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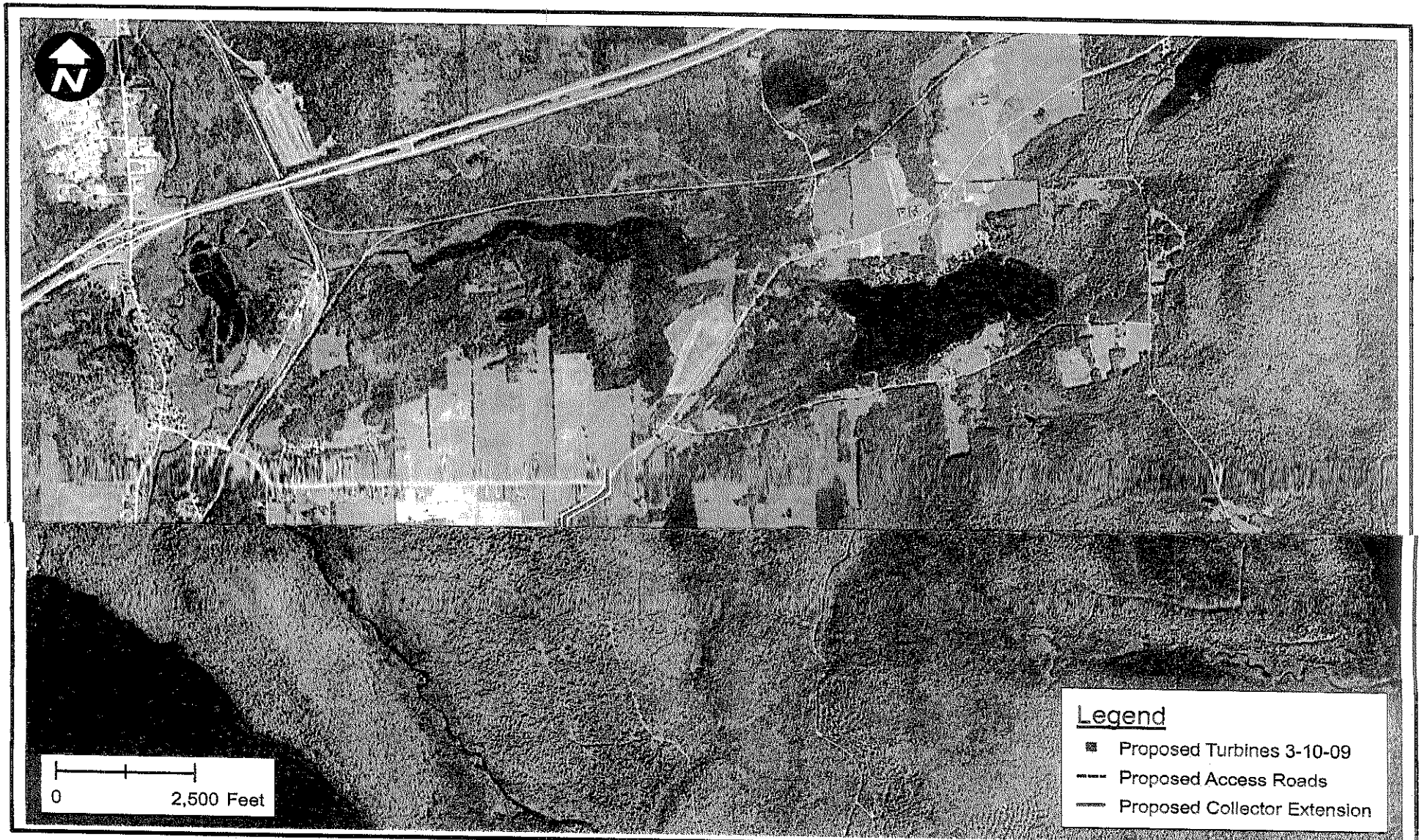

Prepared By:

Stantec

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Project:

Oakfield Wind Project
Oakfield, Maine

Sheet Title:

Project Area Map

Date:	March 26, 2009
Scale:	1"=2500'
Proj. No.:	195600152
Figure:	1

Principal Submissions to Department on Sound Impacts at Oakfield Wind Project

Submission	Submission Date	Submitted By
RSE Sound Level Assessment	April 7, 2009	Evergreen
"Citizen Initiated Review of Oakfield Wind Project Application"	July 16, 2009	Brian Raynes
Final Report – Town of Oakfield Wind Energy Review Committee	September 4, 2009	Town of Oakfield
Objections of Powers Trust (including 16 technical exhibits on potential sound/health impacts)	September 28, 2009	Powers Trust
E-Coustic Solutions Comments on RSE Sound Level Assessment	October 16, 2009	Powers Trust
Evergreen Response to Powers Trust Objection	November 2, 2009	Evergreen
RSE Response to Powers Trust Objection (including Stetson monitoring results)	November 3, 2009	Evergreen
Dr. Dora Mills Response to Powers Trust Submissions	November 30, 2009	MCDC
RSE Response to EnRad Comments on Line Source and Point Source Modeling	December 8, 2009	Evergreen
EnRad Peer Review of RSE Sound Level Assessment	December 18, 2009	EnRad
EnRad Response to Powers Trust Objection	December 31, 2009	EnRad
Town of Oakfield Comments on Draft Order	January 8, 2010	Town of Oakfield
Powers Trust Objections to Draft Order (including 8 technical exhibits on potential sound/health impacts)	January 11, 2010	Powers Trust
Dr. Dora Mills Comments on 2009 World Health Organization Night Noise Guidelines	January 19, 2010	MCDC
Evergreen Response to Powers Trust Objections to Draft Order	January 20, 2010	Evergreen

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Oakfield Wind Project Amendment Sound Level Assessment -- Peer Review

OAKFIELD, MAINE

Warren L. Brown

December 18, 2009

Submitted by:

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Submitted to:

Mark Margerum
Maine Department of Environmental Protection
Augusta ME 04433

Oakfield Wind Project Sound Level Assessment
Peer Review

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Review Basis

Evergreen Wind Power II, LLC proposes a wind energy facility to operate 34 utility-scale wind turbines in the Oakfield area of Aroostook County, Maine. At the request of the Maine Department of Environmental Protection (MDEP) a peer review is undertaken to determine if the noise study is reasonable and technically correct according to standard engineering practices and the Department Regulations on Control of Noise (06-096 CMR 375.10). This review includes amendment changes submitted September 15, 2009.

It is noted that this reviewer concurrently reviewed model predictions, and compliance measurements for Stetson Wind Project, a State of Maine Land Use Regulation Commission zoned development.

1.0 Introduction

The stated objective of the sound assessment was to demonstrate that the Oakfield wind project will meet applicable sound level limits. Sound levels from the construction activity, and operation of the substation and other electrical transmission facilities are briefly discussed.

The routine operation sound level estimates are compared to the Maine DEP sound level limits to demonstrate that Oakfield wind project will meet applicable sound level limits.

2.0 Sound and Decibels

Informational

3.0 Site Description

The wind turbine portion of the project consists of 34 General Electric 1.5 MW turbines located a top Oakfield North and South in Oakfield (Aroostook County). Both clusters include 17 turbine sites and one alternative. Operation of the substation and transmission lines are not expected to generate significant sound levels, which are not included in sound level estimates for the wind project facility.

The turbines will generally run southwest-northeast along various ridges with base elevations of the turbines ranging from approximately 910-1430 feet above mean sea level. The spacing between turbines within the two turbine clusters will range from a minimum of approximately 660-1700 feet. The distance between the two clusters is approximately 1.6 miles. In addition to the turbine structures, the project will include construction of an operations and maintenance facility to the northwest of Oakfield South and a substation to the west of Oakfield North.

Residential properties are located around the perimeter of Oakfield North,

northwest of Oakfield South, along South Road which bisects Oakfield South, and along Nelson Road (including an approved subdivision 1987) between the two clusters otherwise this project site is largely undeveloped forestry land.

Evergreen Wind Power II (Evergreen II) has purchased property or obtained leases with local landowners to install and operate wind turbines at the proposed locations. Evergreen II has also obtained agreements with landowners who may experience sound levels from the project that have the potential to exceed applicable sound level limits (MDEP Chap 375.10)

Parcels for which Evergreen II has a lease, easement or other arrangement are indicated in the assessment.

4.0 Noise Control Standards

The town of Oakfield enacted a land-use ordinance specifically addressing commercial wind turbine permitting (September 28, 2009). This reviewer has considered the aforementioned land-use ordinance in arriving at recommendations, based on Maine DEP Chap 375.10 regulations.

5.0 Existing Sound Levels

Evergreen II proposes to not confirm predevelopment ambient sound levels, but rather, in recognition of the rural nature of the site accept the most conservative regulation levels of 55 dBA daytime and 45 dBA nighttime. Mention is made of elevated wind effects on ambient noise during wind speeds required for turbine operation.

6.0 Sound Level Limits

Sound level limits were determined at protected locations and property lines based on land owner agreements and land uses. As previously mentioned, Evergreen II has obtained leases or agreements with many local landowners to exempt the project from sound level limits at those sites.

Nine nearby sensitive receiver points are listed respective to residences/property boundaries and estimated development impact.

7.0 Future Sound Levels

7.1 Construction

Standard discussion

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7.2 Proposed Operation

Operation sound level estimates were based on an acoustic model employing CADNA/A software utilizing area topography and wind turbine locations as provided by Stantec.

Wind turbine operation and sound power output relative to wind speed are discussed and plotted. Sound level estimates are based on full turbine sound power output plus and an uncertainty factor of + 5 dBA to allow for wind turbine sound power specification (IEC 61400-11) and outdoor propagation prediction (ISO 9613-2) uncertainties. Attenuation factors were intentionally omitted from the estimate model, which may have lessened resulting estimates further.

Selected sensitive receiver position sound level estimates from routine wind turbine operation range from 42-45 dBA. Actual measured sound levels will vary substantially with wind speeds/directions, subsequent to microphone interference and numerous wind generated noise sources (ambient + operation).

Wind speed generally varies with the elevation and may contain both horizontal and vertical components. Sound level measurements taken during turbine operation levels at or near maximum power will occur under a wide range of increased wind speeds. These measurement periods will be characterized by times when wind turbines are completely inaudible due to high ambient noise and times when surface level operation noise is more prominent.

Accurate, measurement-derived operation sound levels can only be made when conditions permit, a clear separation between operation and background sound. Forested receiver locations may not allow adequate separation of operation and ambient sound sources under representative operating conditions.

Tonal sounds (MDEP defined) are not expected based on manufacturer specifications, but may occur. Short duration repetitive sounds (MDEP defined) may occur as a result of amplitude modulation during intermittent conditions.

8.0 Conclusions and Recommendations

Maine DEP sound level limits based on land use and land owner agreements were set at "quiet limits -- 45 dBA nighttime/55 dBA daytime" (within 500 feet of residence).

Future sound level estimates from the proposed development indicate compliance with the Maine DEP requirements.

In addition to this proposed application, the reviewer performed a general review of the Stetson Wind Project data focusing particularly on a singular measurement location chosen for demonstration of the MDEP commercial wind turbine routine operation

compliance measurement protocol [See Conclusion-(Peer Review) Rollins Wind Project Sound Level Assessment -- Peer Review April 6, 2009 *(Rollins compliance protocol)*]. The measurement location selected was near the center of a concave array of five line-of-sight turbines, ranging from 1300-2000 feet from the microphone position and varying in elevation from each turbine hub by 250-400 feet. Meteorological data was correlated between 10 m, and the closest turbine for correlation with sound measurements to achieve desired measurement conditions (> 60% maximum wind turbine operation (maximum sound power output) during light surface winds).

The data was rigorously evaluated *using the Rollins Compliance Protocol* methodology for sound level equivalent, tonal and short duration repetitive sounds. The measurement period was characterized by prolonged stable atmospheric conditions. The Stetson Wind Project predictions were based on CADNA/A software, including numerous prediction assumptions (consistent modeling assumptions used by RSE for this proposed Oakfield site and numerous wind projects before this) and the addition of an uncertainty factor of + 5 dBA were 2-3 dBA less than predicted operating levels.

This singular ridge-top, wind turbine operating sound assessment was conducted under "worst case" array geometry, line-of-sight and meteorological conditions. The documented results support a "calibrated prediction model" which is representative of "sensitive receivers" at similar distances and elevations.

Conclusion - (Peer Review)

In my opinion the Oakfield Wind Project noise assessment is reasonable and technically correct according to standard engineering practices and the Department Regulations on Control of Noise (06-096 CMR 375.10).

The wind project prediction model based on CADNA/A software, based on the following prediction assumptions:

- individual wind turbine spherical wave fronts,
- mixed ground cover attenuation (general) and reflective water surfaces,
- atmospheric attenuation based on 10°C, 70% RH,
- no attenuation due to foliage or barriers,
- all wind turbines operating at maximum sound power output and
- all wind turbines operating under moderate downwind conditions simultaneously.

Incorporation of an uncertainty factor of + 5 dBA for maximum equipment specification potential inaccuracy under stable atmospheric conditions and measurement methodology uncertainties resulted in a reasonable prediction model that is conservative at times.

SDRS was not observed using a rigorous protocol under very favorable geometric and atmospheric conditions. A tonal sound was observed periodically at 3150 Hz, but did not result in a penalty that effectively changed findings.

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I recommend required routine operation noise compliance measurements at a minimum of six protected locations designated in the application noise assessment as "Receiver Positions" R1, R4-7 and R9. These particular sites not only represent the highest predicted levels, but also both the northern and southern turbine arrays from multiple directions and elevations. Please note specific recommendations (pending landowner agreement) for some locations.

Receiver Position	Recommendation/s
R1	as a proxy for the proposed R1 location, compliance measurements should be made in a field west of the residence (same parcel of land) toward the proposed development, at a point where the predicted model indicates a level of 43.8 dBA (PURPOSE -- minimization of extraneous noise sources from the tree canopy)
R4	No additions
R5	Efforts should be made to make measurements at a proxy location on the western end of the northern array at a similar elevation (~800 ft. msl) where predicted sound levels approximate 44 dBA (PURPOSE -- minimization of extraneous noise sources from the tree canopy)
R6	No additions
R7	This forested location should be evaluated during hardwood defoliation. (PURPOSE -- this receiver position is representative of downwind, lower elevation properties along the southern array and suitable alternatives do not exist in this wooded region)
R9	No additions

Compliance should be demonstrated, based on following outlined conditions for 12, 10-minute measurement intervals per monitoring location meeting 06-096 CMR 375.10 requirements.

Background ambient monitoring may be required in the areas where extraneous sounds could potentially or do complicate routine operation compliance assessment. If required, background ambient monitoring locations and times will be determined with concurrence from the MDEP.

a. Compliance will be demonstrated when the required operating/test conditions have been met for twelve 10-minute measurement intervals at each monitoring location.

b. Measurements will be obtained during weather conditions when wind turbine sound is most clearly noticeable, i.e. when the measurement location is downwind of the development and maximum surface wind speeds ≤6 mph with concurrent turbine hub-elevation wind speeds sufficient to generate the maximum continuous rated sound power from the five nearest wind turbines to the measurement location. Measurement intervals affected by increased biological activities, leaf rustling, traffic, high water flow or other extraneous ambient noise sources that affect the ability to demonstrate compliance will be excluded from

reported data. A downwind location is defined as within 45° of the direction between a specific measurement location and the acoustic center of the five nearest wind turbines.

c. Sensitive receiver sound monitoring locations should be positioned to most closely reflect the representative protected locations for purposes of demonstrating compliance with applicable sound level limits, subject to permission from the respective property owner(s). Selection of monitoring locations should require concurrence from MDEP.

d. Meteorological measurements of wind speed and direction should be collected using anemometers at a 10-meter height above ground at the center of large unobstructed areas and generally correlated with sound level measurement locations. Results should be reported, based on 1-second integration intervals, and be reported synchronously with hub level and sound level measurements at 10 minute intervals. The wind speed average and maximum should be reported from surface stations. MDEP concurrence on meteorological site selection is required.

e. Sound level parameters reported for each 10-minute measurement period, should include A-weighted equivalent sound level, 10/90% exceedance levels and ten 1-minute 1/3 octave band linear equivalent sound levels (dB). Short duration repetitive events should be characterized by event duration and amplitude. Amplitude is defined as the peak event amplitude minus the average minima sound levels immediately before and after the event, as measured at an interval of 50 ms or less, A-weighted and fast time response, i.e. 125 ms. For each 10-minute measurement period short duration repetitive sound events should be reported by percentage of 50 ms or less intervals for each observed amplitude integer above 4 dBA. Reported measurement results should be confirmed to be free of extraneous noise in the respective measurement intervals to the extent possible and in accordance with (b).

f. Compliance data collected in accordance with the assessment methods outlined above for representative locations selected in accordance with this protocol will be submitted to the Department for review and approval prior to the end of the first year of facility operation. Compliance data for each location will be gathered and submitted to the Department at the earliest possible opportunity after the commencement of operation, with consideration for the required weather, operations, and seasonal constraints.

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Evergreen Wind Power II, LLC.
Oakfield Wind Project.
Oakfield, Maine

Response to Powers Trust Objection.
December 31, 2009

EnRad Consulting -- Warren Brown, Consultant

Exhibit 1 -- Visual Impact-*no EnRad comment*
Exhibit 2 -- Visual Impact-*no EnRad comment*
Exhibit 3 (objection) –

Precision wind turbine sound prediction modeling for all atmospheric, topographical, array geometries and surface conditions continues to develop[1 2 3]. This knowledge evolution is evidenced by continued changes in turbine sound power output specifications [IEC 61400-11 (2010)][4], numerous proposed prediction model algorithms and a wide variety of recommended approaches. To date, this reviewer found insufficient evidence to suggest a more widely used algorithm, then ISO 9613-2 to model wind turbine projects.

Resource Systems Engineering (RSE) in conjunction with its client proposed a prediction model based on manufacturer specified maximum sound output (IEC 61400-11) for all turbines operating simultaneously upwind of each sensitive receiver locations with an additional +5 dBA buffer for manufacturer specification and sound propagation uncertainties. Given an apparent reasonable prediction methodology, this reviewer, the MDEP and developers collaborated to produce a rigorous compliance measurement protocol to confirm wind turbine operating sound under stable atmospheric conditions, elevated topography, complex geometries and various surface conditions.

Codification of collaborative compliance measurement protocol efforts produced the following requirements:

Compliance sound assessment of wind turbines require carefully specified measurement conditions, monitoring specifications and reporting requirements. Compliance should be demonstrated, based on following outlined conditions for 12, 10-minute measurement intervals per monitoring location meeting 06-096 CMR 375.10 requirements.

Extraneous sounds could potentially or do complicate routine operation compliance assessment. If the applicant must adjust for such sounds, background ambient monitoring will be necessary. If background ambient monitoring is proposed, locations and times should be determined with concurrence from the MDEP.

a. Compliance will be demonstrated when the required operating/test conditions have been met for twelve 10-minute measurement intervals at each monitoring location.

Department at the earliest possible opportunity after the commencement of operation, with consideration for the required weather, operations, and seasonal constraints.

The wind project prediction model utilized for the Oakfield wind power project was based on CADNA/A software using ISO 9613-2 algorithms which included the following prediction assumptions:

- individual wind turbine spherical wave fronts,
- mixed ground cover attenuation (general) and reflective water surfaces,
- atmospheric attenuation based on 10°C, 70% RH,
- no attenuation due to foliage or barriers,
- all wind turbines operating at maximum sound power output
- all wind turbines operating under moderate downwind (simultaneous conditions for each sensitive receiver) and

the incorporation of an uncertainty factor of + 5 dBA for maximum equipment specification potential inaccuracy under stable atmospheric conditions and measurement methodology uncertainties.

The "adjusted" predictive model was found to accurately predict (often conservatively), nine sites (8-retrospective) during stable atmospheric conditions for elevated turbines (hills/mountains), of linear array configurations, during mixed surface conditions (trees-conifer/foliated & defoliated deciduous, cut and uncut fields, open gravel, open rock faces and powder through crusted snow).

Exhibit 4 -- March 5, 2009 conference call

Exhibit 5 -- ISO 9613-2 based software for sounds received beyond 1 km

ISO-9613-2[5] states "an estimate of accuracy is not provided beyond 1000 m." Basic physical principles, indicate attenuation due to divergence (including refractive conditions) and air absorption will continue to lessen sound pressure levels (L_{Aeq}) beyond 1000 m (3300 feet).

Exhibit 6 -- ISO 9613-2 based software for sounds over relatively porous terrain, high wind conditions and propagation modeling (spherical versus cylindrical)

Ground absorption over relatively porous terrain and stable atmospheric maximum turbine sound power output are adequately compensated for in nine compliance test sites. (see Exhibit 3 objection *RESPONSE*). Point source (spherical wave fronts) models appropriately represent sound pressure levels (L_{Aeq}), tonal (MDEP) and short duration repetitive sound (SDRS) for the proposed wind turbine project within the region of MDEP compliance. I find no contradiction to this point in the following reference H.H.Hubbard *and K.P. Shepherd: Aeroacoustics of Large Wind Turbines* J. Acoust. Soc. Am., Volume 89, No 6, June 1991.

Exhibit 7 -- ISO 9613-2 based software for sounds under stable atmospheric conditions

This reviewer evaluated compliance data from nine measurement locations at two separate wind turbine developments similar to the proposed Oakfield project under stable atmospheric condition under maximum sound power output during light surface winds. Minimum turbine hub elevations above receiver locations equaled or exceeded 250 ft.

Responses to E-Coustic Solutions statements by page number

7) General Comments -- wind farm perception study comment -- "... finds that at or over 45 dBA 28% or 1 out of every 3 to 4 people will be "very annoyed." (p. 4)

Response -- studies appear to be yet preliminary due to confounders, that may include visual factors and attitudes toward the impact of wind turbines on the landscape, etc.; studies do not use control groups and do not assure a direct correspondence to siting conditions for a generalized setting. See "Wind Turbine Sound and Health Effects an Expert Panel Review (section 3.4.1-2)

8) Wind Turbine Sounds -- raises Infrasound objection. (p. 5-6)

Response -- MDEP chapter 375.10 does not address infrasound, A-weighted metrics essentially filter out these frequencies from turbine sounds. Infrasound, sonic frequencies <20 Hz, have been widely accepted to be of no concern below the common human perception threshold of 85-90 dBG for non-pure tone sounds. There is insufficient, broadly accepted evidence to conclude otherwise. Numerous national infrasound standards limit industrial facilities, impact equipment and jet engines, but wind turbine infrasound levels fall far below these standards.

Wind turbines, rotating, under conditions necessary for power production produce a measurable broadband (lower frequencies) amplitude modulation of sound ("swoosh" and/or "thump") at ±1 Hz, which should not be confused with infrasound. See "Wind Turbine Sound and Health Effects an Expert Panel Review (section 3.2.1-2)," See also Bo Sondergaard, one of the authors, Specialist, Acoustics for DELTA response to Rick James, Infrasound workshop (Tahiti-2005) interpretation -- "Final RSE Response to Powers Objection 11-03-09[8] (p. 12 electronic copy)."

9) Wind Turbine Noise Is Distinctively Annoying (p. 6)

Response ---- studies appear to be yet preliminary due to confounders, that may include visual factors and attitudes toward the impact of wind turbines on the landscape, etc.; studies do not use control groups and do not assure a direct correspondence to siting conditions in Oakfield. See "Wind Turbine Sound and Health Effects an Expert Panel Review (section 3.4.1-2)

10) Amplitude Modulation (p. 7-9)

Response --. The MDEP chapter 375.10 with clarifying wind turbine compliance measurement protocol (2008) was designed to specifically assess stable atmospheric "worst-case" conditions and specifically requires quantitative documentation of amplitude modulation during measurement periods. This reviewer performed a focused assessment of a unique measurement location chosen for demonstration of the MDEP wind turbine routine operation compliance measurement protocol [See Conclusion-(Peer Review) Rollins Wind Project Sound Level Assessment -- Peer Review April 6, 2009]. The selected measurement location was near the center of a concave array of five line-of-sight turbines, ranging from 1300-2000 feet distance and 250-400 feet elevation from the microphone position. Meteorological data was collected at 10 m, and the closest 5 turbines for correlation with sound measurements to achieve desired measurement conditions (> 60% maximum wind turbine operation -- all 5 turbines (maximum sound power output) during light surface winds).

[4] Søndergaard, B., (DELTA), "T he next version of the IEC 61400-11 measurement method." Proceedings of the Third International Meeting on Wind Turbine Noise, Aalborg, Denmark, June 17-19, 2009.

[5] International Standards Organization, "Acoustics - Attenuation of Sound During Propagation Outdoors, Part 2 – General Method of Calculation." IS0 9613-2, 1996

[6] Roberts, M. & Roberts, J., "Evaluation of the Scientific Literature on the Health Effects Associated with Wind Turbines and Low Frequency Sound," Prepared for Wisconsin Public Service Commission, Docket No. 6630-CE-302, October 20, 2009

[7] Colby, W.D., Dobie, R., Leventhall, G., Lipscomb, D.M., McCunney, R.J., Seilo, M.T., Søndergaard, B., "Wind Turbine Sound and Health Effects: An Expert Panel Review," Prepared for: American Wind Energy Association and Canadian Wind Energy Association, December 2009.

[8] Resource Systems Engineering, "Evergreen Wind Power II, LLC Oakfield Wind Project, Aroostook County, Maine - Response to Powers Trust Objection, November 3, 2009.

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EVERGREEN WIND POWER II, LLC
OAKFIELD WIND PROJECT
AROOSTOOK COUNTY, MAINE

SOUND LEVEL ASSESSMENT

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File 080130

APRIL 2, 2009

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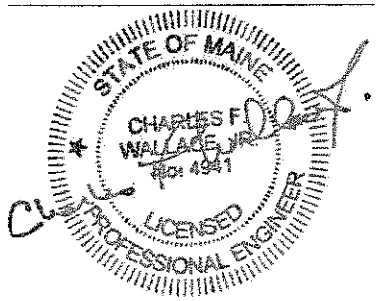
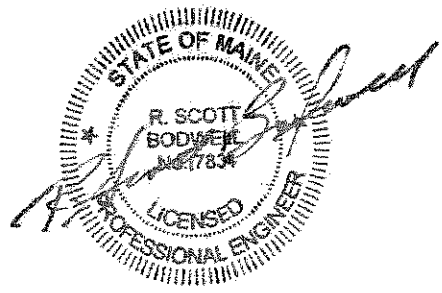
ACKNOWLEDGMENTS

Resource Systems Engineering (RSE) wishes to acknowledge Evergreen Wind Power II, LLC and Stantec Consulting for their contributions to this Sound Level Study. RSE personnel responsible for this investigation and report are Charles F. Wallace, Jr., P.E., R. Scott Bodwell, P.E., Tina J. Jones and C. Phillip Botts.





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EVERGREEN WIND POWER II, LLC
OAKFIELD WIND PROJECT
AROOSTOOK COUNTY, MAINE
SOUND LEVEL ASSESSMENT

CONTENTS

LIST OF ACRONYMS

ANSI	American National Standards Institute
dB	Decibel (Unit of Sound Pressure Level)*
dBA	Decibel A-weighted
DEP	Department of Environmental Protection
Hz	Hertz (cycles per second)
ISO	International Organization for Standardization
kVA	Kilovolt-Ampere
L_{A1}	Sound Level Exceeded 1% of a Measurement Period (dBA)
L_{A10}	Sound Level Exceeded 10% of a Measurement Period (dBA)
L_{A50}	Sound Level Exceeded 50% of a Measurement Period (dBA)
L_{A90}	Sound Level Exceeded 90% of a Measurement Period (dBA)
L_{Aeq}	Equivalent Sound Level (dBA)
$L_{Aeq\text{-}Hr}$	Hourly Equivalent Sound Level (dBA)
L_w	Sound Power Level
L_{wA}	A-weighted Sound Power Level
mph	Miles per hour
MRSA	Maine Revised Statutes Annotated
RSE	Resource Systems Engineering

* Sound Pressure Level is represented by the term Sound Level in this report.

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EVERGREEN WIND POWER II, LLC
OAKFIELD WIND PROJECT
AROOSTOOK COUNTY, MAINE

SOUND LEVEL ASSESSMENT

1.0 INTRODUCTION

Resource Systems Engineering (RSE) completed an analysis of sound levels for the Oakfield Wind Project, a proposed wind energy facility with up to 34 utility-scale wind turbines to be located on 36 potential locations in the Oakfield area of Aroostook County, Maine. The objective of the sound assessment was to determine the expected sound levels from routine operation of the wind project and compare them with relevant environmental noise standards.

Sound levels generated during construction and operation of many types of facilities can be regulated by federal, state, and local noise standards. The Maine Department of Environmental Protection (DEP) regulates noise under authority of the Site Location of Development Law (38 M.R.S.A 481-490). The current Maine DEP noise regulation, Chapter 375.10, Control of Noise, was established in November 1989 to protect certain existing land uses, such as residential properties, schools, and recreation areas, from excessive sound levels generated by new or expanded developments.

The Sound Level Assessment report provides a description of the proposed wind project, identifies land uses in the project vicinity, and presents sound level estimates for future wind turbine operations. Specifically, this report provides a comprehensive evaluation of sound levels from construction and operation of the wind turbines. Operation of the substation and other electric transmission facilities are briefly discussed. The sound level estimates are compared to Maine DEP sound level limits to demonstrate that the Oakfield Wind Project will meet applicable sound level limits.

2.0 SOUND AND DECIBELS

Sound is a rapid fluctuation in pressure that the human ear has the potential to detect. The decibel or dB is the unit of measurement for sound. The decibel scale is logarithmic to avoid large unmanageable numbers normally associated with pressure change. Figure 1 shows a comparison of sound pressure and decibel levels for some typical sound environments.

Sound level performance specifications often provide the sound power level emitted by a particular noise source such as a wind turbine. Similar to sound pressure level, the sound power level or L_w is a logarithmic measure of sound expressed in decibels compared to a specified reference level. The difference is that the reference level for sound power is 10^{-12} watts compared to the reference level for sound pressure which is in units of micropascals.

Undesirable sound is generally referred to as *noise*. The effects of noise depend both on its frequency (or pitch), decibel level, and duration, particularly in relationship to changes in existing sound levels. The frequency of a sound generally refers to the number of vibrations per second, measured in hertz (Hz). The frequencies of sounds audible to humans range from about 20 Hz to 20,000 Hz, with greater sensitivity to frequencies above 1,000 Hz.

Sound may consist of a single frequency known as a pure tone, but is generally a disorderly mixture of many frequencies. When measuring sound, the A-weighted sound levels are typically used in order to

simulate the hearing response of the human ear to varying sound level frequencies. A-weighted sound levels are expressed as dBA.

Sound propagation in air can be compared to ripples on the surface of a pond. The ripples spread out uniformly in all directions of the pond surface decreasing in amplitude as they move further from the source. For every doubling of distance from a stationary hemispherical point source, the sound level drops by 6 dB. Thus if the sound level is 50 dBA at 500 feet, the sound level at 1000 feet will be 44 dBA, and will be 38 dBA at 2000 feet. With an obstacle in the sound path, such as intervening terrain or a building, part of the sound is reflected, part is absorbed and the remainder is transmitted through or around the object. The amount of sound that is reflected, absorbed or transmitted depends on the properties of the object, its size, and the frequency (Hz) of the sound. Properties of an object and its effect on sound propagation are primary considerations in the design of noise control measures.

For constant sounds, a brief measurement close to the source can generally quantify the level of sound over both long and short periods. However, when sound sources vary, longer sampling periods are needed to accurately quantify the sound levels. Integrating sound level meters are commonly used to measure fluctuating sound sources. These meters record the sound level every 1/8 of a second when set to fast response and every one-second on slow response. When set to fast, the instrument measures 480 sound levels every minute and over 28,000 records in an hour. Due to the large number of readings, statistical parameters are used for analysis and comparison of measurement data.

The most commonly used parameter is the A-weighted equivalent sound level or L_{Aeq}. The L_{Aeq} is used to represent the sound energy during a given sampling period as a constant decibel level. The L_{Aeq} takes all sound level fluctuations into account similar to an averaging technique; however, this is accomplished mathematically to deal with decibels as logarithmic expressions. At a site influenced by variable sounds such as vehicle or aircraft traffic, the L_{Aeq} distributes the traffic sound energy over the entire measurement period to calculate a single decibel level. Short periods of elevated sound levels can significantly increase the L_{Aeq} over a measurement period. For example, if the sound level over an hour was 30 dBA except for five minutes when traffic noise measured 60 dBA, the L_{Aeq} for the hour would be 49 dBA.

Other common statistical parameters include L_{A10}, L_{A50} and L_{A90}, which represent the sound level exceeded 10%, 50%, and 90% of the time during the measurement, respectively. The L_{A90} excludes most transient or intermittent noise sources and therefore, is commonly used to determine the value of constant or *background* sound during a measurement. L_{A50} is the median sound level and can be used to quantify nearly steady operations by removing the contribution of occasional, louder sound events such as wind gusts or traffic. L_{A10} is frequently used to quantify sound levels of such occasional events.

In order to calculate sound levels resulting from multiple sources, such as several wind turbines, it is necessary to combine decibel levels from each source. Decibel levels must be added mathematically to reflect the logarithmic nature of the decibel unit. When two sounds of the same decibel level are combined, the resulting combined sound level is just 3 dB higher than the individual sound levels (e.g. 50 dB + 50 dB = 53 dB). The analysis contained in this report addresses both individual and combined sound sources associated with the proposed wind project.

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3.0 SITE DESCRIPTION

The Oakfield Wind Project will consist of up to 34 General Electric 1.5 megawatt (MW) turbines capable of generating as much as 51 megawatts of electricity. The project also includes access roads, permanent meteorological towers, an electrical interconnection facility to tie to the existing Maine Public Service 69kV transmission line, an electrical substation, and an operations and maintenance facility. A site location map is presented as Figure 2.

The project involves permitting 36 potential turbine locations to allow flexibility in final location; only 34 turbines will be constructed. All of the turbines will be located in the town of Oakfield. The wind turbines will be located in two clusters, Oakfield North and Oakfield South. Both clusters include 17 turbine sites and one alternate. Power from the turbines will be collected by an overhead 34.5-kV collector line, delivered to the on-site substation at the north end of the project, and converted to 69 kV for transmission to a connection point. Relative to applicable sound level limits, operation of the substation and transmission line is not expected to generate significant sound levels. Consequently, sound level estimates for the wind project do not include these facilities.

The majority of the proposed project area is presently used for commercial forestry operations and contain developed logging roads that will be upgraded and used, where appropriate, to minimize clearing and wetland impacts. The turbines will generally run southwest to northeast along various ridges with base elevations of the turbines ranging from approximately 910 to 1,430 feet above mean sea level. In addition to the turbine structures, the project will include construction of an operations and maintenance facility to the northwest of Oakfield South and a substation to the west of Oakfield North.

Each turbine is 262 feet from the base to the center of the rotor hub, and a total of 389 feet to the tip of a fully extended rotor blade. For the proposed GE wind turbines, spacing between turbines within the two turbine clusters will range from a minimum of approximately 660 to 1,750 feet. The distance between the two clusters is approximately 1.6 miles. There are no external ladders or similar structures proposed on the towers and no guy wires or external cables. Access for maintenance will be provided by ladders located inside the towers.

Based on aerial photography, field surveys and local tax records, uses in the vicinity of the project consist mostly of undeveloped/forestry land and rural residential properties at various distances from the proposed wind turbines. Residential properties are located around the perimeter of Oakfield North, northwest of Oakfield South, along South Road which bisects Oakfield South, and along Nelson Road between the two clusters. A residential subdivision was approved in 1987 that consists of 23 lots that are generally more than 40 acres in size. Lots within this subdivision are located both north and south of Nelson Road. The large residential subdivision is labeled "Patten Subdivision" on Figure 3.

Evergreen Wind Power II (Evergreen II) has purchased property or obtained leases with local landowners to install and operate wind turbines at the proposed locations. Evergreen II has also obtained agreements with landowners who may experience sound levels from the project that have the potential to exceed applicable sound level limits. A Vicinity Site Plan showing the proposed wind turbine layout and substation location in relation to surrounding land uses and residences is shown as Figure 3. Figure 3 also depicts parcels that Evergreen II has purchased or leased and parcels where required sound easements have been obtained. As set forth by Maine DEP 375.10, Section C.5.s, a noise (sound) easement exempts the project from Maine DEP noise limits and remains in effect for the specific noise, parcel of land and term covered by the agreement.

4.0 NOISE CONTROL STANDARDS

Relevant noise standards consist of regulations established by the Maine DEP. Maine DEP Chapter 375.10, *Control of Noise*, established in November 1989, applies hourly sound level limits at facility property boundaries and at nearby *protected locations*. Protected locations are defined as "any location accessible by foot, on a parcel of land containing a residence or planned residence or approved residential subdivision...." Under this definition, a residence is considered planned when the landowner has received all applicable building and land use permits and the timeframe for beginning construction under such permits has not expired. Similarly, a residential subdivision is considered approved when the developer has received all applicable land use permits for the subdivision and the timeframe for beginning construction under such permits has not expired. In addition to residential parcels, protected locations also include but are not limited to schools, state parks, and designated wilderness areas (ref. Maine DEP 375.10.G.16).

The hourly equivalent sound level ($L_{Aeq\text{-}Hr}$) resulting from routine operation of the wind project is limited to 75 dBA at any facility property boundary. The limits at protected locations vary depending on local zoning or surrounding land uses and existing (pre-development) ambient sound levels.

At protected locations within commercially or industrially zoned areas, or where the predominant surrounding land use is non-residential, the hourly sound level limits for routine operation are 70 dBA daytime (7:00 a.m. to 7:00 p.m.) and 60 dBA nighttime (7:00 p.m. to 7:00 a.m.). At protected locations within residentially zoned areas or where the predominant surrounding land use is residential, the hourly sound level limits for routine operation are 60 dBA daytime and 50 dBA nighttime. In addition, where the daytime pre-development ambient hourly sound level at a protected location is equal to or less than 45 dBA and/or the nighttime hourly sound level is equal to or less than 35 dBA, the hourly sound level limits for routine operation are 55 dBA daytime and 45 dBA nighttime. For areas where pre-development ambient sound levels exceed the specified limits at a protected location, hourly sound level limits may be chosen as 5 dBA less than the pre-development sound levels (ref. Maine DEP 375.10.C.1).

In all cases, nighttime limits apply to areas within a protected location that are up to 500 feet from a residence or sleeping quarters. At distances over 500 feet or where no residence or sleeping quarters exist, daytime limits apply during all facility operating hours (ref. Maine DEP 375.10.G.16). Where various limits apply depending on the distance from a residence or sleeping quarters, all limits must be met at the protected location. For lots within a residential subdivision where no residence has been constructed and no building permit received, RSE assumes in this report that the daytime limit applies during all facility operating hours. For subdivision lots with an existing residence or residential building permit, the nighttime limit applies within 500 feet of the existing or planned residence.

The Maine DEP regulation establishes sound level limits for construction, maintenance, and tonal and short duration repetitive sounds as follows:

Construction - Sound from nighttime construction is subject to the same nighttime limits as routine operation. Even though daytime construction limits are contained in Maine DEP Chapter 375.10, normal daytime construction sound levels are exempt from this regulation by Maine Statute (38 M.R.S.A. Section 484). Equipment used in construction must also comply with applicable federal noise regulations and must include environmental noise control devices in proper working condition as originally provided by its manufacturer (ref. Maine DEP 375.10.C.2).

Maintenance -- Sound from routine, ongoing maintenance activities are considered part of routine operations and subject to the daytime and nighttime limits for routine operation. Sound from occasional, major overhaul activities is regulated as construction activity (ref. Maine DEP 375.10.C.3).

Short Duration Repetitive and Tonal Sounds - When routine operations produce a short duration repetitive or tonal sound, 5 dBA is added to the observed sound levels of these sounds for determining compliance. There is also a maximum sound level (L_{Amax}) limit for certain types of short duration repetitive sounds (ref. Maine DEP 375.10.C.1.d and e).

Sounds associated with certain activities are exempt from regulation under Maine DEP Chapter 375.10. Exempt activities associated with the proposed wind project may include (ref. Maine DEP 375.10.C.5):

- Construction activity during daylight or daytime hours, whichever is longer;
- Emergency maintenance and repairs.

An exemption also applies at protected locations where the landowner has conveyed a sound or noise easement to the project that allows the project to potentially exceed the Maine DEP sound level limits.

When a development is located in a municipality that has duly enacted a quantifiable noise standard that (1) contains limits that are not higher than the Maine DEP limits by more than 5 dBA, and (2) limits or addresses the types of sounds regulated by the Maine DEP, then the Maine DEP is to apply the local standard rather than the Maine DEP standard. Further, when noise produced by a facility is received in another municipality, the quantifiable noise standards of the other municipality must be taken into consideration (ref. Maine DEP 375.10.B.1).

Inquiries to town offices and review of land use ordinances for Oakfield, Maine indicate that no quantitative local noise standards have been enacted.

5.0 EXISTING SOUND LEVELS

Measurements of the pre-development ambient sound levels are required only when the developer elects to establish that the daytime and nighttime ambient hourly sound level at representative protected locations exceed 45 dBA and 35 dBA, respectively (ref. Maine DEP 375.10.H.3.1). Without such ambient measurements, the Maine DEP quiet limits of 55 dBA daytime and 45 dBA nighttime apply at nearby protected locations. In recognition of the rural nature of the site and to be conservative, Evergreen II has elected to apply quiet limits at nearby protected locations even though pre-development ambient sound levels under weather conditions suitable for wind turbine operation can exceed the quiet area thresholds of 45 dBA daytime and 35 dBA nighttime.

6.0 SOUND LEVEL LIMITS

Maine DEP sound level limits at protected locations and property lines have been determined for the Oakfield Wind Project based on land uses and landowner agreements. Evergreen II has purchased land and obtained leases or agreements with local landowners that exempt the project from sound level limits under the Maine DEP noise regulation. As set forth in Maine DEP Chapter 375.10, sound level limits at protected locations not subject to landowner agreements apply to routine operation of the proposed wind project and substation.

The most restrictive Maine DEP sound level limit of 45 dBA applies during nighttime hours at locations on residential parcels that are within 500 feet of an existing or planned residence. The quiet daytime limit of 55 dBA applies during daytime hours (7 am to 7 pm) and during all hours at locations on residential parcels that are over 500 from an existing or planned residence and RSE assumes for this report on the entire area of lots within a residential subdivision where no residence has been constructed or building permit received. Maine DEP sound level limits do not apply at protected locations where

landowners have signed agreements with Evergreen II allowing sound levels from the project that could exceed otherwise applicable Maine DEP sound level limits. Excluding purchase or leased land and parcels where required sound easements have been obtained (see Figure 3), Table 1 presents a list of receiver points in the vicinity of Oakfield Wind where applicable sound level limits are most restrictive to the project. These receiver points are also shown on Figure 3.

Table 1

Maine DEP Hourly Sound Level Limits (dBA)

Receiver Point[A]	Description	Distance From Nearest Wind Turbine (ft)	Maine DEP Hourly Limit (dBA) Daytime	Nighttime	Limit Basis
R1	Residential parcel off Bear Gulch Road north of Oakfield North	2,550	55	45	Quiet limits at protected location within 500 feet of existing dwelling
R2	Residential parcel off North Road northeast of Oakfield North	1,950	55	45	Quiet limits at protected location within 500 feet of existing dwelling
R3	Residential parcel off Brown Road east of Oakfield North	2,160	55	45	Quiet limits at protected location within 500 feet of existing dwelling
R4	Residential parcel off Nelson Road southwest of Oakfield North	1,990	55	45	Quiet limits at protected location within 500 feet of existing dwelling
R5	Residential parcel off Thompson Settlement Road west of Oakfield North	2,200	55	45	Quiet limits at protected location within 500 feet of existing dwelling
R6	Residential parcel off Nelson Road northeast of Oakfield South	1,850	55	45	Quiet limits at protected location within 500 feet of existing dwelling
R7	Residential parcel off South Road east of Oakfield South	2,190	55	45	Quiet limits at protected location within 500 feet of existing dwelling
R8	Residential parcel off Thompson Settlement Road west of Oakfield South	1,860	55	45	Quiet limits at protected location within 500 feet of existing dwelling
R9	Residential parcel off Thompson Settlement Road northwest of Oakfield South	2,690	55	45	Quiet limits at protected location within 500 feet of existing dwelling

[A]See Figure 3, Vicinity Site Plan.

The Maine DEP regulation specifies sound level limits in terms of hourly A-weighted equivalent sound levels (L_{Aeq-Hr}). At protected locations where tonal or short duration repetitive sounds are present from operation of the wind project, 5 dBA is added to these sound levels for purposes of determining compliance with applicable sound level limits.

7.0 FUTURE SOUND LEVELS

7.1 Construction

Sound from construction activity is both temporary and variable. Many construction machines operate intermittently and equipment varies with each construction phase. A variety of construction equipment will be used to build the wind project including earth-moving equipment for land clearing, excavation,

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and site grading, and cranes to erect the wind turbines. Typical earth moving equipment and cranes generate sound levels of 75 to 88 dBA at a distance of 50 feet.

Sound levels from construction may be noticeable in the vicinity of the site, especially during blasting, excavation and grading. Local traffic during construction is expected to increase on some public roads along with associated sound levels from construction vehicles. Because of the temporary nature of construction, no adverse or long-term sound level effects are anticipated.

The mobile nature of construction equipment and the manner in which construction work must be done makes complete control of construction sound infeasible. With the possible exception of nighttime blade lifts, construction activity will occur between the hours of 7 a.m. and 7 p.m. or daylight hours, and therefore is not subject to Maine DEP sound limits. Sound from nighttime crane lifts is not expected to exceed sound levels from routine operation.

Other measures to mitigate construction sound levels will include compliance with federal regulations limiting sound from trucks and portable compressors, and ensuring that equipment and sound muffling devices provided by the manufacturer (or equivalent) are kept in good working condition.

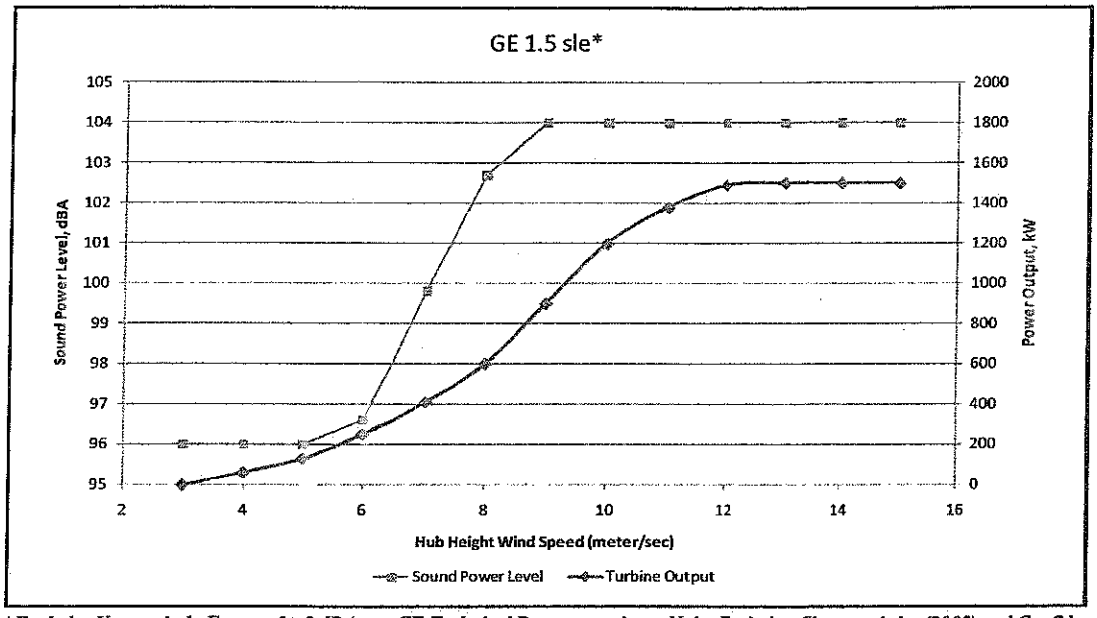
7.2 Proposed Operation

Operation of the proposed project will consist of 34 wind turbines operating up to 24 hours per day and seven days per week depending on weather conditions.

RSE developed a sound level prediction model to estimate sound levels from simultaneous operation of wind turbines at all 36 possible turbine locations for Oakfield Wind. The acoustic model was developed using the CADNA/A software program to map area terrain in three dimensions, locate proposed wind turbines and calculate outdoor sound propagation from the wind turbines. Area topography and wind turbine locations, for entry into CADNA, were provided to RSE by Stantec based on USGS topographic information and project design.

The wind project will be capable of operating any time of the day or night, including holidays and weekends. However, the wind turbines will only operate when the wind incident on the turbine hub is at or above the cut-in wind speed of 3 meters per second (6.7 mph). During periods of light or calm winds, sound level emissions from the wind project will be virtually non-existent. As the hub-height wind speed increases to 3 meters/sec, the turbines begin to rotate and will reach full sound power output at a wind speed of approximately 9 meters per second (20.1 mph) or 60% of rated power output. Full power generation from the wind turbines occurs when the hub-height wind speed is at or above 11.5 meters per second (25.7 mph). The turbines shutdown or "cut-out" when winds reach 25 meters per second (56 mph). Figure 4 presents a plot of the sound power level and power generation versus wind speed at the turbine hub for wind speeds ranging from 3 to 15 meters per second. Figure 4 indicates that full sound power occurs at or above 9 meters per second and the sound power level is approximately 4 dBA less at a wind speed of 7 meters per second.

Figure 4. Sound Power Level and Power Output of GE 1.5 sle Wind Turbine in Relation to Hub Wind Speed



**Excludes Uncertaintly Factor of ± 2 dBA per GE Technical Documentation – Noise Emission Characteristics (2005) and Confidence Level of +2dBA per GE Technical Specification – Noise Emission Compliance, GE Wind Energy, May 2005.*

RSE calculated sound levels for simultaneous operation of the GE 1.5 sle wind turbines at all 36 prospective wind turbine locations at full sound power as defined by GE Energy. These moderate to full load conditions exist with wind speeds at or above 9 meters per second (20.1 miles per hour) at the turbine hub. The wind turbines were treated as point sources at the hub height of 80 meters (262 feet) above base/grade elevation using sound power levels from GE Energy (Technical Documentation Wind Turbine Generator System GE 1.5 sl/sle 50 & 60 Hz, Noise Emission Characteristics, 2005). Sound level estimates are based on the operating sound level at full sound power plus an uncertainty factor of plus 2 dBA based on the GE specification and measurements by RSE of similar turbines during full operation. Sound levels from the wind turbines are not expected to increase at wind speeds greater than 9 meters/sec.

GE Energy determined turbine sound power levels in accordance with IEC 61400-11, Wind Turbine Generator Systems – Part 11: Acoustic Noise Measurement Techniques, 2002. Table 2 provides sound power levels by third octave and whole octave frequency as provided by GE Energy.

Sound levels from wind turbine operation were calculated for nine receiver points (R1 to R9) in the vicinity of the proposed wind project. Receiver points represent nearby protected locations where the most stringent Maine DEP nighttime limits apply. Sound levels at these receiver points have the greatest potential to exceed applicable Maine DEP limits. Dwellings and protected locations closer to the wind turbines than the receiver points (see Figures 3 and 5) have entered into a lease or agreement with Evergreen II so that Maine DEP sound level limits do not apply at these properties (ref. Maine DEP 375.10, Section C.5.s). Sound level attenuation from the wind turbines to the receiver points was calculated by the acoustic model in accordance with ISO 9613-2 "Attenuation of sound during propagation outdoors". ISO 9613-2 is an international standard commonly used for predicting sound levels from a noise source for moderate downwind condition in all directions.

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TABLE 2

WIND TURBINE SOUND POWER LEVELS
(Wind Speed ≥ 9.0 m/s at turbine hub)

3rd Octave Band Center Frequency, Hz	Sound Power Level, dBA	Octave Band Center Frequency, Hz	Sound Power Level, dBA	Sound Power Level, dBA (as modeled by RSE)
50	76.2			
63	79.9	63	85.1	90.1
80	82.6			
100	84.8			
125	86.7	125	94.0	99.0
160	92.4			
200	90.7			
250	92	250	97.2	102.2
315	94			
400	94.3			
500	93.8	500	98.6	103.6
630	93.2			
800	94			
1000	92.8	1000	97.9	102.9
1250	92.3			
1600	91.5			
2000	89.6	2000	94.5	99.5
2500	87.1			
3150	84.8			
4000	82.2	4000	87.3	92.3
5000	78.6			
6300	75.9			
8000	71.3	8000	78.1	83.1
10000	70.8			
SUM	**104**	**SUM**	**104**	**109**

Source: Technical Documentation Wind Turbine Generator System GE 1.5sl/sle 50 & 60 Hz, Noise Emission Characteristics, 2005

For Oakfield Wind, the prediction model calculates attenuation due to distance, atmospheric absorption and intervening terrain. Conservative factors were applied for ground absorption assuming a mix of hard and soft ground. The surfaces of nearby lakes were specifically mapped and assigned no ground absorption as appropriate for a hard, reflective surface. The model calculations exclude attenuation from foliage, which has the potential to reduce sound levels.

The stated accuracy of sound level attenuation calculations per ISO 9613-2 is plus or minus 3 dBA. To compensate for accuracy inherent in the calculation and measurement methods, 3 dBA has been added to the specified sound power levels. This is in addition to the plus 2 dBA uncertainty factor from the GE specification. Consequently, the overall adjustment to the rated sound power levels from GE specifications (Table 2) is plus 5 dBA yielding a sound power level of 109 dBA for model calculations. This adjustment reflects the range of sound levels for the proposed wind project based on RSE sound level measurements of similar operating wind turbines under a variety of weather and site conditions.

Using the model, sound level contours for operation of the proposed wind project were calculated for the entire study area. These results are presented in Figure 5 with the sound level contours of 55 dBA and 45 dBA highlighted to correspond to Maine DEP quiet daytime and nighttime limits. Information for the project study area as presented on Figure 5 includes the turbine locations, parcel mapping, dwelling locations, a residential subdivision, public and private roads, and water bodies. A legend indicating the map symbols is provided on Figure 5.

From these contours, the expected sound level from full operation of the wind turbines can be determined for any point within the study area. Initially, the results were used to identify residential parcels (protected locations) where estimated sound levels may exceed Maine DEP sound level limits and, therefore, sound easements would be required to comply with Maine DEP noise regulations. Evergreen II has either purchased, leased or obtained sound easements on these parcels as indicated on Figure 5. To evaluate compliance with Maine DEP at other protected locations, receiver positions were selected where, excluding purchased, leased or easement parcels, the Maine DEP limits would be most restrictive. In addition to sound level contours, calculated sound levels at these receiver positions are indicated on Figure 5. Table 3 compares estimated sound levels at the receiver positions with Maine DEP nighttime sound level limits.

TABLE 3

ESTIMATED SOUND LEVELS FROM WIND TURBINE OPERATION

Receiver Position	Distance to Nearest Wind Turbine, Feet	Estimated Hourly Sound Level, L_{Aeq-Hr}	Maine DEP Nighttime Limit, dBA
R1	2,550	44	45
R2	1,950	42	45
R3	2,160	43	45
R4	1,990	44	45
R5	2,200	44	45
R6	1,850	45	45
R7	2,190	44	45
R8	1,860	43	45
R9	2,690	44	45

The results from Table 3 indicate that sound levels at full operation of the wind project will be at or below the Maine DEP nighttime noise limits at the receiver points.

Dwelling locations have also been added to Figure 5, Sheets 1 and 2 and are presented in Table 4. Table 4 provides the owners names and ownership status of the properties that require a sound easement or ownership interest to be in compliance with regulatory requirements.

TABLE 4

PROPERTY DESIGNATIONS

Dwelling ID	Map(s)	Lot(s)	Parcel Owner	Document
D1	1	20-A	Collins	Lease
D2	1	21	Franco	Easement
D3	5	12	Gorham	Easement
D4	5	2-15	Greenlaw/Provost	Easement
D5	5	2-18	Michaud	Easement
D6	8	22	Sico	Easement
D7	8	29-6	Hartford	Easement
D8	8	29-8	Greenlaw	Easement
D9	8	23-2	Swallow	Easement
D10	5	7-1	Burpee	PSA

There are likely to be large fluctuations in wind speed from the hub height of the wind turbines at 262 feet to the regulated height of four to five feet above ground level. This can be a significant factor in sound emissions and outdoor propagation from both the wind project and ambient, non-turbine sound levels. The quietest periods of the day or night generally occur when the ground level and 10-meter winds are light or calm. In addition, as the wind speed incident on a wind turbine drops below 9

meters/sec, sound levels from the turbine are reduced. Ambient, non-turbine sound levels, particularly from wind forces acting on trees and vegetation, may increase significantly when the turbine wind speed reaches 9 meters/sec or greater, as required for full sound power.

Variations in wind speed with elevation (wind gradient) may result in very different wind speeds near the ground than at turbine/rotor heights. In addition, there may be areas near the ground that are shielded from winds at certain directions. For example, with the general ridge line direction running north-south, lower land to the east would be protected from a westerly wind. Under these conditions, high winds may be present near the top and to the west of the wind turbines, but winds may be relatively calm just east of the ridgeline. Consequently, the degree of masking by wind-induced ambient sound will fluctuate depending on the wind speed, direction, and location.

A regulated tonal sound occurs when the sound level in a one-third octave band exceeds the arithmetic average of the sound levels in the two adjacent one-third octave bands by a specified dB amount based on octave center frequencies (ref. Maine DEP 375.10.G.24). Turbine performance specifications indicate some potential for tonal sounds to occur in the 160 Hz third-octave band. Both the specifications and measurements of operating turbines by RSE indicate that the tonal threshold of 8 dBA is not likely to be exceeded. Therefore, the wind turbines are not expected to generate regulated tonal sounds.

Short duration repetitive (SDR) sounds are a sequence of sound events each clearly discernible that causes an increase of 6 dBA or more in the sound level observed before and after the event. SDR sound events are typically less than 10 seconds in duration and occur more than once within an hour. Measurements and observations by RSE during wind turbine operations indicate that sound levels can fluctuate over brief periods as noted by the passage of wind turbine blades. Observed measurements further indicate that overall broadband sound level fluctuations typically range from 2 to 4 dBA and thus do not result in the 6 dBA increase required to be SDR sounds as set forth in Maine DEP 375.10.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The primary objectives of the Sound Level Assessment were to determine applicable sound level limits at protected locations and lot lines, estimate future sound levels from the proposed wind power project, and evaluate compliance with applicable sound level limits. Existing land uses were identified using a combination of site maps, aerial images, and field observations. Sound level estimates of future wind operation were calculated using a terrain-based acoustic model.

Sound level limits were applied per Maine DEP 375.10 based on land use mapping, purchased and leased land, and landowner agreements. To be conservative with this sound level assessment, quiet limits of 45 dBA nighttime and 55 dBA daytime were utilized per Maine DEP regulations even though pre-development sound levels during conditions suitable for wind turbine operation can exceed Maine DEP thresholds for existing sound levels in a quiet area.

The results of this assessment indicate that sound levels from operation of the Oakfield Wind Project will not exceed Maine DEP sound levels limits during construction or routine operation and that regulated levels of tonal and short duration repetitive sounds are not expected to be produced. Specifically, model estimates show that sound levels from the wind project will be below the Maine DEP nighttime limit of 45 dBA within 500 feet of a residence at nearby protected locations. Model estimates show that the property limit of 75 dBA will also be met.

Prior to operation of the wind project, RSE recommends monitoring pre-development ambient sound levels at points representing nearby protected locations and during periods representing wind turbine

operating conditions. Ambient sound level measurements will provide useful data concerning the contribution of non-turbine sound levels during future operation of the wind project.

Once construction and startup of the wind project are complete, RSE recommends monitoring sound levels during routine operation to verify compliance with relevant Maine DEP sound level limits.

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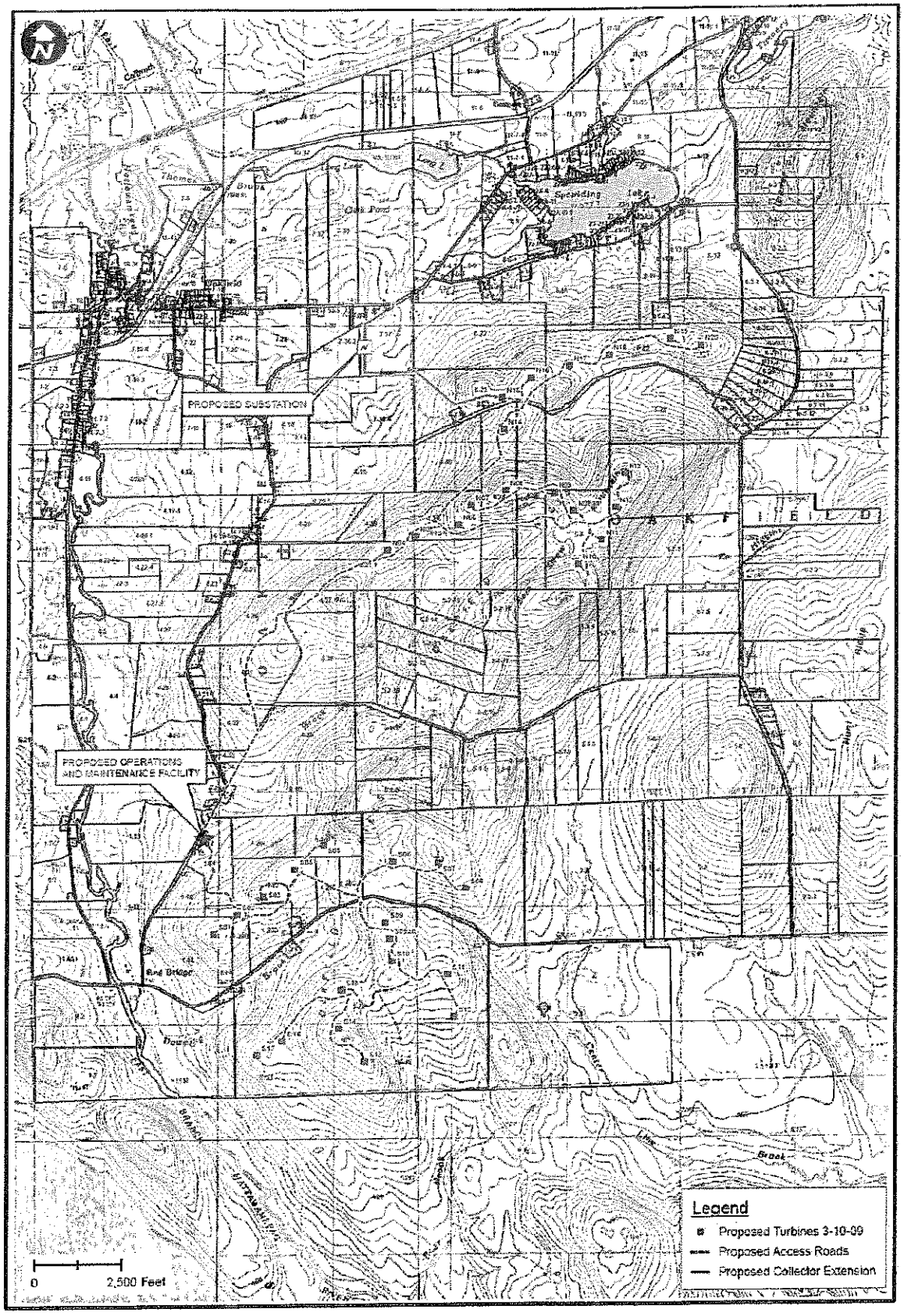
FIGURE 2. SITE LOCATION MAP



Source: Stantec Consulting, March 2009

FIGURE 3. VICINITY SITE PLAN (1 OF 2)

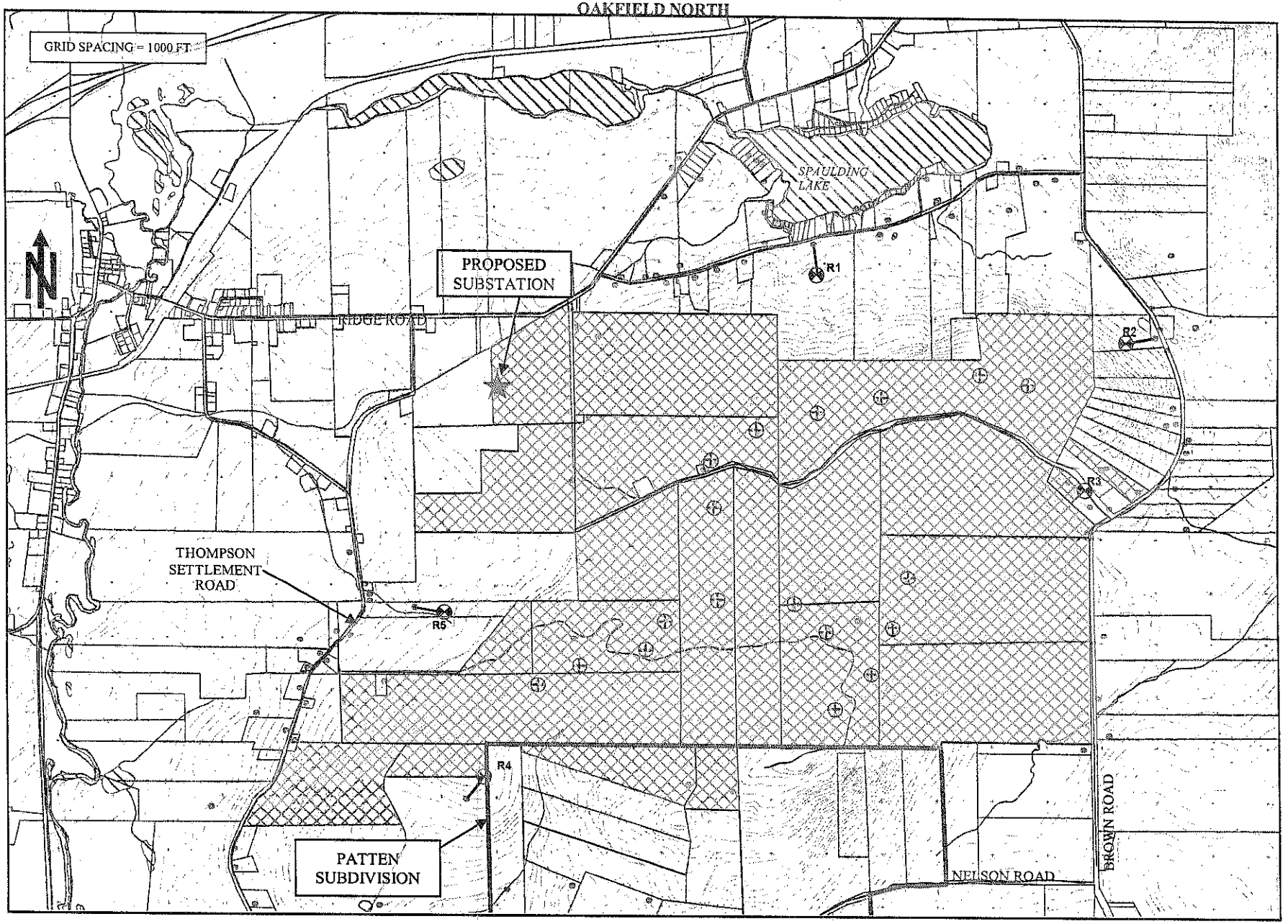
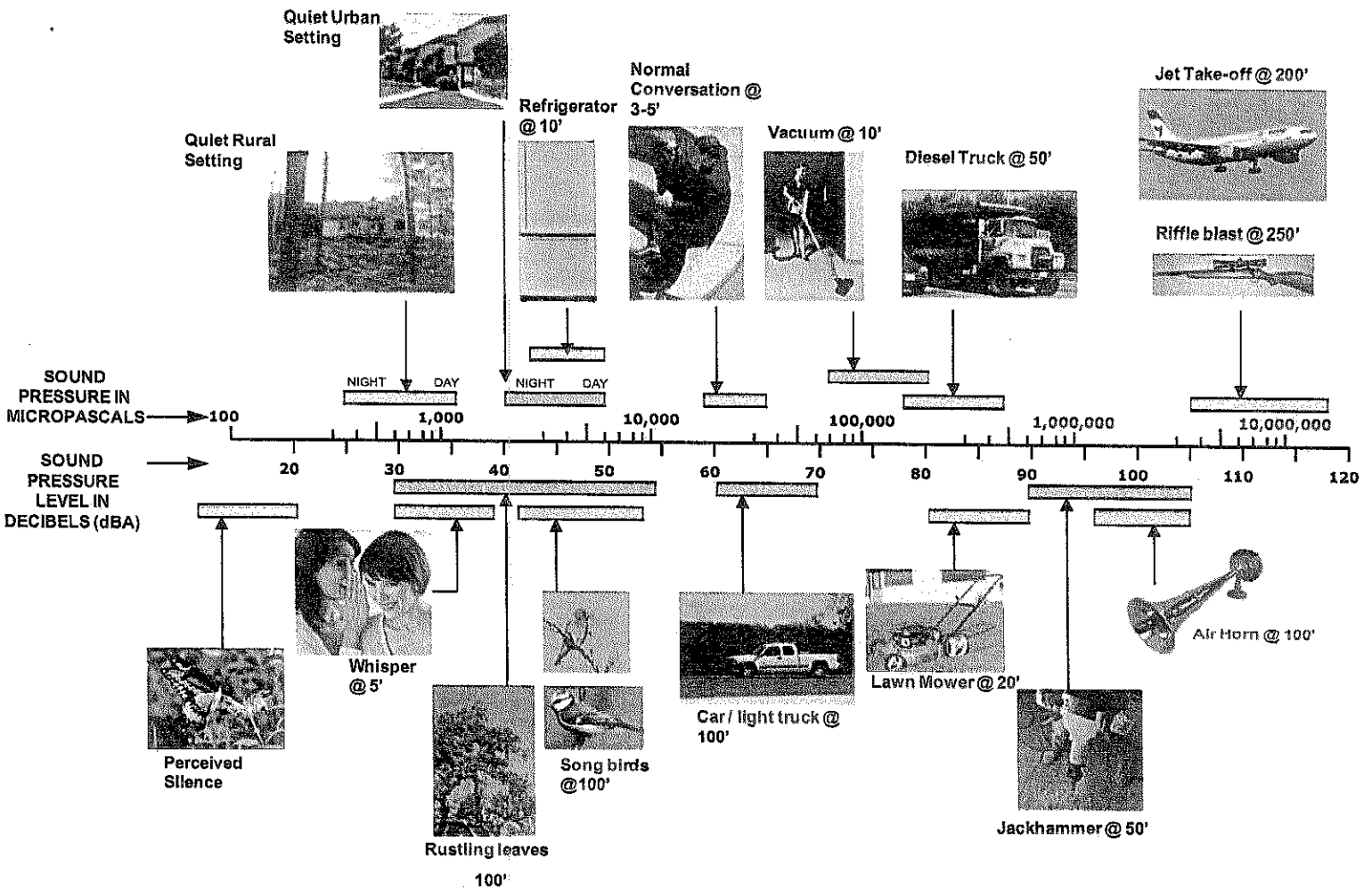


FIGURE 1

RELATION BETWEEN SOUND PRESSURE IN PASCALS AND TYPICAL SOUND PRESSURE LEVELS IN DECIBELS



Compiled by RSE from Multiple Sources including: RSE measurements; U.S.E.P.A, "Noise from Construction Equipment and Operations, Building Equipment and Home Appliances," Dec. 1971.; Handbook of Acoustical Measurements and Noise Control, Third Edition, edited by C.M. Harris, McGraw-Hill,1991.; "FHWA Highway Traffic Noise Prediction Model," U.S. Dept. of Transportation, Federal Highway Admin, Washington D.C., FHWA-RD-77-108, December 1978.; U.S.E.P.A, "Information on Levels Noise Requisite to Protect Health and Welfare with an Adequate Margin of Safety," March 1974.; Handbook of Environmental Acoustics, J.P.Cowan, Van Norstrand Reinhold, 1994.

FIGURE 3. VICINITY SITE PLAN (2 OF 2)

OAKFIELD SOUTH

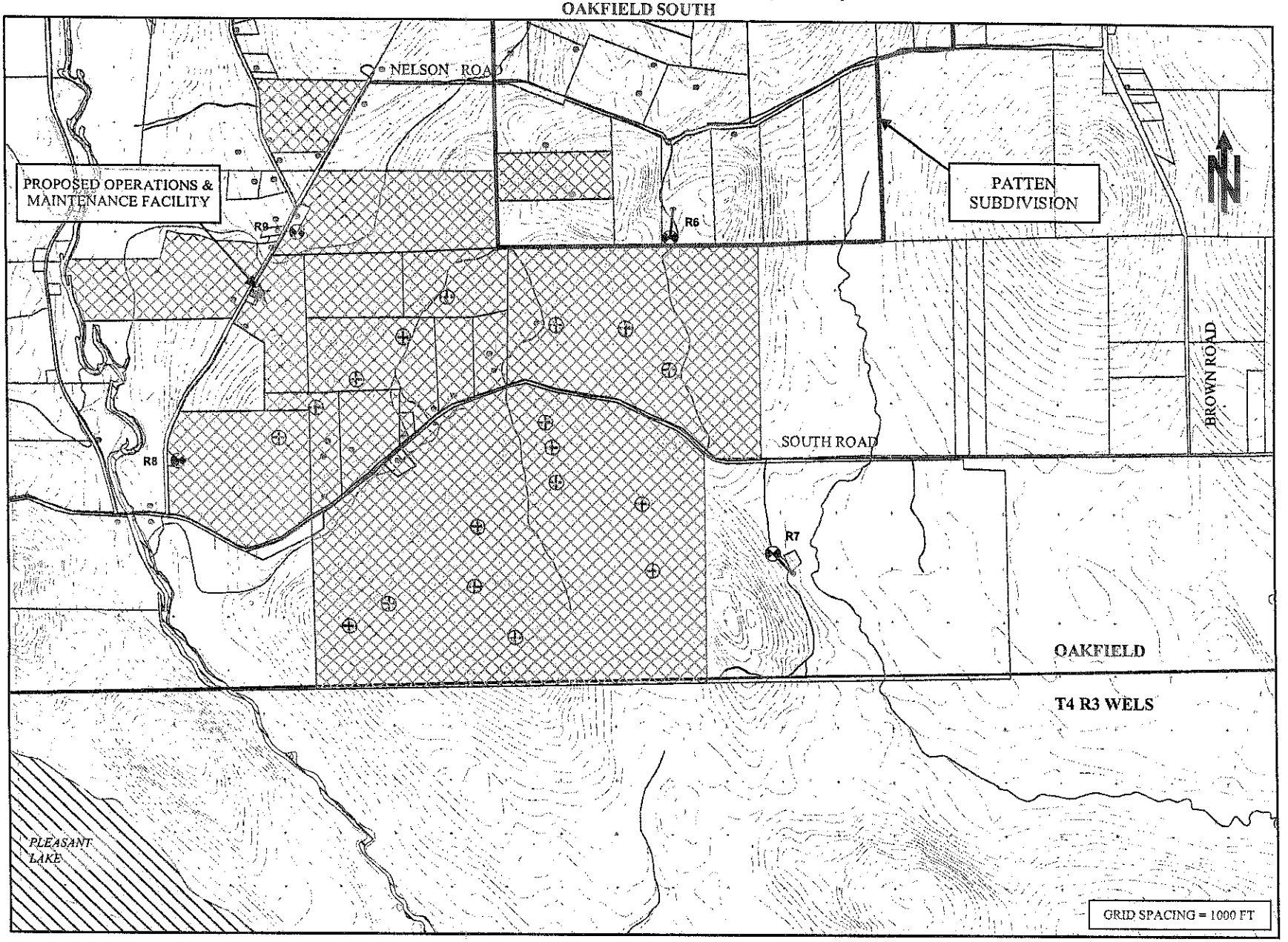
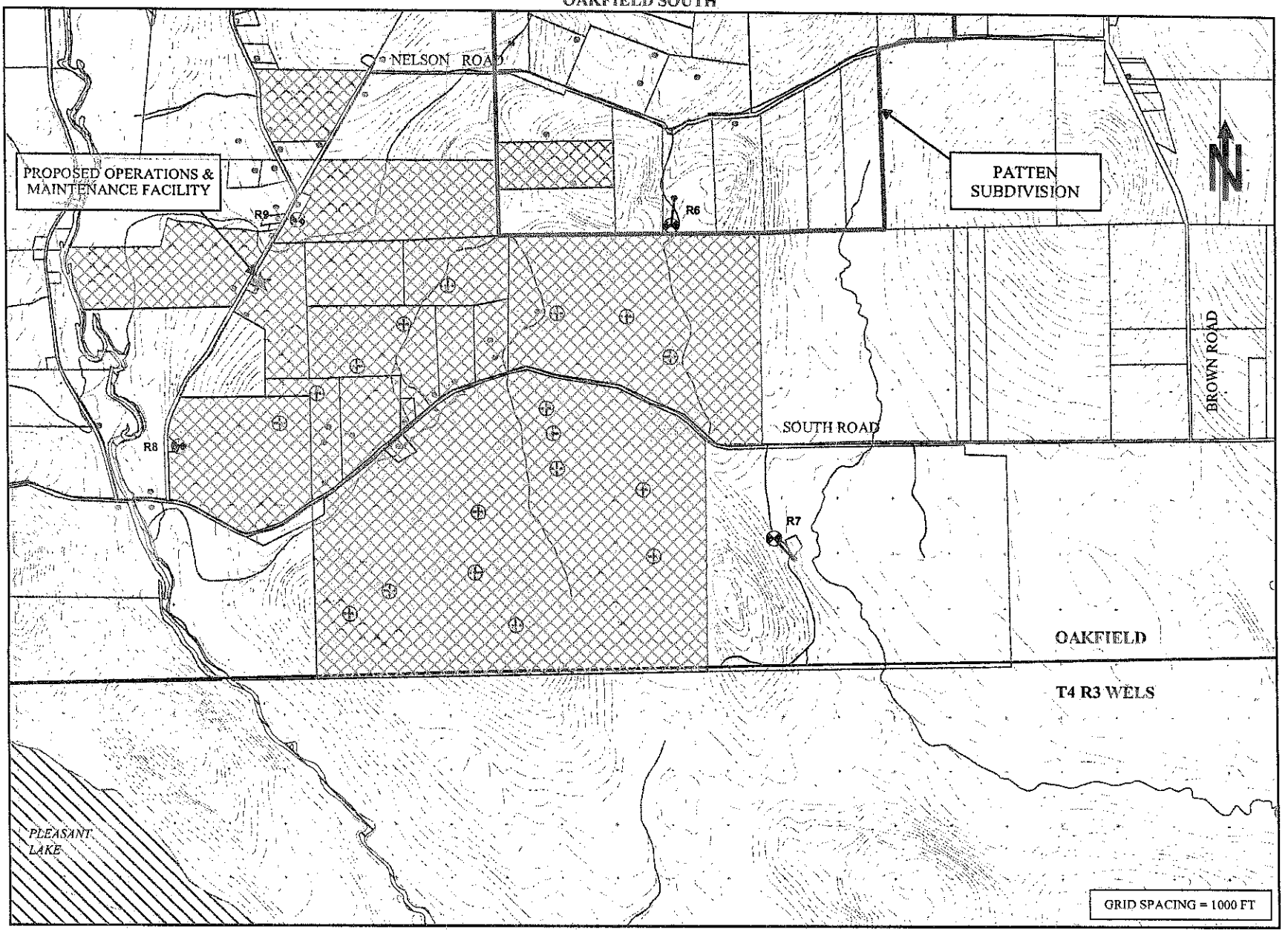
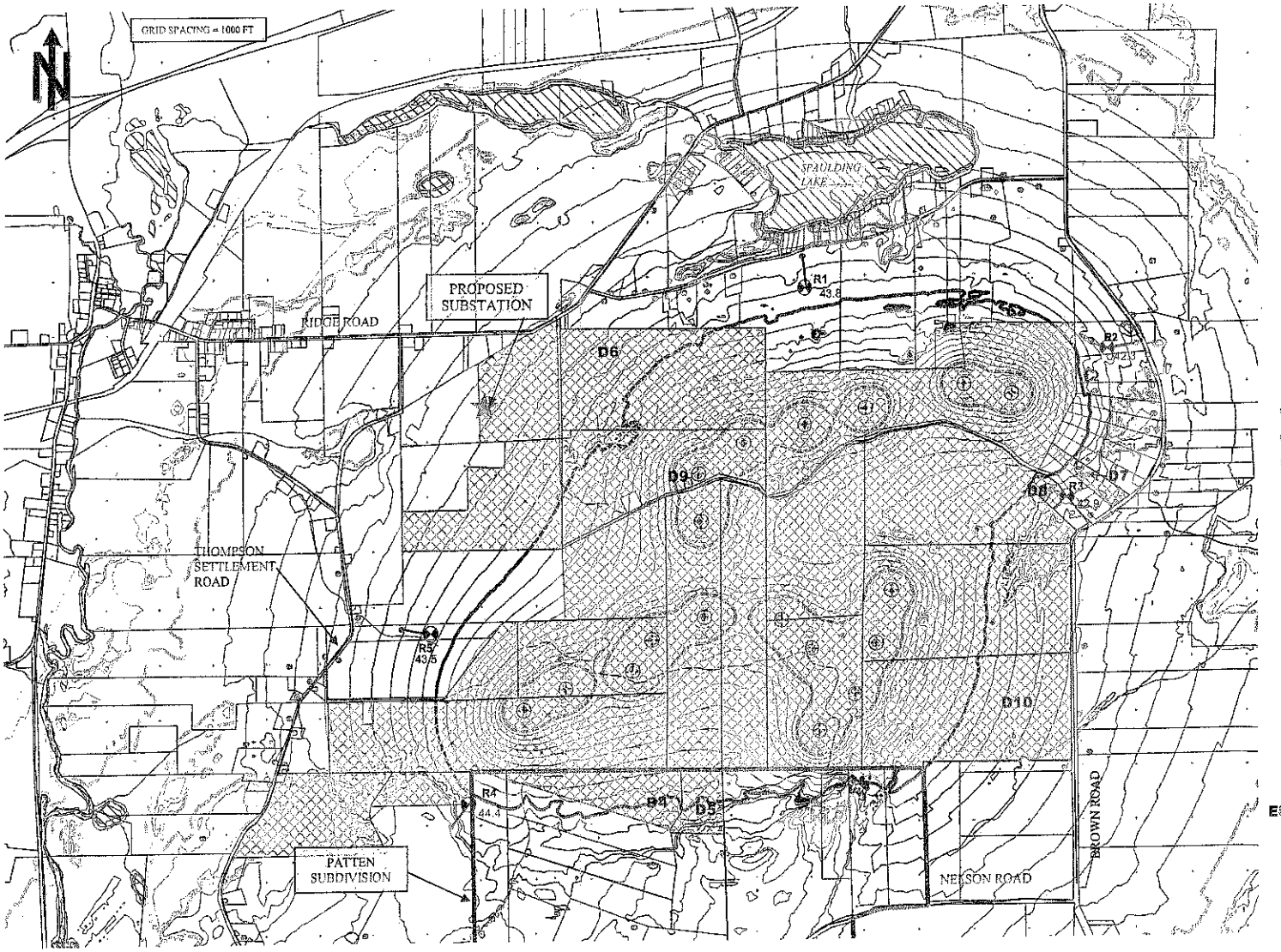


FIGURE 3. VICINITY SITE PLAN (2 OF 2)

OAKFIELD SOUTH





WIND TURBINE LOCATION

DWELLING LOCATION

LEASED OR PURCHASED

SOUND EASEMENT

42.3 RECEIVER POSITION & ESTIMATED SOUND LEVEL

= 55 dBA (MDEP DAYTIME LIMIT)

= 45 dBA (MDEP NIGHTTIME LIMIT)

= 35 dBA

SOUND LEVEL CONTOUR INTERVAL = 1 dBA

FIGURE 5.
ESTIMATED SOUND LEVEL CONTOURS
(1 OF 2)

OAKFIELD NORTH

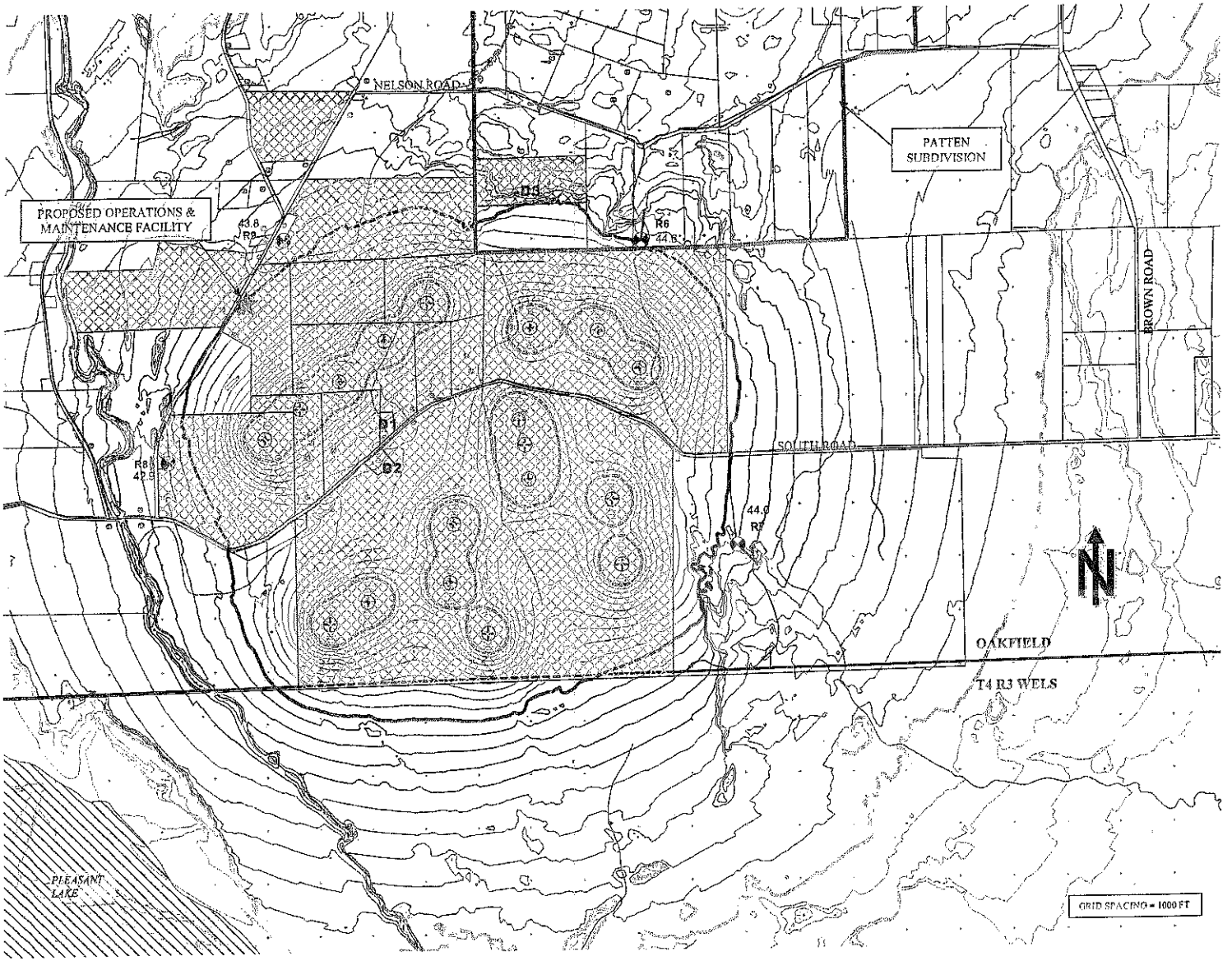
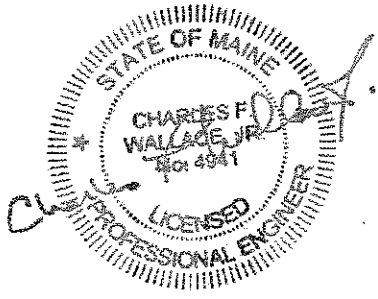


FIGURE 5.
ESTIMATED SOUND LEVEL CONTOURS
(2 OF 2)

OAKFIELD SOUTH

ACKNOWLEDGMENTS

Resource Systems Engineering (RSE) wishes to acknowledge the cooperation of area landowners in providing access to sound level monitoring positions in the vicinity of the Stetson Wind Project. RSE also wishes to thank First Wind Energy, LLC and Evergreen Wind V, LLC for their assistance during conduct of the Compliance Sound Level Study. RSE personnel responsible for this investigation and report are Charles F. Wallace, Jr., P.E., R. Scott Bodwell, P.E., Tina J. Jones and Charles F. Wallace, III.



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First Wind Energy, LLC
Evergreen Wind V, LLC
Stetson Wind Project
T8R3 and T8R4, NBPP, Washington County, Maine

OPERATIONS COMPLIANCE SOUND LEVEL STUDY

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LIST OF ACRONYMS

ANSI	American National Standards Institute
dB	Decibel (Unit of Sound Pressure Level)
dBA	Decibel A-weighted
Hg	mercury
Hz	Hertz (cycles per second)
IEC	International Electrotechnical Commission
In	inches
ISO	International Organization for Standardization
kW	Kilowatt
kWH	Kilowatt Hour
L_nS	Sound Level Exceeded n% of a Measurement Period
L_{A1}	Sound Level Exceeded 1% of a Measurement Period
L_{A10}	Sound Level Exceeded 10% of a Measurement Period
L_{A50}	Sound Level Exceeded 50% of a Measurement Period
L_{A90}	Sound Level Exceeded 90% of a Measurement Period
L_{Aeq}	Equivalent Sound Level
LD	Larson Davis
LMG	LM Glasfiber
LURC	Land Use Regulation Commission
Lw	Sound Power Level
m/s	meters per second
mph	Miles per hour
msl	mean sea level
MW	Megawatt
rpm	revolutions per minute
RSE	Resource Systems Engineering
SWP	Stetson Wind Project

* Sound Pressure Level is represented by the term Sound Level in this report.

LIST OF ACRONYMS

ANSI	American National Standards Institute
dB	Decibel (Unit of Sound Pressure Level) (re 20 Micropascals)
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msl	mean sea level
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SWP	Stetson Wind Project

* Sound Pressure Level is represented by the term Sound Level in this report.

EXECUTIVE SUMMARY

In 2007, First Wind, LLC/Evergreen Wind V, included a Sound Assessment in the Land Use Regulation Commission (LURC) development permit application for the Stetson Wind Project (SWP). Sound level estimates for the proposed 38 turbine wind energy project were calculated using a two dimensional spreadsheet model developed by Resource Systems Engineering (RSE). A LURC *Final Development Plan Permit*, DP 4788, was issued on January 2, 2008. In accordance with Condition 6 of DP 4788, Resource Systems Engineering (RSE) recorded ambient sound level measurements in April 2008 and provided a final report, *Ambient Sound Level Measurements*, October, 16, 2008. Also pursuant to the LURC permit, RSE recorded sound level measurements during routine operation of SWP in May 2009. The primary objective of the May 2009 Sound Level Study was to determine compliance with LURC permit *Findings of Fact – Conclusion D1 and Condition Number 6 Noise*. Measurements were recorded at four positions that were approved by LURC in advance of testing. Prior to testing, and with LURC concurrence, a fourth position was added to the original LURC requirements to ensure that at least one location was in the downwind position from operating wind turbines. Measurements and observations confirmed that rigorous testing occurred during nearly ideal conditions when wind turbines were most noticeable.

As part of the compliance demonstration, a three dimensional sound level prediction model was developed in 2009 for the as-built project. The 2009 model was developed using CadnaA computer software in accordance with the internationally recognized standard for propagation of sound levels outdoors, ISO 9613-2. Conservative model parameters were used with sound power levels derived from GE data, the turbine manufacturer. Sound level measurements of routine operations were compared to 2007 estimates, 2008 ambient sound levels, and the 2009 model of the as-built project. An important secondary objective verified the conservative nature of the 2009 model projections. Therefore, when reviewed in conjunction with measurements at select downwind positions, the 2009 model predictions can be relied upon for compliance determination at all other offsite locations and during downwind conditions.

Data from local meteorological stations (10 meter height) were used to identify periods of low surface winds that occurred while wind turbine power output data demonstrated operations at or above full rated sound power emissions (i.e. 60% of electric power generation capacity). For the periods when wind turbine sound levels were most noticeable, actual power generation was at or near 100% of generation capacity. Sound levels were measured at 10-minute intervals and shorter time history periods (i.e. 1-minute and 50-millisecond). Ten-minute data was compiled on an hourly basis for one representative overnight period to summarize overall operating sound levels historically used by LURC for compliance demonstration. Figures E-1 to E-4 summarize hourly sound level and wind data. Figures E-1 to E-4 clearly show compliance at all positions when sound levels of the project were continuously measured and observed to be most noticeable - the nighttime of May 21-22, 2009. Total hourly average sound levels, L_{Aeq}, of combined ambient and turbine sound were well below the 55 dBA limit for the entire measurement period. Figures E-1 to E-4 also show L_ns for additional comparisons. The difference between nighttime L_{Aeq} and L_{A90} of 1 to 2 dBA at both CP-1 and CP-4 further confirms that wind turbines produced the prominent sound levels during this period with relatively minor contribution from extraneous sources. Though not required for compliance with LURC Permit DP 4748 *Findings of Fact – Conclusion D1 and Condition Number 6 Noise*, data in the body of the report are presented on a 10-minute basis to allow more detailed analyses.

Similar to wind project sound levels, ambient sound levels vary with wind speed. Sound levels from SWP operations were generally higher than the nighttime range of ambient sound level at CP-1, CP-2 and CP-4. At CP-3, located 6,200 feet from the nearest wind turbine, SWP sound levels were at or well below ambient sound levels.

Position CP-1 was selected to represent the nearest location where LURC noise limits apply. During periods with wind turbines most noticeable, the highest measured 10-minute average sound level at CP-1 was 8 dBA below the LURC nighttime limit of 55 dBA. The highest wind turbine sound levels during these periods were 5 to 9 dBA below the 2007 estimates and 3 to 7 dBA below the 2009 as-built model prediction (see Table 7-3).

Position CP-4 was selected to ensure measurements of SWP operations were downwind from the predominant wind direction expected for full sound power emission under stable atmospheric conditions and with low surface winds (i.e.=/<below 6 mph). These are the conditions when SWP sound is most noticeable. Results demonstrate that CP-4 was the best position to measure downwind sound levels and to verify the conservative nature of the 2009 model predictions. Figure E-5 presents an excerpt of the 2009 model and compares the range of 10-minute, measured sound levels to model projections. Measurement results at CP-4 confirm that RSE's estimates are conservative and tended to overstate actual sound levels from operation of the Stetson Wind Project.

RSE recommends that no further testing is required to demonstrate compliance because rigorous sound level measurements at the nearest position where LURC limits apply were well below the 55 dBA limit.

1.0 INTRODUCTION

The objective of this Sound Level Study was to determine compliance with the Land Use Regulation Commission (LURC) Findings of Fact – Conclusion D1 and Condition Number 6 Noise. Compliance was determined by measuring sound levels during routine operations of the Stetson Wind Project (SWP). Measurements were recorded under a variety of conditions including periods when wind turbines were operating at or above 60% of electrical power output. According to General Electric Company (GE) specifications, 60% of electrical power output equates to 100% of the sound power level. All pertinent recorded sound data is reported. Only measurements recorded with nearby wind turbines operating at or above 60% of electrical power output with average surface level winds equal or less than 6 mph (2.7 m/s) were used to compare wind turbine sound levels with LURC Permit limits. Measurements from these periods were also compared to estimates of sound levels and ambient sound levels in the vicinity of SWP.

In March 2007, Resource Systems Engineering (RSE) completed a sound assessment of SWP as part of the Preliminary Development Permit Application submitted to LURC. In the sound assessment RSE estimated future sound levels from routine operation of the proposed project. The estimated sound levels were compared with relevant LURC sound level limits. As proposed, the Wind Project consisted of 38 wind turbines, and three alternate sites, for a total generating capacity of 57 megawatt (MW).

LURC adopted Chapter 10, Land Use Districts and Standards, for areas within its jurisdiction. The latest revision of these standards was adopted November 7, 2005. Sub-Chapter III *Land Use Standards* Section 10.25.F.1 *Noise* establishes noise standards for unorganized territory in the State of Maine. Maximum allowable noise levels produced by a development vary by land use subdistrict.

The Stetson Wind Project received approval from LURC on January 2, 2008 as Final Development Plan Permit DP 4788 Findings of Fact and Decision. Conclusion D.1.c states "that the applicant's proposal for pre- and post-construction sound monitoring and reporting is appropriate. The results of the sound monitoring must be reported to the Commission quarterly for the first year of operation, after which time the results will be reviewed by the Commission to determine if any mitigation of noise is necessary, and whether the monitoring must be continued. The Commission also concludes that during operation, at the D-PD Subdistrict boundaries the sound level must not exceed 55 dBA. If the sound level at the D-PD Subdistrict boundaries during operation exceeds 55 dBA, the applicant must propose remedial measures to the Commission for review and approval. During construction, from 7 am to 7 pm sound levels may be as needed to complete the construction. From 7 pm to 7 am (nighttime) during construction, sound levels must not exceed 55 dBA at the parcel boundary, except as needed for safety signals, warning devices, emergency pressure relief values, other emergency activities, and traffic on roadways."

On April 25 to 26, 2008 RSE measured ambient sound levels at four locations in the vicinity of the SWP prior to commercial operation, the results were submitted to LURC as ***Ambient Sound Level Measurement*** report dated October 16, 2008. In May 2009, RSE measured sound levels at four similar locations during routine operation. Except for unforeseen shutdowns for repair or maintenance and curtailments, all wind turbines were generating electric power at rates determined by wind conditions at Stetson Mountain. For compliance determination, measurements were recorded when wind turbine sounds were dominant and operating at or above 60% of rated power output (100% of sound power) while surface winds were low and extraneous sources were minimal.

The following presents a brief description of SWP, a summary of LURC noise limits, sound level estimates from 2007 and results of ambient measurements from April 2008. An acoustic model of the as-built wind project was developed in 2009 to estimate wind turbine sound levels at the measurement locations. Measured sound levels during SWP operation are compared to ambient sound levels, sound level estimates provided to LURC, 2009 model estimates and LURC sound level limits

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2.0 SOUND AND DECIBELS

Sound is a rapid fluctuation in pressure that the human ear has the potential to detect. The decibel or dB is the unit of measurement for sound. The decibel scale is logarithmic to avoid large unmanageable numbers normally associated with pressure change. Further explanation of sound basics can be found in Appendix I.

3.0 SITE DESCRIPTION

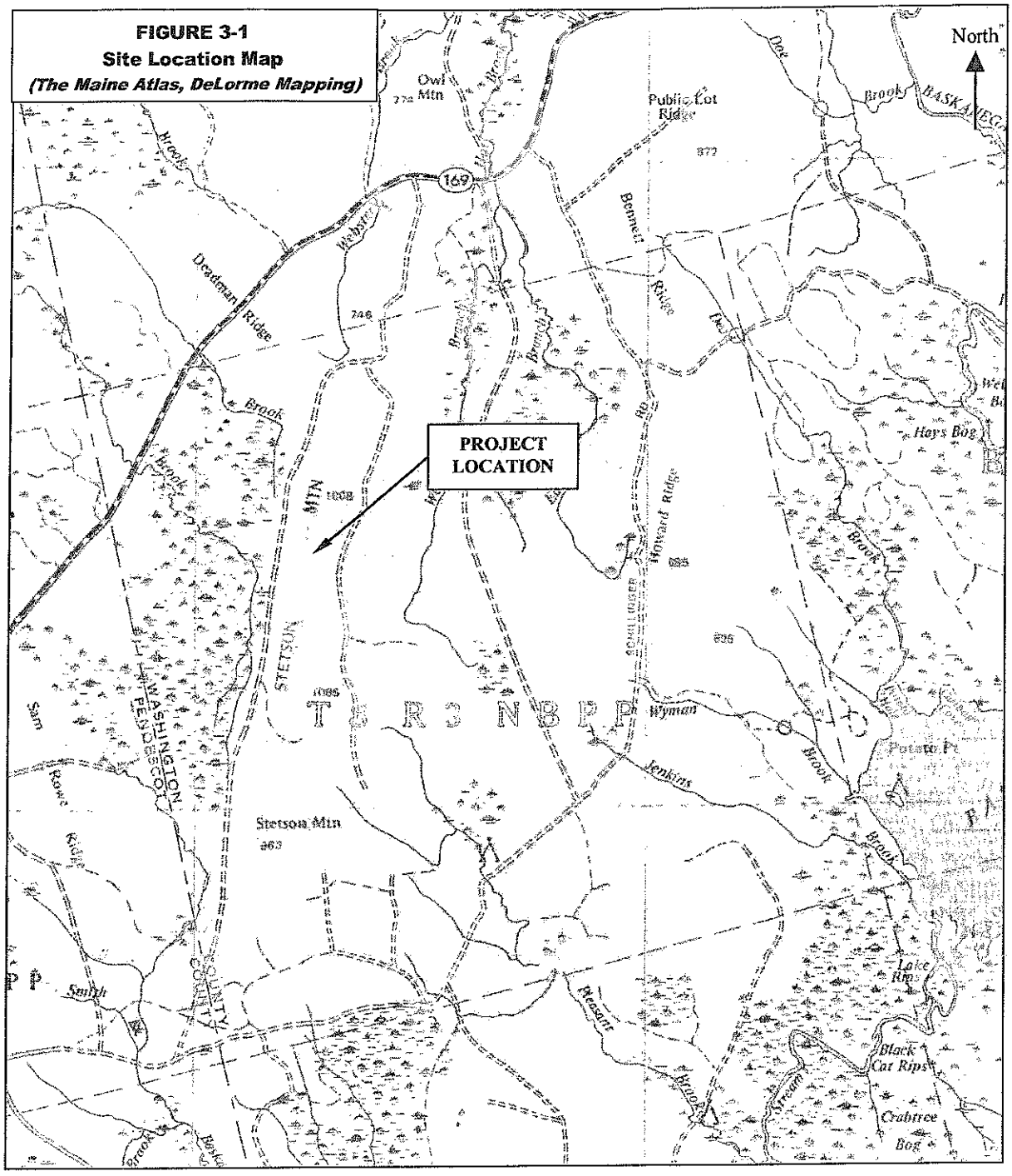
The Stetson Wind Project is located in a remote area of Maine's Washington County. Prior to development, the designated project area was zoned by LURC as General Management Subdistrict, with inclusions of protection subdistricts for wetlands and streams. Evergreen sought and obtained rezoning of the project area to a Planned Development Subdistrict (DP-D) and received regulatory approval from LURC for a wind project consisting of 38 General Electric turbines with an output of 1.5 MW per turbine.

Surrounding land uses consist primarily of forested land used for professionally managed, commercial wood harvesting operations. Other land uses include private logging roads, utility rights-of-way, undeveloped land where commercial harvesting does not occur, and seasonal camps. Some seasonal camps are located on leased parcels of land. The nearest public road is Route 169 that passes within approximately one half mile of the north end of SWP. A Site Location map is shown as Figure 3-1.

Evergreen leases most of T8 R3 NBPP and the project area in T8 R4 NBPP. In the southwest corner of the project, the property boundary is also defined by the boundary line between Penobscot and Washington Counties, and the boundary line between the townships of Prentiss and T8 R3 NBPP. This boundary also forms the limit of the proposed DP-D subdistrict rezoned for the project. With the exception of the southwest corner, the proposed wind turbines are more than 1,500 feet from the rezone area boundary. Here, the distance from the southernmost turbine to the property boundary is approximately 900 feet. The abutting property contains a seasonal camp which is located approximately 2,600 feet from the nearest wind turbine.

Figure 3-2, Proposed Vicinity Site Plan, shows all wind turbine sites and substation location as proposed in relation to the geographical features, rezone area boundary, subdistrict boundaries, and surrounding land uses. Selection of the turbine sites was based on studies related to meteorology, natural resources, and noise emissions as well as other environmental factors. As constructed, SWP consists of 38 wind turbines, access roads, a power collection system, a substation, and an operations/maintenance building. The turbines run north–south along Stetson ridge at elevations varying from 600 to 1,100 feet msl; spacing between turbines ranges from 715 feet to over 2,500 feet. Figure 3-3 shows the 38 wind turbines with sound level estimates calculated in 2009 for as-built conditions.

FIGURE 3-1
Site Location Map
(The Maine Atlas, DeLorme Mapping)



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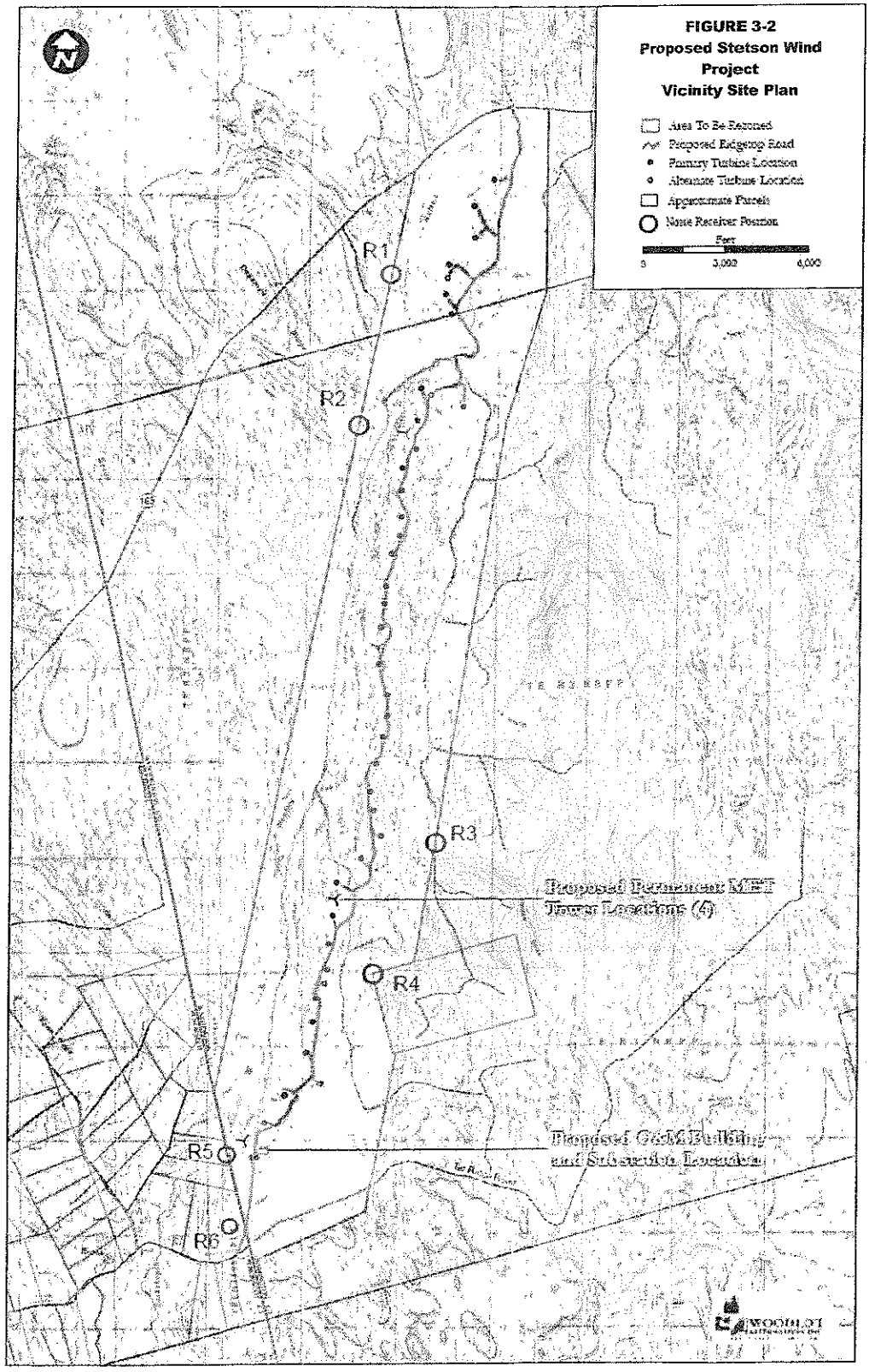
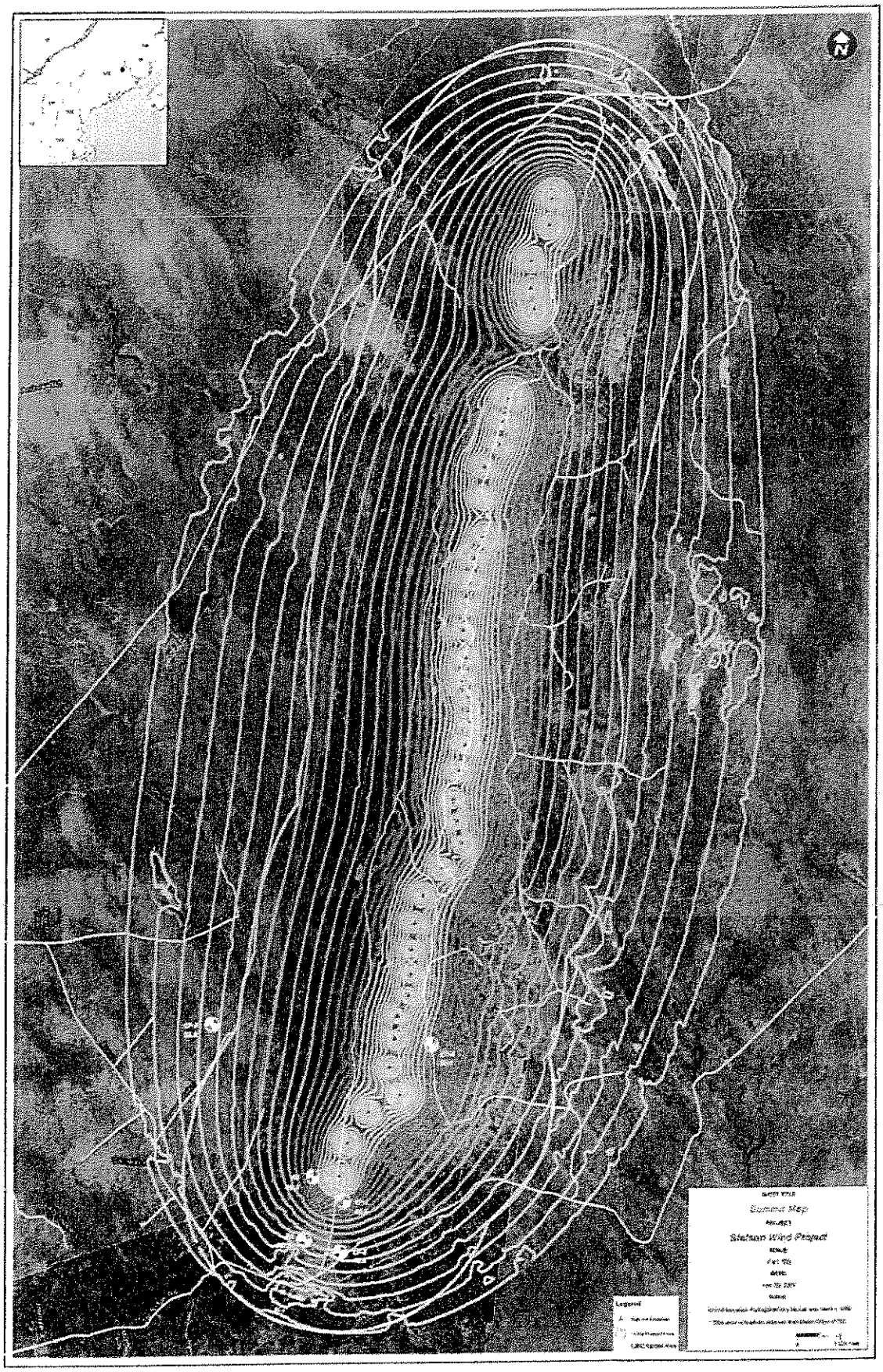


FIGURE 3-2
Proposed Stetson Wind Project
Vicinity Site Plan
Area To Be Rezoned
Proposed Ridgetop Road
Primary Turbine Location
Alternate Turbine Location
Approximate Parcels
Noise Receiver Position
Feet
0
3,000
6,000
R1
R2
R3
R4
R5
R6
Proposed Permanent MET Tower Locations (4)
Proposed O&M Building and Substation Locations
WOODLOT

Figure 3-3

Stetson Wind Project with as-built Sound Level Estimate Contours



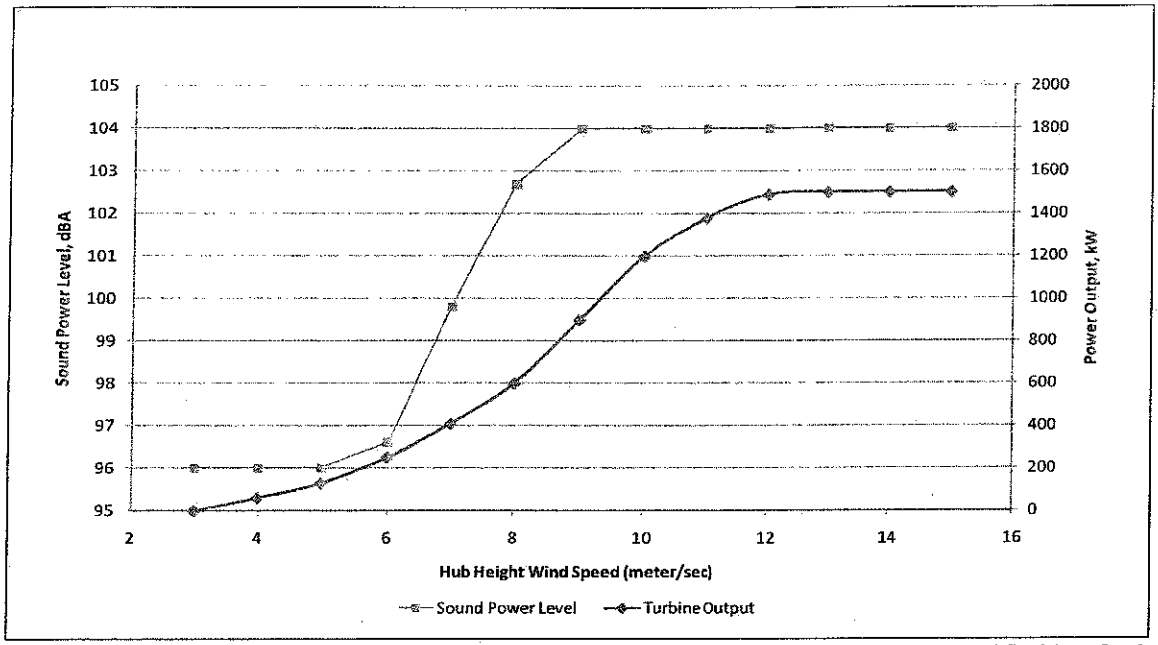
Wind Turbines - Evergreen installed the widely-used General Electric (GE) 1.5sle model wind turbines with a rated electric generating capacity of 1500 kilowatts (kW) (1.5 megawatts (MW)). The turbines feature variable speed control for constant frequency power. Each turbine consists of a free-standing monopole tower, an enclosed nacelle mounted at the top of the tower, and an upwind-mounted, three-blade rotor.

The turbines have hub heights of 80 meters (262 feet) above the base elevation; and rotor diameters of 77 meters (253 feet). Maximum heights, measured from the ground to the vertical tip with the blade fully extended, are approximately 119 meters (389 feet). The turbines begin rotating (cut-in) at hub height wind speeds of 3 to 4 meters/second (6.7 to 8.9 mph), and shutdown (cut-out) when winds reach 25 meters/second (56 mph). Rotation speed varies from about 10 to 22 rpm, or approximately one rotation every three to six seconds.

Major components of the wind turbine are a three-blade rotor; main shaft, gear box, and generator installed inside the nacelle (enclosure) at hub height, and a pad-mounted transformer at ground level. The blades installed at SWP are manufactured by LM Glasfiber (LMG) as Model LM37.3 P2. Information on the LMG web site (lmglasfiber.com) states that the blades employ "vortex generators" and a "low-noise" tip that optimizes both noise and performance.

According to information from General Electric, the GE 1.5sle wind turbine reaches full power generation of 1500 kW at a wind speed of 11.5 m/s (25.7 mph) at the hub height. Figure 3-4 presents a power generation curve for the model 1.5sle GE wind turbines and the sound power level in relation to wind speed at the hub height. Reviewing the information from Figure 3-4 indicates that the GE 1.5sle reaches its maximum sound power level at an electric power output of approximately 900 kW or 60% of full generating capacity. This level of operation is achieved when full rotor rpm is reached at a wind speed of 9 meters per second (20.1 mph) at the hub height of the wind turbine. The sound level specification indicates that the sound emissions do not increase once this rate of wind speed and electric power output occurs.

Figure 3-4. Power Generation of GE 1.5 MW Wind Turbines and Sound Power Level in Relation to Wind Speed at the Hub Height



**Excludes Uncertainty Factor of ± 2 dBA per GE Technical Documentation – Noise Emission Characteristics (2005) and Confidence Level of +2dBA per GE Technical Specification – Noise Emission Compliance, GE Wind Energy, May 2005.*

Sound level performance specifications for the GE 1.5sle wind turbine provide information on how the sound power level emitted by the wind turbine varies with wind speed. The GE specification sound power levels represent sound from the entire wind turbine generator system as a point source at the hub (rotor center) and were simulated in accordance with IEC International Standard 61400-11, Wind Turbine Generator Systems – Acoustic Noise Measurement Techniques. As discussed in Appendix I, the sound power level or L_w is a logarithmic measure of sound expressed in decibels compared to a specified reference level of 10^{-12} watts. The sound pressure level at 50 feet is approximately 32 dBA less than the sound power level of a point source. The maximum continuous sound power level for the 1.5sle wind turbine is 104 dBA, which is equivalent to a sound pressure level of 72 dBA at 50 feet[1]. Typical uncertainty for the specification sound power level is plus or minus 2 dBA.

4.0 MAINE LAND USE REGULATION COMMISSION (MAINE DEPARTMENT OF CONSERVATION) STANDARDS

LURC adopted Chapter 10, Land Use Districts and Standards, for areas within its jurisdiction. The latest revision of these standards was adopted November 7, 2005. Sub-Chapter III *Land Use Standards* Section 10.25.F.1 *Noise* establishes noise standards for unorganized territory in the State of Maine. Maximum allowable noise levels produced by a development vary by land use subdistrict. The LURC noise standard reads as follows:

"a. The maximum permissible sound pressure level of any continuous, regular or frequent source of sound produced by any commercial, industrial and other non-residential development shall be as established by the time period and type of land use subdistrict listed below. Sound pressure levels shall be measured at all property boundary lines, at a height of at least 4 feet above the ground

[1] From attenuation due to hemispherical radiation = 10 log ($2\pi R^2$) where R is the distance in meters. Sound dispersion level at 50 feet from a wind turbine is for comparison purposes and could not actually be measured.

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surface. The levels specified below may be exceeded by 10 dB(A) for a single period, no longer than 15 minutes per day.

Subdistrict	7:00 AM to 7:00 PM	7:00 PM to 7:00 AM
D-CI, D-MT, and D-ES	70 dB(A)	65 dB(A)
D-GN, and D-GN2	65 dB(A)	55 dB(A)
D-PD	As determined by the Commission.	
All Other Subdistricts	55 dB(A)	45 dB(A)

Table 10.25, F-1. Sound pressure level limits.

b. The following activities are exempt from the requirements of Section 10.25,F,1,a:
(1) Sounds emanating from construction-related activities conducted between 7:00 A.M. and 7:00 P.M.;
(2) Sounds emanating from safety signals, warning devices, emergency pressure relief valves, and other emergency activities; and
(3) Sounds emanating from traffic on roadways or other transportation facilities."

The Stetson Wind Project is located within an area that was rezoned as Planned Development Subdistrict (D-PD). As set forth in Subsection F.1, the maximum permissible sound levels in a D-PD zone are "as determined by the Commission". According to the LURC Final Development Plan Permit DP4788, sound level limits for this newly created D-PD zone is 55 dBA.

5.0 SOUND LEVEL ESTIMATES FOR WIND PROJECT OPERATION

In 2007, prior to construction and operation of SWP, RSE estimated sound levels from operation of the proposed wind project based on wind turbine specifications and distances from the wind turbines to receiver points along the perimeter of the rezone area.

RSE calculated sound levels for simultaneous operation of the GE 1.5sle wind turbines, at both proposed and alternate sites, at 95% of rated power as defined by GE Energy. These near-full load conditions exist with a wind speed of approximately 11 meters per second (22.6 miles per hour) at the turbine hub. The wind turbines were treated as point sources at the hub height of 80 meters (262 feet) above base/grade elevation using sound power levels from GE Energy (Technical Documentation Wind Turbine Generator System GE 1.5sl/sle 50 & 60 Hz, Noise Emission Characteristics, 2005). GE Energy simulated turbine sound power levels to be in accordance with International Electrotechnical Commission (IEC) Standard 61400-11, Wind Turbine Generator Systems – Part 11: Acoustic Noise Measurement Techniques, 2002.

Sound levels from wind turbine operation were calculated for six receiver positions (R1 to R6) in the vicinity of the wind project. Receiver positions R1 to R5 are located at points along the perimeter of the rezone area in close proximity to multiple wind turbines. Sound levels at these receiver positions have the greatest potential to exceed the LURC nighttime limit of 55 dBA. Receiver R6 is located at the nearest dwelling (seasonal camp) to the wind turbines. Figure 3-2 shows the locations of the receiver points and proposed turbine locations and alternates.

RSE submitted a sound assessment report which can be found in the LURC application Section III.S. Table 5-1 shows the estimated sound levels from wind turbine operations as presented in the sound assessment.

TABLE 5-1 ESTIMATED SOUND LEVELS FROM WIND TURBINE OPERATION			
Receiver Position	Horizontal Distance to Nearest Wind Turbine, Feet	Estimated Sound Level, dBA	LURC Nighttime Noise Limit, dBA
R1	1908	50	55
R2	2056	50	55
R3	1900	49	55
R4	1575	51	55
R5	922	52	55
R6	2635	44	N/A

In 2009, RSE developed a computer prediction model for Stetson Mountain to conservatively estimate sound levels from simultaneous operation of wind turbines at all 38 turbine locations. The acoustic model was developed using the CADNA/A software program to map area terrain in three dimensions, locate as-built wind turbines and calculate outdoor sound propagation from the wind turbines. Area topography and as-built wind turbine locations, for entry into CADNA, were provided to RSE by Stantec based on USGS topographic information and project design.

RSE calculated sound levels for simultaneous operation of the GE 1.5sle wind turbines at all 38 as-built wind turbine locations at full sound power. These moderate (60%) to full load (100%) conditions exist with wind speeds at or above 9 meters per second (20.1 miles per hour) at the turbine hub. The wind turbines were modeled as point sources at the hub height of 80 meters (262 feet) above base/grade elevation using sound power levels and frequency characteristics from GE Energy (Technical Documentation Wind Turbine Generator System GE 1.5 sl/sle 50 & 60 Hz, Noise Emission Characteristics, 2005). RSE's sound level estimates are based on the specified operating sound level at full sound power plus an uncertainty factor of plus 2 dBA (i.e. L_{wA} equal to 106 dBA). The uncertainty factor is based on the GE specification. An additional 3 dBA was added to reflect the upper level of measurements by RSE of similar turbines during full operation. The overall total sound power level applied in the 2009 model was 109 dBA. Sound levels from the wind turbines are not expected to increase at wind speeds greater than 9 meters/sec. Sound level attenuation from the wind turbines to the receiver points was calculated by the acoustic model in accordance with International Standards Organization (ISO) standard 9613-2 "*Attenuation of sound during propagation outdoors*". ISO 9613-2 is an international standard commonly used for predicting sound levels from a sound source for moderate downwind condition in all directions. The 2009 model used the spectral option with no attenuation due to vegetation and a ground absorption factor of G = 0.5. The accuracy of ISO 9613-2 method is +/- 3 dBA. The methods of ISO 9613-2 are also recommended by independent noise consultants who sat on the European DTI/BERR Noise Working Group on wind turbine noise in 2006/2007. (Ref: ***Prediction and assessment of wind turbine noise. Agreement about relevant factors for noise assessment from wind energy projects***. Bowdler, et. al. Acoustics Bulletin March/April 2009 pp 35-37.) Results from the 2009 as-built model estimate can be found on Figure 3-3.

6.0 AMBIENT SOUND LEVELS

RSE measured ambient sound levels at four locations (Position A through D) near SWP over a 24-hour period from April 25 to 26, 2008. The project was under construction at the time of measurements but no construction activity occurred during ambient measurements. The monitoring positions shown on Figure 6-1 are described as follows:

Position	Description
A	Located on a residential property on Rosewood Lane. Position A represents ambient sound levels at the nearest residential property west of Stetson Mountain.
B	Located on the south end of Stetson Mountain approximately 245 feet west of the OEM Building. Position B represents the ambient sound levels west of the wind project and Receiver Position R5.

C Located south of the project on Tar Ridge Road approximately 189 feet east of Atlas Road. Position C represents ambient sound levels south of the wind project and Receiver Position R6.

D Located near the north end of Stetson Mountain at Turbine site #31. Position D represents ambient sound levels in the area of Receiver Positions R1 and R2.

On April 25 to 26, 2008, temperatures ranged from 25 to 59 degrees F and relative humidity ranged from 21% to 81%. Observations indicated surface winds to be calm to 5 mph from the east and northeast. Skies were mostly clear during the day and night. From Houlton weather data, surface wind speeds ranged from 0 to 10 mph except in the late afternoon on April 25, when surface wind speeds were 12 to 15 mph. There were several hours during the overnight period when surface winds were calm. Ridge top wind speeds ranged from 7 to 19 mph with the majority from 10 to 14 mph. These are average wind speeds over 10-minute periods. Wind direction was from the east and northeast.

Results from the ambient test as presented in the Ambient Sound Level Measurements Report are summarized in Table 6-1 and shown graphically on Figure 6-2.

Table 6-1
Ambient Daytime and Nighttime Sound Levels

Monitoring Position	Range of Hourly L_{Aeq}s		Average Hourly L_{Aeq}	
	Daytime 7 am to 7pm	Nighttime 7 pm to 7 am	Daytime 7 am to 7pm	Nighttime 7 pm to 7 am
A	28 to 44	21 to 33	33	27
B	27 to 46	24 to 49	36	29
C	30 to 53	19 to 44	37	31
D	26 to 39	19 to 27	33	23

Figure 6-1
Stetson Wind Project
Vicinity Site Plan with
Ambient Monitoring Positions

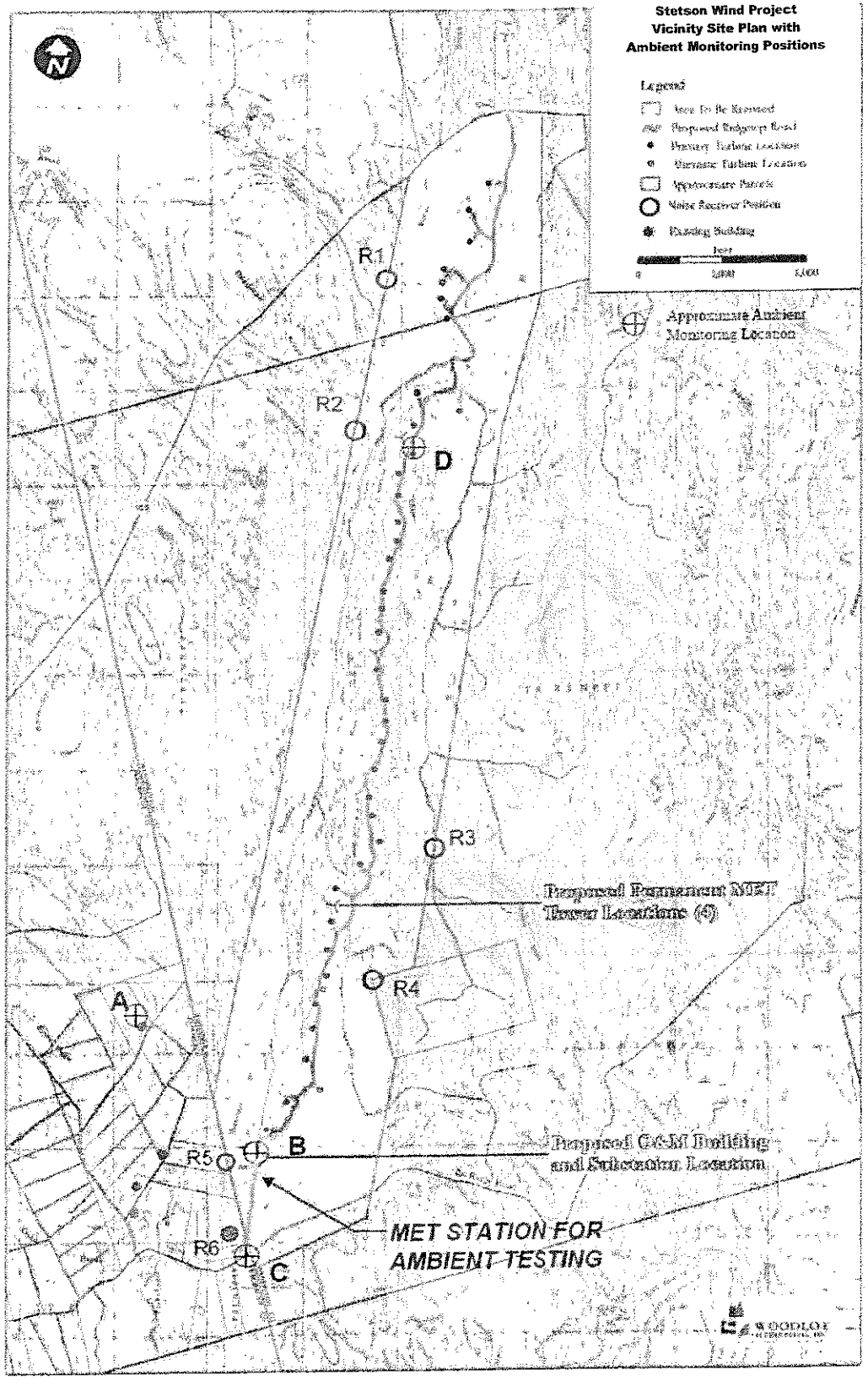
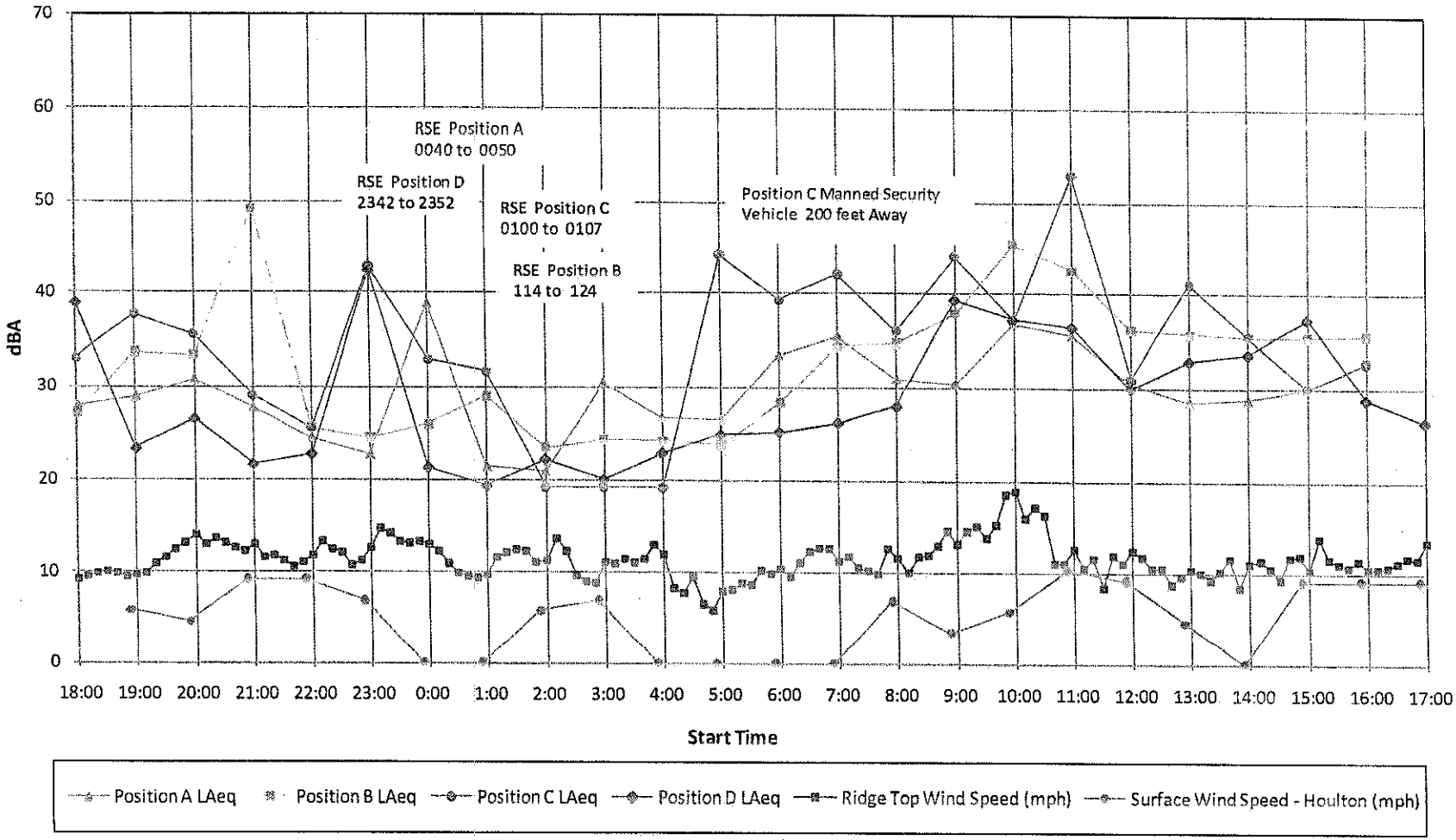


Figure 6-2
Ambient Hourly Sound Levels
April 25 – 26, 2008



7.0 OPERATING SOUND LEVELS

RSE conducted operations sound testing starting the evening of May 19, 2009 and continuing until the morning of May 22, 2009. The monitoring extended over a 59-hour period, exceeding the minimum 24-hour period prescribed by the LURC approved compliance sound level monitoring plan (See Appendix II). Sound levels were measured under a variety of wind and operating conditions in order to determine by measurement, sound levels at community monitoring positions during routine operation of SWP. Measured sound levels are compared to predicted sound levels of Wind Project operation provided to LURC as part of the Preliminary Development Plan application, ambient sound levels recorded in accordance with LURC Condition #2(C) 16 of Zoning Petition ZP 713, and 2009 model estimates of as-built wind turbines.

7.1 Measurement Procedures

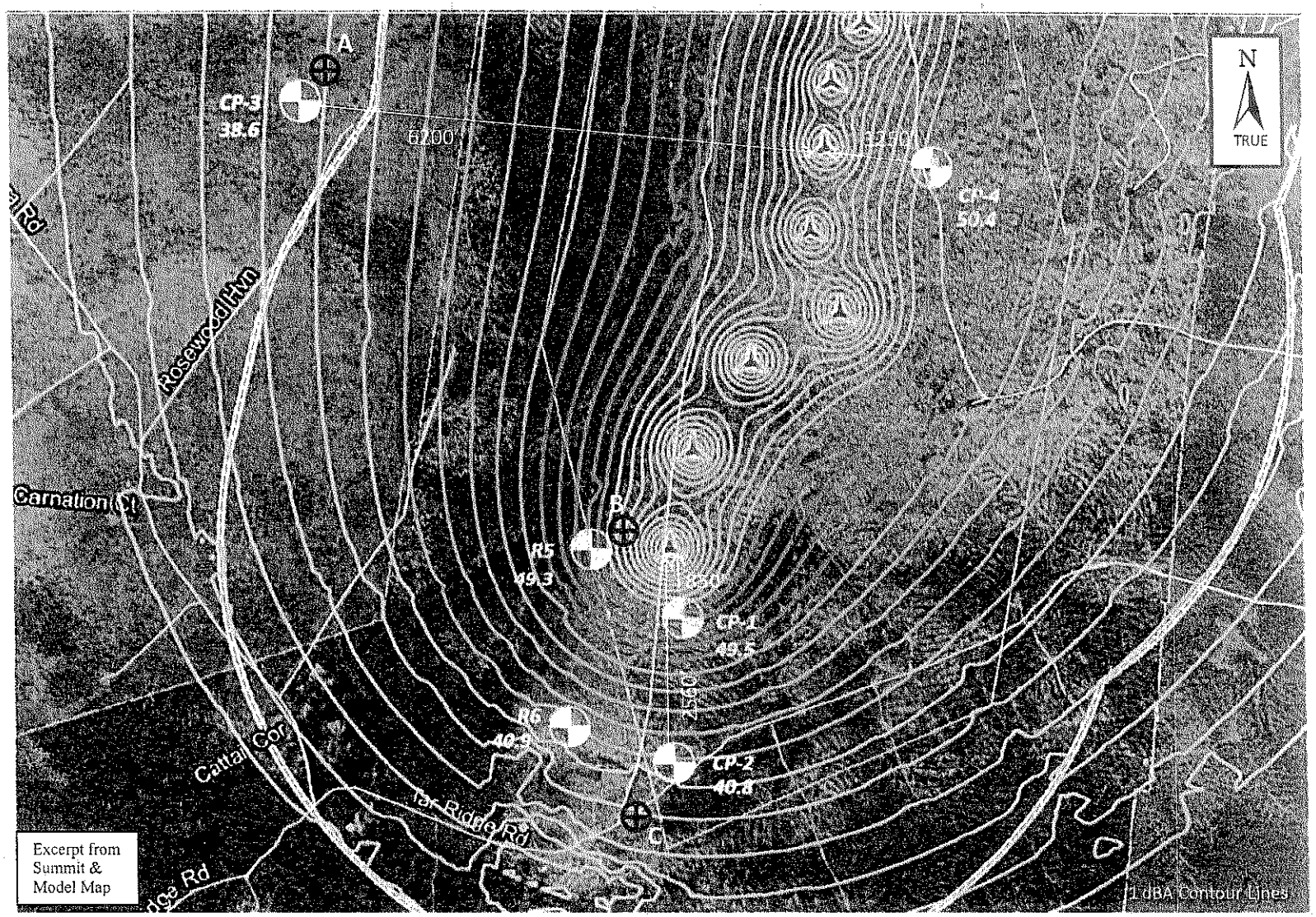
Measurements were conducted in accordance with the Post-Construction Sound Monitoring Protocol approved by LURC with the Final Development Plan permit and revised on May 15, 2009 with LURC approval. Both protocols can be found in Appendix II as well as a summary of the RSE compliance test and field plan.

The primary objective was to measure sound levels at nearby regulated locations during conditions when the sound from SWP was most noticeable. This required ample wind speeds at higher elevations for the wind turbines to operate at or near full sound power with substantially less wind at the lower elevation, community monitoring positions.

Based on their proximity to wind turbines and accessibility, the four selected monitoring positions approved in advance by LURC are representative of receiver positions and study points in the vicinity of SWP. All the monitoring positions are located near the south end of the project and, except for CP-3, are within the boundaries of SWP. The nearest property boundary and noise sensitive areas (dwellings) to wind turbines are also located at the south end of the project. Permission to conduct measurements at CP-3 was granted by the landowner. Figure 7-1 provides a map of the monitoring positions used during operations sound level testing. The following provides a description of each monitoring position and approximate horizontal distance to the nearest wind turbine:

Position	Description
CP-1	Approximately 850 feet south of Wind Turbine No. 1 (T1). Represents receiver R5 and ambient position B.
CP-2	Approximately 2,560 feet south of Wind Turbine No. 1 (T1). Represents receiver R6 and ambient position C.
CP-3	Approximately 6,200 feet west of Wind Turbine No. 5 (T5) on Rosewood Lane. Represents the nearest full-time residential property to SWP and ambient position C.
CP-4	Approximately 1,250 feet east of Wind Turbine No.6 (T6). Selected in a predominately downwind position for comparison to 2009 model estimates.

Figure 7-1, 2009 As-Built Model with Receiver, Ambient and Compliance Measurement Locations



Sound Level Instrumentation consisted of three Larson-Davis Model 812 Integrating Sound Level Meters, two Larson-Davis Model 824 Sound Level Meter/Real Time Analyzers, a CEL 593 Sound Level Analyzer and two Larson Davis Model 831 Sound Level Meters. In addition to overall broadband sound levels, the LD 824s, LD 831s and CEL 593 measured one-third octave band sound levels. The LD 812s, one LD 824, the LD 831s and the CEL 593 were used for continuous sound level measurements at the four community monitoring positions. The second LD 824 was used to conduct short term measurements at the positions on a rotating basis to aid and verify observations. Table 7-1 presents the equipment utilized, date and time the measurements started. Once started, measurements were nearly continuous except when internal sound meter memory was full or during data download. The sound level meters meet Type 1 (precision) performance requirements of American National Standard Specification for Sound Level Meters, ANSI S1.4-1983. Although the specified accuracy varies by octave band frequency, the overall accuracy for measurement of A-weighted broadband sound pressure levels is generally considered to be plus or minus 1.5 dBA for Type 1 meters. The microphones were fitted with standard windscreens and mounted on tripods at a height of approximately five feet above the ground. The sound level meters were calibrated before and after the monitoring period. Additionally, a certified laboratory performs a calibration of the sound level instrumentation within 12 months of the measurement period.

Table 7-1
List of Sound Measuring Equipment

Monitoring Position	Model Number	Serial Number	Calibration Date	Date and Approx. Time Measurements were Started
CP-1	LD831	1738	October 2008	5/19/09 at 1900
CP-1	LD812	A0526	June 2008	5/21/09 at 1700
CP-2	LD824	3395	August 2008	5/19/09 at 2030
CP-3	CEL593	2/0281317	June 2008	5/19/09 at 2000
CP-3	LD812	0308	June 2008	5/19/09 at 2000
CP-4	LD831	1736	October 2008	5/19/09 at 1900
CP-4	LD812	A0544	June 2008	5/21/09 at 2000
Rotating	LD824	0646	June 2008	5/19/09

Sound levels were simultaneously measured at all four monitoring positions over a period of approximately 59 hours representing a range of weather and SWP operating conditions. Over this period, sound levels were measured every 1/8 second or less to record both short-term and one or ten-minute statistics at each position. A project engineer and field technician recorded field observations and weather conditions, and measured one-third octave band sound levels at each monitoring position on a rotating basis. Field observations supplement sound level data to determine the primary contributors to the measured sound levels. These contributors included sound from wind turbines and non-SWP sources such as wind-induced sound from trees, low bushes and terrain and natural sounds particularly frogs and birds. An overall summary of RSE's Field Plan, meter settings and personnel utilization can be found in Appendix II.

RSE deployed portable meteorological (Met) stations by Onset Computer Corporation to record local weather observations on a 3-second basis at three of the four sound monitoring positions: CP-1, CP-3 and CP-4. Each station uses Onset sensors fastened to a pole at heights of approximately 2-meters and 10-meters above ground. Meteorological conditions at CP-2 are represented by weather observations recorded at CP-1. The following provides a brief description of each station:

Position	Description
CP-1	Located approximately 70-feet south of the sound monitoring equipment at a ground elevation of approximately 730 feet.
CP-3	Located approximately 45-feet northwest of the sound-level monitoring equipment at a ground elevation of approximately 720 feet.

CP-4 Located approximately 25-feet southwest of the sound monitoring equipment at a ground elevation of approximately 840 feet.

Wind speed, and direction were measured using a combination anemometer consisting of a direction vane and 3-cup speed sensor. The temperature and relative humidity sensor was housed in a solar radiation shield designed to protect the sensor from the effects of sunlight and moisture while still allowing maximum air flow to achieve a faster response time to changing conditions. The barometric pressure sensor was set inside the data-logger box and provided the average barometric pressure for the monitoring period. An additional wind sensor by R.M. Young, capable of recording data at 1-second intervals, was co-located with the Onset sensors at CP-1 and CP-4 for comparative analysis of the 10-meter wind speed and direction. Weather data was logged to 3-decimal places but rounded to the nearest whole number in this report.

The Onset sensors were configured to log wind speed and direction, temperature, relative humidity and barometric pressure at 3-second intervals. For the purpose of this report, only the wind data recorded at the approximate height of 10-meters above ground was used to represent surface winds. The data collected with the temperature and relative humidity sensor, also located at the approximate height of 10-meters above ground at CP-1 and CP-4 and at the height of 2-meters at CP-3, was used in conjunction with the barometric pressure sensor located approximately 1-meter above ground to represent the weather conditions at surface level. Table 7-2 presents the met equipment utilized. Appendix III presents met station layouts, photographs and details.

Table 7-2
List of Meteorological Equipment

Monitoring Position	Height (meters)	Company	Product Name	Product Type	Product ID	Serial Number.
CP-1	1	Onset Computer Corp	HOBO Microstation	Logger	H21-002	2227735
	1	Onset Computer Corp	Barometric Pressure Sensor	Sensor	S-BPA-CM10	2247681
	2	Onset Computer Corp	Wind Speed/Direction Smart Sensor	Sensor	S-WCA-M003	2274686
	2	Onset Computer Corp	Temperature and Relative Humidity Smart Sensor	Sensor	S-THB-M002	2249583
	2	Onset Computer Corp	Solar Radiation Shield	Sensor	RS3	N/A
	10	Onset Computer Corp	Wind Speed/Direction Smart Sensor	Sensor	S-WCA-M003	2230134
	10	Onset Computer Corp	Temperature and Relative Humidity Smart Sensor	Sensor	S-THB-M002	2249584
	10	Onset Computer Corp	Solar Radiation Shield	Sensor	RS3	N/A
	10	RM Young Company	Wind Monitor-AQ	Sensor	05305V	94122
	1	Onset Computer Corp	HOBO Microstation Logger	Logger	H21-002	2227736
CP-3	1	Onset Computer Corp	HOBO Microstation	Logger	H21-002	2227737
	1	Onset Computer Corp	Barometric Pressure Sensor	Sensor	S-BPA-CM10	2247682
	2	Onset Computer Corp	Wind Speed/Direction Smart Sensor	Sensor	S-WCA-M003	2274688
	2	Onset Computer Corp	Temperature and Relative Humidity Smart Sensor	Sensor	S-THB-M002	2249582
	2	Onset Computer Corp	Solar Radiation Shield	Sensor	RS3	N/A
	10	Onset Computer Corp	Wind Speed/Direction Smart Sensor	Sensor	S-WCA-M003	2230135
CP-4	1	Onset Computer Corp	HOBO Microstation	Logger	H21-002	2239979
	1	Onset Computer Corp	Barometric Pressure Sensor	Sensor	S-BPA-CM10	2247683
	2	Onset Computer Corp	Wind Speed/Direction Smart Sensor	Sensor	S-WCA-M003	2274687
	2	Onset Computer Corp	Temperature and Relative Humidity Smart Sensor	Sensor	S-THB-M002	2249582
	2	Onset Computer Corp	Solar Radiation Shield	Sensor	RS3	N/A
	10	Onset Computer Corp	Wind Speed/Direction Smart Sensor	Sensor	S-WCA-M003	2230132
	10	Onset Computer Corp	Temperature and Relative Humidity Smart Sensor	Sensor	S-THB-M002	2249585

First Wind Operations recorded operating and meteorological data from each turbine every ten seconds and reported the average measurements at ten-minute intervals. Data includes power production, wind speed and wind direction.

Section 7.2 provides the measurement results, including field observations, SWP operating data, and meteorological data at each monitoring position.

7.2 Measurement Results

During the 59-hour test period, sound levels were measured under a variety of wind and operating conditions. Wind turbine operating levels ranged from full power production during periods of strong

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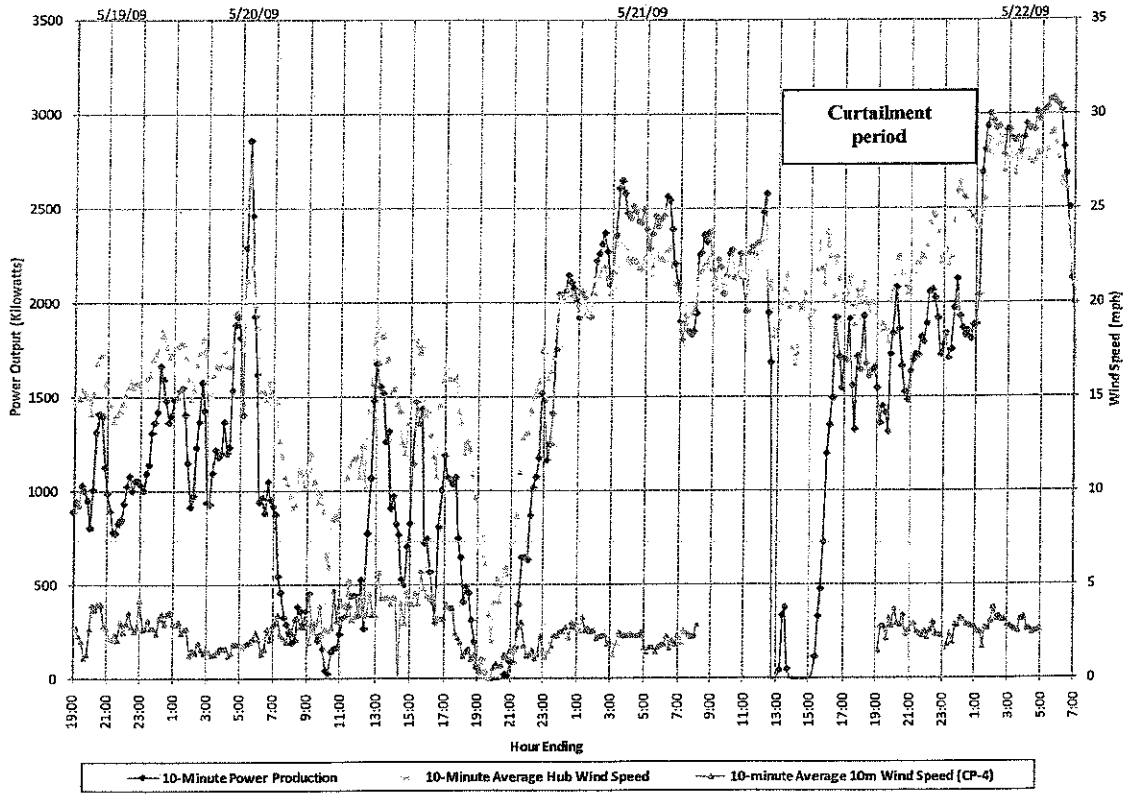
wind to low power production during periods of light winds at the turbine hub. The highest hub wind speeds and turbine operations occurred during the early morning of May 21 and the overnight period of May 21-22. Winds were primarily from the southwest to west but ranged from south to north and reached speeds up to 13 meters/second (29 mph) at the turbine hubs.

RSE recorded sound level measurements at four locations on the south end of Stetson Mountain. For the purpose of this report references to wind turbines and power production is based on data from Wind Turbine Nos. 1 through 12. To provide an overview of SWP operations, Figure 7-2 presents a graph showing the overall average wind speed at the turbine hubs, average surface (10 meter) wind speed at CP-4 and average power production. Each data point represents a ten minute operating period. Electric power production is presented in kilowatts (kW). At 1,500 kWH per wind turbine and 12 turbines operating at full load, the south end of SWP has the capacity to generate 3,000 kW of electric power during a 10-minute period Full rated sound power occurs at 60% of full electric power or 1,800 kW in a 10-minute period.

Figure 7-2. Wind Project Power Generation and Average Wind Speed of Turbine Nos. 1 through 12 during the 59-Hour Operations Test Period



Figures 7-3 through 7-6 present sound levels at each position for the entire measurement period in relation to the average power output of nearby wind turbines, average wind speed and maximum wind speed at the 10 meter height. Overall results at CP-1 and CP-4 present one-minute L_{Aeq} and L_{A90}. Measurements at CP-2 and CP-3 are presented using ten-minute L_{Aeq}, L_{A50} and L_{A90} results. The L_{Aeq} parameter includes all sound energy from wind turbine and other sound sources such as wind, birds, and frogs. Field observations and measurements indicate that other statistical parameters (e.g. L_{A50} and L_{A90}) can be used effectively to validate that L_{Aeq} measurements are representative of wind turbine sound levels. The L_{A50} and L_{A90} indicate variability of measured sound levels relative to the overall equivalent sound level, L_{Aeq}. When the difference between L_{A50} and L_{A90} are within a few decibels of

L_{Aeq} contribution of non-wind turbine sounds are insignificant. When the differences are greater, there is a higher contribution of extraneous sounds within the overall sound level represented by L_{Aeq}.

Figure 7-3. Sound Levels at CP-1 in Relation to Wind Turbine Power Output and Wind Speed

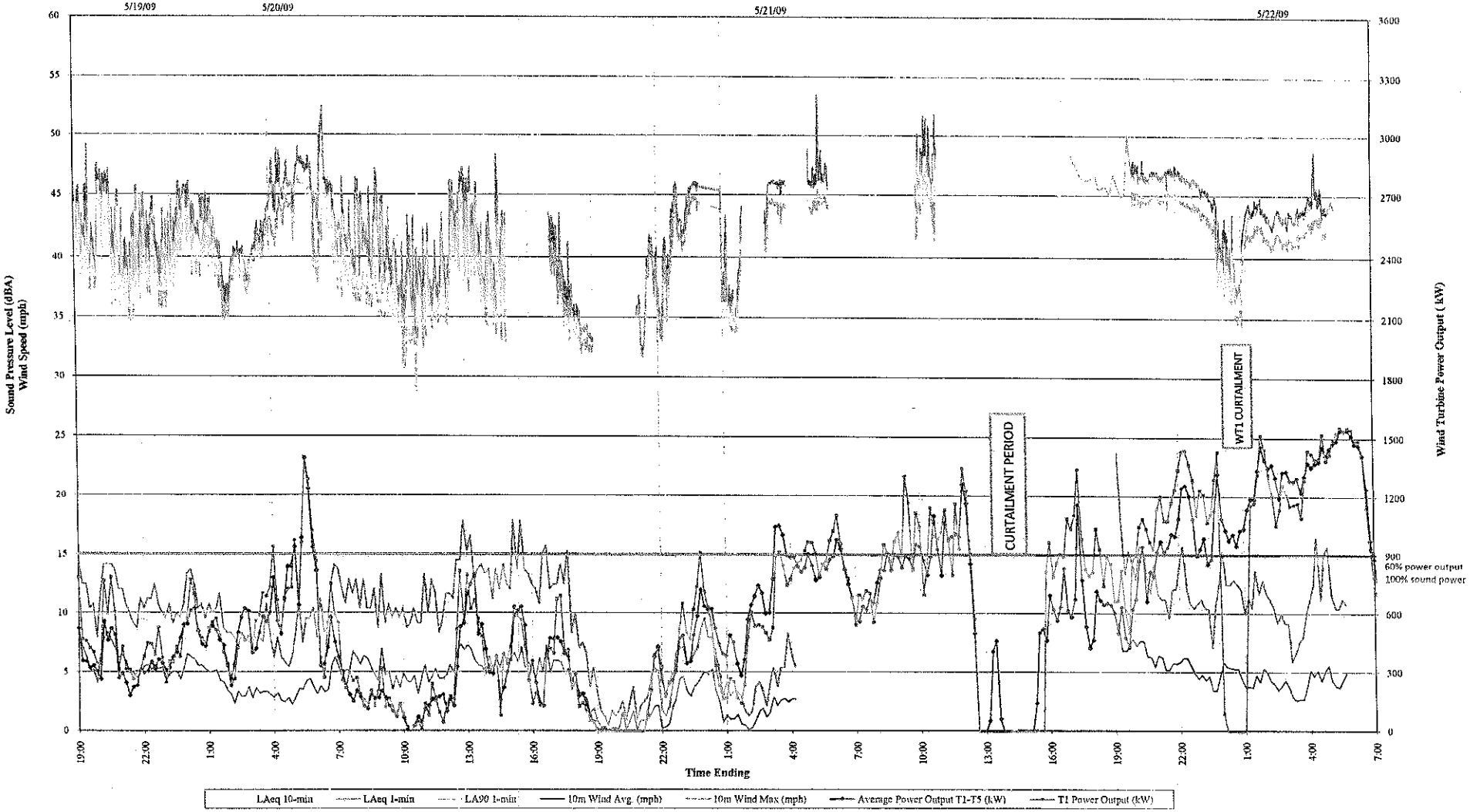


Figure 7-4. Sound Levels at CP-2 in Relation to Wind Turbine Power Output and Wind Speed

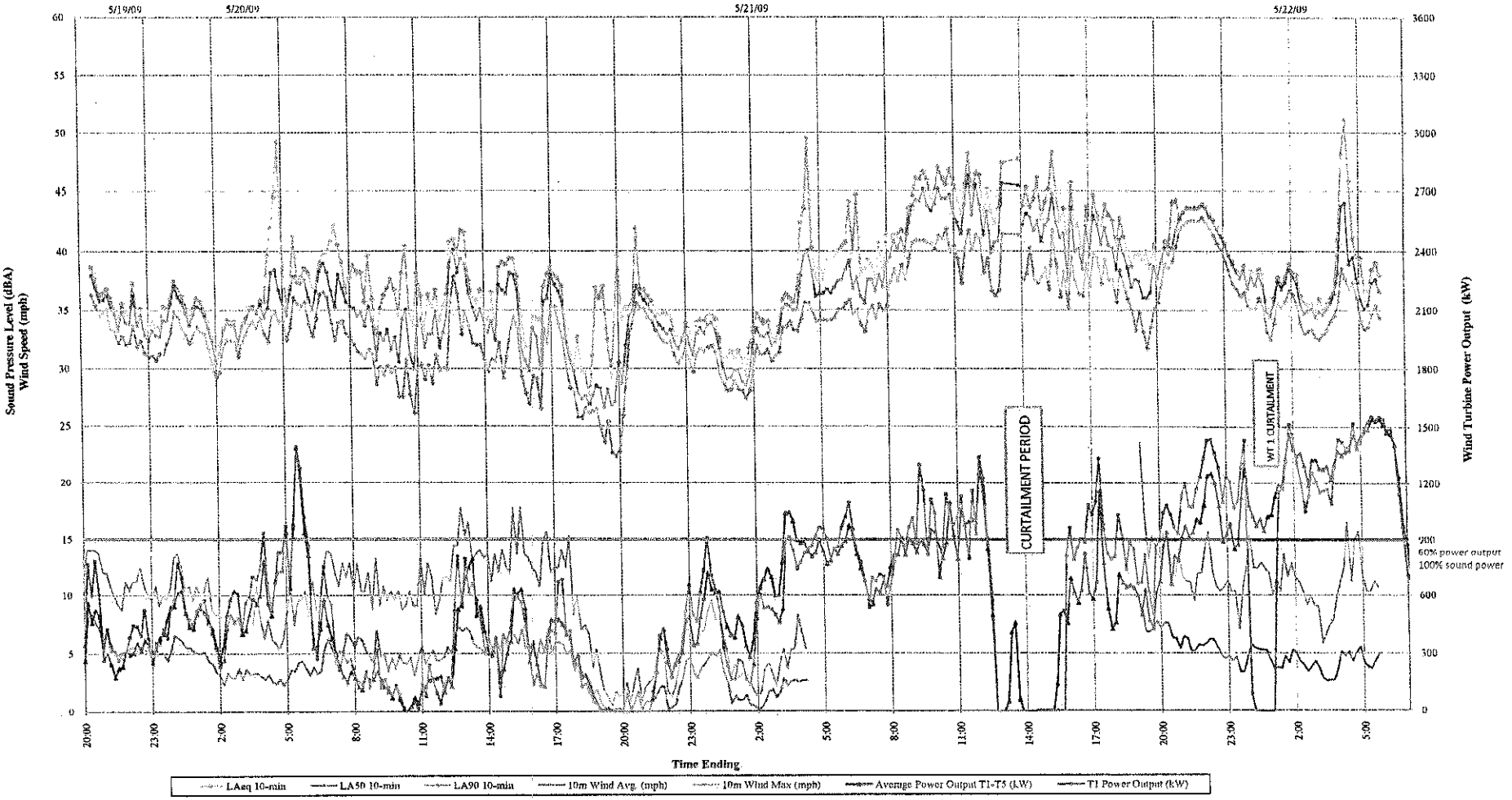


Figure 7-5. Sound Levels at CP-3 in Relation to Wind Turbine Power Output and Wind Speed

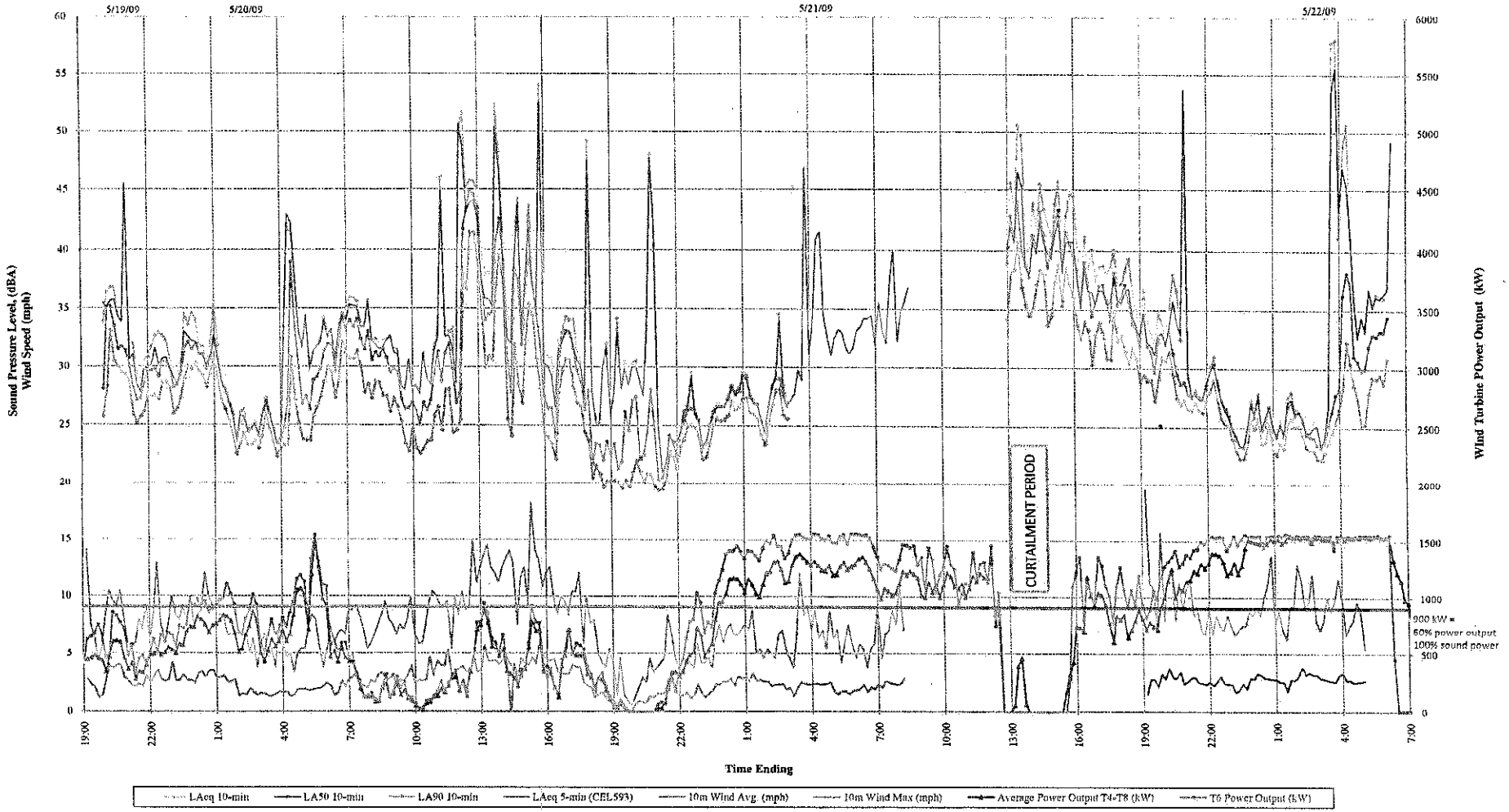
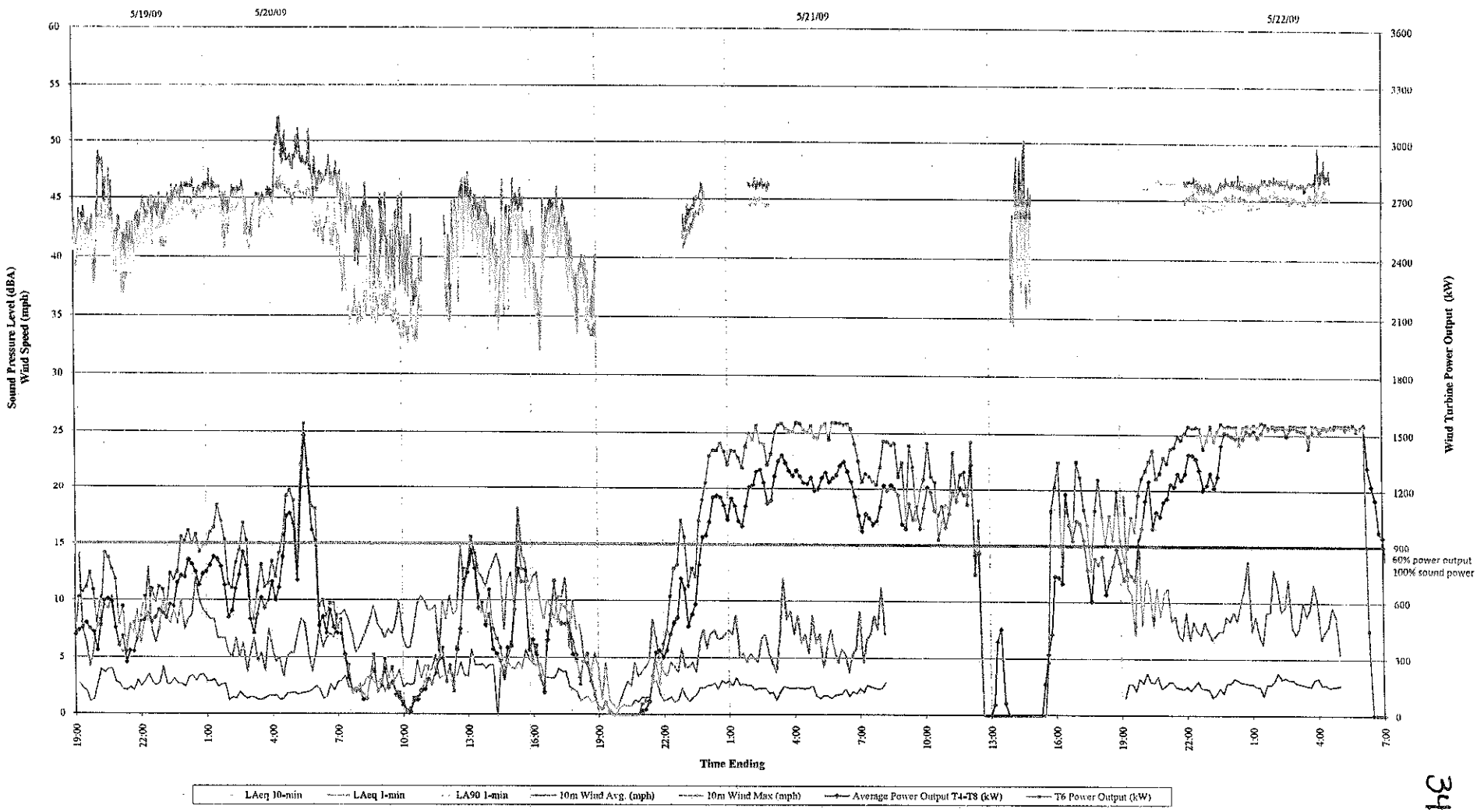


Figure 7-6. Sound Levels at CP-4 in Relation to Wind Turbine Power Output and Wind Speed



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7.2.1 Meteorological Results

RSE observed temperatures dipping into the mid 40's during overnight and early morning periods warming up to an afternoon high in the lower 80's. Day and night time skies were mostly clear throughout the entire test period observing stars at night and scattered cloud cover during daylight hours. Surface winds were moderate to light during the overnight periods with 10-minute average wind speeds ranging from 0 to 8 mph. Daytime surface winds were slightly higher overall typically ranging from 4 to 8 mph on a 10-minute average basis and including more three-second gusts above 10 mph. Wind direction during the test period varied by monitoring position and time of day but generally ranged from the southerly to northwesterly. Relative humidity for the period followed typical day and night time fluctuations as it increased during cooler nighttime periods and decreased during warmer daytime temperatures. Barometric pressure had little to no variation during the 3-day observations. Figures 7-7 through 7-9 present the wind data from the Met stations at CP-1, CP-3 and CP-4 respectively. They also show the wind speed and direction from the hub height of T1 and T6.

The following time periods were selected to best represent 10 meter wind speeds at or below 6 mph on a 3-second basis while wind turbine hub height winds were equal or greater than 20 mph (9 m/s) and power production was at 60% of rated capacity or greater. These conditions ensure that wind turbine sound power emissions were at 100% while surface winds were low and ground level wind turbine sounds were most noticeable.

At CP-1 the wind speed from 03:00-04:00 on 5/21/09, based on 3-second logging intervals at approximately 10-meters above ground, ranged from 0 mph to 8 mph averaging 3 mph for the hour. The wind direction ranged from southwest to west-southwest with southwest being the prevailing direction. The low temperature of 53°F occurred at 03:00 with the high temperature reaching 55°F around 03:30 and averaged 54°F over the one hour period. The relative humidity averaged 56% for the period consisting of a low 55% and a high 57%. The barometric pressure had little to no variation in the period average of 29inHg. At T1, the average 10-minute hub height winds during this period ranged from 15 to 20 mph and were generally from a southwest direction with power output ranging from 462 kW to 915 kW.

For the monitoring period 20:00 5/21/09 to 06:00 5/22/09, the average 10-minute wind speed, based on 3-second logging intervals, at approximately 10-meters above ground, ranged from 3 mph to 8 mph with three-second wind speeds typically ranging from 5 to 10 mph and diminishing to a range of 2 to 7 mph for several hours. The period began with the winds blowing from the southwest shifting gradually throughout the overnight period into an early morning westerly wind. The temperatures at approximately 10-meters above ground started out at 79°F and slowly cooled off overnight to end the period at 65°F. Relative humidity ranged from 36% to 44% averaging 40% and the barometric pressure hovered around 29inHg with little to no fluctuation for the entire 10 hour period. At T1, the average 10-minute hub height winds ranged from 17 to 28 mph and started the period off from the southwest shifting gradually overnight to end the period out of the west. The power output from T1during this period ranged from 0 kW to 1552 kW.

At CP-3, for the period 1900 5/21/09 to 0600 5/22/09, the average 10-minute wind speed at approximately 10-meters ranged from 3 mph to 7 mph with 3-second wind speeds typically ranging from 3 to 10 mph and lower during several 10-minute periods. The wind direction for the overnight period ranged from out of the southwest to out of the west-northwest starting off with more of a southwest wind gradually shifting to more of a west-northwest wind by morning. At the approximate height of 2-meters above ground, the temperature started out the period at 83°F and gradually cooled to 65°F by 0600 on 5/22/09. Relative humidity ranged from 26% to 54% and the barometric pressure hovered around 29inHg with little to no fluctuation for the entire 11 hour period. At T6, the average 10-minute hub height winds during this period ranged from 19 to 32 mph and were generally from west-southwest to west-northwest directions with power output ranging from 815 kW to 1563 kW.

At CP-4 the wind speed from 02:00-03:00 on 5/21/09, based on 3-second logging intervals at 10-meters above ground, typically ranged from 0 mph to 5 mph averaging 2 mph for the hour. The south-southwest wind had very little variation in direction throughout the hour. This period started out with a low temperature of 51°F and increased slightly around 02:30 to 54°F before cooling off to 53°F toward the end of the period. The relative humidity averaged 56% for the period consisting of a low 56% and a high 57%. The barometric pressure had little to no variation within the hour with an average of 29inHg. At T6, the average 10-minute hub height winds ranged from 22 to25 mph and were generally from a west-southwest direction. The power output from T6 during this hour ranged from 1333 kW to 1538 kW.

For the monitoring period 22:00 5/21/09 to 04:00 5/22/09, the average 10-minute wind speed at approximately 10-meters ranged from 2 mph to 4 mph with 3-second wind speeds typically less than 6 mph. However, there were several occurrences of 3-second wind speeds above 6 mph during each hour with occasional gusts above 10 mph. The surface winds for the overnight period ranged from south to west with the average out of a southwesterly direction. The temperature, relative humidity, and barometric pressure sensors were disconnected during this period in an attempt to increase the amount of time the Onset data logger could log wind speed and direction. In general, the temperatures observed by RSE were consistent with CP-1's logged daytime temperatures that reached into the 80's and then cooled off into the 60's during the overnight period. At T6, the average 10-minute hub height winds during this period ranged from 24 to 32mph and were generally from west-southwest to west-northwest directions with power output ranging from 1423 to 1563 kW.

The best periods of wind power production were the morning of May 21 (1:00 a.m. to 11:00 a.m.) and nighttime through early morning of May 21 to 22 (8:00 p.m. to 6:00 a.m.). For portions of these periods, surface winds diminished. During these periods, measurements and observations indicated that sound levels from wind turbines were prominent at three of the four positions (CP-1, CP-2 and CP-4). During daytime hours when the wind power production was high, surface winds were also high causing a mix of sounds from wind turbines and wind acting on trees and terrain. Other times when wind power production was below 60% power output, other non-wind turbine sounds were prominent. Notable non-wind turbine sound sources included wind, wind on trees bushes and terrain, birds, and frogs.

At times during the compliance test power output was approximately 0 kW due to either lack of wind or turbine shutdowns. These included the following periods; on May 21, 2009, all 12 turbines were shutdown during the period beginning approximately 13:00 to 15:00 with start-ups during the period 15:00 to 16:00. Certain wind turbines continued to be curtailed until approximately 01:00 on May 22, 2009. During the curtailment period, hub height wind speeds ranged from 19 to 26 mph (8 to 12 m/s). During the May 21 period from 13:00 to 16:00 hub height wind direction from T6 ranged from the west to northwest. Ten-minute average surface wind speed at CP-4 was less than 5 mph (2 m/s). (Note: RSE Met tower at CP-4 was offline for work from approximately 08:30 to 19:00 on May 21, 2009).

The following section 7.2.2 presents sound levels measurement results during periods when wind turbine sound was most prominent.

Figure 7-7 (1 of 2). Wind Speed and Direction at CP-1 in Relation to Wind Speed and Direction at WT-1

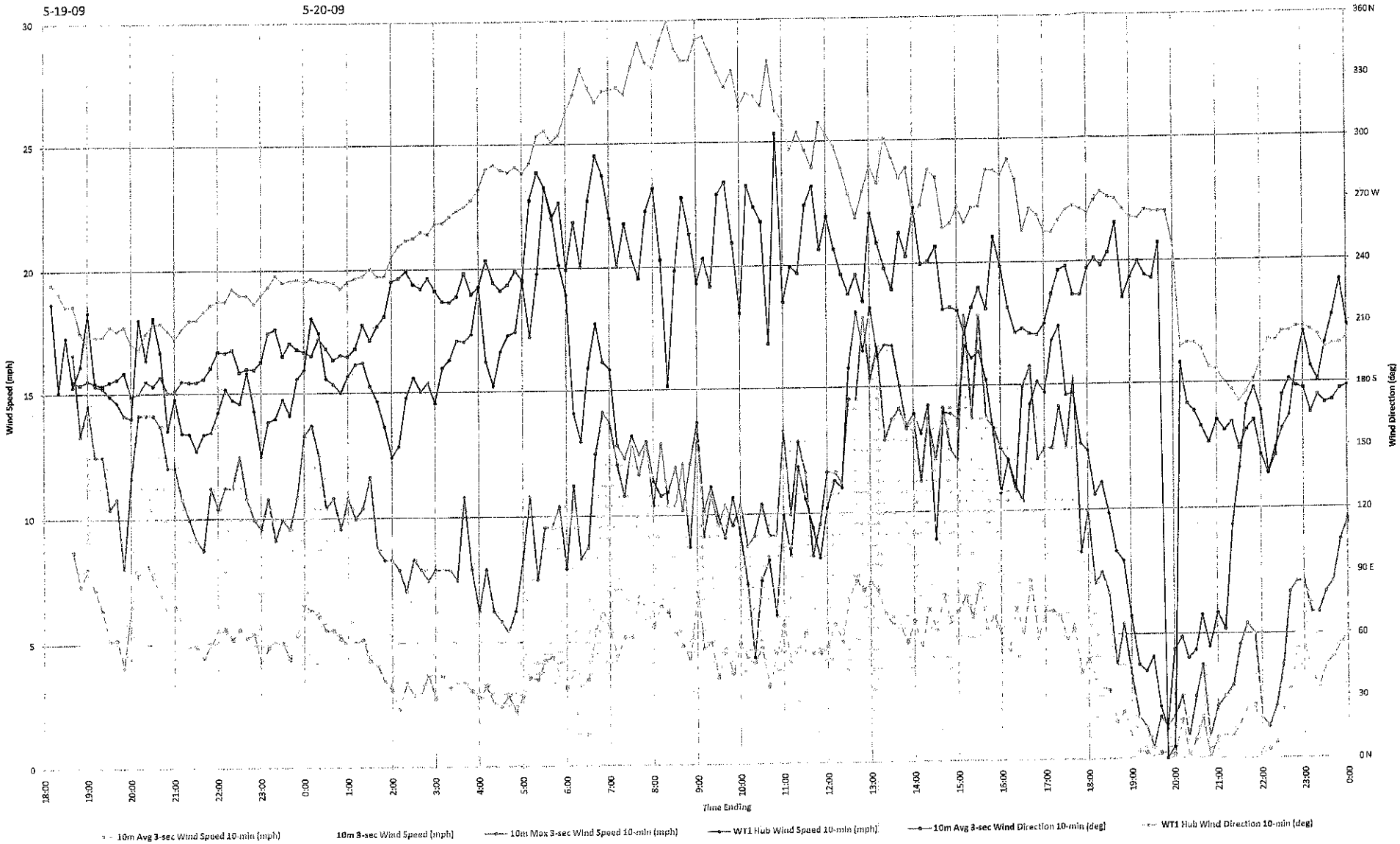


Figure 7-7 (2 of 2): Wind Speed and Direction at CP-1 in Relation to Wind Speed and Direction at WT-1

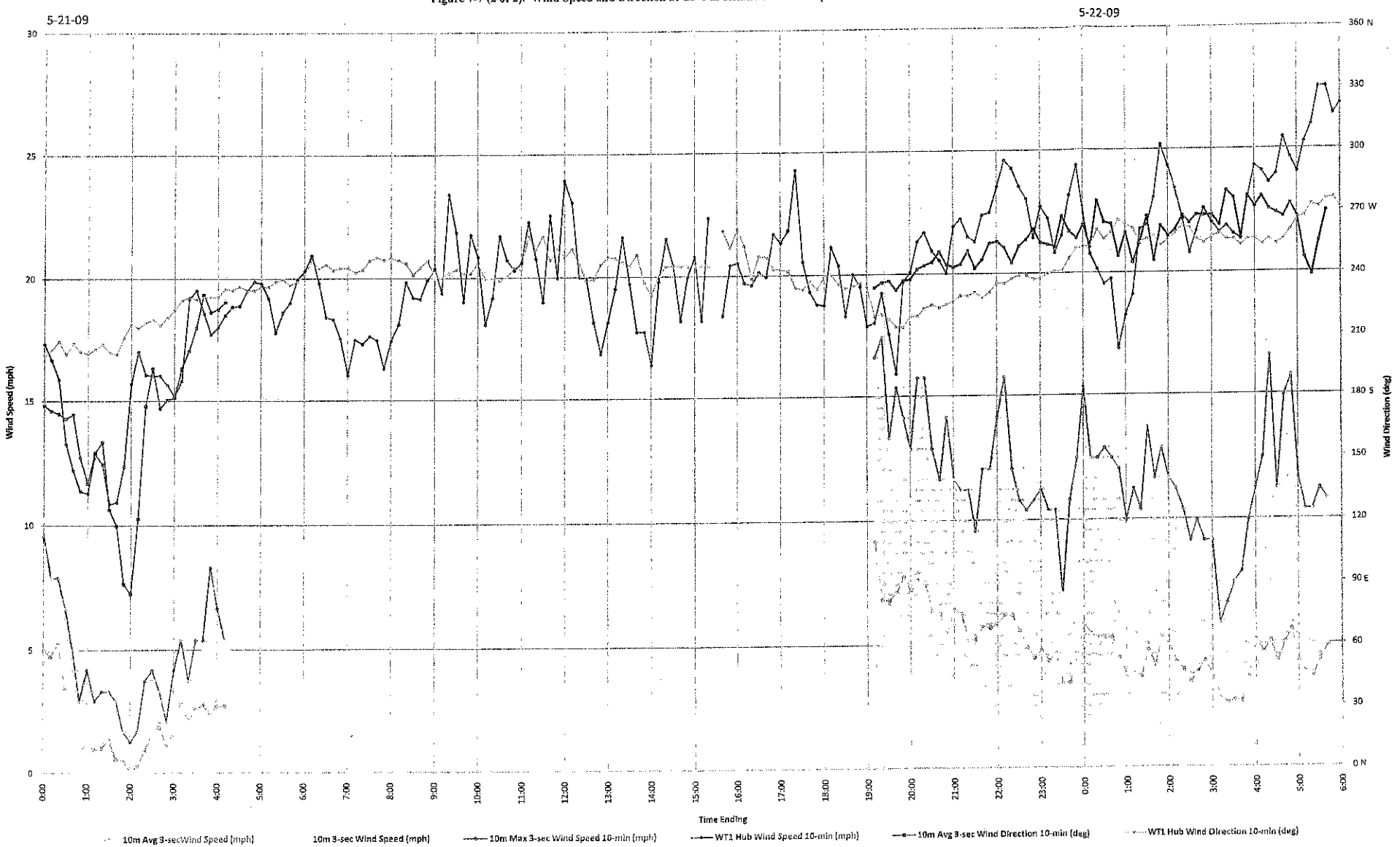


Figure 7-8 (1 of 1). Wind Speed and Direction at CP-3 in Relation to Wind Speed and Direction at WT-6

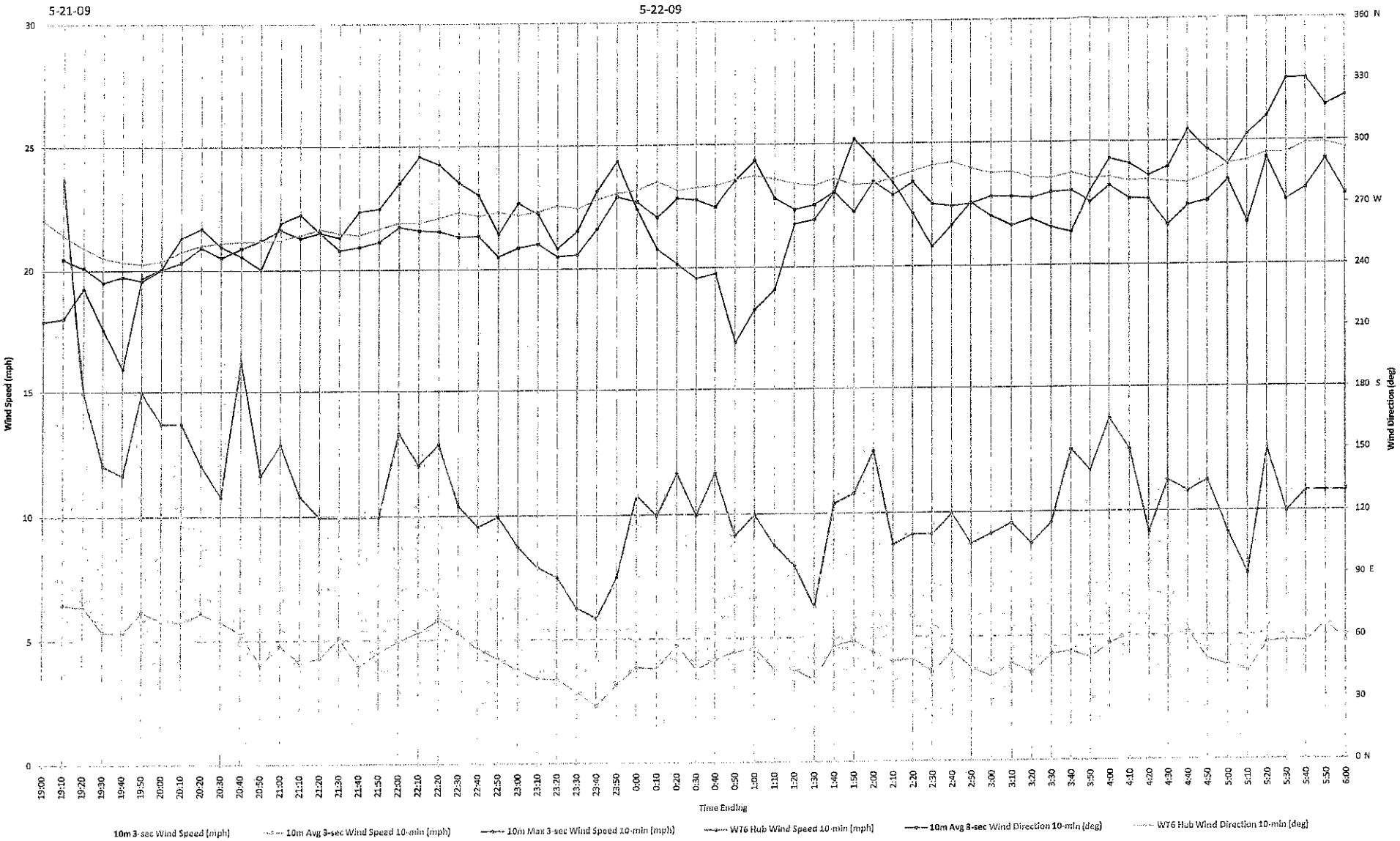


Figure 7-9 (1 of 2). Wind Speed and Direction at **CP-4** in Relation to Wind Speed and Direction at **WT-6**

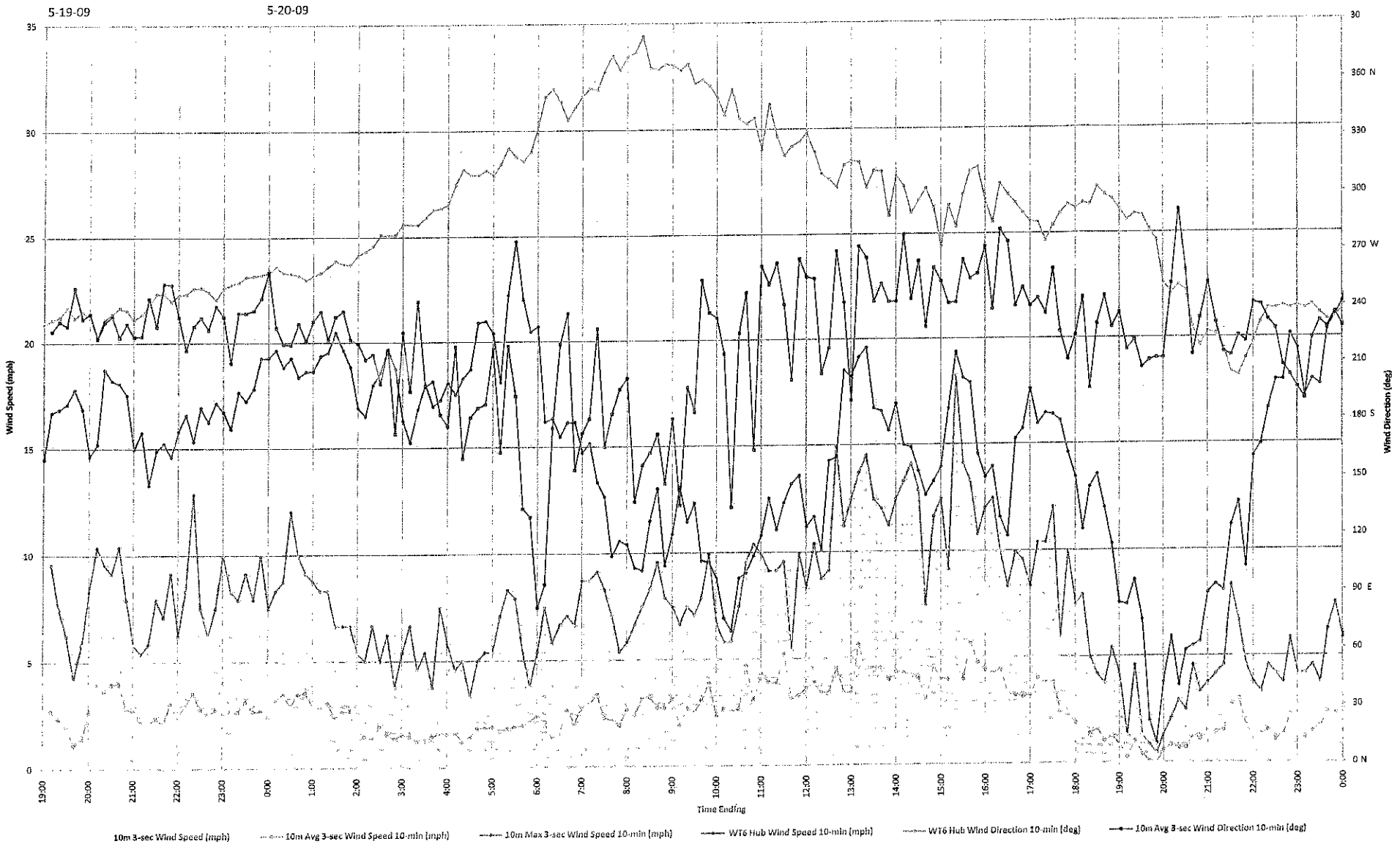
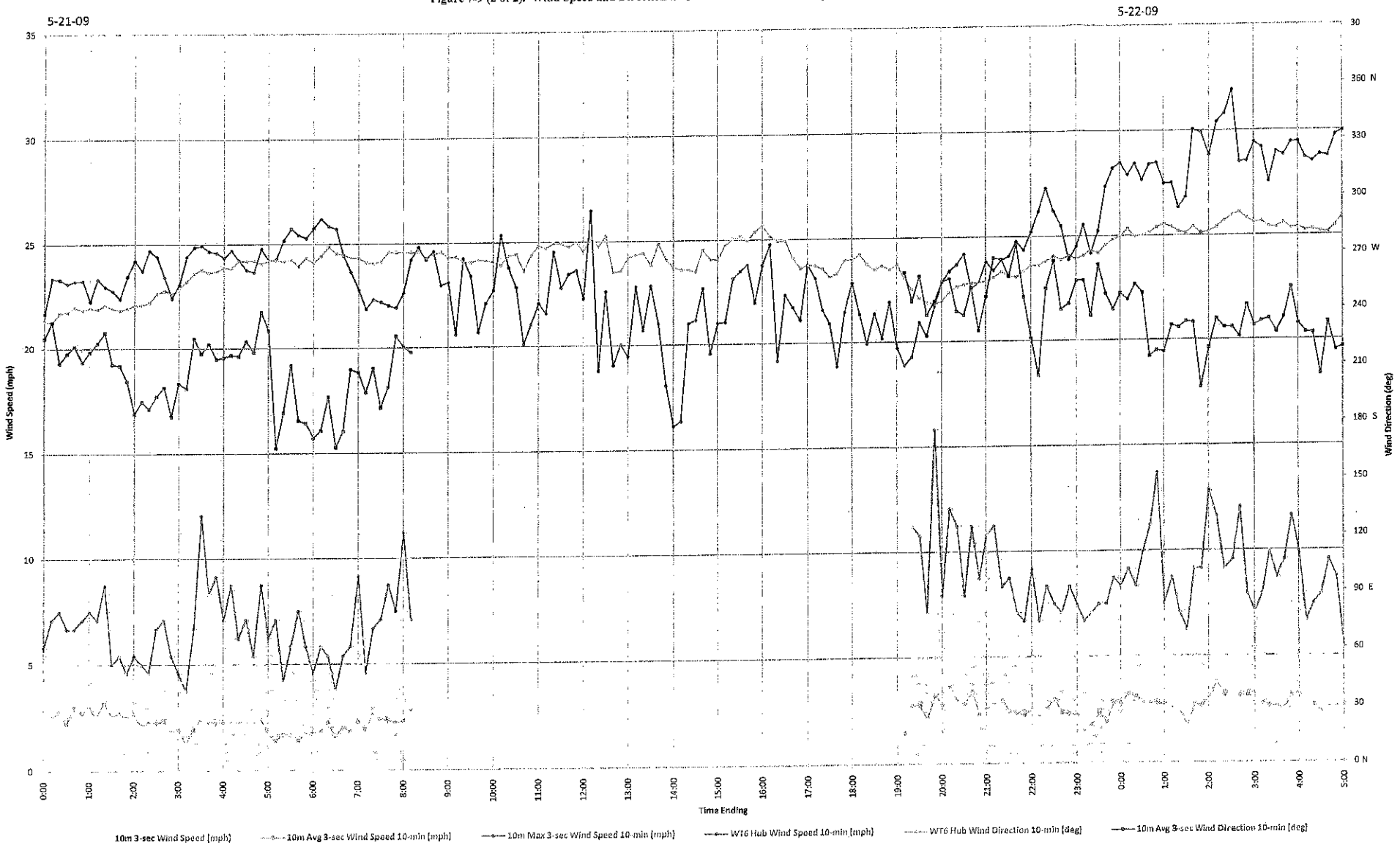


Figure 7-9 (2 of 2). Wind Speed and Direction at CP-4 in Relation to Wind Speed and Direction at WT-6



7.2.2 Wind Turbine Sound Levels

The following provides a summary of operating conditions and measurement results at each monitoring position during periods when the wind turbines were most prominent. Comparisons of operations test data with ambient conditions, sound level model estimates and as-built model estimates are presented. Graphs were prepared presenting one to two hour segments of measured sound levels compared to wind turbine operating rates and surface wind speeds. These graphs show times and locations when wind turbine sounds were prominent. Sample graphs for each position are presented on Figures 7-10 through 7-13. Additional graphs are presented in Appendix IV. The sound level contribution of operating wind turbines was determined from examination of these graphs and field observations.

At Position CP-1, one-minute sound levels from representative SWP operations ranged from 43 to 47 dBA with low (typically ≤6 mph) 10m wind gusts, southwest (SW) to west (W) wind and near full operations. In the LURC permit application, sound level estimates at receiver R5 were 52 dBA at 95% operation (i.e. equal to 100% of sound power). Ambient sound levels represented by measurements at position B in April 2008 ranged from 24 to 49 dBA with generally higher measurements noted during daytime periods and when wind speeds increased. During curtailment of T1 from midnight to 01:00 on May 22, 2009, sound levels at CP-1 ranged from 37 to 41 dBA. The sound level during this period included contributions to measurements at CP-1 from T2 through T5 plus ambient sources. The 2009, as-built sound level model estimates were 50 dBA at full sound power level output.

At Position CP-2 ten-minute sound levels from representative SWP operations ranged from 35 to 37 dBA with low (typically ≤6 mph) 10m wind gusts, SW to W wind and near full operations. In the LURC permit application, sound level estimates at receiver R6 were 44 dBA at 95% operation. Ambient sound levels represented by measurements at position C in April 2008 ranged from 19 to 44 dBA with higher measurements noted during daytime periods and when wind speeds increased. The 2009, as-built sound level model estimates were 41 at full sound power level output.

At Position CP-3 ten-minute sound levels from SWP operation were difficult to isolate and were barely audible to RSE field personnel at night. Measurements during compliance testing recorded sound levels at this position from 20 to 58 dBA with generally higher records noted during daytime periods. Sound level estimates were not presented in the LURC permit application at this location. Ambient sound levels measured at position A in April 2008 ranged from 21 to 33 dBA with higher measurements noted during daytime periods. The 2009, as-built sound level model estimates were 39 at full sound power level output. Review of Figure 7-5 during shutdown due to low hub winds with low surface wind and then during the curtailment period indicates that the sound levels at CP-3 are primarily a function of surface winds and not due to SWP operations.

At Position CP-4, one-minute sound levels from representative SWP operations were approximately 47 dBA with low (typically ≤6 mph) 10m wind gusts, SW to W wind and near full operations This position was not evaluated as part of the LURC permit application. The 2009, as-built sound level model estimates were 50 at full sound power level output.

SWP operations were curtailed during a portion of the compliance measurements. This curtailment period is shown on Figure 7-2 through Figure 7-6. Also shown on these figures is a period on 5/20/09 from approximately 1900 to 2100 hours when hub winds fell below the cut-in wind speed and the turbine power was at or near 0 kW. During this low hub height wind, surface winds were also low. Review of sound levels before, during and after these curtailments and shutdown indicate that wind turbines were clearly dominant at CP-1 and CP-4 during periods that RSE selected for detailed analysis. This is also shown by the consistently small differences between the L_{A50} and L_{A90} statistics and the approximately 10 dBA reduction in the 1-minute L_{A90} shown on Figure 7-3 when T1 was curtailed during a period with sufficient hub wind to generate approximately 60% electric power output (i.e. 100% of sound power emission).

An overall results summary is presented in Table 7-3 which compares sound level measurements of SWP operation with LURC sound level limits, sound level model predictions from 2007 prior to construction, nighttime ambient measurement results from 2008 and 2009 as-built sound level model estimates. Figure 7-1 provides a site map showing as-built sound level model estimates.

Table 7-3

Measured Sound Levels from SWP Operation Compared to LURC Limits, Sound Model Estimates and Ambient Conditions (Sound Levels in dBA)

Monitoring Position	LURC Compliance Limit	Measured Sound Levels 2009	Measured vs. LURC Limits	Nighttime Ambient Hourly Sound Levels 2008	Sound Model Estimates 2007	As-Built Sound Model Estimates 2009	Highest Measured vs 2009 As-Built Model
CP-1	55	43-47	-12 to -8	24-49[A]	52 (R5)	49.5	-2.5
CP-2	55	35-37	-20 to -18	19-44[B]	44 (R6)	40.8	-3.8
CP-3	n/a	~30	n/a	21-33[C]	n/a	38.6	-8.6
CP-4	n/a	47	n/a	n/a	51 (R4)	50.4	-3.4

[A] From ambient measurements at Position B.
[B] From ambient measurements at Position C.
[C] From ambient measurements at Position A

During periods when SWP was most noticeable, CP-1 was mostly crosswind from the nearest five wind turbines and closest to the southernmost turbine, T1. CP-1 was approximately 850 feet from T1 and 2,000 feet south of T2. This makes CP-1 an ideal location for assessing sound levels from routine operations in close proximity to a single wind turbine. Based on 2009 as-built model estimates and distance from T1, CP-1 is also representative of sound levels expected at the nearest LURC compliance location on the SWP zone boundary. Figure 7-10 shows measured 1-minute L_{Aeq}s relatively constant around 47 dBA. The 1-minute L_{A90}s were also relatively constant and closely followed the L_{Aeq}s within approximately 2 to 3 dBA. Combined with field observations, this demonstrates that the wind turbines were clearly prominent with little or no influence from extraneous sources such as wind over terrain, wind in trees, birds, insects and frogs.

During periods when SWP was most noticeable, CP-4 was downwind from the nearest five wind turbines, perpendicular to the turbine array and approximately 1, 250 feet east of T6. This makes CP-4 an ideal location for assessing downwind sound levels from routine operations at full sound power. Figure 7-13 shows downwind, measured 1-minute L_{Aeq}s relatively constant around 47 dBA during full sound power operations. The 1-minute L_{A90}s were also relatively constant and closely followed the L_{Aeq}s within approximately 2 to 3 dBA. Combined with field observations, this shows that the wind turbines were clearly prominent with little or no influence from extraneous sources. Results at CP-4 are especially useful for assessing the accuracy of the 2009 as-built sound model and can be extrapolated to be a valid representation of sound levels expected when CP-1 and all other locations around SWP are in the downwind position.

Figure 7-14 provides typical one-third octave band sound level measurements at two positions in close proximity to wind turbines, CP-1 and CP-4. These results are representative of one-third octave sound levels expected with significantly reduced wind turbine contributions (i.e. CP-1) and at downwind positions perpendicular to the wind turbine array when wind turbine sounds are most noticeable (i.e. CP-4).

The one third octave measurements presented at CP-1 show equivalent sound levels measured continuously for an hour beginning at midnight (12 am) on May 22 when the nearest wind turbine, T1, was shut down. The next nearest wind turbine is approximately 2,000 feet north of CP-1. During the shutdown period at CP-1, winds were typically from 4 to 8 mph (1.8 to 3.6 m/s) with several 3-second gusts reaching 12 mph (5.4 m/s). Results indicate that these measurements at CP-1 include significantly lower wind turbine sound mixed with sound level contributions from ambient sources.

The one-third octave measurements at CP-4 show sound levels for the two hours when all nearby turbines were operating at or near full power generation and surface winds were at their lowest levels, 2 am and 10 pm on May 21. When these atmospheric conditions occur, extraneous sound from wind in trees is significantly reduced and sound levels from wind turbines are most noticeable. The hour beginning at 2:00 am on May 21 had the lowest surface winds at or below 5 mph (2.2 m/s) except for two 3-second periods when the wind reached 7 mph (3.1 m/s). The hour beginning at 10:00 pm also had light surface winds but with several 3-second gusts in the 6 to 8 mph range (2.7 to 3.6 m/s).

Among the three measurement periods, the highest one-third octave sound levels at frequencies below 20 Hz and above 4,000 Hz occurred at CP-1 when the nearest turbine was shut down. Surface wind speeds (10 meter) were also higher at CP-1 than at CP-4 during these hours. This could indicate that the higher sound levels at low and high frequencies were from ambient (non-wind turbine) sources such as wind acting on trees. Figure 7-14 graphs show lower sound levels at these frequencies, as well as frequencies between 20 and 125 Hz, when the surface winds at CP-4 were lowest (hour beginning 2 am). Overall, the hourly sound levels at CP-4 for the hour beginning at 2:00 am on May 21 are most representative of wind turbine sound levels at full sound output. The hourly equivalent sound level at CP-4 for this period was 46.3 dBA.

Figure 7-10. Sound Levels at CP-1 in Relation to Wind Turbine Power Output and Wind Speed
5/21/09 300 to 400

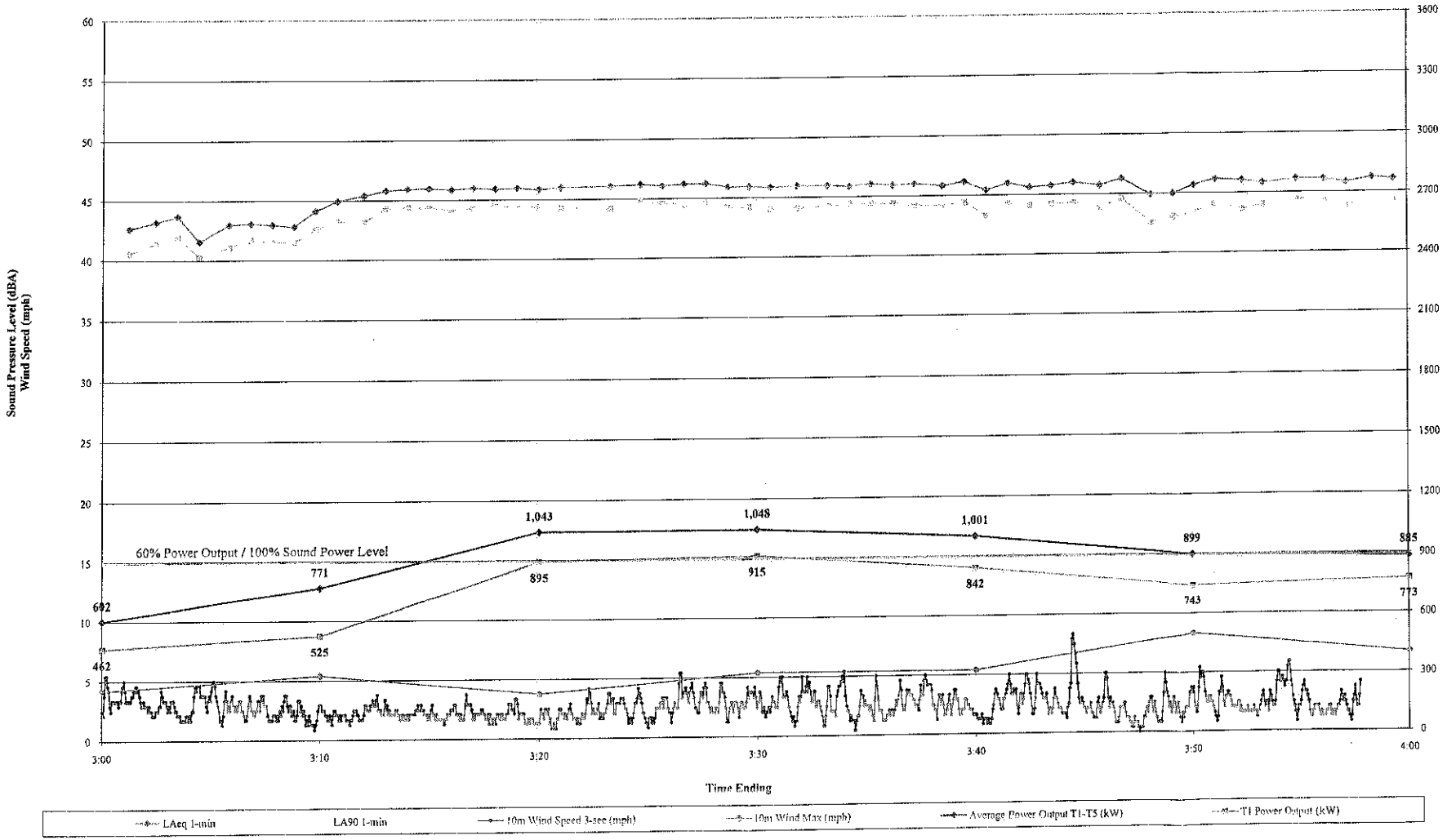


Figure 7-11. Sound Levels at CP-2 in Relation to Wind Turbine Power Output and Wind Speed
5/21/09 200 to 400

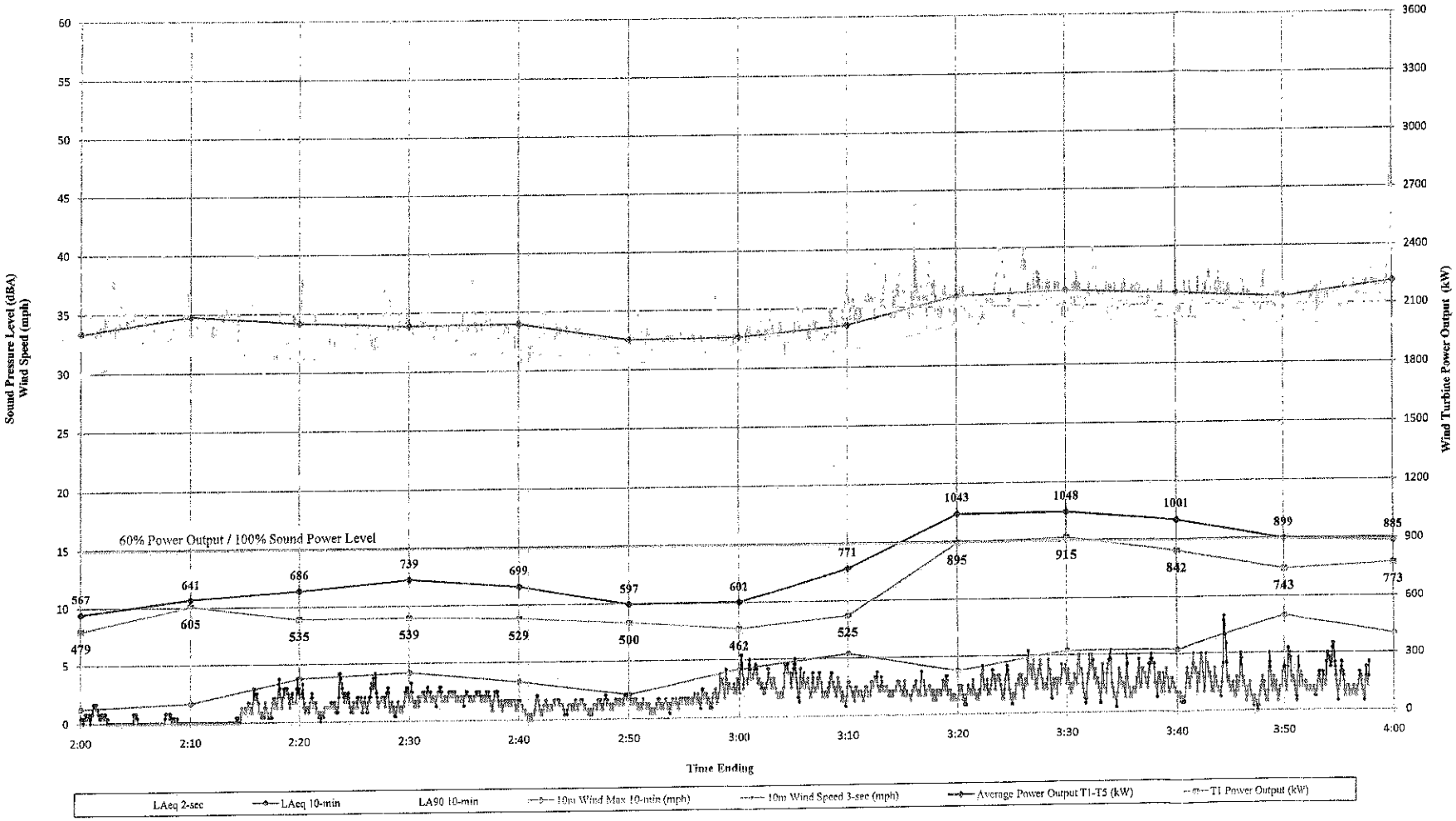


Figure 7-12. Sound Levels at CP-3 in Relation to Wind Turbine Power Output and Wind Speed
5/21/09 200 to 400

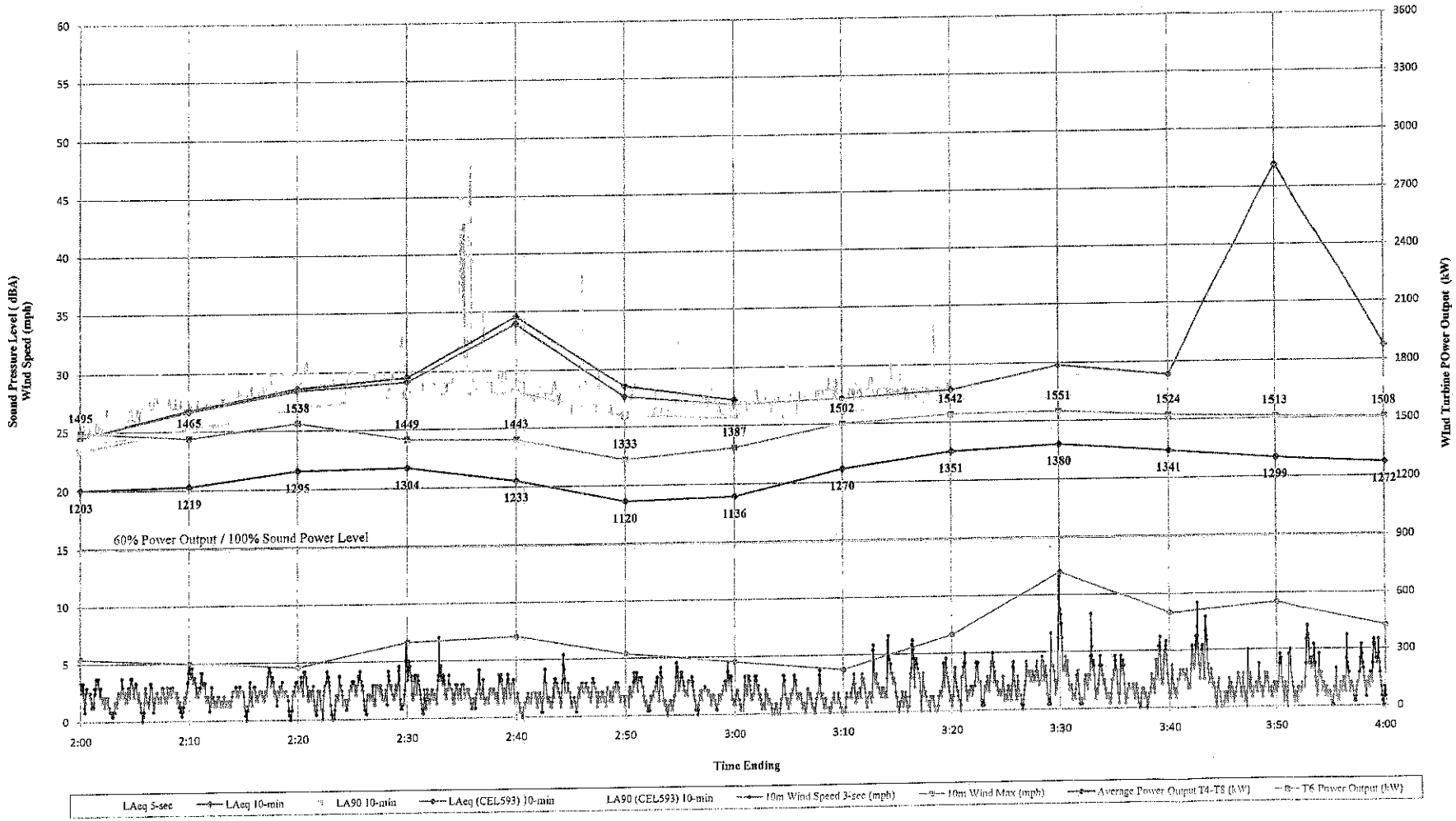


Figure 7-13. Sound Levels at CP-4 in Relation to Wind Turbine Power Output and Wind Speed
5/21/09 2200 to 000

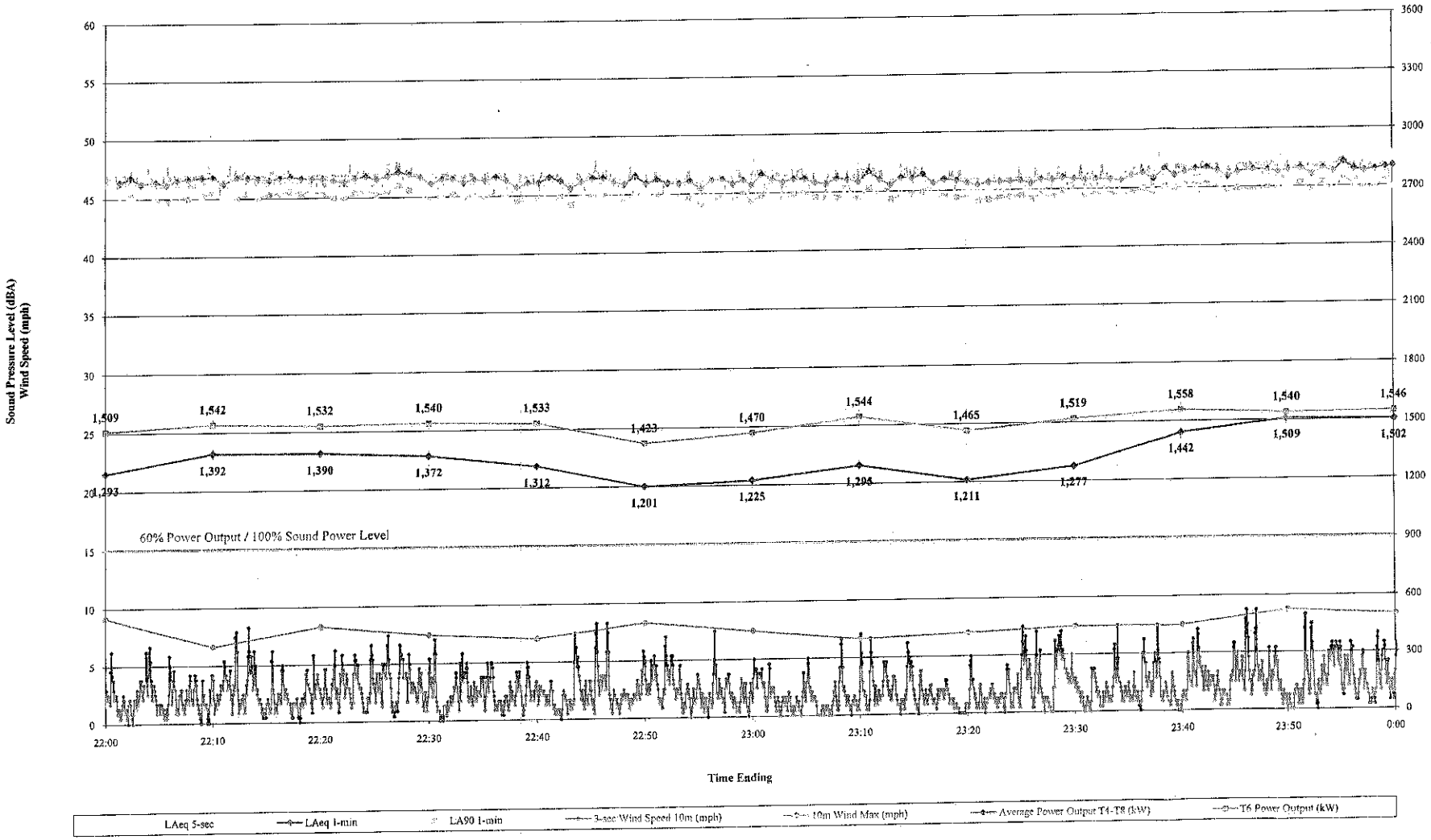
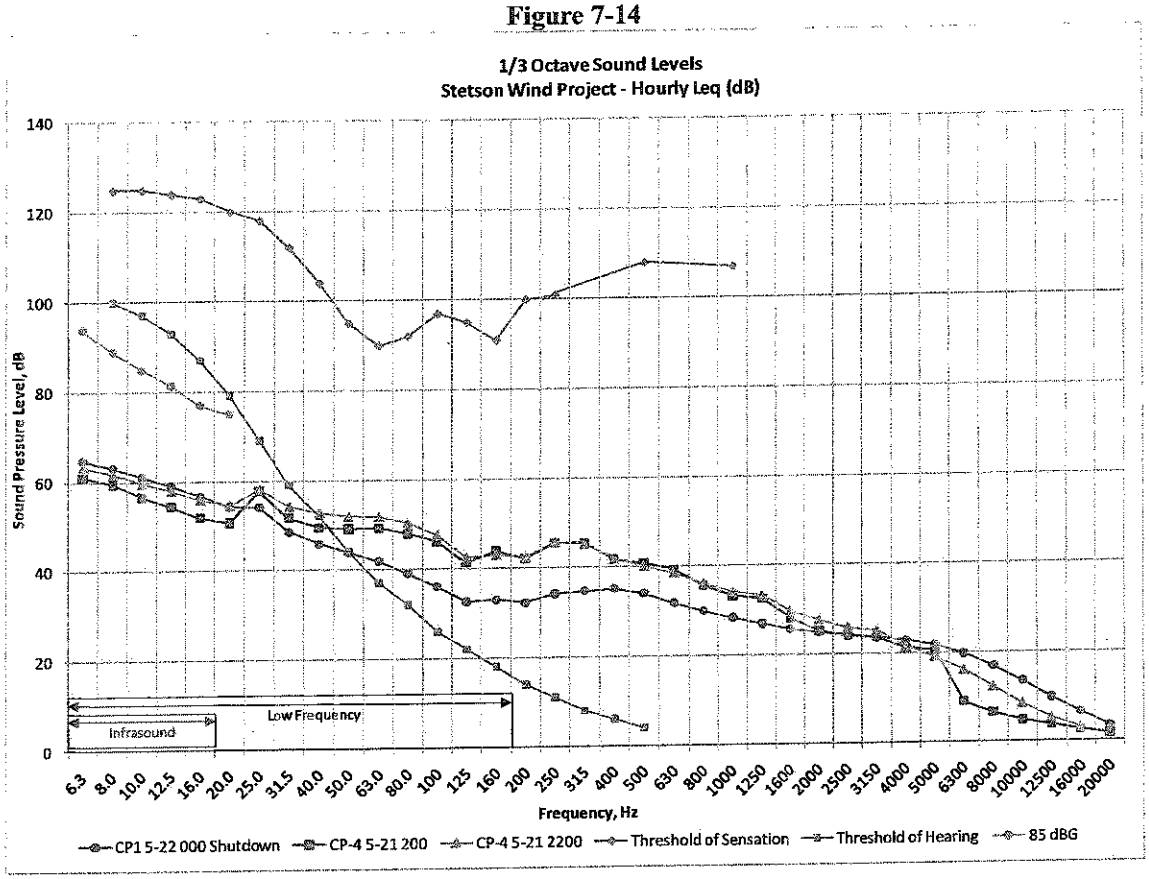


Figure 7-14



Source: Threshold of Hearing. Hayes, Malcolm. Low Frequency and Infrasound Noise Immissions from Wind Farms and the Potential for Vibroacoustic Disease. 2006.
Threshold of Sensation. Shinji, Yamada. Body Sensation of Low Frequency Noise of Ordinary persons and Profoundly Deaf Persons. 1983.

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8.0 FINDINGS AND RECOMMENDATIONS

In 2007, First Wind, LLC/Evergreen Wind V, included a Sound Assessment in the Land Use Regulation Commission (LURC) development permit application for the Stetson Wind Project (SWP). Sound level estimates for the proposed 38 turbine wind energy project were calculated using a two dimensional spreadsheet model developed by Resource Systems Engineering (RSE). A LURC *Final Development Plan Permit*, DP 4788, was issued on January 2, 2008. In accordance with Condition 6 of DP 4788, Resource Systems Engineering (RSE) recorded ambient sound level measurements in April 2008 and provided a final report, *Ambient Sound Level Measurements*, October, 16, 2008. Also pursuant to the LURC permit, RSE recorded sound level measurements during routine operation of SWP in May 2009. The primary objective of the May 2009 Sound Level Study was to determine compliance with LURC permit *Findings of Fact – Conclusion D1 and Condition Number 6 Noise.* Measurements were recorded at four positions that were approved by LURC in advance of testing. Prior to testing, and with LURC concurrence, a fourth position was added to the original LURC requirements to ensure that at least one location was in the downwind position from operating wind turbines. Measurements and observations confirmed that rigorous testing occurred during nearly ideal conditions when wind turbines were most noticeable.

As part of the compliance demonstration, a three dimensional sound level prediction model was developed in 2009 for the as-built project. The 2009 model was developed using CadnaA computer software in accordance with the internationally recognized standard for propagation of sound levels outdoors, ISO 9613-2. Conservative model parameters were used with sound power levels derived from GE data, the turbine manufacturer. Sound level measurements of routine operations were compared to 2007 estimates, 2008 ambient sound levels, and the 2009 model of the as-built project. An important secondary objective verified the conservative nature of the 2009 model projections. Therefore, when reviewed in conjunction with measurements at select downwind positions, the 2009 model predictions can be relied upon for compliance determination at all other offsite locations and during downwind conditions.

Data from local meteorological stations (10 meter height) were used to identify periods of low surface winds that occurred while wind turbine power output data demonstrated operations at or above full rated sound power emissions (i.e. 60% of rated electric power generation capacity). For the periods when wind turbine sound levels were most noticeable, actual power generation was at or near 100% of generation capacity. Sound levels were measured at 10-minute intervals and shorter time history periods (i.e. 1-minute and 50-millisecond). Ten-minute data was compiled on an hourly basis for one representative overnight period to summarize overall operating sound levels historically used by LURC for compliance demonstration. These hourly results are presented in the Executive Summary of this report as Figures E-1 to E-4. Figures E-1 to E-4 clearly show compliance at all positions when sound levels of the project were continuously measured and observed to be most noticeable - the nighttime of May 21-22, 2009. Total hourly average sound levels, L_{Aeq}, of combined ambient and turbine sound were well below the 55 dBA limit for the entire measurement period. Figures E-1 to E-4 also show L_ns for additional comparisons. The difference between nighttime L_{Aeq} and L_{A90} of 1 to 2 dBA at both CP-1 and CP-4 further confirms that wind turbines produced the prominent sound levels during this period with relatively minor contribution from extraneous sources. Though not required for compliance with LURC Permit DP 4748 *Findings of Fact – Conclusion D1 and Condition Number 6 Noise*, data in the body of this report are presented on a 1-minute and 10-minute basis to demonstrate rigorous measurements and analyses.

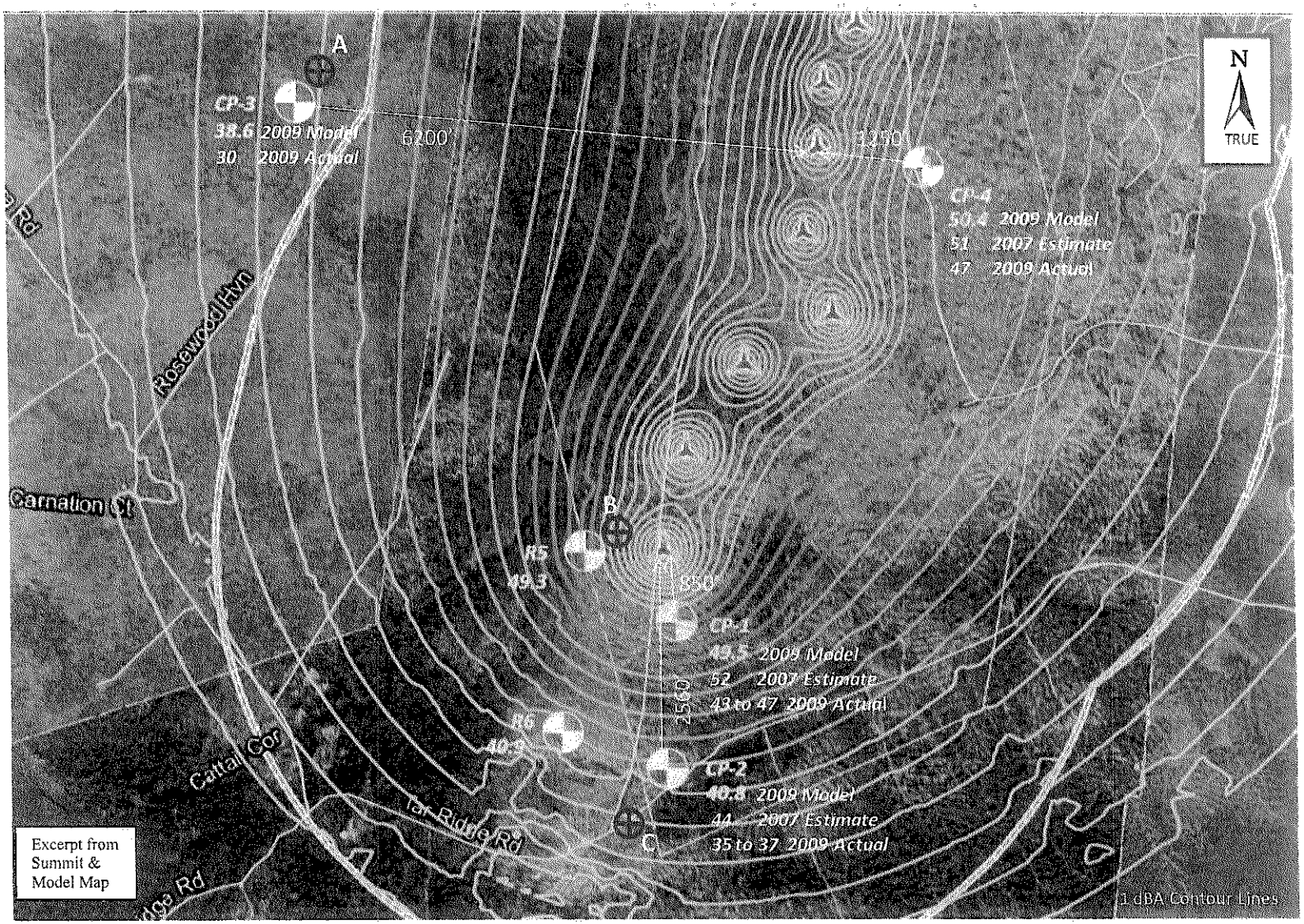
Similar to wind project sound levels, ambient sound levels vary with wind speed. Sound levels from SWP operations were generally higher than the nighttime range of ambient sound level at CP-1, CP-2 and CP-4. At CP-3, located 6,200 feet from the nearest wind turbine, SWP sound levels were at or well below ambient sound levels.

Position CP-1 was selected to represent the nearest location where LURC noise limits apply. During periods with wind turbines most noticeable, the highest measured 10-minute average sound level at CP-1 was 47 dBA, 8 dBA below the LURC nighttime limit of 55 dBA. The highest wind turbine sound levels during these periods were 5 to 9 dBA below the 2007 estimates and 3 to 7 dBA below the 2009 as-built model prediction (see Table 7-3).

Position CP-4 was selected to ensure measurements of SWP operations were downwind from the predominant wind direction expected for full sound power emission under stable atmospheric conditions and with low surface winds (i.e. equal or less than 6 mph). These are the conditions when SWP sound is most noticeable. Results demonstrate that CP-4 was the best position to measure downwind sound levels and to verify the conservative nature of the 2009 model predictions. Figure 8-1 presents an excerpt of the 2009 model and compares the range of 10-minute, measured sound levels to model projections. Measurement results at CP-4 confirm that RSE's estimates are conservative and tended to overstate actual sound levels from operation of the Stetson Wind Project. This validation of the 2009 as-built sound model demonstrates that predictions can be relied upon to further demonstrate compliance with the LURC 55 dBA limit applicable to all zone boundaries surrounding SWP.

RSE recommends that no further testing is required to demonstrate compliance because rigorous sound level measurements at the nearest position where LURC limits apply were 8 to 12 dBA below the 55 dBA limit. In addition, the validated 2009 as-built sound model further verifies that downwind sound levels from SWP are well below the LURC limits.

Figure 8-1. Stetson Wind Project 2009 As-Built Model with Receiver, Ambient and Compliance Measurement Locations and sound level results



9.0 REFERENCES

LURC REGS Land Use Regulation Commission, Final Development Plan Permit DP 4788, 2008.

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IEC International Standard 61400-11, Wind Turbine Generator Systems – Acoustic Noise Measurement Techniques, Edition 2.1, 2006.

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Prediction and assessment of wind turbine noise. Agreement about relevant factors for noise assessment from wind energy projects. Bowdler, et. al. Acoustics Bulletin March/April 2009 pp 35-37.

RECYCLED

ADDENDUM

VISUAL ASSESSMENT

of the Proposed Oakfield Wind Project

June 30, 2009

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An Important Note Regarding This Addendum

This addendum to the "Visual Assessment of the Proposed Oakfield Wind Project" dated June 30, 2009 and prepared for Evergreen Wind Power II, LLC by LandWorks, Middlebury, VT has been necessitated by the discovery of an omission of 2 pages of the June 1, 1987 Maine Wildlands Lake Assessment (Lake Assessment) found on the Wind Power Task Force website. Pleasant Lake was on one of the missing pages not on the website and therefore was not included in our initial assessment. Pleasant Lake has been identified as "significant" on the Lake Assessment in Land Use Regulation Commission (LURC) territory.

Our conclusions with regard to the visual impacts from the Oakfield Wind Project and the potential effects on Pleasant Lake do not alter or replace any of the conclusions forwarded in the Visual Assessment already filed.

LandWorks

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1. VISUAL ASSESSMENT ADDENDUM

1.1 Existing Conditions and Context of Pleasant Lake

1. View looking east from the Pleasant Lake boat launch area - portions of 4 turbines may be visible from this location on the low ridge (the right-hand ridge in the photo) but will be partially obscured by the intervening treeline. The closest visible turbine will be about 3.1 miles from this location.

2. View looking northerly from a point on the south shore of Pleasant Lake in T4R3 WELS. Hilltop road clearing is visible through the trees on the near ridge.

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3. View looking west from eastern portion of Pleasant Lake towards distant mountains.

4. Close up of typical wooded conditions on the north shore of Pleasant Lake.

1.2 Visual Impacts to Great Ponds within the Viewshed 369

In addition to Mattawamkeag Lake, a portion of Pleasant Lake is considered to be a great pond having "significant" scenic value in accordance with 35-A M.R.S.A, Section 3452.

Table 1. Inventory of Resources of State or National Significance

GREAT PONDS
Location 2: Pleasant Lake is located in Island Falls and T4R3 WELS, with the portion in T4R3 WELS being listed as "significant" for scenic resources in the Maine Wildlands Lake Assessment June 1987. The closest turbine to the lake, S17, is approximately 1 mile from the nearest point on the northerly shore, and approximately 3.1 miles from the boat launch which is on the western-most shore.
Character: Pleasant Lake is developed at the westerly end of the lake and primarily undeveloped in that portion of the lake which falls within T4R3 WELS. Low hills and ridges surround the lake, and the shoreline is wooded and has a landscape character typical of many similar lakes in this region of Maine. There are no identified state lands, parks or publicly conserved properties on Pleasant Lake and there is one public boat launch on the most westerly cove of the Lake, in Island Falls. Camps line the north and south shores in Island Falls, the portion of the lake in T4R3 WELS has one camp area on the north shore. There are a number of jeep trails, wood roads and logging areas around the perimeter of the lake.
Viewers: Boaters, fishing parties, selected camp residents
Project Visibility: Limited views of 4 turbines may be possible above the treeline from the boat launch on the western edge of the lake, with the closest turbine, S17, being about 3.1 miles from the boat launch. The views of turbines S16 and S17 will be primarily of a portion of the turbines from the nacelles and above, and the views of turbines S13 and S14 will include a portion of the towers below the nacelles. It is possible that the very tip of a rotor of a fifth turbine, S15, may also be visible, but will be hard to discern given the distance and foreground vegetation. None of the associated project facilities are visible from any portion of the lake (see Exhibit 2).

Pleasant Lake is an approximately 4 mile long lake that is about a mile at its widest point. About half the lake is in Island Falls, with the other (eastern) half situated in T4R3 WELS. It is this portion that is listed as "significant" on the Lakes Assessment published by the Land Use Regulation Commission (LURC). Despite the listing of the eastern end of the lake as having "significant" (but not "outstanding" scenic qualities) it is difficult to distinguish the scenic and visual qualities from scores of similar lakes that

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are present throughout this region of Maine. The surrounding terrain is not unusual, distinct or compelling compared to other lakes in this region and, in fact, given the lack of mountainous backdrops and distinctive landforms or characteristics, this lake and its visual qualities can be considered common and typical.

The western half of the lake, in Island Falls, has camps lining both the north and south shores, and the public boat launch is located at the far western end, which has a developed character. The summer time users tend to congregate on the western end and activity often focuses around the boat launch and camp areas. The eastern end of the lake sees far less use and activity and is primarily frequented by fishing parties.

In reviewing the proposed project it was determined that the various qualities of the project are such that the landscape can "absorb" it to the extent that the project will not significantly compromise the views from the resource or have an unreasonable adverse effect on scenic character, or existing uses related to that scenic character.

Table 2. Pleasant Lake Visibility Facts (for the entire lake)

Oakfield Wind Project: Pleasant Lake Visibility Facts			
	Area	**Percent of study area**	**Percent of viewshed**
Total area of Pleasant Lake	3 sq. mi.	1.1%	
Total area of Pleasant Lake with potential visibility	2 sq. mi.	.7%	1.1 %
Percent of Pleasant Lake with potential visibility of the project		67%	

The annotated aerial photograph included on page 6 in this addendum also demonstrates that even where the lake appears to be undeveloped, there are actually extensive trails, woods roads and logging activity around its perimeter. Some substantial new roads have been built to serve a development area on the western portion of the lake north of the north shore. Boaters will be able to see portions of the Oakfield Wind Project as it has been proposed, and the visibility will most likely be of 5 of the closest turbines, 1-1/2 to 2 miles distant depending on the vantage point. The turbines appear in a compact group and will only be visible over one small section of the shoreline (see Exhibit 1: Visual Simulation from Pleasant

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Lake). Thus, this will de-emphasize their presence and the turbines will not appear dominant nor will they compromise the experience of the lake to a substantial degree. There will remain many areas on the lake where those who wish to fish or boat out of sight of the turbines, or with a different orientation, may do so. Boaters and those fishing from boats can choose locations where, if they do not want to experience the turbines, they will not be visible, particularly along most of the north shore. They can anchor in particular locations where the orientation is away from the project. In fact, given the east-west orientation of the lake, the eye is drawn in these two directions, and from the eastern end there appears to be a long distance view of Mt. Chase, which draws the eye and the viewer's attention. The large cove in the far northeastern portion of the lake will remain secluded and without any visibility of the project. As with Mattawamkeag Lake, the visibility of the turbines will be subject to atmospheric conditions.

Project Aesthetics and Viewer Expectations

A brief summary of the project's aesthetics and the viewer's expectations is added to this narrative and is generally applicable to the project as a whole, particularly when views from both Mattawamkeag and Pleasant Lakes are considered.

Project Aesthetics

The following narrative uses the generally accepted means of describing a project's visual relationship to the landscape and its context, and these terms and the analyses have been referenced in the Maine Department of Environmental Protection's guidelines for "Assessing Impacts to Existing Scenic and Aesthetic Uses under the Natural Resource Protection Act" (Augusta, 2003).

Color - The grey and muted white colors of the project's turbines and towers are such that they blend, to the extent possible, with background atmospheric conditions and sky color.

Form - the turbines have a vertical form with three distinct blades, which are distinct from other elements in the landscape. Until wind energy projects are more widespread in Maine, such projects will not be considered common, everyday forms in the landscape. The width of the tower and blades is such that with distance the form becomes less obtrusive, and less noticeable in the landscape. This is not the case for close in views a mile or less from the turbine site itself. In viewing distances over 6 miles the rotors[1], in particular,

[1] "Rotors" are the whole assembly, blades plus the hub they are bolted to.

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become more difficult to observe and do not stand out, diminishing the overall form and presence of the structure

Line - "Lines" are applicable to the project's aesthetics when one sees views of cut lines for roads and electrical corridors. Such linear patterns are not unusual or unexpected in this landscape, given the network of roads and utilities present in the area, as well as the tradition of timber harvesting. When viewed against a backdrop, the vertical forms of the turbine tower and linear forms of the blades help them to blend in against a wooded hillside.

Contrast - The turbines, when viewed as elements situated above the treeline, do contrast with the surrounding landscape. This contrast is more pronounced the closer the viewer is to the structure, less pronounced with distances over 6 miles. At eight to ten miles the size, scale, and color of the project turbines is such that it becomes less distinct in the long view, and thus does not contrast as distinctly with its surroundings when viewed at closer range.

Intactness – In the context of this commercial forest, the project does not require the removal of extensive areas of forest cover, nor will its associated facilities create unnatural breaks or changes in the landscape. Thus, the overall landscape form will remain intact and unbroken, reducing the potential for visual impact from the project and its associated facilities.

Texture - The smooth form of the turbine towers do not share the same texture of the landscape, but do often assume the same or similar visual qualities of atmospheric conditions, allowing them to blend into skylines that have clouds or grey/white color.

Scale - When seen in the foreground (0-1/2 mile or mile maximum), the project will be of a large scale and therefore its visual impact will be more noticeable and in contrast with its surroundings. As the distance from the project increases, the scale of the project diminishes as well, and fits better within the landscape. At a distance of 2 miles, as shown on the Visual Simulation presented in Exhibit 1, the scale of the turbines, given the mass and form of the structures, and the background sky, do not appear to be overwhelming in scale, although they will be visible well above the treeline.

Spatial Dominance - This project's form will contrast with its surroundings, although from viewing points associated with Pleasant Lake the landscape will remain intact, and the presence of the visible towers will not overly dominate the lake environment due to the distance of the visible portion of the array at a 1/2 mile length along the hillside when seen on the northern horizon. This project site is not located on a dominant or distinct landform.

Distances - when seen from Pleasant Lake, the project will be viewed in the mid-ground, normally considered to be 1/2 to 4 miles from any given vantage point. The closest point of the nearest turbine to the north shore of the lake is about 1 mile.

Viewer Expectations

There are three primary viewer groups that will have potential views of the project from Pleasant Lake: camp users, recreational boaters and anglers.

Camp Users and Owners. The camp users and owners are located on the portion of Pleasant Lake that is in Island Falls - this segment of the lake is not considered significant for its scenic quality and therefore views of the project will not unduly affect those who are experiencing what is already a developed lake environment. This group of viewers expects to see and experience development of the lakeshore; are located some distance from the project; and, are generally oriented away from the project site. Only two camps to the east of Whitney Point are oriented northeast in the direction of the project.

Recreational Boaters. Informal observations on Lake Pleasant on 3 separate occasions during the boating season of 2008 indicated that the bulk of the boating activity occurs in the Island Falls portion of the lake. Boaters on motorboats are less likely to be focused on the sight of the turbines. These boaters can quickly move out of the viewshed or orient in a different direction. Some boaters who kayak, row or paddle canoes are seeking a more quiet, unfettered experience and share this interest and expectation with anglers. They will still be able to have this type of experience given that: 1) not all of the lake area is within the viewshed of the project; 2) the project's presence in relation to the lake is not dominant or overwhelming; and, 3) these viewers have the option to orient themselves away from the project or out of its view.

Anglers. This user group has similar expectations to the non-motorized boaters group insofar as they often seek quiet, out of the way locations where they can fish successfully. This group of viewers, while enjoying and expecting an experience that includes quiet, scenic environs, are likely focused on their primary activity, which is fishing. As with recreational boaters, anglers have the same options if they wish to avoid any visual contact with the project, such that they will be able to enjoy their activity in a manner that is essentially unchanged from the conditions that exist currently. This conclusion is qualified with the consideration that their activities will need to be undertaken with some forethought and action as to selecting where and how they choose to engage in their activity, should they wish to avoid extended views of the project.

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Other considerations include:

• Views down lake are more compelling and viewers' attention is typically drawn to and engaged in the long distance views rather than nearby views. Given that Pleasant Lake is most dramatic along its east west orientation, and this orientation draws the viewer's interest, the proposed project will be less prominent and will not serve as a focal point or dominant element when viewed from many, if not most areas of the lake.

• Four to seven turbines will be visible from those portions of the lake and lakeshore, which are within the project's viewshed. As shown in Exhibit 1, which represents the most prominent view of the project from the lake, 5 turbines are visible and the tips of the rotors of 2 additional turbines are barely discernible. The visible turbines are limited to a 1/2-mile distance from the westerly to easterly turbine along the ridge above the north shore. The overall length of Pleasant Lake is approximately 4-1/4 miles.

• Camps, for the most part, are oriented away from the project site with the exception of several of the easternmost camps on the south shore, east of Whitney Point.

• The entire north shore of the lake is wooded, except for the developed area on Birch Point, and one camp that is part of the Powers Trust land, located approximately 3.5 miles to the east of Birch Point, and are all oriented in the opposite direction from the project. Thus, there will be no views of the project from any point along its entire north shore, due to its intact woodlands, with the exception being those areas that have been substantially cleared or are open. These locations will most likely have limited views of only portions of 2 or 3 turbines. Additionally, many areas of the northern portion of the lake surface will be out of the viewshed, including an area stretching a half a mile into the lake from the north shore just to the east of the Islands Falls town boundary with T3R4 WELS (see Exhibit 3).

• Boaters and fishing parties will have many options to orient away from or out of sight of the project and thus the recreational experience will not be compromised.

• Energy generation from natural resources and natural resource development and management in this area of Maine is commonplace and consistent with local culture and land use history. Wind energy generation is and will become part of this form of resource use. Some smaller scale wind energy turbines are present in the region. Additionally, those who frequent lakes in this area for fishing and boating are used to seeing and experiencing

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resource use and development, including timber harvesting and road access and construction.

Overall Conclusion

There are a number of factors and conditions that diminish the overall visual impacts of the proposed project and as a result the proposed Oakfield Wind Project will not result in visual or aesthetic impacts that will substantially undermine the experience and enjoyment of the lake and its resources.

Given the foregoing analysis, and the considerations presented above, it can be concluded that the project, as proposed, will not substantially compromise the experience of those who fish, boat and recreate on Pleasant Lake. The development will not significantly compromise the views from this resource, and will not have an unreasonable adverse effect on the scenic character or the existing uses related to that character.

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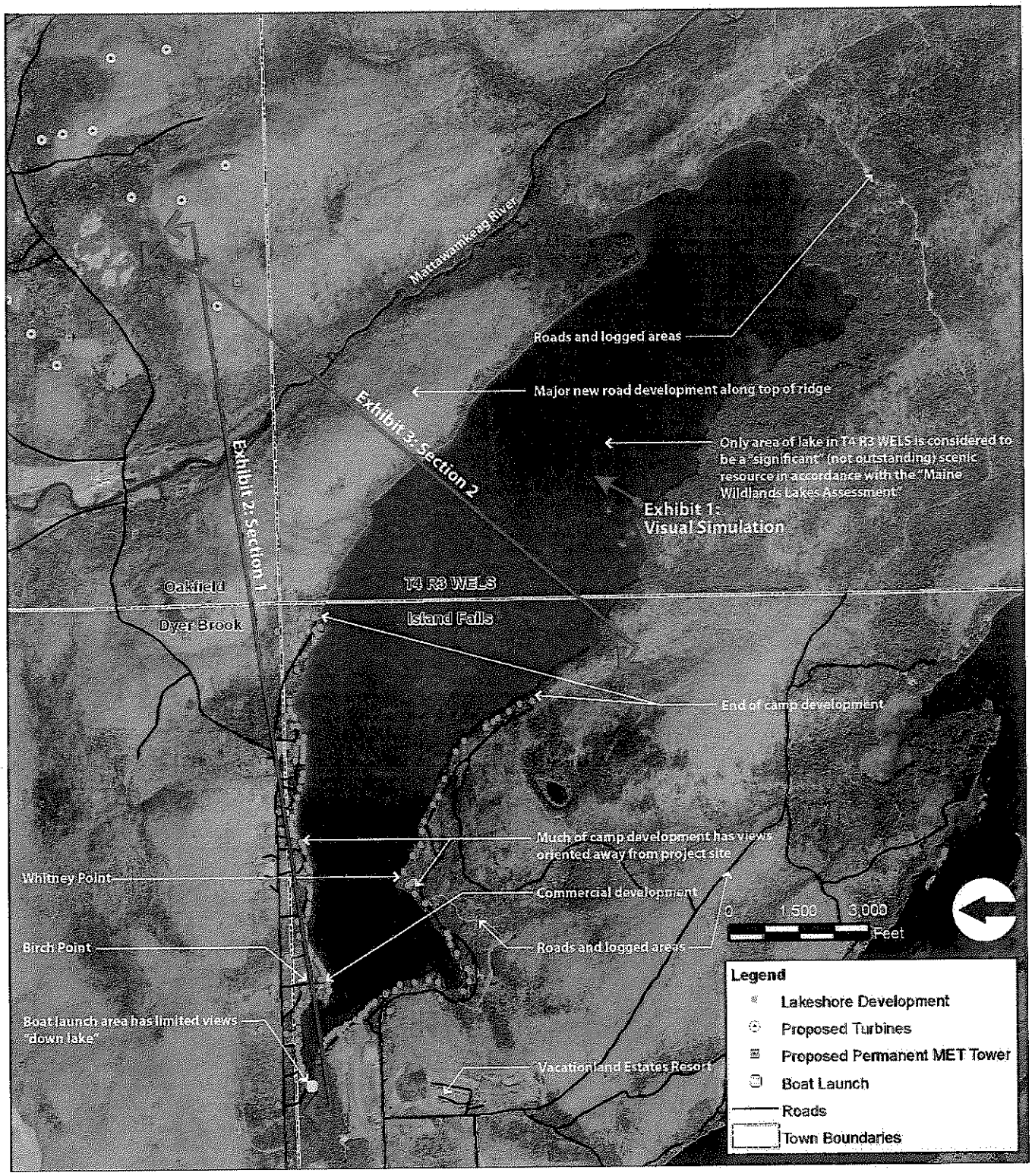
Diagram 1. Typical Landscape & Land Use Conditions – Pleasant Lake



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EXHIBITS (attached)

Exhibit 1: Visual Simulation from Pleasant Lake
Exhibit 2: Section 1, Line of Sight from Pleasant Lake boat launch looking west
Exhibit 3: Section 2, Line of Sight from south shore of Pleasant Lake looking north