DEFINITIONS

WIND ENERGY SYSTEM (WES): "Wind Energy System" shall mean all, or any combination of the following:

1. A wind mill, turbine or machine operated by wind acting on oblique vanes or sails that radiate from a shaft;
2. A surface area, either variable or fixed, for utilizing the wind for electrical or mechanical power;
3. A shaft, gearing, belt, or coupling utilized to convey the rotation of the surface areas into a form suitable for driving a generator, alternator, or other mechanical or electricity producing device;
4. The generator, alternator, or other device to convert the mechanical energy of the surface area into electrical energy;
5. The tower, pylon, or other structure upon which any, all, or some combination of the above are mounted, and
6. A wind monitoring station or a system designed to convert kinetic energy from the wind to electrical energy.

WIND ENERGY SYSTEM, LARGE (LWES): A wind energy system as defined herein, consisting of a wind turbine, a tower, associated control or conversion electronics and/or anemometer tower(s) with the sole purpose of producing commercial energy.

WIND MONITORING STATION: An instrument for measuring and indicating the speed of wind. Also known as an anemometer.

HEIGHT, WIND ENERGY SYSTEMS: For purposes of this ordinance, the height of any Wind Energy System shall be measured from the median grade at the foundation to the top of the tower and shall include the height of the blade at its highest point.

SETBACK: The horizontal distance from the WES including overhang from any

- adjoining property line
- any adjoining public or private road right of way
- inhabited structure
- ordinary high watermark of lakes
- delineated boundary of wetlands

PARTICIPATING PROPERTY: A parcel or parcels of record that is used, occupied, maintained, let, leased or authorized to be used for a LWES.

AMBIENT: The sound pressure level exceeded 90% of the time or L90.

ANSI: American National Standards Institute.

BLADE GLINT: The reflection of the sun off a wind turbine blade.

SHADOW FLICKER: The phenomenon where the blades of a rotating wind turbine cast a moving shadow on an observation point.

dB(A): The sound pressure level in decibels. Refers to the "a" weighted scale defined by ANSI. A method for weighting the frequency spectrum to mimic the human ear.

dB(c): The sound pressure level in decibels. Refers to the "c" weighted scale defined by ANSI. A method for weighting the frequency spectrum to account for amount of very low frequency sound.

SECTION 4.22 LARGE WIND ENERGY SYSTEMS (LWES)

A. Purpose and Intent. The purpose of this article is to establish general guidelines for the location and operation of wind generation commonly known as wind turbines or windmills. The township recognizes that it is in the public interest to permit the location and operation of LWES within the township so long as the scenic beauty of Solon Township is protected from unnecessary and unreasonable interference. As such this ordinance seeks to:

- Protect public health, safety, and welfare, including property values
- Ensure that the location and scale of LWES within the township are consistent with the vision and goals of the master plan
- Avoid potential damage to adjacent property from hazards associated with/ and or failure of LWES
- Ensure the compatibility of adjacent land uses

B. Regulations. A LWES shall require a special land use permit, shall be subject to a public hearing, and shall be approved only in the A/C Districts. The Planning Commission shall take into consideration the documentation required in section C. Permit Requirements in determining whether or not to issue a special land use permit.

C. Permit Requirements: A special land use permit request filed under Section ____ for a Large Wind Energy System shall include a Basic Site Plan as required under Article ____ for accessory structures and additional supporting information with the following information:

1. **Studies**
    a. Sound Modeling Study. A predictive sound study of turbine noise shall accompany an application for a wind energy system to verify that ordinance requirements can be met for dBA and dBC sound levels. The applicant shall present the maximum sound power level of proposed turbine on both the dBA and dBC scales, and will calculate the difference in decibels and compare it to the 20 decibel threshold in IEC 61400-11, Annex A, as an indicator of whether the turbine is likely to produce low-frequency noise that could create annoyance. The sound modeling must follow the most recent version of International Standard, ISO 9613-2 "Acoustics – Attenuation of sound during propagation outdoors – Part 2: General Method of Calculation." The sound modeling study shall use wind turbine sound power levels determined according to the most recent version of IEC 61400 – Part 11. The sound study shall include a map with sound contour lines for both dBA and dBC sound emitted from the proposed wind energy system. The study shall include a map showing sound contours at 5 dBA intervals, proposed wind turbine locations, participating and non-participating properties, and all occupied buildings. The predicted values must include sound levels created by all turbines from the applicant's project. The sound study shall extend out to a 3000' radius.

    b. An avian study based on the US Fish and Wildlife Service's 'Interim Guidelines To Avoid and Minimize Wildlife Impacts From Wind Turbines,'

and an inventory of endangered and/or threatened species impacted by the proposed LWES in the vicinity of the proposed site conducted by a qualified biologist. The study shall indicate whether a post construction wildlife mortality study will be conducted and, if not, the reasons why such a study does not need to be conducted.

c. A copy of shadow flicker and blade glint analysis on adjacent properties to identify the locations of shadow flicker and blade glint that may be caused by the project and the expected durations of the flicker and glint at these locations from sun-rise to sun-set over the course of a year.
d. A wind study assessment performed by a qualified registered engineer documenting the wind resource at the site of the proposed LWES at 40 foot increments starting at 160 feet in height to a maximum of 360 feet.

2. **Site Plans**
   a. Standard construction drawings including but not limited to Structural, Electrical, and Mechanical components of the Large Wind Energy Systems, including structures, tower, base, and footings. A registered engineer shall certify drawings and any necessary calculations so that the system complies with all applicable local, state, and federal building, structural and electrical codes.
   b. The right-of-way of any public road that is contiguous with the property;
   c. Wind energy system specifications, including manufacturer and model, rotor diameter, tower height, tower type, and color;
   d. Location and elevation of all components of the proposed Large Wind Energy System.
   e. Height of any structures or trees over thirty-five (35) feet within a five hundred (500) foot radius on-site or off-site of the proposed Large Wind Energy Systems
   f. Surrounding land use and locations and dimensions of structures, within 3000 feet of LWES.
   g. Location of any overhead utility lines on the parcel

3. **Additional Information**
   a. Insurance policy for liability to cover any accidental damage or injury, during construction, operation, or decommissioning of the LWES system.
   b. Written documentation that the applicant has notified the operators of any microwave or communication link towers or similar facilities of a proposed LWES when the proposed location of the LWES is within the line of sight between two or more microwave or communication link towers or similar facilities.
   c. A comprehensive fire control and prevention, and emergency response plan to coordinate with local emergency response providers.
   d. A description, or travel plan, of the routes to be used by construction and delivery vehicles and of any road improvements, to include construction of temporary roads, that will be necessary to accommodate construction vehicles, equipment or other deliveries. The travel plan must include the load capacity

of the affected roads, an assessment of the roadway prior to and after the construction efforts have been completed, and an intersection display or diagram indicating where and what type of improvements are necessary for transportation, delivery or maintenance purposes for any LWES related items. Any road repairs necessary post construction to impacted roadways will be the responsibility of the owner of the LWES and such necessary construction must be performed in compliance with all applicable requirements of the Leelanau County Road Commission.

e. Certification from a registered engineer or qualified person that the rotor and over speed control have been designed for the proposed use on the proposed site per (IEC-61-400-2),
f. For Large Wind Energy Systems of 100 kW or greater, evidence that there is a substantial need for the proposed use,
g. Registered engineer's certification of the design and safety of the proposed tower to withstand winds of ninety (90) miles per hour, per (IEC-61-400-2),
h. Registered engineer's certification that if the wind turbine were to fall, no existing inhabited building or structure would be damaged.
i. Written documentation that the applicant has notified the owners and occupants of properties within a 3000' radius of proposed LWES as well as properties adjacent to those properties within 7 days of permit application.
j. Any other information necessary to demonstrate compliance with the standards and requirements of this Ordinance.

D. Height: The tower height for a LWES shall be set by the Planning Commission based on the minimum height necessary to efficiently access the available wind resource per the wind study assessment, not to exceed 360 feet. The Planning Commission shall also take into consideration the visual impact of the LWES from residential properties and Lake Leelanau per public hearing comments.

E. Location and Setbacks: The LWES shall be set back:

1. 3000' from non-participating residential structures – waivers can be signed by non-participating properties to shorten setbacks.
2. 1500' from all other non-participating occupied structures and from the ordinary high water mark of Lake Leelanau.
3. 3X height of turbine to all occupied structures on participating parcels and property lines of non-participating parcels.
4. 2X height of turbine to designated wetlands, and right-of-ways.

F. Noise: No LWES may exceed forty five (45) dB(A) at any adjacent property line. Further, the dB(A) shall not exceed 40 dB(A) at non-participating parcel residential buildings, that are not subject to a setback waiver, from 10 pm to 8 am. During short-term events including but not limited to severe wind, snow or rain storms if the ambient sound pressure level exceeds forty (40) dB(A), the standard shall be ambient dB(A) plus five (5) dB(A) for both of these requirements.

G. Vibrations: The LWES shall not produce vibrations beyond the property lines of the site in question of such intensity, duration, frequency or character which annoy, disturb, or cause or tend to cause adverse psychological or physiological effects on any reasonable person of normal

sensitiveness. Furthermore, dBC shall not exceed 60 dBC at any adjacent property line, or at any residential building including interior of building within 3000' of LWES.

G. Regulatory Compliance LWES must comply with all State, Federal, and local laws and regulations, including but not limited to the applicable requirements of the Federal Aviation Administration ("FAA"), the Michigan Airport Zoning Act and the Michigan Tall Structures Act both prior to and after installation.

H. Abandonment. A Large Wind Energy System that has not been producing electricity for at least twelve (12) months not to exceed eighteen (18) months shall be deemed to have been abandoned and the Zoning Administrator shall order the decommissioning of the LWES. The owner/operator of such LWES shall begin decommissioning the same within ninety (90) days of receipt of notice from the Solon Township Zoning Administrator notifying the owner of such abandonment. Failure to decommission an abandoned LWES within said ninety (90) day shall be grounds to decommission the LWES at the owner's expense making use of the escrow account.

I. Decommissioning: 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 by removing all supporting infrastructure and the site being returned to grade, the following steps shall be followed:

1. For each wind energy system, the owner/operator shall determine an amount of money equal to the estimated removal and restoration cost. The Planning Commission shall require independent verification of the adequacy of this amount at owner/operator's expense.
2. This money shall be deposited in an escrow account specified by Solon 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.
3. Solon Township reserves the right to review the amount in escrow over the life of the LWES and require an increase in escrow
4. Withdrawals will be made from this account, solely by Solon Township or its designee, only to pay for removal and site restoration of the wind energy system as provided for in this Ordinance.
5. Any money left in the account for each wind energy system after removal and site restoration shall be returned by Solon Township to the then owner/operator.

K. Lighting: The LWES shall not be artificially lighted unless required by the FAA. Where the FAA requires lighting, the lighting shall be the lowest intensity allowable under FAA regulations, the fixtures shall be shielded and directed to the greatest extent possible to minimize glare and visibility from the ground, and no strobe lighting shall be permitted, unless expressly required by the FAA. Unless the FAA requires otherwise, the lighting shall be a non-pulsating/non-blinking red light.

L. Anemometer Removal: Any anemometer tower shall be removed within one year of installation. The Township may require a financial guarantee to insure removal.

M. Shadow Flicker and Blade Glint: A wind energy system shall be designed to minimize shadow flicker from moving blades or reflected blade glint occurring off the Participating Property on which the facility is located. Should shadow flicker or blade glint be expected to fall on a portion of an off-site property, the system may be operated within the following conditions:

The shadow flicker or blade glint will not fall on any off-site existing or planned residential buildings nor exceed thirty (30) hours per year on an off-site property. If shadow flicker or blade glint violate any of these conditions, violations shall be handled by the township zoning administrator or township designee.

N. Ice Throw: The ice throw or ice shedding from the wind energy system shall not cross the property lines of the Participating Property on which the facility is located and shall not impinge on any public right-of-way or overhead utility line. Violations shall be handled by the township zoning administrator or township designee.

O. Electrical: All electrical components will be consistent and conform with the National Electric Code (NEC) along with any other local, state, and federal regulations. The on-site electrical transmission lines connecting the LWES to a public utility electricity distribution system shall be located underground.

P. Ground Clearance: For both horizontal and vertical axis LWES turbines, the rotor shall be located on the tower such that the minimum blade clearance above the ground level is 30 feet.

Q. Speed Limiters: All LWES turbines shall be equipped with controls to limit the rotational speed of the blades within design limits for the specific LWES.

R. Color and Finish: LWES 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, subject to any applicable FAA Standards.

S. Tower Design: The LWES tower shall be a monopole style construction (as distinguished from a lattice-style tower) with no guy wires or platform and no more than one (1) exterior ladder. LWES must be un-climbable by design or include non-climbing measures.

T. Spacing: Towers shall be separated by a minimum of 3000 feet.

U. Conditions: The Planning Commission may attach reasonable conditions to the approval of a LWES or anemometer tower. These conditions may include those necessary to insure that public services and facilities affected by the LWES or anemometer tower will be capable of accommodating increased service and facility loads caused by the LWES or anemometer tower, to protect the natural environment and conserve natural resources and energy, to insure compatibility with adjacent uses of land, and to promote the use of land in a socially and economically desirable manner. Any conditions imposed, however, shall meet all of the following requirements:

- Be designed to protect natural resources, the health, safety, and welfare and the social and economic well being of those who will use the LWES or anemometer tower under consideration, residents and landowners immediately adjacent to the proposed LWES or anemometer tower, and the community as a whole.
- Be related to the valid exercise of the police power, and purposes which are affected by the proposed LWES or anemometer tower
- Be necessary to meet the intent and purpose of the zoning ordinance, be related to the standards established in the ordinance for the LWES or anemometer tower under consideration, and be necessary to insure compliance with those standards.

V. Safety Measures:

1. The Planning Commission shall determine the height, color, and type of fencing for the Large Wind Energy Systems installation if required or deemed necessary per the existing ordinance.
2. Appropriate warning signs shall be posted. The Planning Commission shall determine the type and placement of the signs per the existing ordinance.

W. Radio and Television Interference: Wind Energy Systems shall be designed and constructed so as not to cause radio and television interference. If degradation of television, radio, or microwave reception occurs, the owner/operator shall pay to correct the reception.

X. Use of Current Technology: Large Wind Energy Systems shall be designed to the current state of the technology as of the date of application. Outdated or obsolete Wind Energy Systems equipment shall not be permitted to be constructed or installed, however used equipment shall be allowable if brought up to date to current technology standards.

Y. Maintenance and Compliance:

a. In order to ensure safety and compliance with the Ordinance: The owner or operator shall conduct regular monthly monitoring, physical inspections and maintenance of the wind energy system. Copies of monitoring and inspection reports and maintenance logs shall be submitted to the Solon Township Zoning Administrator or the Township's designee at least once a year or more often if requested in writing by the Solon Township Zoning Administrator or the Township's designee. Solon 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's or operator's expense.
b. The fire control and prevention and emergency response plan shall be posted on-site and with local emergency response providers, and shall be updated as needed or as requested by the Solon Township Zoning Administrator or the township's designee.
c. Post Construction Sound Survey. Documentation of sound pressure level measurements shall be provided to the Zoning Administrator by a third-party qualified professional selected by the Planning Commission and at the expense of the LWES owner within 12 months of the commencement of the operation of the project. The study should generally follow the procedures in the most recent versions of ANSI S12.9 Part 3 (with or without an observer present) and ANSI S12.18. All sound pressure levels shall be measured with instruments that meet ANSI or IEC Type 1 Precision integrating sound level meter performance specifications. In addition to measuring A-weighted sound levels, at least three monitoring locations shall collect one-third octave band data down to 6.3 Hertz. The post construction test shall verify that equivalent sound level limits in dBA and dBC are in compliance with the standards of this ordinance. The compliance test procedure will use an alternating series of turbine-on and turbine-off 10-minute Leq measurements when wind speeds are fairly constant. Measured levels (turbine-on and turbine-off) for similar hub height wind speeds will be compared to determine the sound level from only the wind turbines. The firm conducting the study shall collect LA90 and LA10 data. The study shall address noise complaints on file with the township. The firm conducting the

post-construction sound survey shall consult with the Planning Commission, or their representative, prior to conducting the study to agree on the compliance testing locations. The study shall delineate participating and non-participating properties, and all occupied buildings. Should the study indicate a non-compliant measurement, the owner of the LWES will be required to obtain compliance through mitigation or other measures.

NOTES:

1. **Article II: Definitions has different definitions for wind energy systems.**
2. Article II: Definitions has definition of "temporary anemometer tower" that is **inconsistent with requirement in this article.**
3. **We have not altered the draft ordinance numbering system, but it is recommended that the Large Wind Energy Ordinance be made Article 35 of the Ordinance.**