusively in northern Michigan, and a habitat for the Eastern massasauga rattlesnake, as well as a feeding area for migratory birds and waterfowl. The USFWS recommends that on the ground surveys using radar infrared and/or acoustic monitoring be conducted during the peak of spring and fall bird migrations and during the breeding season over a period of three years to identify breeding and feeding areas, as set forth in the Interim Guidelines.

PURPOSE

The purpose of this Ordinance is to define standards and procedures governing installation and operation of commercial wind energy systems as a special use in Lake Township. Standards and procedures are necessary to:

- Ensure that the location and scale of commercial wind energy systems within the Township are consistent with the vision and goals of the master plan;
- Protect all areas of the Township and the Township’s natural resources from potential adverse impacts of wind energy systems, including adverse visual and environmental impacts;
- Protect public health, safety and welfare;
- Avoid potential damage to adjacent property from hazards associated with and/or failure of wind energy conversion systems;
- Ensure the compatibility of adjacent land uses;
- Protect property values;

- Protect aesthetics, scenic views and viewsheds, and tourism based economy;
- Protect sensitive receptors and wildlife habitat;
- Define regulatory requirements and procedures for:
 - o Permit application and review
 - o Monitoring and compliance
 - o Revocation and/or decommissioning

DEFINITIONS

For purposes of this section of the Ordinance, the following terms shall be interpreted or defined below:

Aerodynamic Sound: A noise that is caused by the flow of air over and past the blades of a WES.

Ambient Sound: Encompasses all sound present in a given environment, being usually a composite of sounds from many sources near and far. It includes intermittent noise events, such as, from aircraft flying over, dogs barking, wind gusts, mobile farm or construction machinery, and the occasional vehicle traveling along a nearby road. The ambient also includes insect and other nearby sounds from birds and animals or people. The near-by and transient events are part of the ambient sound environment but are not to be considered part of the long term background sound.

American National Standards Institute (ANSI): Standardized acoustical instrumentation and sound measurement protocol shall meet all the requirements of the following ANSI Standards:

- ANSI S1.43 Integrating Averaging Sound Level Meters: Type-1 (or IEC 61672-1)
- ANSI S1.11 Specification for Octave and One-third Octave-Band Filters (or IEC 61260)
- ANSI S1.40 Verification Procedures for Sound Calibrators
- ANSI S12.9 Part 3 Procedures for Measurement of Environmental Sound
- ANSI S12.18 Measurement of Outdoor Sound Pressure Level
- IEC 61400-11 Wind turbine generator systems – Part 11: Acoustic noise measurements

Anemometer: A device for measuring the speed and direction of the wind.

Applicant: The individual or business entity that seeks to secure a license under this section of the Township zoning ordinance.

A-Weighted Sound Level (dBA): A measure of over-all sound pressure level designed to reflect the response of the human ear, which does not respond equally to all frequencies. It is used to describe sound in a manner representative of the human ear's response. It reduces the effects of the lower frequencies on the measured sound levels with respect to the higher and mid-range frequencies centered around 1000 Hz or higher. The resultant sound level is said to be "A-weighted" and the units are "dBA." Sound level meters have an A-weighting network for measuring A-weighted sound levels (dBA) meeting the characteristics and weighting specified in ANSI Specifications for Integrating Averaging Sound Level Meters, S1.43-1997 for Type 1 instruments and be capable of accurate readings (corrections for internal noise and microphone response permitted) at 20 dBA or lower. In this document dBA means LAeq unless specified otherwise.

Background Sound (L90): The sound level present at least 90% of the time. Background sounds are those heard during lulls in the ambient sound environment. That is, when transient sounds from flora, fauna, and wind are not present. Background sound levels vary during different times of the day and night. Because WES operates 24/7, the background sound levels of interest are those during the quieter periods which are often the evening and night. Sounds from the WES of interest, near-by birds, insects and animals or people must be excluded from the background sound test data. Nearby electrical noise from streetlights, transformers and cycling AC units and pumps, etc. must also be excluded from the background sound test data.

Background sound level (dBA and dBC (as L90)) is the sound level present 90% of the time during a period of observation that is representative of the quiet time for the soundscape under evaluation and with duration of ten (10) continuous minutes. Several contiguous ten (10) minute tests may be performed in one hour to determine the statistical stability of the sound environment. Measurement periods such as at dusk when bird and insect activity is high or the early morning hours when the 'dawn chorus' is present are not acceptable measurement times. Longer term sound level averaging tests, such as 24 hours or multiple days are not at all appropriate since the purpose is to define the quiet time background sound level. It is defined by the L90A and L90C descriptors. It may be considered as the quietest one (1) minute during a ten (10) minute test. L90A results are valid only when L10A results are no more than 10 dBA above L90A for the same time period. L10C less L90C should not exceed 15 dBC to be valid.

Background L90 sound levels documenting the pre-construction baseline conditions should be determined when the ten (10) minute maximum wind speed is less than 2 m/s (4.5 mph) near ground level/microphone location 1.5 m height.

Blade Glint: The intermittent reflection of the sun off the surface of the blades of a single or multiple wind energy system.

Blade Passage Frequency (BPF): The frequency at which the blades of a turbine pass a particular point during each revolution (e.g. lowest point or highest point in rotation) in terms of events per second. A three bladed turbine rotating at 28 rpm would have a BPF of 1.4 Hz. [e.g. ((3 blades times 28rpm)/60 seconds per minute = 1.4 Hz BPF)]

Commercial or Industrial Scale Wind Turbine: A Wind Turbine or Wind Energy System that exceeds the height restriction established for a Private Wind Turbine.

C Weighted Sound Level (dBC): Similar in concept to the A-Weighted sound Level (dBA) but C-weighting does not de-emphasize the frequencies below 1k Hz as A-weighting does. It is used for measurements that must include the contribution of low frequencies in a single number representing the entire frequency spectrum. Sound level meters have a C-weighting network for measuring C-weighted sound levels (dBC) meeting the characteristics and weighting specified in ANSI S1.43-1997 Specifications for Integrating Averaging Sound Level Meters for Type 1 instruments. In this document dBC means LCeq unless specified otherwise.

Decibel (dB): A dimensionless unit which denotes the ratio between two quantities that are proportional to power, energy or intensity. One of these quantities is a designated reference by which all other quantities of identical units are divided. The sound pressure level (Lp) in decibels is equal to 10 times the logarithm (to the base 10) of the ratio between the pressure squared divided by the reference pressure squared. The reference pressure used in acoustics is 20 MicroPascals.

Emission: Sound energy that is emitted by a noise source (wind farm) is transmitted to a receiver (dwelling) where it is immitted (see "immission").

Frequency: The number of oscillations or cycles per unit of time. Acoustical frequency is usually expressed in units of Hertz (Hz) where one Hz is equal to one cycle per second.

Height: The total distance measured from the grade of the property as existed prior to the construction of the wind energy system, facility, tower, turbine, or related facility at the base to its highest point.

Hertz (Hz): Frequency of sound expressed by cycles per second.

Immission: Noise immitted at a receiver (dwelling) is transmitted from noise source (wind turbine) that emitted sound energy (see "emission").

Immission spectra imbalance: The spectra are not in balance when the C-weighted sound level is more than 20 dB greater than the A-weighted sound level. For the purposes of this requirement, the A-weighted sound level is defined as the long-term background sound level (LA90) +5 dBA. The C-weighted sound level is defined as the LCeq measured during the operation of the wind turbine operated so as to result in its highest sound output. A Complaint test provided later in this document is based on the immission spectra imbalance criteria.

Infra-Sound: Sound with energy in the frequency range of 0-20 Hz is considered to be infra-sound. It is normally considered to not be audible for most people unless in relatively high amplitude. However, there is a wide range between the most sensitive and least sensitive people to perception of sound and perception is not limited to stimulus of the auditory senses. The most significant exterior noise induced dwelling vibration occurs in the frequency range between 5 Hz and 50 Hz. Moreover, levels below the threshold of audibility can still cause measurable resonances inside dwelling interiors. Conditions that support or magnify resonance may also exist in human body cavities and organs under certain conditions. Although no specific test for infrasound is provided in this document, the test for immission spectra imbalance will limit low frequency sound and thus, indirectly limit infrasound. See low-frequency noise (LFN) for more information.

Low Frequency Noise (LFN): Sounds with energy in the lower frequency range of 20 to 200 Hz. LFN is deemed to be excessive when the difference between a C-weighted sound level and an A-weighted sound level is greater than 20 decibels at any measurement point outside a residence or other occupied structure. The criteria for this condition is the “Immission Spectra Imbalance” entry in the Table of Not To Exceed Property Line Sound Immission Limits.

Measurement Point (MP): The location where sound measurements are taken such that no significant obstruction blocks sound from the site. The Measurement Point should be located so as to not be near large objects such as buildings and in the line-of-sight to the nearest turbines. Proximity to large buildings or other structures should be twice the largest dimension of the structure, if possible. Measurement Points should be at quiet locations remote from street lights, transformers, street traffic, flowing water and other local noise sources.

Measurement Wind Speed: For measurements conducted to establish the background noise levels (LA90 10 min, LC90 10 min, and etc.) the maximum wind speed, sampled within 5m of the microphone and at its height, shall be less than 2 m/s (4.5 mph) for valid background measurements. For valid wind farm noises measurements conducted to establish the post construction sound level, the maximum wind speed, sampled within 5m of the microphone and at its height, shall be less than 4m/s (9 mph). The wind speed at the WES blade height shall be at or above the nominal rated wind speed and operating in its highest sound output mode. For purposes of enforcement, the wind speed and direction at the WES blade height shall be selected to reproduce the conditions leading to the enforcement action while also restricting maximum wind speeds at the microphone to less than 4 m/s (9 mph). For purposes of models used to predict the sound levels and sound pressure levels of the WES to be submitted with the Application, the wind speed shall be the speed that will result in the worst-case LAeq and LCeq sound levels at the nearest non-participating properties to the WES. If there may be more than one set of nearby sensitive receptors, models for each such condition shall be evaluated and the results shall be included in the Application.

Mechanical Noise: Sound produced as a byproduct of the operation of the mechanical components of a WES(s) such as the gearbox, generator and transformers.

Noise: Any unwanted sound. Not all noise needs to be excessively loud to represent an annoyance or interference.

Overlay District: Those identified sections within the Lake Township agricultural district wherein commercial wind energy systems are allowed as a special land use.

Private Wind Energy System: Wind energy system with a height of 75' feet or less that is used to generate electricity or produce mechanical energy for use on the property where located. Total electricity generated is thirty (30) kilowatts or less, and sale of excess electric power is allowed only via net metering. Height restrictions applicable to private wind energy systems are those height restrictions within the Lake Township Zoning Ordinance for the specific zoning district. Setbacks from property lines shall be 1-1/2 times the height. Private wind turbines are exempt from the requirements of this ordinance except that they must comply with sections and pertaining to noise.

Project Boundary: The external property boundaries of parcels owned by or leased by the WES developers. It is represented on a plot plan view by a continuous line encompassing all WES(s) and related equipment associated with the WES project.

Property Line: The recognized and mapped property parcel boundary line.

Qualified Independent Acoustical Consultant: Qualifications for persons conducting baseline and other measurements and reviews related to the application for a WES or for enforcement actions against an operating WES include, at a minimum, demonstration of competence in the specialty of community noise testing. An example is a person with Full Membership in the Institute of Noise Control Engineers (INCE). Certifications such as Professional Engineer (P.E.) do not test for competence in acoustical principles and measurement and are thus not, without further qualification, appropriate for work under this document. The Independent Qualified Acoustical Consultant can have no financial or other connection to a WES developer or related company.

Sensitive Areas: Rush Lake Wildlife and Preserve Area, Lake Huron Shoreline, Pigeon and Pinnebog Rivers, or an identified habitat for threatened or endangered species, or other designated areas, including those with important natural resources, as identified by Lake Township, Huron County, state, or federal authorities such as:

- Floodplains
- Designated environmental areas
- High risk erosion areas
- Designated sand dunes
- Priority habitat areas
- State/federal/county/township owned lands
- Lands subject to a conservation easement with, or owned or managed by, a land conservancy
- Known water well locations from District Health Department
- Scenic resources
- Historic and other cultural resources (i.e. Pine Oaks Barrens)
- Great Lakes shoreline area
- Wooded ridge line south of shoreline area
- Migration pathways and feeding areas for migratory waterfowl and birds

Sensitive Receptor: Places or structures intended for human habitation, whether inhabited or not, public parks, state and federal wildlife areas, the manicured areas of recreational establishments designed for public use, including but not limited to golf courses, camp grounds and other nonagricultural state or federal licensed businesses. These areas are more likely to be sensitive to the exposure of the noise, shadow or flicker, etc. generated by a WES or WESF. These areas include, but are not limited to: schools, daycare centers, elder care facilities, hospitals, places of seated assemblage, non-agricultural businesses and residences.

Shadow Flicker: The effect produced when the blades of an operating wind energy system pass between the sun and an observer, casting a readily observable, moving shadow on the observer and his/her immediate environment.

Sound: A fluctuation of air pressure which is propagated as a wave through air

Sound Power: The total sound energy radiated by a source per unit time. The unit of measurement is the watt. Abbreviated as Lw. This information is determined for the WES manufacturer under laboratory conditions specified by IEC 61400-11 and provided to the local developer for use in computer model construction. There is known measurement error in this test procedure that must be disclosed and accounted for in the computer models. Even with the measurement error correction it cannot be assumed that the reported Lw values represent the highest sound output for all operating conditions. They reflect the operating conditions required to meet the IEC 61400-11 requirements. The lowest frequency is 50 Hz for acoustic power (Lw) requirement (at present) in IEC 61400-11. This Ordinance requires wind turbine certified acoustic power (Lw) levels at rated load for the total frequency range from 6.3 Hz to 10k Hz in one-third octave frequency bands tabulated to the nearest 1 dB. The frequency range of 6.3 Hz to 10k Hz shall be used throughout this Ordinance for all sound level modeling, measuring and reporting.

Sound Pressure: The instantaneous difference between the actual pressure produced by a sound wave and the average or barometric pressure at a given point in space.

Sound Pressure Level (SPL): 20 times the logarithm, to the base 10, of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micronewtons per square meter. In equation form, sound pressure level in units of decibels is expressed as $SPL (dB) = 20 \log p/pr$.

Spectrum: The description of a sound wave's resolution into its components of frequency and amplitude. The WES manufacturer is required to supply a one-third octave band frequency spectrum of the wind turbine sound emission at 90% of rated power. The published sound spectrum is often presented as A-weighted values but C-weighted values are preferred. This information is used to construct a model of the wind farm's sound immission levels at locations of interest in and around the WES. The frequency range of interest for wind turbine noise is approximately 6 Hz to 10k Hz.

Statistical Noise Levels: Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LNA, where LNA is the A-weighted sound level exceeded for N% of a given measurement period. For example, L10 is the noise level exceeded for 10% of the time. Of particular relevance, are: LA10 and LC10 the noise level exceeded for 10% of the ten (10) minute interval. This is commonly referred to as the average maximum noise level. LA90 and LC90 are the A-weighted and C-weighted sound levels exceeded for 90% of the ten (10) minute sample period. The L90 noise level is defined by ANSI as the long-term background sound level (i.e. the sounds one hears in the absence of the noise source under consideration and without short term or near-by sounds from other sources), or simply the "background level." Leq is the A or C-weighted equivalent noise level (the "average" noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

Tonal sound or tonality: Tonal audibility. A sound for which the sound pressure is a simple sinusoidal function of the time, and characterized by its singleness of pitch. Tonal sound can be simple or complex.

Viewshed: The entire area that an individual can see from a given point.

Wind Energy System (WES): A wind energy conversion system that converts wind energy into electricity through the use of a wind turbine generator and includes the turbine, blades, and tower as well as related electrical equipment. This does not include wiring to connect the wind energy system to the grid.

Wind Turbine" or Turbine (WT): A mechanical device which captures the kinetic energy of the wind and converts it into electricity. The primary components of a wind turbine are the blade assembly, electrical generator and tower.

Wetland: Land characterized by the presence of water at a frequency and duration sufficient to support, and that under normal circumstances does support, wetland vegetation or aquatic life, and is commonly referred to as a bog, swamp, or marsh. (from Michigan Natural Resources and Environmental Protection Act 451 of 1994: Section 30301(p) of the Act, 1994 PA 451, MCL 324.30301(p).) Wetlands not protected by the Michigan Natural Resources Environmental Protection Act shall be regulated by Lake Township

and shall include isolated wetlands smaller than 5 acres that are not contiguous to the Great Lakes or an inland lake or pond, or a river or stream.

GENERAL PROVISIONS

Applicability:

Commercial wind energy systems shall not be regulated or permitted as essential services, public utilities, or private utilities. Commercial wind energy systems are allowed as a special land use within Sections 25, 34, 35, 36 and part of Section 26, only, in Lake Township subject to the requirements of this Ordinance. All interconnected wind energy systems, except those that meet the definition of private wind energy systems, shall be considered commercial and subject to special land use permit approval by the Lake Township Planning Commission according to the Purpose and Intent, General Provisions, Performance and Regulatory Standards, and Application Requirements within the ordinance.

Application for Special Land Use Permit:

A commercial wind energy system shall not be located, constructed, erected or operated without first obtaining a Special Land Use Permit subject to all the requirements of this Section and the other applicable provisions of the Lake Township Zoning Ordinance, including the approval standards in Section ____ of the Zoning Ordinance pertaining to Special Land Uses. Lake Township shall have the right to impose conditions upon the approval of any Special Use, including time-related conditions such as phased development, to effectuate the purpose and intent of this Ordinance, to protect the health, safety and welfare of the Township residents, to protect the social and economic well-being of nearby residents and landowners, and to protect against pollution, impairment or destruction of the Township's natural resources.

Procedures for application and site plan review shall comply with requirements set forth for Major Projects in "Procedures for Site Plan Review" of the *Lake Township Zoning Ordinance* except that the Planning Commission may require more than one public hearing. Notice of all hearings shall be published in a newspaper of record and shall be mailed to all Lake Township property owners and residents.

Approval Standards:

The Lake Township Planning Commission shall not approve a Special Land Use Permit unless it finds that:

The applicant/owner has demonstrated compliance with the Purpose and Intent, General Provisions, Performance and Regulatory Standards, and Application Requirements of this Ordinance, as well as "Standards for Granting Site Plan Approval" from the *Lake Township Zoning Ordinance* and other conditions imposed by the Township.

- The wind energy system will not pose a risk to the health, safety and welfare of the Township residents.
- The wind energy system will not pollute, impair or destroy the Township's natural resources.
- The wind energy system will not cause damage or harm to sensitive areas within Lake Township as defined and set forth herein based upon recommendations of the U.S. Fish Wildlife Service.
- The wind energy system will not destroy the aesthetics of the community.
- The wind energy system will not destroy the tourism based economy.

Issuance of Special Land Use Permit for Construction and Operation:

If the Lake Township Planning Commission finds that the applicant/owner has met the approval standards, it may issue a Special Land Use Permit for Construction of a Wind Energy System that shall be valid for five years from the date of issue.

Upon completion of construction, the applicant/owner shall submit to the Lake Township Zoning Administrator proof of compliance with all requirements of the Ordinance. If such submission does not occur within two years, the Special Land Use Permit is no longer valid.

The Lake Township Planning Commission shall determine that all provisions, requirements, standards, and conditions have been complied with fully before issuing a final Special Land Use Permit for Operation of the Wind Energy System that shall be valid for five years from the date of issue.

Six months prior to the expiration of the Special Land Use Permit for Operation of the Wind Energy System, the applicant/owner/operator shall submit to the Lake Township Zoning Administrator proof of continued compliance, including safety and maintenance records, and records on the useful life of similar equipment. The Lake Township Planning Commission may reissue the Special Land Use Permit for Operation of the Wind Energy System for another five-year period if it finds sufficient evidence of continued compliance.

In the event that the Special Land Use Permit for Operation of the Wind Energy System is not reissued, the wind energy system shall be considered in violation of the Ordinance.

Lake Township shall have the right to limit the duration of any Special Land Use Permit for Construction and/or Operation of a Wind Energy System in order to minimize risks or adverse impacts to the public health, safety and welfare, or private or public property and the air, water or natural resources of the Township. The Township reserves the right of review of compliance with the conditions and limitations imposed upon such use, and any failure to comply may result in termination of the permit by action of the Planning Commission.

Enforcement and Penalties:

The enforcement of the Ordinance shall be the responsibility of the Lake Township Zoning Administrator, unless otherwise specified in the ordinance or designated by the Township.

An owner/operator, landowner, firm, association, corporation or representative agent of any wind energy system that is found by Lake Township, or its designee, to be in violation of the special use permit, or to be abandoned, inoperable, or unsafe as defined in this Ordinance, or to have a serious adverse impact as defined in this Ordinance:

Shall provide abatement by shut down, repair, or removal of the wind energy system upon written notification from the Zoning Administrator (or other Township designee).

May be subject to a fine in the event of non-compliance with written notification from the Zoning Administrator (or other Township designee) for abatement or shut down. The penalty shall be not less than \$1,000 per occurrence for the first day and shall be doubled from that of the previous day for each day of continued violation.

May be subject to revocation of the special use permit for excessive and continued violations.

May be required to reimburse Lake Township for cost(s) and expenses of obtaining other relief including a temporary or permanent injunction; such reimbursement may include costs and actual attorney fees.

Certification of Insurance:

Applicant/owner/operator shall indemnify and hold harmless Lake Township, the Township residents, and the landowner, all as additional named insureds, against any and all claims arising out of the existence and operation of the wind energy system.

Applicant/owner/operator shall procure comprehensive general liability, casualty, wrongful acts insurance policies, and any other policies customary to the wind energy system industry. This insurance shall be in

the amount of \$5 million per wind energy system but not to exceed \$100 million in the aggregate if the applicant/owner/operator owns more than one wind energy system in Lake Township. The Planning Commission may adjust these amounts periodically to reflect inflation.

The applicant/owner/operator shall maintain these insurances for the duration of the construction, operation, decommissioning, removal and site restoration of the wind energy system. The insurance carrier shall be instructed to provide Lake Township with certificates of the existence of such insurances, and shall be instructed to notify the Township if such insurances expire for any reason.

Failure of the applicant/owner/operator to maintain these insurances at all times shall result in termination of the permit.

Removal Cost Guarantee:

The cost of removal and site restoration is the full responsibility of the applicant and/or owner/operator. In order to provide the greatest possible financial assurance that there will be sufficient funds to remove the wind energy system and to restore the site, the following steps shall be followed:

- For each wind energy system, the applicant/owner/operator shall determine an amount of money equal to the estimated removal and restoration cost, net of any salvage proceeds estimated to be realized during removal. The Planning Commission may require independent verification of the adequacy of this amount.
- This money shall be deposited in a bank account specified by Lake Township, which may be an interest-bearing account. There shall be no alternative to such an account. A surety bond, letter of credit, or other financial promise shall not be accepted.
- Withdrawals will be made from this account, solely by Lake Township or its designee, only to pay for removal and site restoration of the wind energy system as provided for in this Ordinance or as determined by the owner/operator.
- Any money left in the account for each wind energy system after removal and site restoration shall be returned by Lake Township to the then owner/operator.

Separation and Management of Each Removal Cost Account:

If more than one wind energy system is owned by the same applicant/owner/operator, the removal/restoration guarantee accounts may be joined together by Lake Township into a single account for that applicant/owner/operator. However, accounts for different applicant/owner/operators shall be kept separate. Lake Township may, from time to time, change the financial institution in which such accounts are deposited.

Administration Costs—Initial Application and Ongoing:

For each wind energy system, the applicant/owner/operator shall deposit into an escrow account the amount of \$15,000. Said amount shall be deposited at Independent Bank, a Michigan Banking Corporation, with its office located at 6727 Main Street, Caseville, Michigan. The purpose of this joint escrow account is:

To reimburse Lake Township for its costs incurred to hire consultants and experts as the Township, at its sole discretion, deems desirable to examine, evaluate and verify the data and statements presented by the applicant/owner/operator

For the life of each wind energy system, to cover the administrative and legal costs incurred by Lake Township in monitoring and enforcing the owner/operator's ongoing compliance with the Ordinance.

The account shall be managed as follows:

Funds can be withdrawn from this account only by the signature of a Township designee.

If at any time the balance of this account shall fall below \$5,000, the applicant/owner/operator shall deposit an amount necessary to restore the balance of said account to \$15,000.

If at any time the balance of this fund shall fall below \$5,000 for a continuous period of thirty days, the application shall be considered to have been withdrawn, or the Permit for the wind energy system may be terminated.

After the wind energy system has been removed and site restoration has been completed, as defined in this Ordinance, any balance remaining in this account shall be returned to the applicant/owner/operator.

Insufficiency of Removal and Administrative Cost Accounts:

During the useful life and operation of the wind energy system, Lake Township may from time to time determine, in its sole discretion, whether the amounts deposited for removal, site restoration, and administration costs are adequate for these purposes. (Costs of removal, restoration and administration may change due to technology, environmental considerations, inflation, and many other causes.) If the Township determines that these amounts, including any interest earned to date, are not adequate, the Township shall require the owner/operator to make additional deposits to the accounts to cure such inadequacy. The Township shall consider the wind energy system in violation of the Ordinance if the owner/operator fails to cure the inadequacy within sixty (60) days of notification.

Road Repair Costs:

Any damage to a public road within Lake Township resulting from the construction, maintenance or operation of a wind energy system shall be repaired at the applicant/owner/operator's expense. For each wind energy system:

The applicant/owner/operator, Lake Township and the Huron County Road Commission shall agree upon and document construction routes and public road conditions before construction begins.

The applicant/owner/operator shall provide security in an amount to be agreed upon by the applicant/owner/operator and Lake Township with guidance from applicable experts, including the Huron County Road Commission, to be used by the Township and/or the Huron County Road Commission to pay for the repair of damage to public roads.

Failure of the applicant/owner/operator to provide these funds shall result in termination of the Permit.

PERFORMANCE AND REGULATORY STANDARDS

All commercial wind energy systems and testing structures shall comply with the performance and regulatory standards set forth in this section.

Height Limit:

The maximum permitted height of an anemometer tower or a horizontal axis wind energy system shall be no greater than one hundred seventy-five (175') feet in height to the tip of the blade. *(The reasoning behind this height limit by the Planning Commission is the fact that wind speeds are greater closer to the shoreline. In light of increased wind speeds, tower height does not need to be as great as wind facility sites located farther inland and thus may lessen environmental, wildlife and viewshed impacts).*

Setbacks: The setbacks set forth herein are minimum setbacks for Commercial Wind Turbines. These setbacks may be greater based upon the noise regulatory standards set forth within this ordinance, but in no case may they be any less than set forth herein.

- **Property line and road setback:** The setback of an anemometer tower or a wind energy system from any public or private road shall be no less than two thousand six hundred forty (2,640) feet except that this requirement shall not apply if:
 - The owner/operator owns the adjoining property or
 - The owner/operator has recorded lease agreements or easements with adjoining property owners.
- **Inhabited structure setback and water wells:** The setback of an anemometer tower or a wind energy system from any inhabited structure shall be no less than one mile except that this requirement shall not apply if:
 - The owner/operator owns the adjoining property.
 - The owner/operator has recorded lease agreements or easements with adjoining property owners.

- **Wetland Setbacks:** The setback of an anemometer tower or a wind energy system from the delineated boundary of wetlands shall be one thousand three hundred (1,300) feet or ten (10) times the diameter of the rotor, whichever is greater.
- **Setbacks to Other Sensitive Areas:** The setback of an anemometer tower or a wind energy system from other sensitive areas, except as specified herein, including lands subject to a conservation easement with, or owned or managed by a land conservancy, no less than one thousand three hundred (1,300) feet or ten (10) times the diameter of the rotor, whichever is greater.
- **Rush Lake Wildlife Refuge and Preserve Setback:** The setback of a wind energy system from the boundary of the Rush Lake Wildlife Refuge and Preserve Area shall be a minimum of one and one-half mile.
- **Pigeon & Pinnebog Rivers:** The setback of a wind energy system from the Pigeon and Pinnebog Rivers shall be a minimum of one and one-half mile.
- **Eagles Nest:** The setback of an anemometer tower or Commercial Wind Turbine from a known eagles nest shall be in accordance with the recommendations of the U.S. Fish & Wildlife Service of the U.S. Department of Interior.
- **Great Lakes Shoreline:** The setback of an anemometer tower or Commercial Wind Turbine from the Great Lakes Shoreline shall be in accordance with the recommendations of the U.S. Fish & Wildlife Service of the U.S. Department of Interior.

Spacing:

Adjacent wind energy systems must be spaced at least one-half (1/2) mile apart.

Tower and Turbine Design:

The wind energy system tower shall be a monopole or monotube style construction (as distinguished from a lattice-style tower) with no guy wires, exterior ladders or platforms.

Color and Finish:

Wind energy systems shall have a non-reflective finish and shall be a non-obtrusive, neutral color that is compatible with the natural environment, such as white, gray, or beige. Wind energy systems shall not display logos, advertising or promotional materials.

Lighting:

The Lake Township Planning Commission shall not permit any wind energy system that requires Federal Aviation Administration-mandated lighting. Continuous nighttime lighting onsite shall not be permitted. Lighting shall be used only as needed for maintenance and inspection. Lighting shall be shielded to minimize glare, visibility and impact on wildlife.

Construction Codes, Towers and Interconnection Standards:

Wind energy systems together with all related components, including but not limited to transmission lines and transformers, shall comply with all federal, state and county requirements and standards, including applicable construction and electrical codes, local permit requirements, and applicable utility, Michigan Public Service Commission, and Federal Energy Regulatory Commission interconnection standards. Wind energy systems including towers shall comply with Federal Aviation Administration requirements, the Michigan Airport Zoning Act (Public Act 23 of 1950, MCL 259.431 et seq.), the Michigan Tall Structures Act (Public Act 259 of 1959, MCL 259.481 et seq.), and local jurisdiction airport overlay zone regulations.

Interconnection and Electrical Distribution Facilities:

All electrical transmission lines including those from the wind energy system to the electrical grid connection shall be located and maintained underground, in accordance with best practice guidelines, both on the property where the wind energy system is located and off-site.

Safety:

- All utility grid wind energy systems shall be designed to prevent unauthorized access to electrical and mechanical components and shall have access doors that are kept securely locked at all times when service personnel are not present.
- Signs no more than four (4) square feet in area and without advertising or promotional materials shall be posted at the wind energy system tower and at the wind energy system service drive entrance at the minimum setback distance. Signs shall display:
 - a. Address and telephone numbers that allow a caller to directly contact a responsible individual to deal with emergencies at any time during or after business hours and on weekends and holidays.
 - b. A warning about the dangers of falling ice.
- All spent lubricants and cooling fluids shall be properly and safely removed in a timely manner from the site of the wind energy system.
- The minimum vertical blade tip clearance from grade shall be twenty-five (25) feet for a wind energy system employing a horizontal axis rotor.

Impacts on Wildlife Species and Habitat:

Site Selection: Applicants shall follow as closely as deemed possible the U.S. Fish and Wildlife Service *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines (2003)* for selecting appropriate wind energy system site(s).

Endangered or Threatened Species: Development and operation of a wind energy system shall not have a significant adverse impact on endangered or threatened fish, wildlife, or plant species, as defined by *Michigan Endangered Species Protection, Part 365 of the Natural Resources and Environmental Protection Act (Act 451 of 1994)* and identified in the Michigan Natural Features Inventory, the Federal Endangered Species Act, Bald and Golden Eagle Protection Act, and the Fish and Wildlife Act of 1956, or their critical habitats, or other significant habitats identified in studies and plans of local, regional, and federal governmental bodies. The setback of an anemometer tower or a wind energy system from designated critical habitat for any endangered species shall be five (5) miles.

Migratory Birds: Development and operation of a wind energy system shall not have an adverse impact on migratory bird species. The wind energy system shall not result in the taking of migratory birds in violation of the migratory Bird Treaty Act, 16 USC 703-712.

Eagles: Development and operation of a wind energy system shall not have an adverse impact on eagles. The setback of an anemometer tower or a wind energy system from any known eagle's nest shall take into consideration the recommendation of the U.S. Fish & Wildlife Service.

Imposed Conditions for Monitoring and Operation: The Lake Township Planning Commission may impose special conditions for monitoring and operation during seasonal bird and bat migrations. Conditions for operation may include:

- Shut-down during periods of high seasonal concentrations of migrating birds and bats and/or low visibility weather conditions.
- Limits on rotational speed to less than sixteen (16) rpm during periods of high seasonal concentrations of bats accompanied by low wind and/or low visibility weather conditions.

Monitoring:

Avian and bat impact reporting: The owner/operator shall submit a quarterly report to the Lake Township Zoning Administrator or the Township’s designee that identifies all dead birds and bats found within five hundred (500) feet of the wind turbine generator. Reporting shall continue for at least two years after turbine operations begin, or longer if required by the Lake Township Planning Commission. Monitoring shall follow protocols referenced in this Ordinance under “Application Requirement: Avian, Bat and Wildlife Impact Analysis and Plan,” and results shall be adjusted for predation and observer bias. These reports shall be prepared by a third-party qualified professional approved by the Lake Township Planning Commission.

Notification and mitigation: In the event of extraordinary mortality of threatened or endangered species, or discovery of an unexpected large number of dead birds and bats of any variety on site, the Michigan DNR and the Lake Township Zoning Administrator or the Township’s designee shall be notified within twenty-four (24) hours. The owner/operator shall, within thirty (30) days, submit a report to the Lake Township Zoning Administrator describing the cause of the occurrence and the steps taken to avoid future occurrences.

Noise Regulatory Standards:

1. Establishing Long-Term Background Noise Level

a. Instrumentation: ANSI or IEC Type 1 Precision Integrating Sound Level Meter plus meteorological instruments to measure wind velocity, temperature and humidity near the sound measuring microphone. Measurement procedures must meet ANSI S12.9, Part 3 with required Amendments (See note at bottom of Table of Immission Limits below)

b. Measurement location(s): Nearest property line(s) from proposed wind turbines representative of all non-participating residential property within 2.0 miles.

c. Time of measurements and prevailing weather: The atmosphere must be classified as stable with no vertical heat flow to cause air mixing. Stable conditions occur in the evening and middle of the night with a clear sky and very little wind near the surface. Sound measurements are only valid when the measured wind speed at the microphone is less than 2 m/s (4.5 mph).

d. Long-Term Background sound measurements: All data recording shall be a series of contiguous ten (10) minute measurements. The measurement objective is to determine the quietest ten minute period at each location of interest. Nighttime test periods are preferred unless daytime conditions are quieter. The following data shall be recorded simultaneously for each ten (10) minute measurement period: dBA data includes L_{A90} , L_{A10} , L_{Aeq} and dBC data includes L_{C90} , L_{C10} , and L_{Ceq} . Record the maximum wind speed at the microphone during the ten minutes, a single measurement of temperature and humidity at the microphone for each new location or each hour whichever is offener shall also be recorded. A ten (10) minute measurement contains valid data provided: Both L_{A10} minus L_{A90} and L_{C10} minus L_{C90} are not greater than 10 dB and the maximum wind speed at the microphone was less than 2 m/s during the same ten (10) minute period as the acoustic data.

2. Wind Turbine Sound Immission Limits

No wind turbine or group of turbines shall be located so as to cause wind turbine sound immission at any location on non-participating property containing a residence in excess of the limits in the following table:

Table of Not-To-Exceed Property Line Sound Immission Limits ¹			
Criteria		dBA	dBC
A	Immission above pre-construction background:	$L_{Aeq} = L_{A90} + 5$	$L_{Ceq} = L_{C90} + 5$
B	Maximum immission:	$35 L_{Aeq}$	55 L_{Ceq} for quiet ² rural environment 60 L_{Ceq} for rural-suburban environment
C	Immission spectra	L_{Ceq} (immission) minus (L_{A90} (background) +5 dBA) \leq 20 dB	

	imbalance		
D	Prominent tone penalty:	5 dB	5 dB
Notes			
1	Each Test is independent and exceedances of any test establishes non-compliance. Sound "immission" is the wind turbine noise emission as received at a property		
2	A "Quiet rural environment" is a location 2 miles from a state road or other major transportation artery without high traffic volume during otherwise quiet periods of the day or night.		
3	Prominent tone as defined in IEC 61400-11. This Standard is not to be used for any other purpose.		
¹ Required Procedures are provided in the Section titled "Wind Turbine Siting Acoustical Measurements" in this ordinance..			

3. Wind Farm Noise Compliance Testing

All of the measurements outlined above in 1. Establishing Nighttime Background Noise Level must be repeated to determine compliance with 2. Wind Turbine Sound Immission Limits. The compliance test location is to be the pre-turbine background noise measurement location nearest to the home of the complainant in line with the wind farm and nearer to the wind farm. The time of day for the testing and the wind farm operating conditions plus wind speed and direction must replicate the conditions that generated the complaint. Procedures of ANSI S12.9- Part 3 apply. The effect of instrumentation limits for wind and other factors must be recognized and followed.

Operations

The WES/WT is non-compliant and must be shut down immediately if it exceeds any of the limits in the **Table of Not To Exceed Property Line Sound Immission Limits.**

Shadow Flicker and Blade Glint:

A wind energy system shall be designed and operated so that shadow flicker from moving blades or reflected blade glint will not occur off the site on which the facility is located. Shadow flicker or blade glint expected to fall on a roadway or a portion of an off-site property may be acceptable under the following conditions:

- The flicker or glint will not exceed thirty (30) hours per year; and
- The flicker or glint will fall more than five hundred (500') feet from an existing residence; or
- The affected property owner has signed a written agreement with the owner-operator.
- The traffic volumes are less than one hundred (100) vehicles per day on the roadway.

If shadow flicker or blade glint violate any of these conditions, the problem should be reported to Lake Township who shall be required to contact the owner/operator of the wind energy system. The owner/operator of the wind energy system shall institute abatement of this problem by shutting down the turbine/turbines causing the flicker during the times of the day that generates flicker.

Groundwater Protection:

A wind energy system shall be designed and operated so as not to cause groundwater contamination in violation of applicable law. Nothing contained in the special use permit is intended to authorize or permit any degradation of the quantity or quality of the groundwater in connection with the WES. Furthermore, no wells may be drilled within 1.1 times the height of the wind energy system tower or the safe clearance, whichever is greater. In addition, owner/operator of the WES shall complete a plan for managing surface water runoff to prevent pollution of groundwater through sinkholes and infiltration through the soil and underlying bedrock in the vicinity of each Wind Turbine site.

Blasting:

Applicant/owner/operator of a WES shall not undertake any blasting in connection with the construction of a Wind Energy System unless applicant shall have notified the Lake Township Planning Commission and submitted a blasting plan consistent with applicable laws and regulations. The blasting plan must be reviewed and approved by the Lake Township Planning Commission before any blasting may take place. The plan shall provide, at a minimum, (1) all blasts must comply with the State ground vibration limitations; (b) flyrock traveling in the air or along the ground must remain in the controlled blasting area site owned or controlled by the applicant; (c) all blasting must be performed by or under the direct supervision of a State-licensed blaster; (d) a blasting log for each blast will be maintained by the applicant/owner/operator with copies of said log provided to lake Township; (e) a resident call list must be established for the purpose of notifying neighbors at homes in the vicinity of the WES of eminent blasting activity. This call list must be maintained and utilized on a "request basis only" for all residents in the vicinity of the WES who asked to be notified prior to any blast; and (f) the storage of explosives will be in accordance with applicable Michigan law.

Electromagnetic Interference:

A wind energy system shall be located so that it is not within the line of sight of an existing microwave communications link where operation of the wind energy system is likely to produce electromagnetic interference in the link's operation unless the interference is insignificant.

A wind energy system shall be located, constructed and operated so that the system together with all related components, including but not limited to transmission lines and transformers, does not produce electromagnetic interference which would diminish quality of reception with television, telephone (including cellular and land line), wireless and/or broadband internet, microwave, navigational, or radio signal transmission or reception to the neighboring area. The applicant and/or owner/operator of the WES shall be responsible for the full cost of remediation necessary to correct any problems caused or exacerbated by the operation of the wind energy system and related components. Complaints shall be reported to the Lake Township Zoning Administrator or the Township's designee by the affected party and shall be investigated and resolved within thirty (30) days in a manner that is acceptable to the affected resident.

Ice Throw:

The potential ice throw or ice shedding zone for the proposed wind energy system shall not cross the property lines of the site on which the facility is located and shall not impinge on any public right-of-way or overhead utility line. Violations shall be reported to the Lake Township Zoning Administrator or the Township's designee.

Maintenance and Compliance:

In order to ensure safety and compliance with the Ordinance:

- The owner/operator shall conduct regular monitoring, physical inspections and maintenance of the wind energy system. Copies of monitoring and inspection reports and maintenance logs shall be submitted to the Lake Township Zoning Administrator or the Township's designee at least once a year or more often if requested in writing by the Lake Township Zoning Administrator or the Township's designee.
- Lake Township shall have the right to inspect the premises on which the wind energy system is located and to hire a consultant to assist with any such inspection at the owner/operator's expense.

Abandoned, Inoperable and Unsafe Wind Energy Systems and Adverse Impacts:

Abandoned: Any wind energy system or anemometer tower that is not operated for a continuous period of six (6) months shall be considered abandoned and subject for removal.

Inoperable: Any wind energy system that has not generated power within the preceding six (6) months equal to at least 50 percent of the expected production shall be deemed inoperable and subject for

removal if the owner/operator cannot demonstrate to the Township that modernization or repair will be completed within six (6) months.

Unsafe: Any wind energy system or anemometer tower that is found to present an imminent physical threat of danger to life or a significant threat of damage to property shall be shut down immediately and removed or repaired or otherwise made safe. A Michigan professional engineer shall certify its safety prior to resumption of operation. The owner/operator shall notify the Lake Township Zoning Administrator or the Township's designee within twenty-four (24) hours of an occurrence of tower collapse, turbine failure, fire, thrown blade or hub, collector or feeder line failure, or injury. If a serious adverse impact develops due to the operation of any wind energy system or associated equipment that has a detrimental effect on property or resident(s), the affected property owner(s) or resident(s) has a right to request the Lake Township Planning Commission to order repair or shut down of the wind energy system(s) in question until the situation has been corrected.

Removal and Site Restoration:

Within ninety (90) days of receipt of written notification from the Township, the owner/operator shall remove any wind energy system or anemometer tower

- If the owner/operator determines the system is at the end of its useful life, or
- If the Township determines the system is subject for removal because it is unsafe, abandoned or inoperable, or
- If the Township determines the special use permit is expired or has been revoked.

Failure to remove a wind energy system or anemometer tower within the 90-day period provided in this subsection shall be grounds for the Township to remove the wind turbine generator or anemometer tower at the owner's expense.

All equipment associated with the wind energy system or anemometer tower including all materials above and below ground shall be removed, and the site shall be restored to a condition that reflects the specific character of the site including topography, vegetation, drainage, and any unique environmental features. The restoration shall include: road repair, if any, and all re-grading, soil stabilization, and re-vegetation necessary to return the subject property to a stable condition consistent with conditions existing prior to establishment of the wind energy system. The restoration process shall comply with all state, county, or local erosion control, soil stabilization and/or runoff requirements or ordinances and shall be completed within one year.

Construction Activities:

Construction activities shall be organized and timed to minimize impacts on township residents and wildlife from noise, disruption (including disruption of wildlife habitat), and the presence of vehicles and people. Construction activities shall occur only between the hours of 8:00 A.M. and 6:00 P.M.

Complaint Resolution:

1. Any complaints related to noise, flicker or blade glint, electromagnetic interference, stray voltage or ground currents will be made to Lake Township and the Township will notify the owner/operator of the WES. The owner/operator of the WES shall respond within five (5) business days after being notified of a complaint by any property owner.
2. For noise complaints, the tests shall be performed by a qualified independent acoustical consultant acceptable to the complainant and Lake Township. For all other type of complaints, the Township may designate a person qualified to seek a complaint resolution that is acceptable to the complainant, the Township and the owner/operator. If such a resolution cannot be obtained, the Township may take action as authorized by the enforcement section of the Ordinance.

3. Any testing for complaint resolution shall commence within ten (10) working days of the request. If testing cannot be initiated within ten (10) days, the WES(s) in question shall be shut down until the testing can be started.
4. A copy of the test results shall be sent to the property owner, and Lake Township's Planning or Zoning department within thirty (30) days of test completion.
5. If a Complaint is made, the presumption shall be that it is reasonable. Lake Township shall undertake an investigation of the alleged operational violation by a qualified individual acceptable to Lake Township.
 - a) The reasonable cost and fees incurred by Lake Township in retaining said qualified individual shall be reimbursed by the owner of the WES.
 - b) Funds for this assessment shall be paid or put into an escrow account prior to the study and payment shall be independent of the study findings.
6. After the investigation, if Lake Township reasonably concludes that operational violations are shown to be caused by the WES, the licensee/operator/owner shall use reasonable efforts to mitigate such problems on a case-by-case basis including such measures as not operating during the nighttime or other noise sensitive period if such operation was the cause of the complaints.

Reimbursement of Fees and Costs.

Licensee/operator/owner agrees to reimburse Lake Township's reasonable fees and costs incurred in the preparation, negotiation, administration and enforcement of this Ordinance, including, without limitation, Lake Township's attorneys' fees, engineering and/or consultant fees, township meeting and hearing fees and the costs of public notices. If requested by Lake Township, the funds shall be placed in an escrow account under the management of Lake Township. The preceding fees are payable within thirty (30) days of invoice. Unpaid invoices shall bear interest at the rate of 1% per month until paid. Lake Township may recover all actual costs of collection, including attorneys' fees.

The owner/operator of the wind energy system shall file an annual report to Lake Township of all complaints received concerning any aspect of the wind energy system construction or operation.

Real Property Value Protection Plan

To assure that real property owners near by the Wind Energy System, or nonparticipating owners who are not lessors to the applicant/owner/operator, are protected from negative impacts to their real property values, a Real Property Value Protection Plan will be entered into and agreed to by Applicant/owner/operator based upon the vicinity maps included with the site plan application as follows:

1. Applicant/owner/operator agrees to guarantee the property values of all real estate within the footprint of the WES project area and within one (1) mile of the footprint of WES project area. The real property owner may elect one of the following options:
 - a. Applicant/owner/operator and the property owner shall each select an independent Michigan licensed appraiser, the cost of which shall be paid for by applicant/owner/operator, and the appraisers shall each prepare a written appraisal report setting forth their opinion as to the fair market value for the real property assuming that no wind energy system was proposed or constructed. If one of the appraisals submitted is no more than ten percent (10%) higher than the other, the appraisal values shall be averaged ("Average Appraisal Value"), and the property owner may elect to sell to applicant/owner/operator at the Average Appraisal Value, within thirty-six (36) months of the WES receiving final approval of the special use permit application from Lake Township. If one of the appraisals submitted is more than ten percent (10%) higher than the other, then the two (2) independent appraisers will select a third independent Michigan licensed appraiser who shall prepare and present to applicant/owner/operator and property owner his written appraisal report setting forth his opinion as to the fair market value for the real property assuming that no

WES was proposed or constructed. The parties agree that appraisal of the third independent appraiser shall constitute the Appraised Fair Market Value and the property owner may elect to sell to applicant/owner/operator at the Appraised Fair Market Value, within thirty-six (36) months of the WES receiving final approval of the special use permit application from Lake Township; or

b. Applicant/owner/operator and the property owner shall each select an independent Michigan licensed appraiser, the cost of which shall be paid for by applicant/owner/operator. Each appraiser shall determine the diminution in value to the real property caused by the proximity to the wind turbines by determining the difference between the fair market value of the real property assuming no WES is proposed or constructed and the fair market value at the time of exercising this option ("Diminution Value"). If one of the appraisals submitted is no more than ten percent (10%) higher than the other, the appraisal values shall be averaged ("Average Diminution Value"), and the property owner may elect to receive payment from applicant/owner/operator of the Average Diminution Value. If one of the appraisals submitted is more than ten percent (10%) higher than the other, then the two (2) independent appraisers will select a third independent Michigan licensed appraiser who shall prepare and present to applicant/operator/owner and property owner his written appraisal report setting forth his opinion as to the Diminution Value for the real property. The parties agree that appraisal of the third independent appraiser shall constitute the Diminution Value and the property owner may elect to receive payment from applicant/owner/operator of the Diminution Value. This option must be exercised within ten (10) years of the date of final approval of the special use permit application by Lake Township.

2. Applicant/owner/operator agrees to guarantee the property values of all real estate located between one (1) mile and two (2) miles of the WES footprint boundary.

a. Applicant/owner/operator and the property owner shall each select an independent Michigan licensed appraiser, the cost of which shall be paid for by applicant/owner/operator. Each appraiser shall determine the diminution in value to the real property caused by the proximity to the WES by determining the difference between the fair market value of the real property assuming no WES is proposed or constructed and the fair market value at the time of exercising this option ("Diminution Value"). If one of the appraisals submitted is no more than ten percent (10%) higher than the other, the appraisal values shall be averaged ("Average Diminution Value"), and the property owner may elect to receive payment from applicant/owner/operator of the Average Diminution Value. If one of the appraisals submitted is more than ten percent (10%) higher than the other, then the two (2) independent appraisers will select a third independent Michigan licensed appraiser who shall prepare and present to applicant/owner/operator and property owner his written appraisal report setting forth his opinion as to the Diminution Value for the real property. The parties agree that appraisal of the third independent appraiser shall constitute the Diminution Value and the property owner may elect to receive payment from applicant/owner/operator of the Diminution Value. This option must be exercised within ten (10) years of the date of final approval of the special use permit application by Lake Township.

APPLICATION REQUIREMENTS

An application for a special use permit for a wind energy system or an anemometer tower shall meet requirements of "Procedures for Site Plan Review" and "Requirements for Site Plan" in the *Lake Township Zoning Ordinance* and shall also include all of the following information, unless expressly indicated otherwise:

Registered in Michigan:

The applicant shall provide evidence of being registered to do business in Michigan.

Wind Resources:

The applicant shall submit information showing adequate wind resources and summarizing site wind characteristics, including minimum, maximum and average wind speeds, directions, seasonal variations

and dominant wind direction in the direction from which 50 percent or more of the energy contained in the wind flows.

Wind Energy System Information:

The applicant shall supply the following information pertaining to the wind energy system: type, manufacturer and model, total installed height, rotor material, rated power output, performance history, safety history, electrical system, and rotor over-speed control system(s). The Township may require, at its discretion, complete wind energy system specifications and drawings and professional certification of these data.

Manufacturers' Material Safety Data Sheet(s):

Documentation shall include the type and quantity of all materials used in the operation of all equipment including, but not limited to, all lubricants and coolants.

List of Experts and Evidence of Qualifications:

The applicant shall supply the name, address and resumé or other written summary of the education, experience, and other qualifications of each expert providing information concerning the wind energy system or anemometer tower project.

Certification of Compliance:

The applicant shall provide certification that the applicant has complied or will comply with all applicable county, state and federal laws and regulations including but not limited to:

- Copies of all such permits and approvals that have been obtained or applied for at time of the application.
- Written documentation that the applicant has notified the Federal Aviation Administration and any other applicable state and federal regulatory agencies of the proposed wind energy system or anemometer tower.

Copies of Leases, Agreements and Recorded Easements:

The applicant shall provide written permission from the property owner(s) or from multiple property owner(s) if that is necessary to meet setback requirements. Before a special use permit shall be granted by the Planning Commission, the applicant shall submit copies of leases and all recorded agreements and easements, such as non-development agreements within a specified setback and/or easements for rights-of-way, from all affected landowners and governmental units. Easements shall be recorded prior to a special land use permit being issued.

Site Plan:

The applicant shall submit vicinity maps and site plans showing the physical features and land uses of the project area. The vicinity maps and site plan drawings shall meet requirements listed in the *Lake Township Ordinance* in Chapter 16, Special Use Permits. The vicinity maps and site plans shall also include maps, plans, section and elevation drawings and written specifications in sufficient detail to clearly describe the following: *(The following are either not included or included to a lesser standard in Section 1602 through 1604.)*

With vicinity map(s)

- Existing zoning districts, land uses, including all dwellings, public and private airstrips within two (2) miles of the boundary of the property upon which the commercial wind energy facility is to be located.

- Planned land uses (based on the current *Lake Township Master Plan*) within two (2) miles of the boundary of the property upon which the commercial wind turbine generator facility is to be located.

With vicinity map(s), site plan(s) and written specifications as required

- Location of all proposed new infrastructure above and below ground related to the project including meteorological and wind testing towers
- Location of existing and proposed electrical lines and facilities.
- Proposed setbacks
- Location of all active or abandoned wells within the proposed project boundary and a one (1) mile radius beyond the project boundary.
- Identification and location of sensitive areas and sensitive environmental resources that are in the vicinity of the proposed wind turbine, including but not limited to endangered or threatened fish, wildlife, or plant species or their critical habitats, and other significant habitats identified by government and other authoritative sources. The vicinity map and site plan shall include all sensitive areas within the project boundary and a five (5) mile radius beyond the project boundary.
- Ingress and egress information including:
- Location, grades, dimensions and surfacing materials of all temporary and permanent onsite and access roads.
- Distances from the nearest county or state maintained road.
- Evidence of compliance with standards required for year-round emergency access.

With site plan, plan, section and elevation drawings, and with written specifications and reports as required

- Project area boundaries and physical dimensions of the proposed project area.
- Soils on site delineated and described in a soil survey map accompanied by a report of the soil conditions based on soil borings prepared by a firm that specializes in soil borings and is approved to perform such work for the Michigan Department of Transportation. The report shall include soil and geologic characteristics of the site based upon on-site sampling and testing. The soil boring reports and the proposed plans for the foundation shall be certified by a registered Professional Engineer licensed in the State of Michigan, who is practicing in his or her area of competency. Location, height, and dimensions of all existing and proposed structures and fencing.
- Drawings and specifications, bearing the seal of a professional engineer licensed in Michigan, of all proposed new infrastructure above and below ground related to the project including meteorological and wind testing towers.
- Lighting on site described with a lighting plan and specifications that show location, color, type, intensity, direction, shielding and control of all on-site lighting.

Electrical Interconnection Plan:

The applicant shall provide a plan for electrical interconnection showing methods and standards for interconnection and copies of contracts or letters of intent with the electric utility and the electric transmission service provider.

Visual Simulations and Drawings and Viewshed Analysis:

The applicant shall provide elevation drawings, detailed computer and/or photographic simulations and other models and visual aids showing the wind energy system with all related facilities as they will appear on the proposed site from vantage points north, south, east, and west of the project. The applicant also shall provide a viewshed analysis plan of the project showing locations from which the wind energy system will be visible.

Hazard Plan:

An application for a wind turbine shall be accompanied by a hazard prevention plan. At a minimum such a plan shall include the following:

- Certification by an engineer licensed in the State of Michigan that the electrical wiring between turbines and the utility right-of-way does not pose a fire or stray voltage hazard.
- A landscape plan designed to avoid spread of fire from any source on the turbine.
- A listing of any hazardous fluids that may be used on site and manufacturers' material safety data sheet(s) as specified herein.
- Certification by an engineer licensed in the State of Michigan that the turbine has been designed to contain any hazardous fluids and a statement certifying that the turbine shall be routinely inspected to ensure that no fluids are released or leaked from the turbine or any other equipment or on the site.
- A Hazardous Materials Waste Plan complying with all federal, state, and county laws and regulations. Further, approvals or waivers, by the state Department of Environmental Quality, the state Department of Natural Resources and/or the Corp of Army Engineers shall also be submitted prior to the issuance of any permit.

Environmental Impact Analysis and Plan:

The applicant shall submit a report demonstrating compliance with development, design and operation recommendations contained in the current version of U.S. Fish and Wildlife Service *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbine*. The applicant shall have a third party, qualified professional, approved by the Lake Township Planning Commission, conduct a site characterization and evaluation study and an analysis following accepted scientific procedures to identify and assess any potential impacts on the natural environment including, but not limited to, wetlands and other fragile ecosystems, historical and cultural sites, and antiquities. The site characterization report shall include:

- A description of the environmental characteristics of the site prior to development, i.e., topography, soils, vegetative cover, drainage, streams, creeks or ponds.
- Natural features that will be retained, removed and/or modified including vegetation, drainage, hillsides, streams, wetlands, woodlands, wildlife and water. A description of the areas to be changed shall include their effect on the site and adjacent properties. An aerial photo may be used to delineate the areas of change.

The applicant shall provide a plan and take appropriate measures to minimize, eliminate or mitigate adverse impacts identified in the analysis and to demonstrate compliance with applicable parts of the *Michigan Natural Resources and Environmental Protection Act* (Act 451 of 1994, MCL 324.101 et seq.). The applicant shall identify and evaluate the significance of any net effects or concerns that will remain after mitigation efforts.

Avian, Bat and Wildlife Impact Analysis and Plan:

The applicant shall have a third-party, qualified professional, approved by the Lake Township Planning Commission, conduct a site wildlife characterization and evaluation study and an analysis to identify and assess any potential impacts on wildlife, especially birds, bats and endangered species, following accepted scientific procedures. Avian studies shall follow protocols described in the National Wind Coordinating Committee, *Studying Wind/Energy Interactions: A Guidance Document, 1999* and the U.S. Fish and Wildlife Service *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines*, Federal Register: July 10, 2003 (Volume 68, Number 132). The applicant shall submit this study and shall provide a plan and take appropriate measures to minimize, eliminate or mitigate adverse impacts identified in the analysis and to demonstrate compliance with *Michigan Endangered Species Protection, Part 365 of the Natural Resources and Environmental Protection Act* (Act 451 of 1994). The applicant shall identify and evaluate the significance of any net effects or concerns that will remain after mitigation efforts.

Erosion Control, Site Restoration and Road Maintenance Plan:

Before the issuance of a Special Land Use Permit for Construction of a Wind Energy System the applicant shall submit a copy of a Huron County Soil Erosion Permit and an erosion control plan, including a grading plan, a plan for site restoration after construction and a road maintenance plan. The plan shall:

- Show the integration of the overall construction design and activities to fit the physical features of the site.
- Describe the staging of construction and stabilization activities to minimize the area and duration of disturbance.
- Identify control measures that will minimize erosion, including a description of measures to control soil erosion and sedimentation during grading and construction operations and until a permanent ground cover is established.
- Identify controls that will prevent off-site sedimentation.
- Identify methods to control drainage on the site and from the site.
- Establish an inspection and maintenance schedule.

Noise Report: Information to be submitted with Application

1. Sound Power Levels (Lw) for each 1/3 octave band from 6.3 Hz to 10,000 Hz;
2. A sound propagation model predicting the sound levels emitted into the community computed using at minimum 1/1 octave bands;
3. Sound power levels to compute the LCeq and LAeq levels to generate LAeq and LCeq contours in 5 dB increments overlaying an aerial view and property survey map from the WES property out to a distance to include all residential property within two (2) miles of the WES Property.
4. Appropriate corrections for model algorithm error, IEC61400-11 test measurement accuracy, and directivity patterns for each model of WT shall be disclosed and accounted for in the model(s).
5. Predictions shall be made at all property lines within and outward for two (2) miles from the project boundary for the wind speed, direction and operating mode that would result in the worst case WT nighttime sound emissions.
6. The prediction model shall assume that the winds at hub height are sufficient for the highest sound emission operating mode.
7. The projection shall include a description of all assumptions made in the model's construction and algorithms. If the model does not consider the effects of wind direction, geography of the terrain, and/or the effects of reinforcement from coherent sounds or tones from the turbines, all these items should be identified and all other means used to adjust the model's output to account for these factors. The results shall be displayed as a contour map of the predicted levels as over-all LAeq and LCeq contours out to 2 miles from the WES property, and shall also include a table showing the 1/3 or 1/1 octave band sound pressure as LCeq levels for the nearest property line(s) for sensitive receptor sites (including residences) within the model's boundaries. The predicted values must include the over-all sound levels and 1/1 or 1/3 octave band sound pressure levels from 6 Hz to 10k Hz in data tables that include the location of each receiving point by GPS location or other repeatable means.

Preconstruction Background Noise Survey

1. Lake Township reserves the right to require the preparation of a preconstruction noise survey for each proposed Wind Turbine location conducted per procedures provided in the section on Measurement Procedures showing long-term background LA90 and LC90 sound levels. This must be completed and accepted prior to approval of the final layout and issuance of project permits.
 - a. If any proposed wind farm project locates a WES within two miles of a sensitive receptor, these studies are mandatory. The preconstruction baseline studies shall be conducted by an Independent Qualified Acoustical Consultant selected and hired by Lake Township.
 - b. The applicant shall be responsible for paying the consultant's fees and costs associated with conducting the study. These fees and costs shall be negotiated with the consultant and determined prior to any work being done on the study. The

applicant shall be required to set aside 100% of these fees in an escrow account managed by Lake Township before the study is commenced by the consultant. Payment for this study does not require the WES developer's acceptance of the study's results.

- c. If the review shows that the predicted LAeq and LCEq sound levels exceed any of the criteria specified in the Table of Not To Exceed Property Line Sound Immission Limits then the application cannot be approved.
2. Lake Township will refer the application to an independent qualified acoustical consultant for further review and comparison of the long term background sound levels against the predicted LAeq and LCEq sound levels reported for the model using the criteria in the Table of Not To Exceed Property Line Sound Immission Limits. The reasonably necessary costs associated with such a review shall be the responsibility of the applicant, in accordance with the terms of this ordinance.

Post Construction Noise Measurement Requirements

1. Sound Regulations Compliance: A WES shall be considered in violation of the conditional use permit unless the applicant demonstrates that the project complies with all sound level limits using the procedures specified in this ordinance. Sound levels in excess of the limits established in this ordinance shall be grounds for Lake Township to order immediate shut down of all noncompliant WT units.
2. Post-Construction Sound Measurements: Within twelve months of the date when the project is fully operational, and within four weeks of the anniversary date of the pre-construction background noise measurements, repeat the existing sound environment measurements taken before the project approval. Post-construction sound level measurements shall be taken both with all WES's running and with all WES's off. At the discretion of Lake Township, the Preconstruction background sound levels (LA90 and LC90) can be substituted for the "all WES off" tests if a random sampling of 10% of the pre-construction study sites shows that background L90A and L90C conditions have increased less than 3 dB from those measured under the pre-construction nighttime conditions. The post-construction measurements will be reported to Lake Township (available for public review) using the same format as used for the preconstruction sound studies. Post-construction noise studies shall be conducted by a firm chosen and hired by Lake Township. Costs of these studies are to be reimbursed by the Licensee in a similar manner to that described above. The wind farm developer may ask to have its own consultant observe the publicly retained consultant at the convenience of the latter. The WES Licensee shall provide all technical information and wind farm data required by the qualified independent acoustical consultant before, during, and/or after any acoustical studies required by this document and for acoustical measurements.

Shadow Flicker and Blade Glint:

The applicant shall submit:

- A shadow flicker and blade glint analysis and computer simulation or model including topography and structures. The analysis and model shall identify the locations of shadow flicker and blade glint caused by the wind energy system and the expected durations of the shadow flicker and blade glint at these locations from sunrise to sunset over the course of a year. The analysis and model shall identify problem areas where shadow flicker or blade glint may affect parcels of land, roadways, and existing or future structures. The analysis and model also shall describe measures that shall be taken to eliminate or mitigate the problems, including, but not limited to, a change in siting of the facility, a change in the operation of the facility, or grading or landscaping mitigation measures.
- Copies of agreements signed with adjacent property owners affected by shadow flicker and/or blade glint.

Ice Throw and Blade Throw:

The applicant shall submit:

- A report on the incidence of blade throw and ice throw for similar equipment,
- An analysis and calculations of blade and ice throw potential, and
- A plan showing locations likely to be affected by blade throw and by ice throw under a variety of conditions.

Decommissioning Removal and Restoration Plan:

The applicant shall submit a decommissioning removal and restoration plan describing the intended disposition of the wind energy system and all equipment associated with the system upon termination of the lease, revocation of the permit, or at the end of the system's useful life. The plan shall include:

- The anticipated life of the project,
- Any agreement with the landowner regarding equipment,
- The estimated decommissioning costs net of salvage value in current dollars, and
- The anticipated manner in which the project will be decommissioned and the site restored.

APPENDIX

NOISE MEASUREMENT PROTOCOLS

Measurement Protocol for Sound and Vibration Assessment of Proposed and Existing Wind Energy System:

I. Introduction

The potential impact of sound and sound induced building vibration associated with the operation of wind powered electric generators is often a primary concern for citizens living near proposed wind energy systems (WES(s)). This is especially true of projects located near homes, residential neighborhoods, businesses, schools, and hospitals in quiet residential and rural communities. Determining the likely sound and vibration impacts is a highly technical undertaking and requires a serious effort in order to collect reliable and meaningful data for both the public and decision makers.

This protocol is based in part on criteria published in American National Standards S12.9 – Part 3 Quantities and Procedures for Description and Measurement of Environmental Sound, and S12.18 and for the measurement of sound pressure level outdoors.

The purpose is to first establish a consistent and scientifically sound procedure for evaluating existing background levels of audible and low frequency sound in a WES project area, and second to use the information provided by the applicant in its application showing the predicted over-all sound levels in terms of LAeq and LCEq and 1/3 or 1/1 octave bands as part of the required information submitted with the application.

The over-all values shall be presented as overlays to the applicant's iso-level plot plan graphics and, for 1/1 or 1/3 octave data, in tabular form with location information sufficient to permit comparison of the baseline results to the predicted levels. This comparison will use the level limits of the ordinance to determine the likely impact operation of a new wind energy system project will have on the existing community soundscape. If the comparison demonstrates that the WES project will not exceed any of the level limits, the project will be considered to be within allowable limits for safety and health. If the applicant submits only partial information required for this comparison, the application cannot be

approved. In all cases the burden to establish the operation as meeting safety and health limits will be on the applicant.

Next, it covers requirements for the sound propagation model to be supplied with the application.

Finally, if the project is approved, this section covers the study needed to compare the post-build sound levels to the predictions and the baseline study. The level limits in the ordinance apply to the post-build study. In addition, if there have been any complaints about WES sound or low frequency noise emissions or wind turbine noise induced dwelling vibration by any resident of an occupied dwelling, that property will be included in the post-build study for evaluation against the rules for sound level limits and compliance.

The characteristics of the proposed WES project and the features of the surrounding environment will influence the design of the sound and vibration study. Site layout, types of WES(s) selected and the existence of other significant local audible and low frequency sound sources and sensitive receptors should be taken into consideration when designing a sound study. The work will be performed by a qualified independent acoustical consultant for both the pre-construction background and post-construction sound studies as described in the body of the ordinance.

II. Instrumentation

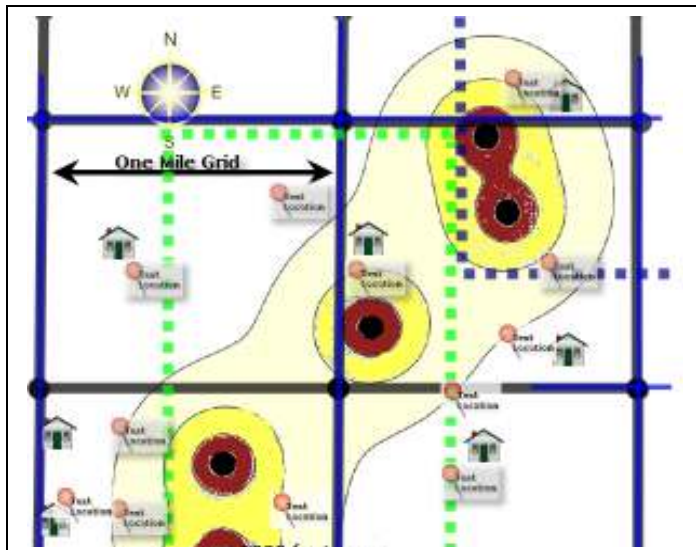
All instruments and other tools used to measure audible, inaudible and low frequency sound shall meet the requirements for ANSI or IEC Type 1 Integrating Averaging Sound Level Meter Standards. The principle standard reference for this document is ANSI 12.9/Part 3 with important additional specific requirements for the measuring instrumentation and measurement protocol.

III. Measurement of Pre-Construction Sound Environment (Base-line)

An assessment of the proposed WES project areas existing sound environment is necessary in order to predict the likely impact resulting from a proposed project. The following guidelines must be used in developing a reasonable estimate of an area's existing background sound environment. All testing is to be performed by an independent qualified acoustical consultant approved by the Lake Township Planning Commission as provided in the body of the ordinance. The WES applicant may file objections detailing any concerns it may have with the Lake Township Planning Commission's selection. These concerns will be addressed in the study. Objections must be filed prior to the start of the noise study. All measurements are to be conducted with ANSI or IEC Type 1 certified and calibrated test equipment per reference specification at the end of this section. Test results will be reported to the Lake Township Planning Commission or its appointed representative.

Sites with No Existing Wind Energy Systems (Baseline Sound Study)

Sound level measurements shall be taken as follows:



The results of the model showing the predicted worst case LAeq and LCEq sound emissions of the proposed WES project will be overlaid on a map (or separate LAeq and LCEq maps) of the project area. An example (left) shows an approximately two (2) mile square section with iso-level contour lines prepared by the applicant, sensitive receptors (homes) and locations selected for the baseline sound tests whichever are the controlling metric. The test points shall be located at the property line bounding the property of the turbine's host closest to the wind turbine. Additional sites may be added if appropriate. A grid comprised of one (1) mile boundaries (each grid cell is one (1) square mile) should be used to assist in identifying between two (2) to ten (10) measurement points per cell. The grid shall extend to a minimum of two (2) miles beyond the perimeter of the project boundary. This may be extended to more than two (2) miles at the discretion of the Lake Township Planning Commission. The measurement points shall be selected to represent the noise sensitive receptor sites based on the anticipated sound propagation from the combined WT in the project. Usually, this will be the closest WT. If there is more than one WT near-by, then more than one test site may be required.

The intent is to anticipate the locations along the bounding property line that will receive the highest sound immissions. The site that will most likely be negatively affected by the WES project's sound emissions should be given first priority in testing. These sites may include sites adjacent to occupied dwellings or other noise sensitive receptor sites. Sites shall be selected to represent the locations where the background soundscapes reflect the quietest locations of the sensitive receptor sites. Background sound levels (and 1/3 octave band sound pressure levels if required) shall be obtained according to the definitions and procedures provided in the ordinance and recognized acoustical testing practice and standards.

All properties within the proposed WES project boundaries will be considered for this study. One test shall be conducted during the period defined by the months of April through November with the preferred time being the months of June through August. These months are normally associated with more contact with the outdoors and when homes may have open windows during the evening and night. Unless directed otherwise by the Lake Township Planning Commission, the season chosen for testing will represent the background soundscape for other seasons. At the discretion of the Lake Township Planning Commission, tests may be scheduled for other seasons.

All measurement points (MPs) shall be located with assistance from the Lake Township Planning Commission and property owner(s) and positioned such that no significant obstruction (building, trees, etc.) blocks sound and vibration from the nearest proposed WES site.

Duration of measurements shall be a minimum of ten (10) continuous minutes for all criteria at each location. The duration must include at least six (6) minutes that are not affected by transient sounds from near-by and non-nature sources. Multiple ten (10) minute samples over longer periods such as 30 minutes or one (1) hour may be used to improve the reliability of the LA90 and LC90 values. The ten (10) minute sample with the lowest valid L90 values will be used to define the background sound.

The tests at each site selected for this study shall be taken during the expected 'quietest period of the day or night' as appropriate for the site. For the purpose of determining background sound characteristics the preferred testing time is from 10pm until 4 am. If circumstances indicated that a different time of the day should be sampled the test may be conducted at the alternate time if approved by the Township.

Sound level measurements shall be made on a weekday of a non-holiday week. Weekend measurements may also be taken at selected sites where there are weekend activities that may be affected by WT sound.

Measurements must be taken with the microphone at 1.2 to 1.5 meters above the ground and at least 15 feet from any reflective surface following ANSI 12.9 Part 3 protocol including selected options and other requirements outlined later in this Section.

Reporting

1. For each Measurement Point and for each qualified measurement period, provide each of the following measurements:
 - a. LAeq, LA10, and LA90, and
 - b. LCeq, LC10, and LC90
2. A narrative description of any intermittent sounds registered during each measurement. This may be augmented with video and audio recordings.
3. A narrative description of the steady sounds that form the background soundscape. This may be augmented with video and audio recordings.
4. Wind speed and direction at the microphone (Measurement Point), humidity and temperature at time of measurement will be included in the documentation. Corresponding information from the nearest 10 meter weather reporting station shall also be obtained. Measurements taken only when wind speeds are less than 2m/s (4.5 mph) at the microphone location will be considered valid for this study. A windscreen of the type recommended by the monitoring instrument's manufacturer must be used for all data collection.
5. Provide a map and/or diagram clearly showing (Using plot plan provided by LGA or Applicant):
 - a. The layout of the project area, including topography, the project boundary lines, and property lines.
 - b. The locations of the Measurement Points.
 - c. The distance between any Measurement Points and the nearest WT(s).
 - d. The location of significant local non-WES sound and vibration sources.
 - e. The distance between all MPs and significant local sound sources. And,
 - f. The location of all sensitive receptors including but not limited to: schools, day-care centers, hospitals, residences, residential neighborhoods, places of worship, and elderly care facilities.

Sites with Existing Wind Energy Systems

Two complete sets of sound level measurements must be taken as defined below:

1. One set of measurements with the wind generator(s) off unless the LGA elects to substitute the sound data collected for the background sound study. Wind speeds must be suitable for background sound tests as specified elsewhere in this ordinance.
2. One set of measurements with the wind generator(s) running with wind speed at hub height sufficient to meet nominal rated power output or higher and less than 2 m/s below at the microphone location. Conditions should reflect the worst case sound emissions from the WES project. This will normally involve tests taken during the evening or night when winds are calm (less than 2m/sec) at the ground surface yet, at hub height, sufficient to power the turbines.

Sound level measurements and meteorological conditions at the microphone shall be taken and documented as discussed above.

Sound level Estimate for Proposed Wind Energy Systems (when adding more WT to existing project)

In order to estimate the sound impact of the proposed WES project on the existing environment, an estimate of the sound produced by the proposed WES(s) under worst-case conditions for producing sound emissions must be provided. This study may be conducted by a firm chosen by the WES operator with oversight provided by the Lake Township Planning Commission.

The qualifications of the firm should be presented along with details of the procedure that will be used, software applications, and any limitations to the software or prediction methods as required elsewhere in this ordinance for models.

Provide the manufacturer's sound power level (L_{Aw}) and (L_{Cw}) characteristics for the proposed WES(s) operating at full load utilizing the methodology in IEC 61400-11 Wind Turbine Noise Standard. Provide one-third octave band sound power level information from 6.3 Hz to 10k Hz. Furnish the data using no frequency weighting. A-weighted data is optional. Provide sound pressure levels predicted for the WES(s)

in combination and at full operation and at maximum sound power output for all areas where the predictions indicate LAeq levels of 30 dBA and above. The same area shall be used for reporting the predicted LCEq levels. Contour lines shall be in increments of 5 dB.

Present tables with the predicted sound levels for the proposed WES(s) as LAeq and LCEq and at all octave band centers (8 Hz to 10k Hz) for distances of 500, 1000, 1500, 2000, 2500 and 5000 feet from the center of the area with the highest density of WES(s). For projects with multiple WES(s), the combined sound level impact for all WES(s) operating at full load must be estimated.

The above tables must include the impact (increased dBA and dBC (Leq) above baseline L90 background sound levels) of the WES operations on all residential and other noise sensitive receiving locations within the project boundary. To the extent possible, the tables should include the sites tested (or likely to be tested) in the background study.

Provide a contour map of the expected sound level from the new WES(s), using 5dB LAeq and LCEq increments created by the proposed WES(s) extending out to a distance of two (2) miles from the project boundary, or other distance necessary, to show the 25 LAeq and 50 LCEq boundaries.

Provide a description of the impact of the proposed sound from the WES project on the existing environment. The results should anticipate the receptor sites that will be most negatively impacted by the WES project and to the extent possible provide data for each MP that are likely to be selected in the background sound study (note the sensitive receptor MPs):

1. Report expected changes to existing sound levels for LAeq and LA90
2. Report expected changes to existing sound levels for LCEq and LC90
3. Report the expected changes to existing sound pressure levels for each of the 1/1 or 1/3 octave bands in tabular form from 8 Hz to 10k Hz.
4. Report all assumptions made in arriving at the estimate of impact, any limitations that might cause the sound levels to exceed the values of the estimate, and any conclusions reached regarding the potential effects on people living near the project area. If the effects of coherence, worst case weather, or operating conditions are not reflected in the model, a discussion of how these factors could increase the predicted values is required.
5. Include an estimate of the number of hours of operation expected from the proposed WES(s) and under what conditions the WES(s) would be expected to run. Any differences from the information filed with the application should be addressed.

IV. Post-Construction Measurements

Post Construction Measurements should be conducted by a qualified noise consultant selected by and under the direction of the Lake Township Planning Commission. The requirements of this Appendix for Sites with Existing Wind Energy Systems shall apply:

1. Within twelve months of the date when the project is fully operational, preferably within two weeks of the anniversary date of the pre-construction background sound measurements, repeat the measurements. Post-construction sound level measurements shall be taken both with all WES(s) running and with all WES(s) off except as provided in this ordinance.
2. Report post-construction measurements to the Lake Township Planning Commission using the same format as used for the background sound study.

V. REFERENCE Standards and ANSI S12.9 Part 3 with Required Amendments

ANSI/ASA S12.9-1993/Part 3 (R2008) - American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound, Part 3: Short-Term Measurements with an Observer Present.

This standard is the second in a series of parts concerning description and measurement of outdoor environmental sound. The standard describes recommended procedures for measurement of short-term, time-average environmental sound outdoors at one or more locations in a community for environmental assessment or planning for compatible land uses and for other purposes such as demonstrating compliance with a regulation. These measurements are distinguished by the requirement to have an observer present. Sound may be produced by one or more separate, distributed sources of sound such as a highway, factory, or airport. Methods are given to correct the measured levels for the influence of background sound.

Wind Turbine Siting Acoustical Measurements

ANSI S12.9 Part 3 Selected Options and Requirement Amendments

For the purposes of this ordinance, specific options provided in ANSI S12.9 - Part 3 (2008) shall apply with the additional following requirements to Sections in ANSI S12.9/Part 3:

- 5.1 background sound: Use definition (1) 'long-term'
- 5.2 long-term background sound: The L90 excludes short term background sounds
- 5.3 basic measurement period: Ten (10) minutes L90(10 min)
- 5.6 Sound Measuring Instrument: Type 1 Integrating Meter meeting ANSI S1.43 or IEC 61672-1. The sound level meter shall cover the frequency range from 6.3 Hz to 20k Hz and simultaneously measure dBA LN and dBC LN. The instrument must also be capable of accurately measuring low-level background sounds down to 20 dBA.
- 6.5 Windscreen: Required
- 6.6(a) An anemometer accurate to $\pm 10\%$ at 2m/s. to full scale accuracy. The anemometer shall be located 1.5 to 2m above the ground and orientated to record maximum wind velocity. The maximum wind velocity, wind direction, temperature and humidity shall be recorded for each ten (10) minute sound measurement period observed within 5 m. of the measuring microphone.
- 7.1 Long-term background sound
- 7.2 Data collection Methods: Second method with observed samples to avoid contamination by short-term sounds (purpose: to avoid loss of statistical data)
- 8 Source(s) Data Collection: All requirements in ANSI S12.18 Method #2 precision to the extent possible while still permitting testing of the conditions that lead to complaints. The meteorological requirements in ANSI S12.18 may not be applicable for some complaints. For sound measurements in response to a complaint, the compliance sound measurements should be made under conditions that replicate the conditions that caused the complaint without exceeding instrument and windscreen limits and tolerances.
- 8.1(b) Measuring microphone with windscreen shall be located 1.2m to 1.8m (1.5m preferred) above the ground and greater than 8m from large sound reflecting surface.
- 8.3(a) All meteorological observations required at both (not either) microphone and nearest 10m weather reporting station.
- 8.3(b) For a 10 minute background sound measurement to be valid the wind velocity shall be less than 2m/s (4.5 mph) measured less than 5m from the microphone. Compliance sound measurements shall be taken when winds shall be less than 4m/s at the microphone.
- 8.3(c) In addition to the required acoustic calibration checks, the sound measuring instrument internal noise floor, including microphone, must also be checked at the end of each series often minute measurements and no less frequently than once per day. Insert the microphone into the acoustic calibrator with the calibrator signal off. Record the observed dBA and dBC reading on the sound level meter to determine an approximation of the instrument self noise. Perform this test before leaving the background measurement location. This calibrator covered microphone test must demonstrate the results of this test are at least 5 dB below the immediately previous ten-minute acoustic test results, for the acoustic background data to be valid. This test is necessary to detect undesired increase in the

microphone and sound level meter internal self-noise. As a precaution, sound measuring instrumentation should be removed from any air-conditioned space at least an hour before use. Nighttime measurements are often performed very near the meteorological dew point. Minor moisture condensation inside a microphone or sound level meter can increase the instrument self noise and void the measured background data.

8.4 The remaining sections starting at 8.4 in ANSI S12.9 Part 3 Standard do not apply.

ANSI S12.18-1994 (R2004) American National Standard Procedures for Outdoor Measurement of Sound Pressure Level

This American National Standard describes procedures for the measurement of sound pressure levels in the outdoor environment, considering the effects of the ground, the effects of refraction due to wind and temperature gradients, and the effects due to turbulence. This standard is focused on measurement of sound pressure levels produced by specific sources outdoors. The measured sound pressure levels can be used to calculate sound pressure levels at other distances from the source or to extrapolate to other environmental conditions or to assess compliance with regulation.

This standard describes two methods to measure sound pressure levels outdoors. METHOD No. 1: general method; outlines conditions for routine measurements. METHOD No. 2: precision method; describes strict conditions for more accurate measurements. This standard assumes the measurement of A-weighted sound pressure level or time-averaged sound pressure level or octave, 1/3-octave or narrow-band sound pressure level, but does not preclude determination of other sound descriptors.

ANSI S1.43-1997(R2007) American National Standard Specifications for Integrating Averaging Sound Level Meters

This standard describes instruments for the measurement of frequency-weighted and time-average sound pressure levels. Optionally, sound exposure levels may be measured. This standard is consistent with the relevant requirements of ANSI S1.4-1983(R 1997) American National Standard Specification for Sound Level Meters, but specifies additional characteristics that are necessary to measure the time-average sound pressure level of steady, intermittent, fluctuating, and impulsive sounds.

ANSI S1.11-2004 American National Standard 'Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters'

This standard provides performance requirements for analog, sampled-data, and digital implementations of band-pass filters that comprise a filter set or spectrum analyzer for acoustical measurements. It supersedes ANSI S1.11-1986 (R1998) American National Standard Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters, and is a counterpart to International Standard IEC 61260:1995 Electroacoustics - Octave-Band and Fractional-Octave-Band Filters. Significant changes from ANSI S1.11-1986 have been adopted in order to conform to most of the specifications of IEC 61260:1995. This standard differs from IEC 61260:1995 in three ways: (1) the test methods of IEC 61260 clauses 5 is moved to an informative annex, (2) the term 'band number,' not present in IEC 61260, is used as in ANSI S1.11-1986, (3) references to American National Standards are incorporated, and (4) minor editorial and style differences are incorporated.

ANSI S1.40-2006 American National Standard Specifications and Verification Procedures for Sound Calibrators

IEC 61400-11

Second edition 2002-12, Amendment 1 2006-05

IEC 61400-11

Second edition 2002-12, Amendment 1 2006-0

Wind turbine generator systems – Part 11: Acoustic noise measurement techniques

The purpose of this part of IEC 61400 is to provide a uniform methodology that will ensure consistency and accuracy in the measurement and analysis of acoustical emissions by wind turbine generator systems. Its purpose is to standardize testing of wind turbine sound emissions so that the purchasers can compare noise emissions. It also provides the data needed to construct noise models. It is not intended as a community noise standard and should not be used or referenced as such.

End of Measurement Procedure