equipment must be provided and used to reduce noise exposure. In compliance with OSHA, Project contractors will be required to readily provide construction workers with OSHA approved hearing protection devices (HPD) and to identify high noise areas and activities where hearing protection will be required. Operational sound generated from the Project will not approach OSHA noise exposure limits even in very close proximity to individual WTG locations.

3.4 Summary of Acoustic Criteria

A summary of the pertinent acoustic criteria used to assess sound levels at existing sensitive areas during Project operation is provided below:

- EPA 70 dBA L_{eq} (24) at publicly accessible Project property lines or extents of work areas where extended public exposure is possible;
- EPA 55 dBA L_{eq} (24) in outdoor areas where limited time is spent;
- 55 dBA L_{dn} (24) outdoors at all residential receptor locations where extended periods of time are spent outdoors, residential structures and areas in close proximity to the residential structure. i.e. yards. Wind turbines operate intermittently depending on wind conditions at hub height. Assuming the wind turbine is operating as a continuous steady state sound and is the dominant contributor of environmental sound level at the receiver location, the L_{dn} is approximately 6.4 dB above the measured L_{eq}. Consequently, an L_{dn} of 55 dBA corresponds to a maximum instantaneous L_{eq} of 48.6 dBA;
- IPCB nighttime octave band frequency dBL dependent limits for Class C land emitting sound to present Class A use located within the designated Class C land (Table 5); and
- OSHA regulatory limits for worker and public safety exposure to high noise levels.

State and community noise standards are one important aspect of affording adequate protection of human health and of quality of life. Noise criteria identified cannot be used to infer audibility thresholds; however, compliance with IPCB standards and EPA guidelines would likely result in reduced probability of annoyance and noise complaints. Inaudibility under all operating conditions is an unrealistic expectation, and one that is not required under any other industrial, commercial, or agricultural activity in the State of Illinois. These EPA noise guidelines are considered unenforceable internal design guidelines. OSHA safety and IPCB environmental noise regulatory limits are mandatory requirements at all times. Regulations and guidelines presented are absolute and are assessed for Project generated noise only. They are independent of existing acoustic environment; therefore, no baseline sound survey is required to assess conformity.

4.0 ACOUSTIC MODELING METHODOLOGY

4.1 Wind Turbine Sound Characteristics

There are two principal sound sources from an operating wind turbine generator (WTG): mechanical and aerodynamic sound. Mechanical sound is generated at the gearbox, generator, and cooling fan and is radiated from the surfaces of the nacelle and machinery enclosure and by openings in the nacelle casing. Aside from upset conditions that may create mechanical noise, the dominant noise generating components of utility scale WTGs are aerodynamic.

Aerodynamic sound is related to air flow and the interaction with the tower structure and rotor blades when in motion. Air flow entering the rotor swept area is not completely smooth, consisting of turbulent eddies of air that results in inflow turbulence noise. Air flow occurring across the blade produces turbulence at the surface boundary layer, resulting in trailing edge boundary sound. Trailing edge sound is generally considered the principal aerodynamic noise source component and results in the characteristic amplitude modulated (time-varying) swooshing sound at the rate at which the blade passes the tower. In addition, tip sound is created by vortices shedding as the blade tips pass through the air. Aerodynamic WTG sound is made up of several frequencies (broadband) and therefore, it does not contain distinguishable pure tones.

Wind turbine manufacturers have instituted sound reduction measures to both reduce aerodynamic sound and increase power generation efficiencies by reducing trailing edge and tip sound generation. Efforts to reduce aerodynamic sounds have included the use of lower tip speed ratios, lower blade angles of attack, upwind rotor designs, variable speed operation and the use of specially modified blade trailing edges to reduce turbulence. When discussing sound from wind turbines, it is important to distinguish between turbines with downwind rotors as opposed to upwind rotors. Some early wind turbine designs with downwind rotors produced significant levels of sound under certain operational conditions. The downwind design is rarely used in modern utility-scale wind power turbines. Modern wind turbines employing the now standard upwind rotor design have been shown to be significantly quieter than earlier technologies due to the reduction of inflow turbulence and low frequency sound that has been associated with tower wake shedding. This change in rotor location has resulted in a decrease of 10 dBA or more, or nearly half as loud in terms of perceptibility.

A somewhat unique acoustic characteristic of wind energy projects is that the sound generated by each individual wind turbine will increase as the wind speed across the site increases, up to a certain maximum sound level under elevated wind conditions (i.e., greater than approximately 8 m/s). The GE 1.5 XLE is a variable speed type wind turbine, with sound emissions escalating with increasing wind speed up to rotational maximum. Once at this maximum rotational speed, the turbines adjust the pitch of the blades into the wind, to maintain this rotational speed resulting in near-uniform sound emission levels. Background ambient sound levels will continue to increase due to wind generated masking effects.

4.2 Existing Acoustic Environment

Existing ambient (or background) sound level can help determine the potential of when an adverse noise impact may potentially occur. Background sound levels are variable based on location and proximity to area sound sources and activities. There are also diurnal effects in background sound levels, with nighttime sound levels typically being quieter than daytime. In areas with elevated existing sound levels, masking of sound from a new source will occur through a mechanism referred to as acoustic masking. Seasonal effects, such as the presence of crickets chirping in the evening and overnight periods during warmer months may mask new sounds as will natural sound occurring during windy days due to wind generated sound. This masking effect by wind generated sound is most prevalent in rural and suburban areas with established tree stands. Wintertime defoliate conditions typically have lower background sound levels due to lower wind masking effects and reduced outdoor activities in colder climates. This also results in people exhibiting lower sensitivities to outdoor sound levels, particularly in this geographical region of the U.S., as windows are closed and less time is spent outdoors.

Principal contributors to the existing acoustic environment within DeKalb County likely include motor vehicle traffic, mobile farming equipment, farming activities such as plowing and irrigation, all-terrain vehicles, local roadways, rail movements, periodic aircraft flyovers, and natural sounds such as birds, insects, and leaf or vegetation rustle during elevated wind conditions in areas with established tree stands or established crops. The acoustic environment of DeKalb County is generally characterized as agricultural rural where existing sound levels are expected to be relatively quiet.

4.3 Acoustic Modeling Software and Calculation Methods

The operational acoustic assessment was performed using the Project design layout dated March 6, 2009 following an iterative review process, and employing the most recent version of Datakustic GmbH's CadnaA, the computer aided noise abatement program (v 3.7.123). CadnaA is a comprehensive 3-dimensional acoustic software model that conforms to the International Standard Organization's (ISO) standard ISO 9613.2 "Attenuation of Sound During Propagation Outdoors". The topographic information for DeKalb County was imported into CadnaA using the official USGS digital elevation dataset and visually confirmed using digital orthophotos to accurately describe both on and offsite topography and terrain in 3-dimensions. The engineering methods specified in this standard consist of 1/1 octave band algorithms that incorporate the following:

- Geometric spreading wave divergence;
- Reflection from surfaces;
- Atmospheric absorption;
- Screening by topography and obstacles;
- Terrain complexity and ground effects;
- Source directivity factors;
- Height of both sources and receptors;
- Seasonal foliage effects; and
- Meteorological conditions including the effects of wind and atmospheric inversions.

The CadnaA acoustic modeling software has been shown to be a highly accurate and effective acoustic modeling tool for wind energy projects sited in Europe, Canada and the U.S. when appropriate wind turbine acoustic modeling techniques and site-specific terrain and topographical features are considered. Calculation correction factors have been applied to account for inherent limitations in the ISO 9613 standard to account for specialized application of a large dimension-elevated sound source such as a WTG. CadnaA modeling calculations consist of 1/1 octave band center frequency and overall broadband algorithms conforming to the ISO 9613 standard. ISO 9613.2 has been developed to ensure the highly accurate calculation of environmental sound attenuation over long distances in an outdoor environment. In accordance with ISO9613.2, the downwind (DW) equivalent A-weighted sound pressure level (L_A(DW)) is defined as:

$$L_A\,(\mathrm{DW}) = 10\log\left\{\left[\,(1/T)\int_0^T p_A{}^2(t)\,dt\,\right]/p_o{}^2\right\} \quad \text{in dBA}$$

In this equation:

p_A (t) = the instantaneous A-weighted sound pressure, in Pascals;

p_o = is the reference sound pressure 20 μPa (microPascals)

T = is a specified time interval, in seconds.

The Lee-DeKalb WEC Project is subject to frequency (Hz) regulatory limits by the IPCB, requiring the calculation of the downwind equivalent octave band center frequency sound pressure level:

$$L_f\,(DW) = 10\log\left\{\left[(1/T)\int_0^T p_f^{\,2}(t)\,dt\right]/p_o^{\,2}\right\} \quad \text{in dBL (linear)}$$

Where pf(t) is the instantaneous octave-band sound pressure downwind, in Pascals, and the subscript f represents a nominal center frequency of an octave band filter.

4.4 Acoustic Modeling Input Parameters

In order to assist Project developers and acoustical engineers, commercial wind turbine manufacturers report wind turbine sound power data at each integer wind speed referenced to a height of 10 meters (32.8 ft) above grade, ranging from cut-in to full rated power. This internationally accepted International Electrotechnical Commission (IEC) standard was specifically developed to ensure consistent and comparable sound emission data of utility-scale wind turbines between WTG manufacturers.

Acoustic modeling was conducted accounting for wind speeds covering the entire range of future operating conditions extending from cut-in to full rotational rotor speeds. The wind turbine sound source data used in the analysis were assessed based on guaranteed maximum generated sound levels and manufacturer confidence intervals as per the IEC 614100-11 acoustic measurement standards. These data are inclusive of mechanical and aerodynamic source components. Wind turbines can be somewhat directional, radiating more sound in some directions than others. The IEC test measurement protocol requires that sound measurements are made for the maximum downwind directional location when reporting apparent sound power levels. Thus, worst case directivity and sound generating efficiencies of the WTG are reported in the sound source data and used in the acoustic model calibration. A summary of sound power data for the GE XLE 1.5 MW WTG correlated by wind speed at a height of 10 meters (32.8 ft) above grade are presented in Table 8. Source data were modeled at the rotor hub height of 80 meters (262.4 ft) using the site specific roughness length coefficient which describes changes in wind speed with increase height above the ground.

Table 8 Wind Turbine Sound Power Levels Correlated with Wind Speed

	Sound Power Level (L_W) at Reference 10 m (32.8 ft) Wind Speed (dBA)						
	3 m/s (6.7 mph)	4 m/s (9 mph)	5 m/s (11.2 mph)	6 m/s (13.4 mph)	7 m/s (15.9 mph)	8 m/s (17.9 mph)	9 m/s (20.2 mph)
GE XLE -1.5 MW	< 96	<96	<96	98.8	102.3	≤104	≤104

Within CadnaA, wind turbines can be modeled as a disk of point sources, as a ring of point sources or as an idealized single point source and the tower as a cylinder. The elevated point source at the position of the hub is the most straightforward approach to simulate a wind turbine and is appropriate when the distance from the source is large compared to the dimensions of the source. The equivalent continuous downwind octave band sound pressure level at a receiver location is calculated for each individual turbine

source and its image sources on both a broadband and frequency dependent basis from 63 Hz to 8 kHz. Geometrical divergence accounts for spherical spreading in the free field from a point sound source according to the equation below:

$$L_P = L_W + DI_\theta + 10\log\left(\frac{1}{2}\pi R^2\right) - A \quad \text{in dBA or dBL}$$

Where:

L_P = calculated sound pressure level at receiver location

L_W = reference sound power level by octave band center frequency

DI_θ = directivity index correction to account for the variation in sound intensity with orientation relative to the noise source.

R = linear (slant) distance of Lp from source in meters (or feet multiplied by 3.28) to calculate geometrical divergence with distance

A = extraneous attenuation factors that may occur during propagation from the point sound source to the receiver.

For idealized point sources, sound levels will attenuate with increased distance from the source in accordance with the "inverse square law" due to geometric divergence which occurs as the sound energy is spread across a sphere of greater dimensions. In addition to standardized geometrical divergence, other extraneous attenuation factors (A) include meteorological conditions, topographical features, terrain coverage, and/or other natural or anthropogenic obstacles that can affect sound attenuation and result in acoustical screening. Meteorological factors can influence the wind turbine sound propagation and include (in approximate order of increasing importance): humidity, precipitation, temperature, atmospheric stability, turbulence, wind speed and direction.

The effects of wind on outdoor sound propagation during different weather conditions can cause significant variations in Project-related sound levels measured at receptor locations. If the receptor is located upwind of the facility, the wind could cause greater than normal outdoor sound attenuation due to wind shadow, resulting in lower sound levels at the residence than would occur under calm conditions. If the residence is downwind of the facility, the opposite effect could occur, resulting in higher sound levels than normal at the receptor location. Sound propagation perpendicular to the wind direction has little to no effect on outdoor sound propagation.

Though a physical impracticality, the ISO 9613 standard simulates favorable sound propagation conditions that would occur during omnidirectional downwind propagation and worst case WTG source directivity factors. For receptors located immediately between discrete WTG locations or WTG arrays, the acoustic model may actually over-predict received sound levels. Under a more realistic scenario, with a wind velocity predominantly from the west, sound contour isopleths would be positioned closer to the turbines on the west side and would extend further from the turbines in the east. The omnidirectional downwind propagation condition and worst case directivity effects resulted in contour isopleths presented further from the turbine locations (i.e., higher sound levels at all receptor locations-ensuring conservative modeling results). Temperature gradients (i.e., atmospheric inversions) can cause similar

effects with respect to sound propagation; however, such temperature gradients tend to occur during calm conditions or at relatively low wind speeds, when wind turbines are not operating.

Wind speeds and directions are dynamic and constantly shifting. Turbulence due to shifts in wind speeds and directions often result in the formation of turbulence eddies. The acoustic modeling algorithms essentially assume laminar atmospheric conditions. In reality, atmospheric inhomogeneity and turbulent eddies commonly occur along the propagation path between the wind turbine and receiver, which can scatter sound and contribute to sound attenuation between the wind turbine and receiver. The scattering effects of an atmospheric inhomogeneity are strongly dependent on frequency and acoustic wavelength. If the atmospheric inhomogeneity is small in relation to sound frequency wavelength, the scattering effect will be minor. Due to the complexities of such calculations, the acoustic model has not included adjustments for atmospheric scattering, which leads to conservative modeling results.

Factors such as terrain, types of vegetation, ground cover and type, and the density and height of foliage can also influence the absorption that takes place when sound waves travel over land. Per ISO 9613-2, ground absorption rates are accounted for by assigning absorptive surface coefficients according to site-specific ground conditions. If the ground is hard-packed dirt typically found in industrial complexes, pavement, or for sound traveling over bodies of water, the absorption coefficient is defined as reflective, resulting in reduced sound attenuation with distance. In contrast, ground covered in snow (common in this particular area during the winter season), vegetation including suburban lawns, livestock and agricultural fields (both fallow with bare soil and planted with crops), will be acoustically absorptive and aid in sound attenuation.

The land surrounding the proposed wind energy project is largely rural with only moderate changes in ground elevation, consisting of low-lying vegetated ground with some intermittent tree stands and roadways. In addition, farm fields found throughout the PSA are considered highly acoustic absorptive. A conservative ground absorption rate was selected for Project acoustic modeling, accounting for semi-reflective ground surfaces across the entire acoustic study area. This ground absorption coefficient was further reduced for receptor locations in close proximity to WTGs to account for decreased ground attenuation effects for an elevated sound source relative to receiver height. In addition, sound attenuation through wooded areas was conservatively ignored even in areas with mature tree stands. Sound diffraction around and over existing and future structures both on and offsite were conservatively ignored. Sound attenuation resulting from diffraction of sound rays around buildings and trees only affects receivers that are immediately adjacent. By conservatively ignoring these features, worst case defoliate conditions are represented.

5.0 CALCULATED OPERATIONAL SOUND LEVELS

The 133 GE XLE 1.5 MW WTGS were modeled as idealized point sources having a hub height of 262 feet (80 meters) above existing grade at the UTM coordinate locations per the latest Project layout dated March 6, 2009. The acoustic model assumes that all wind turbines are operating continuously and concurrently at the maximum manufacturer-rated sound level at the given operational condition and sound energy is summed using the following equation, in accordance with ISO9613.2:

$$L_{PA}(DW) = 10\log\left\{\sum_{i=1}^{\#}\left[\sum_{j=1}^{9} 10^{0,1[L_{fT}(ij)+f(A-wtd)(j)]}\right]\right\}$$

Where:

n = # is the number of contributions i (sources and paths);

j = is an index indicating the nine standard octave band center frequencies spanning from 31 Hz to 8 kHz;

Calculations were completed using a 82 foot (25 meter) by 82 foot grid with a receiver height of 5 feet (1.5) meters above grade (the approximate height of ears of a standing person). Calculations at discrete residential receptor locations were also completed at the same receiver height.

5.1 Acoustic Modeling Results

Acoustic modeling for wind energy conversion is largely an iterative process. Several Project layouts were assessed during the initial engineering acoustic review. The initial model involved the elimination and relocation of several WTGs. Subsequent iterations were completed during the adjustment of WTG locations to reduce wake effects and the identification of additional prospective wind turbine sites, and the reassessing of these changes to ensure compliance with voluntary internal acoustic design goals and applicable regulatory requirements.

Acoustic modeling for the Project layout was completed for both cut-in and full rotational operating conditions, which describes future sound levels over the entire range of Project operational conditions. The Project layout consisted of modeling received sound levels at residences in DeKalb County. A list of these residences, addresses and maximum received sound levels are tabulated in Table 9. Sound contour plots displaying Project operational sound levels in color-coded isopleths are provided in Figures 2-13. Figure 3 shows broadband (dBA) operational sound levels under low level wind speeds sufficient for WTGs to operate at initial WTG cut-in rotational speeds. Figures 3 and 4 show broadband (dBA) operational sound levels under wind speeds sufficient for WTGs to operate at maximum rotational speeds for both moderate downwind propagation and worst case anomalous meteorological conditions, which can result in increased sound propagation over long distances, respectively. Figures 5 through 13 provide sound level contour isopleths for Project operational sound levels for the individual octave band center frequencies ranging from 31.5 Hz to 8 kHz, where all WTGs are operating concurrently at maximum rotational speeds. The color red in the octave band figures represents the IPCB octave band sound limits at that given frequency. The figures are subdivided into two sections to better present the extended area included in the acoustic analysis. The guaranteed maximum sound power level per the GE XLE specification is 104 dBA with a stated 2 dB confidence interval and maximum directivity for all turbines were incorporated into the modeling analysis to ensure conservative results. The guaranteed maximum sound power level of 106 dBA was incorporated into the modeling analysis to ensure conservative results.

Table 9 Summary of WTG Acoustic Model Output at Residences

ID	Figure ID	UTM Coordinates Easting	UTM Coordinates Northing	Broadband dBA	31 Hz dBL	63 Hz dBL	125 Hz dBL	250 Hz dBL	500 Hz dBL	1k Hz dBL	2k Hz dBL	4k Hz dBL	8k Hz dBL
1331100005	D001	338558	4621452	39	54	53	46	41	38	34	23	<0	<0
1331100005	D002	338569	4621502	40	55	53	46	42	38	34	24	1	<0
1331100005	D003	338578	4621546	40	55	53	47	42	39	35	25	3	<0
1331100003	D004	338588	4621408	39	54	53	45	41	37	33	23	<0	<0
1330300005	D005	338604	4622546	43	57	55	49	44	41	37	27	4	<0
1319100002	D006	338647	4624930	42	57	55	48	44	40	37	26	3	<0
1318300002	D007	338706	4625415	40	55	54	46	42	38	34	21	<0	<0
1030300003	D008	338814	4631799	37	53	52	44	39	35	30	15	<0	<0
1030100005	D009	338839	4632587	39	54	53	45	41	37	33	22	<0	<0
1018300005	D010	338891	4634806	42	56	55	48	44	41	37	28	7	<0
1019100006	D011	338908	4634582	41	56	54	47	43	40	36	26	2	<0
1019300003	D012	339002	4633198	42	56	54	48	43	40	37	28	10	<0
1018100002	D014	339165	4636295	44	57	56	50	45	42	38	30	12	<0
1330200007	D015	339741	4623363	45	58	56	51	46	43	39	31	13	<0
1319400003	D016	339766	4623752	43	57	55	49	44	41	37	27	3	<0
1007200001	D017	339794	4637258	40	55	54	47	42	39	35	23	<0	<0
1018400008	D018	339880	4634792	45	58	57	51	46	43	40	31	12	<0
1332100007	D019	339889	4621302	39	54	52	45	41	37	33	22	<0	<0
1318200004	D020	339898	4626293	45	58	57	51	46	43	40	32	14	<0
1006400003	D021	339909	4638007	41	55	54	47	43	40	36	26	2	<0
1307200006	D022	339911	4627398	36	53	51	44	39	35	30	16	<0	<0
1307200006	D023	339930	4627311	37	54	52	44	39	35	30	17	<0	<0
1332100010	D024	339945	4621355	39	54	52	45	41	38	33	22	<0	<0
1030400006	D025	339983	4632220	41	56	55	47	43	39	35	24	<0	<0
1320100004	D026	339997	4624265	41	56	54	47	43	39	35	23	<0	<0
1332100010	D027	340003	4621397	39	54	53	46	41	38	34	23	<0	<0
1019400005	D028	340060	4633918	45	59	57	51	46	43	40	31	14	<0
				EPA Guideline 48.6 dBA	**IPCB 31 Hz Limit 69 dBL**	**IPCB 63 Hz Limit 67 dBL**	**IPCB 125 Hz Limit 62 dBL**	**IPCB 250 Hz Limit 54 dBL**	**IPCB 500 Hz Limit 47 dBL**	**IPCB 1000 Hz Limit 41 dBL**	**IPCB 2000 Hz Limit 36 dBL**	**IPCB 4000 Hz Limit 32 dBL**	**IPCB 8000 Hz Limit 32 dBL**
Number of Potential Exceedances Identified				**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**

Table 9 Summary of WTG Acoustic Model Output at Residences (Cont.)

ID	Figure ID	UTM Coordinates Easting	UTM Coordinates Northing	Broadband dBA	31 Hz dBL	63 Hz dBL	125 Hz dBL	250 Hz dBL	500 Hz dBL	1k Hz dBL	2k Hz dBL	4k Hz dBL	8k Hz dBL
1019400002	D029	340064	4633494	43	58	56	49	45	42	38	28	5	<0
1030400004	D030	340069	4631522	42	57	55	48	44	40	36	26	2	<0
1030200005	D031	340121	4632785	44	58	57	50	46	42	39	30	12	<0
1018200003	D032	340150	4635591	44	58	56	50	45	42	39	29	8	<0
1019200003	D033	340158	4634695	44	58	56	50	45	42	39	29	10	<0
731400003	D034	340158	4640228	33	50	48	40	35	31	26	10	<0	<0
1018200009	D035	340160	4635728	44	58	57	50	46	43	39	30	10	<0
1007400001	D036	340171	4637089	43	57	55	49	45	41	38	28	5	<0
1006200003	D037	340171	4639293	40	54	53	46	42	38	35	25	0	<0
1029100002	D038	340213	4632502	43	57	56	49	45	42	38	29	8	<0
1329100012	D039	340231	4623181	43	57	55	49	45	42	38	28	7	<0
1308300003	D040	340269	4626735	40	55	54	46	42	38	34	23	<0	<0
1008300003	D041	340278	4636935	45	58	57	50	46	43	39	31	11	<0
1005300010	D042	340283	4638248	43	57	55	49	45	42	38	29	9	<0
1008100003	D043	340307	4637595	43	57	56	49	45	41	38	29	11	<0
1005300009	D044	340317	4638363	44	57	56	50	45	42	39	31	13	<0
732300004	D045	340322	4640061	34	51	49	41	36	32	27	12	<0	<0
1020100004	D047	340347	4634561	44	57	56	50	45	42	38	29	8	<0
1017300001	D048	340364	4635283	42	56	55	48	44	40	36	25	<0	<0
1329100011	D049	340387	4623305	43	57	56	49	45	41	38	27	2	<0
1029300005	D050	340440	4631538	43	57	56	49	44	41	37	27	4	<0
1317300002	D051	340466	4625339	42	56	55	48	44	40	36	26	4	<0
1320300004	D052	340576	4623422	44	57	56	50	45	42	38	29	8	<0
1317400005	D053	340790	4625028	40	56	54	47	42	39	34	22	<0	<0
1032100002	D054	340852	4631442	44	58	57	50	46	43	39	30	9	<0
1329200009	D055	340853	4623321	44	58	56	50	45	42	39	30	9	<0
1017400001	D056	341136	4634785	41	56	54	47	43	39	35	24	<0	<0
				EPA Guideline 48.6 dBA	**IPCB 31 Hz Limit 69 dBL**	**IPCB 63 Hz Limit 67 dBL**	**IPCB 125 Hz Limit 62 dBL**	**IPCB 250 Hz Limit 54 dBL**	**IPCB 500 Hz Limit 47 dBL**	**IPCB 1000 Hz Limit 41 dBL**	**IPCB 2000 Hz Limit 36 dBL**	**IPCB 4000 Hz Limit 32 dBL**	**IPCB 8000 Hz Limit 32 dBL**
Number of Potential Exceedances Identified				**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**

Table 9 Summary of WTG Acoustic Model Output at Residences (Cont.)

ID	Figure ID	UTM Coordinates Easting	UTM Coordinates Northing	Broadband dBA	31 Hz dBL	63 Hz dBL	125 Hz dBL	250 Hz dBL	500 Hz dBL	1k Hz dBL	2k Hz dBL	4k Hz dBL	8k Hz dBL
1329200003	D057	341177	4623314	44	58	56	50	45	42	39	30	10	<0
1329200004	D058	341320	4623292	44	57	56	50	45	42	39	29	8	<0
1305200010	D059	341385	4629805	39	55	54	46	42	38	33	20	<0	<0
1329200007	D060	341482	4623218	43	56	55	48	44	41	37	27	5	<0
1317200005	D061	341497	4626416	42	56	55	48	44	40	37	27	5	<0
1317400006	D062	341516	4625385	45	58	57	51	46	43	40	31	13	<0
1317400004	D063	341522	4625326	44	58	56	50	45	42	39	30	10	<0
1017200001	D064	341542	4636321	40	55	54	46	42	38	34	22	<0	<0
1308400003	D065	341544	4626631	40	55	54	46	42	38	34	23	<0	<0
1316100002	D066	341633	4626483	41	56	55	47	43	40	36	26	2	<0
1005400002	D067	341657	4638017	42	56	55	48	44	41	37	27	4	<0
1321300007	D068	341672	4623421	44	57	56	50	45	42	39	30	12	<0
1033300003	D069	341742	4630249	43	57	56	49	45	41	38	28	5	<0
1020200003	D070	341749	4634246	43	57	56	49	44	41	38	29	11	<0
1328100008	D071	341791	4623318	42	56	54	48	43	40	37	27	6	<0
1008400003	D072	341836	4636881	43	57	56	49	45	42	38	29	8	<0
1005200003	D073	341852	4639410	35	51	50	42	38	34	28	14	<0	<0
1009300002	D074	341920	4636816	43	57	55	49	44	41	37	28	6	<0
1004300001	D075	341974	4638612	38	54	52	45	40	37	32	19	<0	<0
1016100003	D076	341988	4636321	39	54	53	45	41	37	33	20	<0	<0
1321100002	D077	342029	4624888	40	55	54	47	42	39	35	23	<0	<0
1028300001	D078	342053	4631545	43	57	56	49	44	41	37	27	1	<0
1304100004	D079	342130	4629617	39	55	54	46	42	38	33	21	<0	<0
1021100003	D080	342213	4634642	38	54	53	45	40	36	31	17	<0	<0
1321300004	D081	342279	4623425	39	53	52	45	41	37	33	22	<0	<0
1316400011	D082	342356	4625032	41	54	53	47	42	39	35	25	<0	<0
1021300003	D083	342367	4633170	39	55	54	46	41	37	32	18	<0	<0
				EPA Guideline 48.6 dBA	**IPCB 31 Hz Limit 69 dBL**	**IPCB 63 Hz Limit 67 dBL**	**IPCB 125 Hz Limit 62 dBL**	**IPCB 250 Hz Limit 54 dBL**	**IPCB 500 Hz Limit 47 dBL**	**IPCB 1000 Hz Limit 41 dBL**	**IPCB 2000 Hz Limit 36 dBL**	**IPCB 4000 Hz Limit 32 dBL**	**IPCB 8000 Hz Limit 32 dBL**
Number of Potential Exceedances Identified				**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**

Table 9 Summary of WTG Acoustic Model Output at Residences (Cont.)

ID	Figure ID	UTM Coordinates Easting	UTM Coordinates Northing	Broadband dBA	31 Hz dBL	63 Hz dBL	125 Hz dBL	250 Hz dBL	500 Hz dBL	1k Hz dBL	2k Hz dBL	4k Hz dBL	8k Hz dBL
1009100003	D084	342415	4637921	43	57	55	49	44	41	38	29	9	<0
1033100003	D085	342462	4631427	43	57	56	49	45	41	38	28	6	<0
1016300001	D086	342465	4634764	37	54	53	44	40	35	30	15	<0	<0
1028100003	D087	342533	4633061	38	55	53	45	41	37	31	17	<0	<0
733400002	D088	343070	4639567	36	52	50	42	38	34	29	17	<0	<0
1016200005	D089	343183	4636074	36	53	52	43	38	34	28	11	<0	<0
1033400007	D090	343235	4630050	39	55	53	46	41	37	33	20	<0	<0
1028400001	D091	343259	4631922	40	56	54	47	42	38	34	22	<0	<0
1303100001	D092	343282	4629641	38	55	53	45	40	36	31	16	<0	<0
1027300002	D093	343400	4631670	42	57	55	48	44	40	37	27	9	<0
1027300007	D094	343415	4631815	42	57	55	48	43	40	36	26	7	<0
1004400001	D095	343417	4638501	40	55	53	47	42	39	35	26	6	<0
1009200001	D096	343436	4637745	38	53	52	44	40	36	31	19	<0	<0
1004200003	D097	343453	4639414	39	54	52	45	41	37	34	24	4	<0
733200003	D098	343467	4640271	33	50	48	40	35	31	25	10	<0	<0
1010300002	D099	343480	4637065	37	54	52	44	39	35	30	17	<0	<0
1010100002	D100	343513	4637730	37	54	52	44	40	36	31	18	<0	<0
1003300001	D101	343530	4637967	38	54	52	44	40	36	32	19	<0	<0
1034100002	D102	343535	4631022	42	57	55	48	44	40	36	26	2	<0
1003300003	D103	343539	4638227	39	54	53	45	41	37	33	22	<0	<0
734300004	D104	344104	4639643	38	53	51	44	40	36	32	22	<0	<0
1003100005	D105	344188	4639414	41	55	53	47	42	39	36	27	7	<0
1027400005	D106	344367	4631505	44	58	57	50	45	42	39	29	9	<0
1034200002	D107	344861	4631036	44	58	57	50	46	43	39	30	11	<0
1022400003	D108	344878	4633109	39	55	54	46	41	37	32	19	<0	<0
1010200003	D109	345025	4637802	41	56	54	47	43	40	36	26	4	<0
1003200005	D110	345031	4639319	38	53	51	44	40	36	32	20	<0	<0
				EPA Guideline 48.6 dBA	**IPCB 31 Hz Limit 69 dBL**	**IPCB 63 Hz Limit 67 dBL**	**IPCB 125 Hz Limit 62 dBL**	**IPCB 250 Hz Limit 54 dBL**	**IPCB 500 Hz Limit 47 dBL**	**IPCB 1000 Hz Limit 41 dBL**	**IPCB 2000 Hz Limit 36 dBL**	**IPCB 4000 Hz Limit 32 dBL**	**IPCB 8000 Hz Limit 32 dBL**
Number of Potential Exceedances Identified				**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**

Table 9 Summary of WTG Acoustic Model Output at Residences (Cont.)

ID	Figure ID	UTM Coordinates Easting	UTM Coordinates Northing	Broadband dBA	31 Hz dBL	63 Hz dBL	125 Hz dBL	250 Hz dBL	500 Hz dBL	1k Hz dBL	2k Hz dBL	4k Hz dBL	8k Hz dBL
1026300003	D111	345133	4631554	45	59	57	51	46	43	39	30	10	<0
1002100006	D112	345159	4639449	37	52	51	43	39	35	31	18	<0	<0
1035100003	D113	345360	4631277	44	58	57	50	46	42	39	29	7	<0
1026100005	D114	345633	4632995	40	56	54	46	42	38	34	22	<0	<0
1011100001	D115	345642	4637577	42	56	55	48	44	40	37	27	3	<0
1002100003	D116	345878	4639435	37	52	51	43	39	35	31	19	<0	<0
1311200001	D117	345935	4628082	38	54	53	45	40	37	32	21	<0	<0
1002400005	D118	346173	4637905	44	57	56	50	45	43	39	31	13	<0
1035200002	D119	346191	4631354	43	58	56	49	45	41	38	27	0	<0
1035200003	D120	346289	4631324	43	58	56	49	45	41	37	26	<0	<0
1314200007	D121	346309	4626141	31	51	49	40	34	29	21	<0	<0	<0
1026200002	D122	346322	4632722	43	57	56	49	44	41	37	28	8	<0
1035200004	D123	346394	4631325	43	58	56	49	45	41	37	26	<0	<0
1311400005	D124	346432	4627025	35	52	51	42	37	33	27	12	<0	<0
1311400001	D125	346443	4627213	36	53	51	43	38	34	29	15	<0	<0
1035400003	D126	346449	4630393	44	58	57	50	45	42	39	29	10	<0
1302200001	D127	346453	4629646	42	57	55	48	44	40	36	24	<0	<0
1023400004	D128	346497	4633252	38	55	53	45	41	36	31	18	<0	<0
1035200005	D129	346505	4631328	43	58	56	49	45	41	38	27	1	<0
1312300001	D130	346512	4626831	34	52	50	42	37	32	26	10	<0	<0
1313100005	D131	346530	4626120	31	51	49	40	34	29	21	0	<0	<0
1036100002	D132	346628	4630064	43	57	56	49	45	41	37	26	2	<0
1011200002	D133	346632	4637591	39	54	52	45	41	37	34	23	<0	<0
1002200002	D134	346640	4639247	37	52	50	43	39	35	31	20	<0	<0
1025100001	D135	346642	4632539	44	58	56	50	45	42	39	29	10	<0
735400002	D136	346680	4639654	34	50	48	40	36	32	27	13	<0	<0
1012100003	D137	346683	4637200	37	52	51	43	39	35	31	18	<0	<0
				EPA Guideline 48.6 dBA	**IPCB 31 Hz Limit 69 dBL**	**IPCB 63 Hz Limit 67 dBL**	**IPCB 125 Hz Limit 62 dBL**	**IPCB 250 Hz Limit 54 dBL**	**IPCB 500 Hz Limit 47 dBL**	**IPCB 1000 Hz Limit 41 dBL**	**IPCB 2000 Hz Limit 36 dBL**	**IPCB 4000 Hz Limit 32 dBL**	**IPCB 8000 Hz Limit 32 dBL**
Number of Potential Exceedances Identified				**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**

Table 9 Summary of WTG Acoustic Model Output at Residences (Cont.)

ID	Figure ID	UTM Coordinates Easting	UTM Coordinates Northing	Broadband dBA	31 Hz dBL	63 Hz dBL	125 Hz dBL	250 Hz dBL	500 Hz dBL	1k Hz dBL	2k Hz dBL	4k Hz dBL	8k Hz dBL
1001300002	D138	346704	4637898	42	55	54	48	43	40	37	28	8	<0
1001300001	D139	346774	4638670	42	55	54	48	43	40	37	29	11	<0
1001100001	D140	347344	4639105	34	50	48	40	36	32	28	14	<0	<0
1312400006	D141	347436	4626594	33	51	50	41	36	31	24	7	<0	<0
1313200006	D142	347537	4626331	32	51	49	40	35	29	22	3	<0	<0
1312400007	D143	347746	4626603	33	51	50	41	36	31	24	6	<0	<0
1312200001	D144	347807	4628090	42	56	55	48	44	40	37	27	6	<0
1301400003	D145	348012	4628182	42	56	55	48	43	40	36	26	4	<0
1036200005	D146	348033	4630896	41	56	55	48	44	40	36	23	<0	<0
1024400003	D147	348044	4633032	40	56	54	47	42	39	35	24	0	<0
1036400003	D148	348082	4630516	44	58	56	50	45	42	38	29	8	<0
1407300005	D149	348225	4626551	31	47	46	39	35	29	22	3	<0	<0
1407100001	D150	348271	4628089	40	55	53	46	42	38	34	22	<0	<0
1406100003	D151	348481	4629041	42	57	55	48	44	41	37	26	5	<0
1406100004	D152	348528	4628922	42	57	55	48	44	40	36	26	4	<0
1406100003	D153	348551	4628983	42	57	55	48	44	40	36	25	3	<0
1418200001	D154	348612	4626058	30	50	48	39	34	28	20	<0	<0	<0
1406200001	D155	348648	4629426	43	58	56	49	45	42	38	28	9	<0
1407400002	D156	348737	4626538	32	51	49	40	35	30	22	1	<0	<0
1131200003	D157	349062	4631159	42	57	56	49	44	41	37	26	6	<0
1407400005	D158	349072	4626512	31	51	49	40	35	29	22	0	<0	<0
1119400004	D159	349072	4633379	39	55	53	45	41	37	33	21	<0	<0
1130200004	D160	349092	4632904	44	57	56	50	45	42	39	30	11	<0
1407200003	D161	349375	4628076	38	54	52	45	40	36	31	19	<0	<0
1405300002	D162	349428	4628134	38	54	53	45	41	37	32	20	<0	<0
1129300007	D163	349672	4632092	45	59	57	51	47	44	40	32	13	<0
1408100001	D164	349758	4628046	39	54	53	46	41	38	34	23	0	<0
				EPA Guideline 48.6 dBA	**IPCB 31 Hz Limit 69 dBL**	**IPCB 63 Hz Limit 67 dBL**	**IPCB 125 Hz Limit 62 dBL**	**IPCB 250 Hz Limit 54 dBL**	**IPCB 500 Hz Limit 47 dBL**	**IPCB 1000 Hz Limit 41 dBL**	**IPCB 2000 Hz Limit 36 dBL**	**IPCB 4000 Hz Limit 32 dBL**	**IPCB 8000 Hz Limit 32 dBL**
Number of Potential Exceedances Identified				**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**

Table 9 Summary of WTG Acoustic Model Output at Residences (Cont.)

ID	Figure ID	UTM Coordinates Easting	UTM Coordinates Northing	Broadband dBA	31 Hz dBL	63 Hz dBL	125 Hz dBL	250 Hz dBL	500 Hz dBL	1k Hz dBL	2k Hz dBL	4k Hz dBL	8k Hz dBL
1405300008	D165	349771	4628189	41	55	54	47	42	39	35	26	6	<0
1132100015	D166	349810	4630900	42	57	55	48	44	41	37	25	0	<0
1405300006	D167	349855	4628152	41	55	54	47	43	39	36	26	7	<0
1129300004	D168	349972	4632046	45	58	57	51	46	43	40	31	12	<0
1408100002	D169	350109	4627545	36	52	50	43	39	34	30	16	<0	<0
1405300009	D170	350176	4628117	42	56	55	48	43	40	37	28	8	<0
1405100006	D171	350207	4629085	44	58	56	50	45	42	39	30	10	<0
1132100014	D172	350253	4630700	42	57	55	48	44	40	36	25	<0	<0
1132100011	D173	350266	4631052	43	57	56	49	45	41	38	27	5	<0
1132100004	D174	350290	4631040	43	57	56	49	45	41	37	27	5	<0
1129100003	D175	350304	4632611	40	55	54	46	42	38	34	22	<0	<0
1132200006	D176	350306	4631108	43	57	56	49	45	42	38	28	7	<0
1132200002	D177	350311	4631051	43	57	56	49	45	41	38	27	5	<0
1405200003	D178	350346	4629169	44	58	56	50	45	42	39	29	9	<0
1132200003	D179	350367	4631015	43	57	55	49	44	41	37	27	3	<0
1132200007	D180	350408	4631104	43	57	56	49	45	42	38	28	6	<0
1132200011	D181	350525	4631096	43	57	56	49	45	42	38	28	6	<0
1405400004	D182	350620	4628132	42	55	54	48	43	40	36	27	8	<0
1405400009	D183	350751	4628150	41	55	54	47	43	39	36	26	6	<0
1120400001	D184	350827	4633473	35	52	51	43	38	33	27	10	<0	<0
1408200004	D185	350919	4628025	39	54	52	45	41	38	34	23	<0	<0
1129200003	D186	351021	4632907	37	54	52	44	40	36	31	16	<0	<0
1128100003	D187	351254	4632872	37	54	52	44	40	36	31	16	<0	<0
1404300001	D188	351275	4628112	39	54	52	45	41	37	33	22	<0	<0
1409100001	D189	351481	4627903	18	30	28	26	22	17	9	<0	<0	<0
1133100002	D190	351588	4631177	45	58	57	51	46	43	40	31	13	<0
1133300005	D191	351554	4629742	43	57	56	49	45	41	38	29	9	<0
				EPA Guideline 48.6 dBA	**IPCB 31 Hz Limit 69 dBL**	**IPCB 63 Hz Limit 67 dBL**	**IPCB 125 Hz Limit 62 dBL**	**IPCB 250 Hz Limit 54 dBL**	**IPCB 500 Hz Limit 47 dBL**	**IPCB 1000 Hz Limit 41 dBL**	**IPCB 2000 Hz Limit 36 dBL**	**IPCB 4000 Hz Limit 32 dBL**	**IPCB 8000 Hz Limit 32 dBL**
Number of Potential Exceedances Identified				**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**

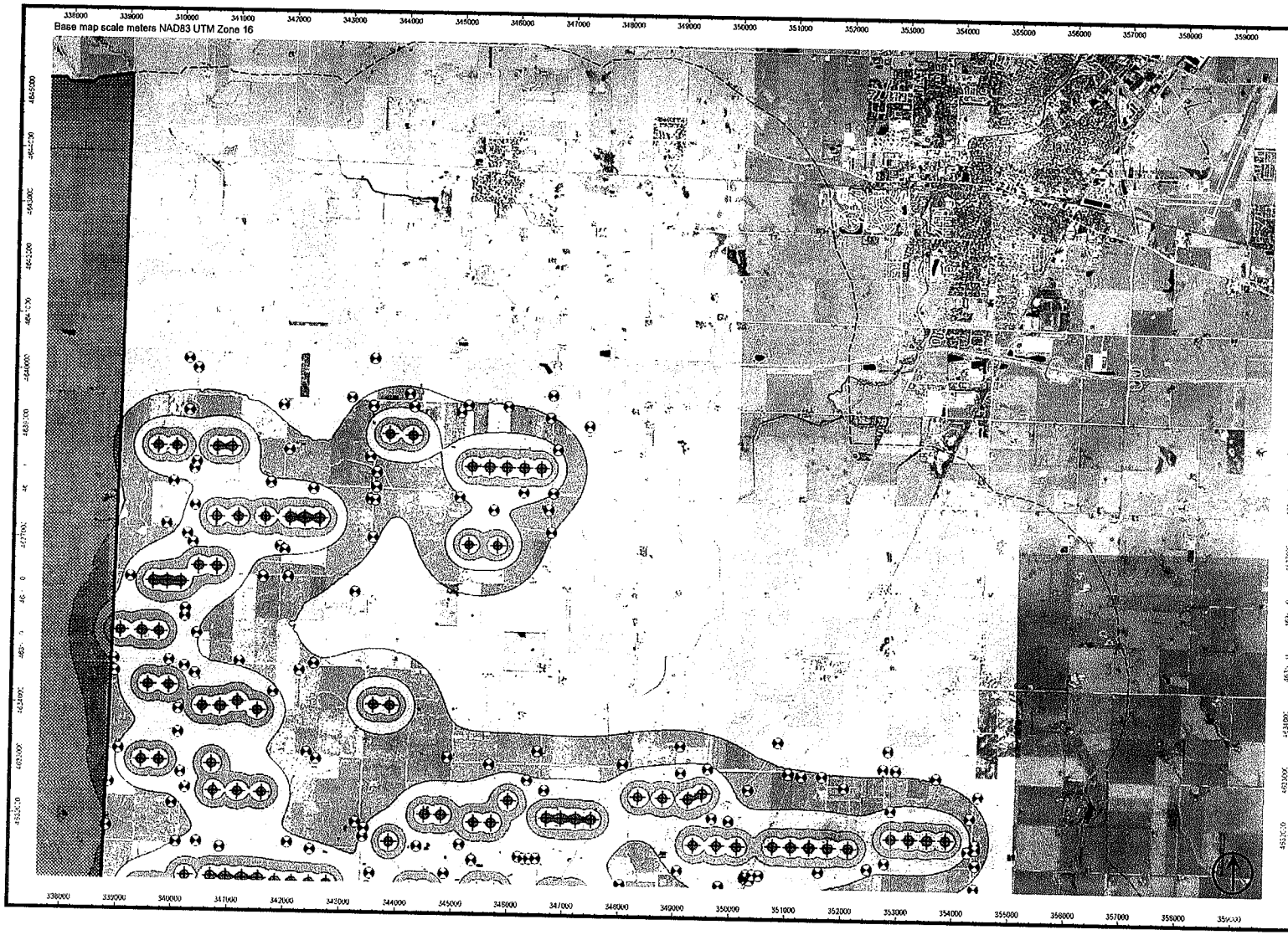
Table 9 Summary of WTG Acoustic Model Output at Residences (Cont.)

ID	Figure ID	UTM Coordinates Easting	UTM Coordinates Northing	Broadband dBA	31 Hz dBL	63 Hz dBL	125 Hz dBL	250 Hz dBL	500 Hz dBL	1k Hz dBL	2k Hz dBL	4k Hz dBL	8k Hz dBL
1128100002	D192	351621	4632875	37	53	52	44	39	35	30	16	<0	<0
1133400012	D193	351897	4629733	41	55	54	47	42	39	35	24	<0	<0
1128100002	D194	352012	4632675	38	54	52	45	40	36	32	19	<0	<0
1133400013	D195	352017	4629768	40	54	52	46	42	38	34	22	<0	<0
1409200003	D196	352068	4627943	35	51	50	42	38	34	29	15	<0	<0
1404400006	D197	352275	4628097	35	51	49	42	38	33	29	15	<0	<0
1133200003	D198	352465	4631236	43	57	55	49	44	41	38	28	8	<0
1404400002	D199	352529	4628759	37	53	51	43	39	35	30	18	<0	<0
1404400011	D200	352540	4628522	36	51	49	42	38	34	29	17	<0	<0
1404200009	D201	352555	4629259	37	52	51	43	39	35	31	18	<0	<0
1404400010	D202	352556	4628638	36	51	49	42	38	34	29	17	<0	<0
1404200005	D203	352571	4628907	37	53	51	43	39	35	30	18	<0	<0
1404200009	D204	352577	4629261	37	52	51	43	39	35	30	18	<0	<0
1404200010	D205	352618	4629220	36	52	51	43	39	35	30	17	<0	<0
1133400010	D206	352623	4630004	37	53	51	44	39	35	30	14	<0	<0
1410100001	D207	352637	4628016	33	50	49	41	36	31	26	10	<0	<0
1133400006	D208	352660	4630498	37	53	51	44	40	36	31	17	<0	<0
1403100001	D209	352695	4628997	36	52	51	43	38	34	29	16	<0	<0
1121400003	D210	352719	4633022	36	52	51	43	38	34	29	15	<0	<0
1134300003	D211	352755	4630349	37	53	51	44	39	35	30	15	<0	<0
1134100001	D212	352759	4630651	38	54	52	45	40	36	32	19	<0	<0
1127300002	D213	352768	4631348	44	57	56	50	45	42	38	30	11	<0
1122300006	D214	352805	4633348	34	51	50	41	37	32	27	11	<0	<0
1403300004	D215	352841	4628652	34	50	48	41	37	33	27	13	<0	<0
1127100004	D216	352873	4632277	43	56	55	48	44	41	37	28	9	<0
1122300008	D217	352950	4633000	36	52	51	43	38	34	29	16	<0	<0
1127200008	D218	353674	4632872	36	51	50	42	38	34	30	18	<0	<0
				EPA Guideline 48.6 dBA	**IPCB 31 Hz Limit 69 dBL**	**IPCB 63 Hz Limit 67 dBL**	**IPCB 125 Hz Limit 62 dBL**	**IPCB 250 Hz Limit 54 dBL**	**IPCB 500 Hz Limit 47 dBL**	**IPCB 1000 Hz Limit 41 dBL**	**IPCB 2000 Hz Limit 36 dBL**	**IPCB 4000 Hz Limit 32 dBL**	**IPCB 8000 Hz Limit 32 dBL**
Number of Potential Exceedances Identified				**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**

Table 9 Summary of WTG Acoustic Model Output at Residences (Cont.)

ID	Figure ID	UTM Coordinates Easting	UTM Coordinates Northing	Broadband dBA	31 Hz dBL	63 Hz dBL	125 Hz dBL	250 Hz dBL	500 Hz dBL	1k Hz dBL	2k Hz dBL	4k Hz dBL	8k Hz dBL
1127400002	D219	354261	4631570	42	55	53	48	43	40	37	28	11	<0
1134400005	D220	354278	4630209	33	50	48	40	35	31	25	8	<0	<0
1127200004	D221	354291	4632159	40	54	52	46	41	38	34	25	4	<0
1135100003	D222	354383	4630918	35	51	50	42	38	34	29	17	<0	<0
1126300006	D223	354392	4631685	40	53	52	46	41	38	35	26	6	<0
1126300007	D224	354395	4631612	40	53	52	46	41	38	35	25	5	<0
1126300005	D225	354399	4631330	38	53	51	44	40	36	33	22	<0	<0
1126100003	D226	354426	4632551	35	51	50	42	38	34	29	17	<0	<0
	D227	340009	4630363	44	58	56	50	45	42	39	30	12	<0
	D228	340207	4630499	44	58	56	50	46	43	39	31	12	<0
	D229	349580	4632981	43	57	55	49	44	41	37	28	10	<0
	D230	350211	4629010	45	58	57	51	46	43	40	31	14	<0
				EPA Guideline 48.6 dBA	**IPCB 31 Hz Limit 69 dBL**	**IPCB 63 Hz Limit 67 dBL**	**IPCB 125 Hz Limit 62 dBL**	**IPCB 250 Hz Limit 54 dBL**	**IPCB 500 Hz Limit 47 dBL**	**IPCB 1000 Hz Limit 41 dBL**	**IPCB 2000 Hz Limit 36 dBL**	**IPCB 4000 Hz Limit 32 dBL**	**IPCB 8000 Hz Limit 32 dBL**
Number of Potential Exceedances Identified				**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**	**None**

*Compliance inclusive of a 30 meter accommodation for yards in proximity to residential structures



Sound Contour Isopleths

- 28.6 to 33.6 dBA
- 33.6 to 38.6 dBA
- 38.6 to 43.6 dBA
- 43.6 to 48.6 dBA
- 48.6 to 53.6 dBA
- > 53.6 dBA

EPA Guideline = 48.6 dBA

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

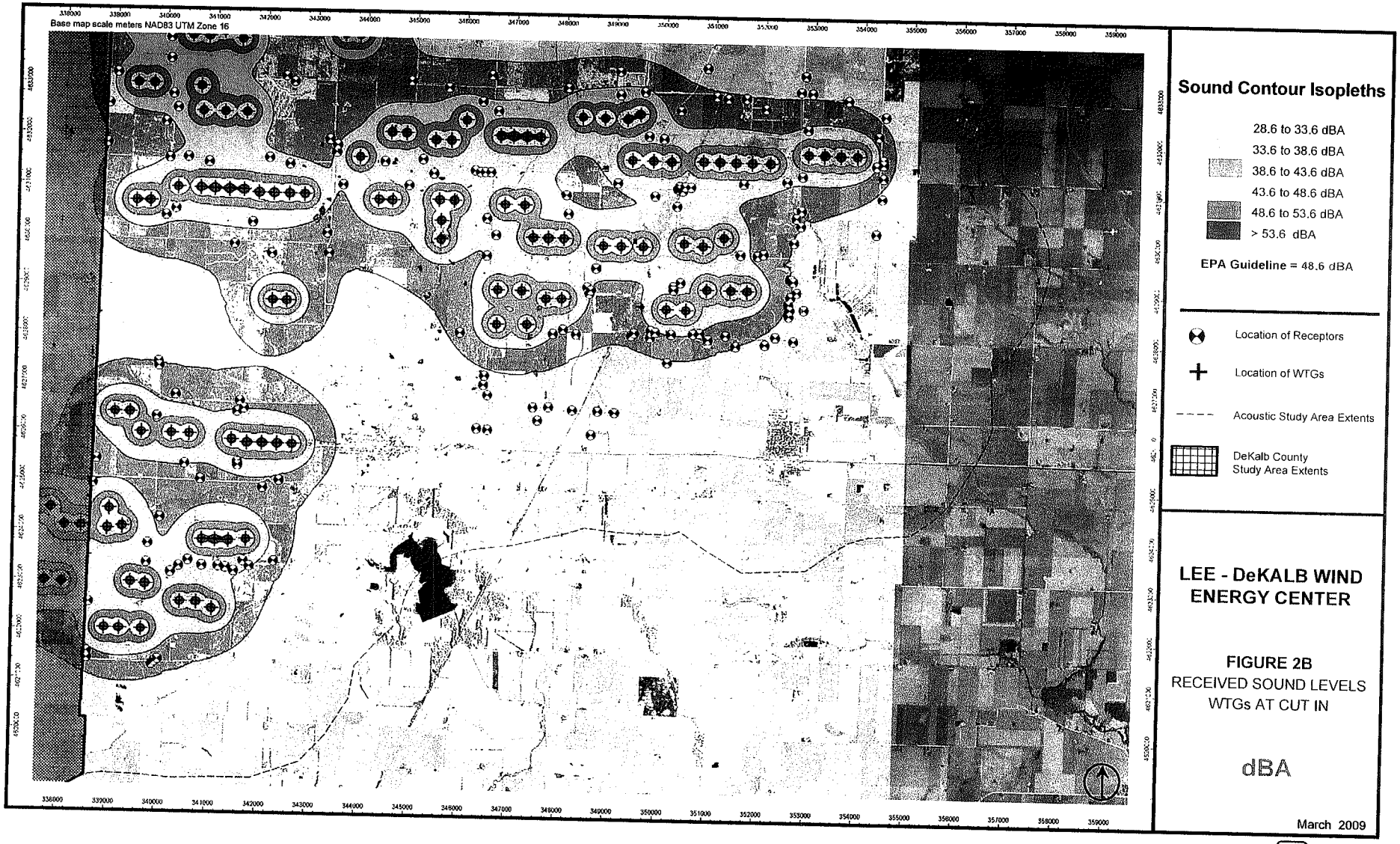
LEE - DeKALB WIND ENERGY CENTER

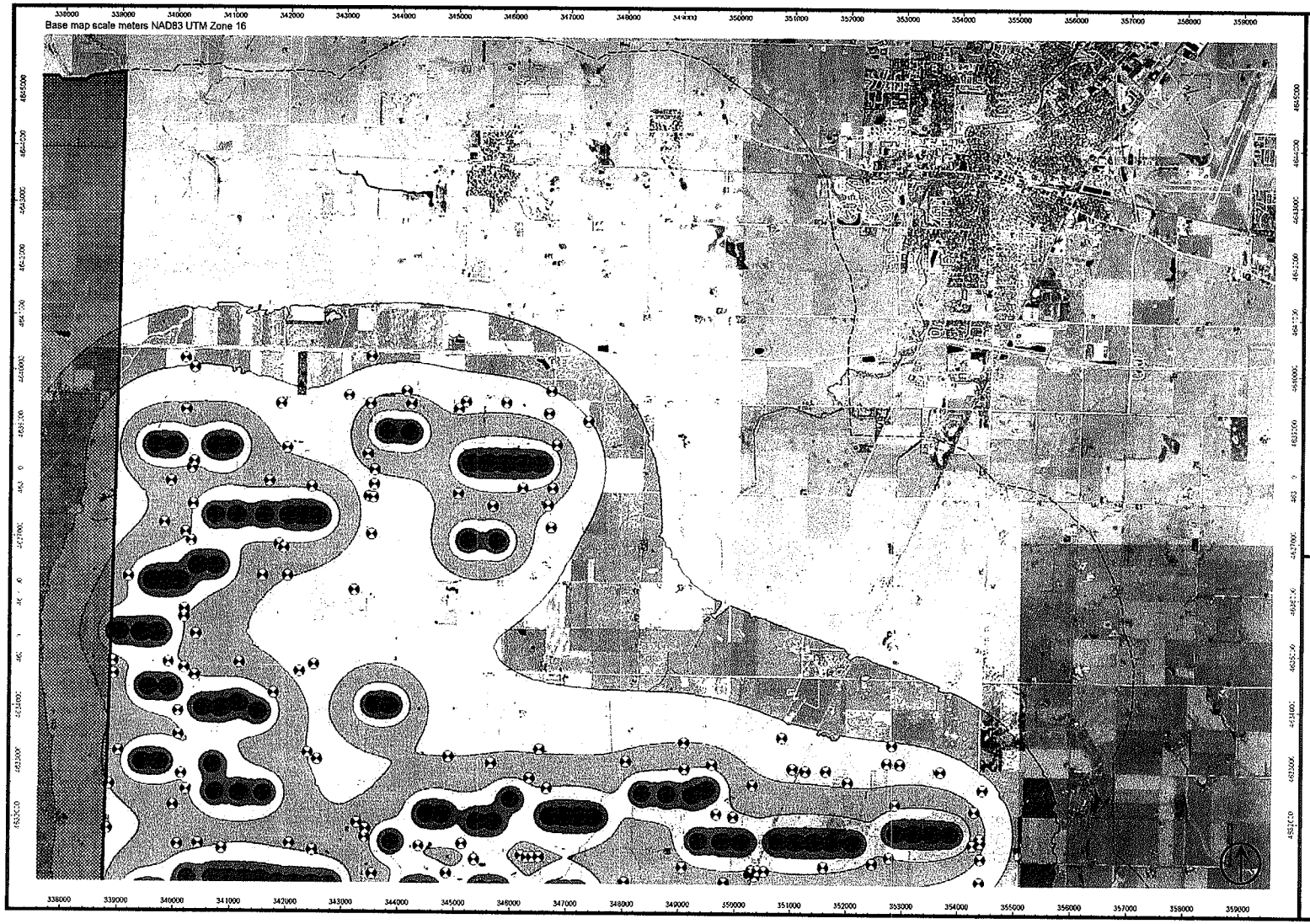
FIGURE 2A
RECEIVED SOUND LEVELS
WTGs AT CUT IN

dBA

March 2009

TETRA TECH


Base map scale meters NAD83 UTM Zone 16
Sound Contour Isopleths
28.6 to 33.6 dBA
33.6 to 38.6 dBA
38.6 to 43.6 dBA
43.6 to 48.6 dBA
48.6 to 53.6 dBA
> 53.6 dBA
EPA Guideline = 48.6 dBA
Location of Receptors
Location of WTGs
Acoustic Study Area Extents
DeKalb County Study Area Extents
LEE - DeKALB WIND ENERGY CENTER
FIGURE 2B
RECEIVED SOUND LEVELS
WTGs AT CUT IN
dBA
March 2009
TETRA TECH EC



Sound Contour Isopleths

- 28.6 to 33.6 dBA
- 33.6 to 38.6 dBA
- 38.6 to 43.6 dBA
- 43.6 to 48.6 dBA
- 48.6 to 53.6 dBA
- > 53.6 dBA

EPA Guideline = 48.6 dBA

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

LEE - DeKALB WIND ENERGY CENTER

FIGURE 3A
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

dBA

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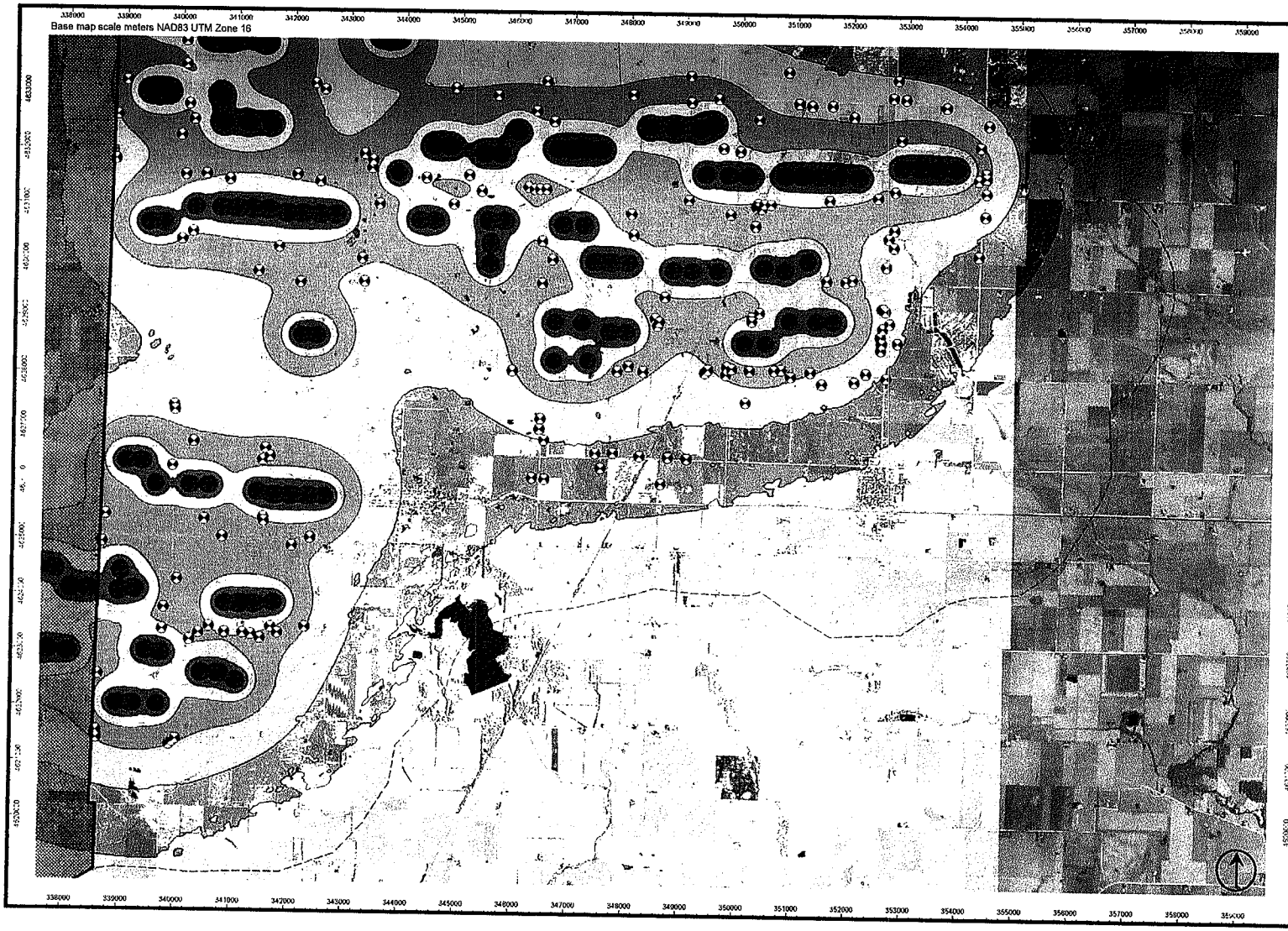

Sound Contour Isopleths

- 28.6 to 33.6 dBA
- 33.6 to 38.6 dBA
- 38.6 to 43.6 dBA
- 43.6 to 48.6 dBA
- 48.6 to 53.6 dBA
- > 53.6 dBA

EPA Guideline = 48.6 dBA

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

LEE - DeKALB WIND ENERGY CENTER

FIGURE 3B
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

dBA

March 2009

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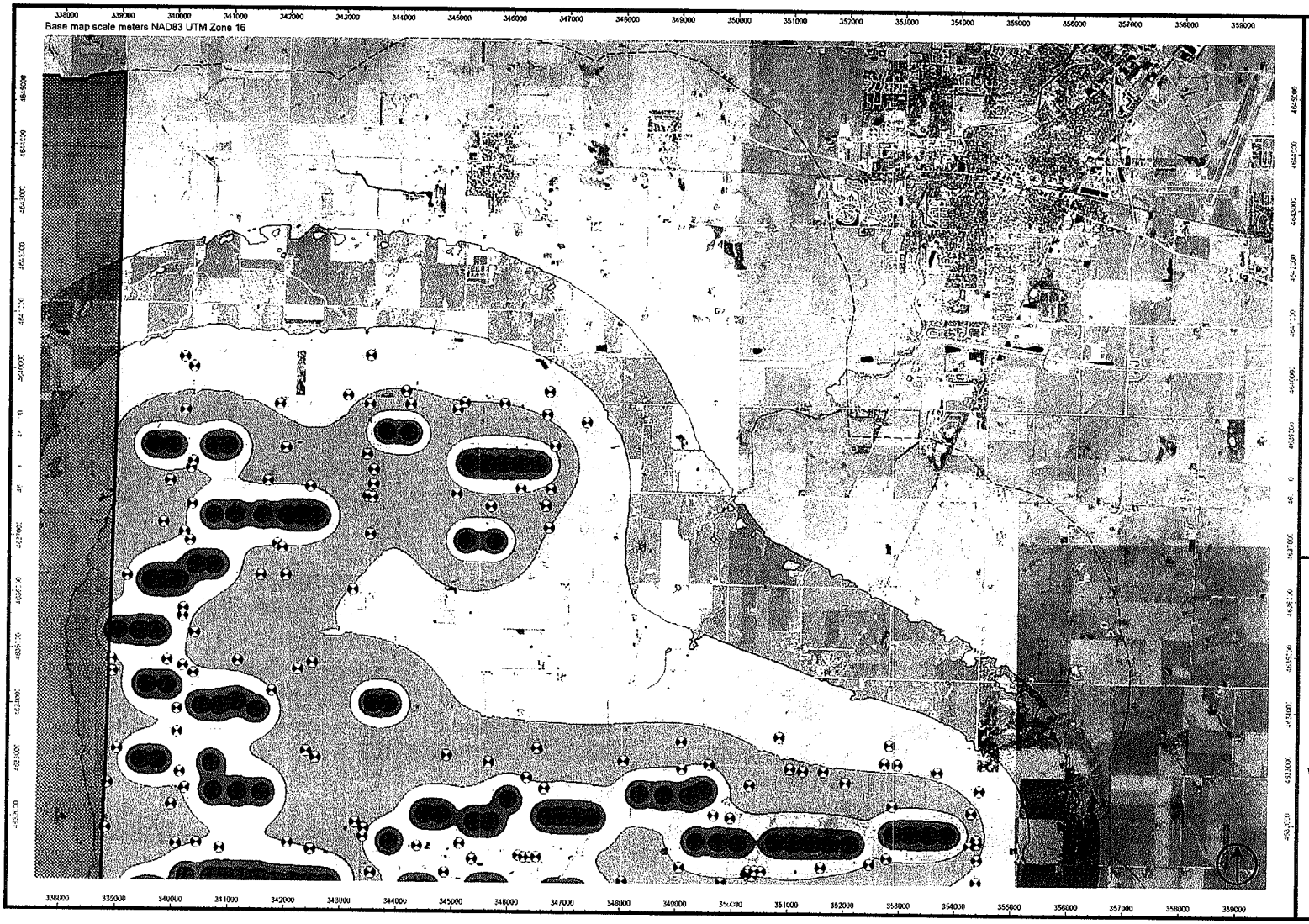

Sound Contour Isopleths

- 28.6 to 33.6 dBA
- 33.6 to 38.6 dBA
- 38.6 to 43.6 dBA
- 43.6 to 48.6 dBA
- 48.6 to 53.6 dBA
- > 53.6 dBA

EPA Guideline = 48.6 dBA

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

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FIGURE 4A

RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL
ANAMOLOUS METEROLOGICAL CONDITIONS

dBA

March 2009

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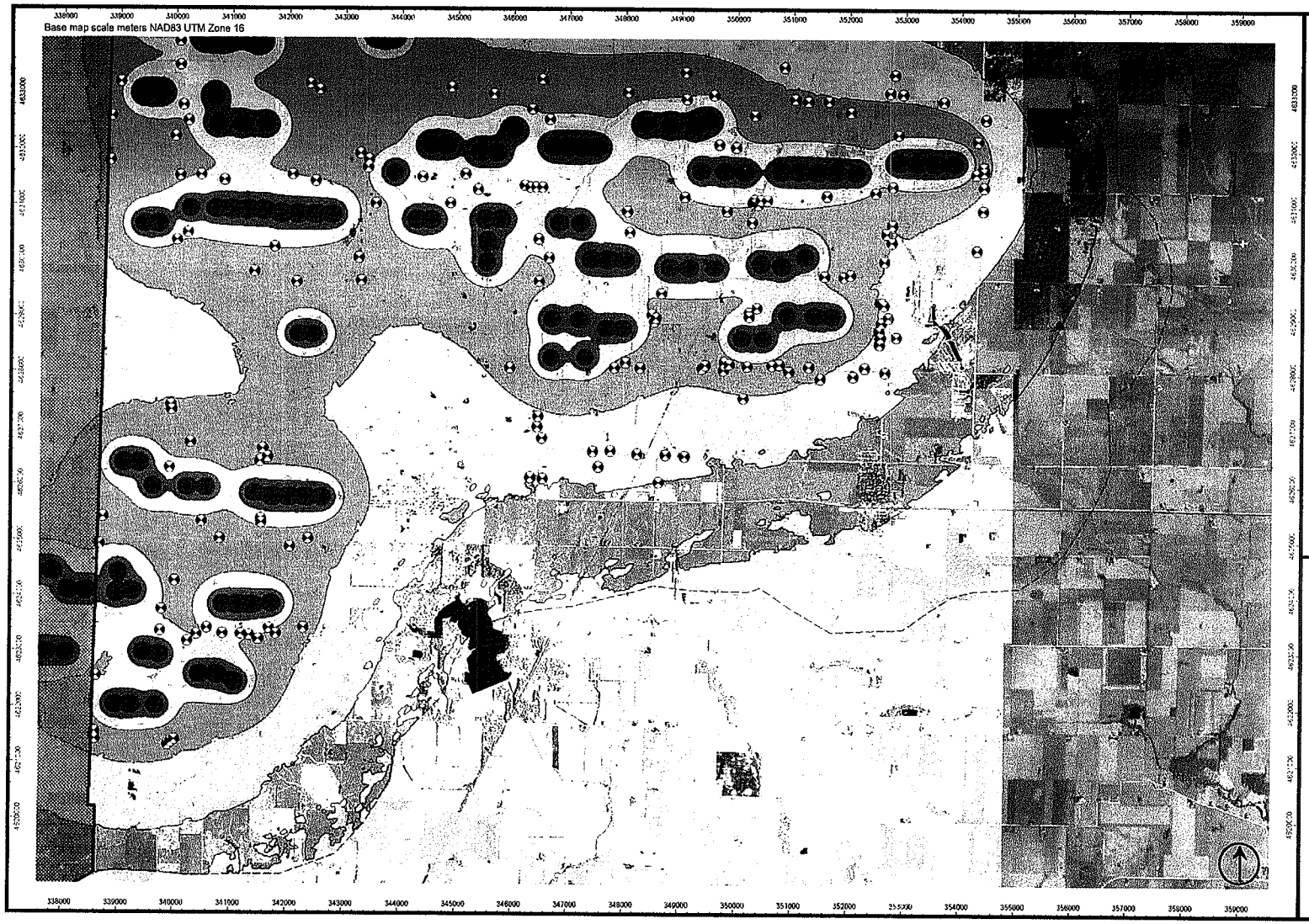

Sound Contour Isopleths

- 28.6 to 33.6 dBA
- 33.6 to 38.6 dBA
- 38.6 to 43.6 dBA
- 43.6 to 48.6 dBA
- 48.6 to 53.6 dBA
- > 53.6 dBA

EPA Guideline = 48.6 dBA

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

LEE - DeKALB WIND ENERGY CENTER

FIGURE 4B
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL
ANAMOLOUS METEROLOGICAL CONDITIONS

dBA

March 2009

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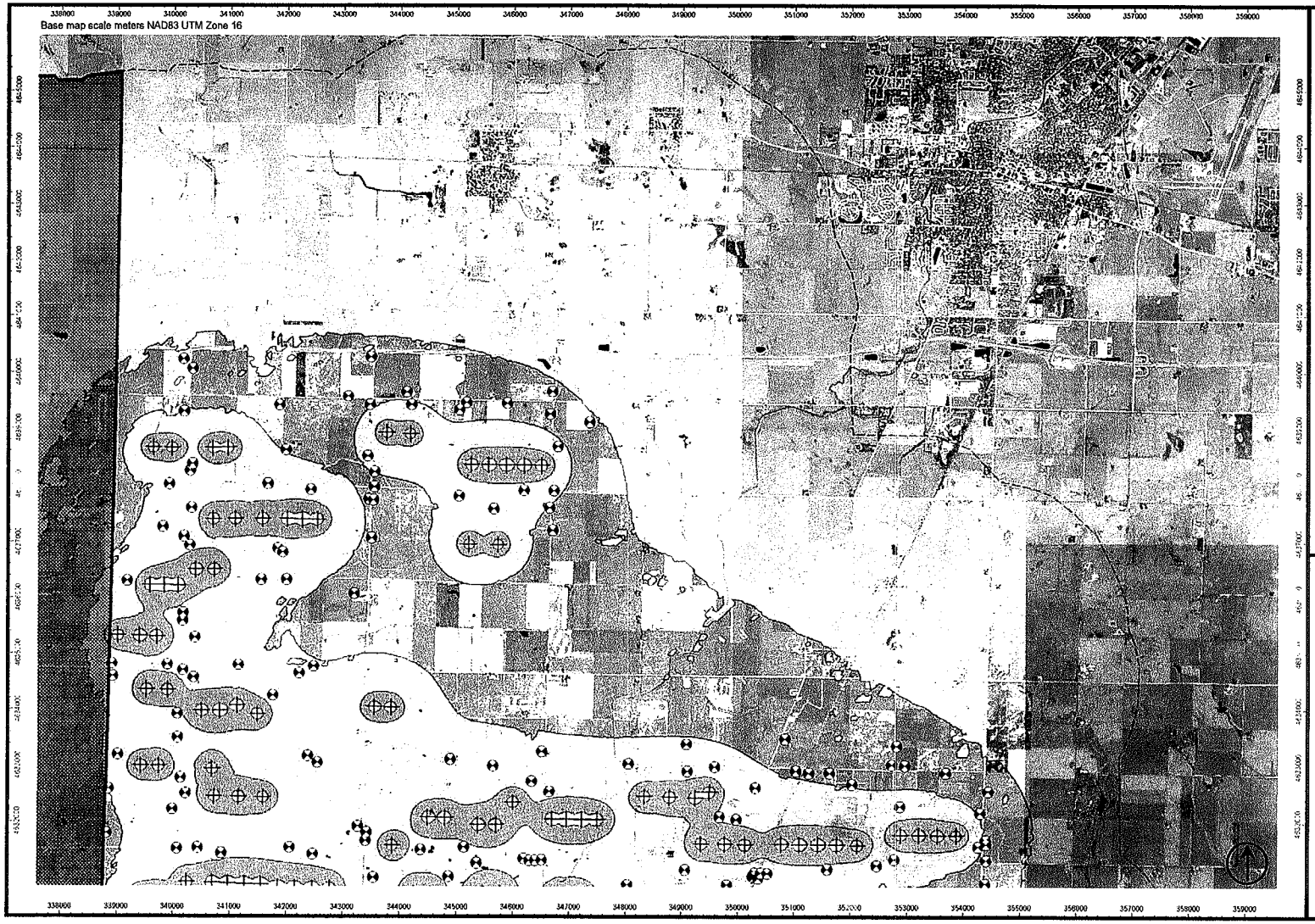


Sound Contour Isopleths

- 49 to 54 dBL
- 54 to 59 dBL
- 59 to 64 dBL
- 64 to 69 dBL
- 69 to 74 dBL
- > 74 dBL

IPCB 31 Hz Limit = 69 dBL

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

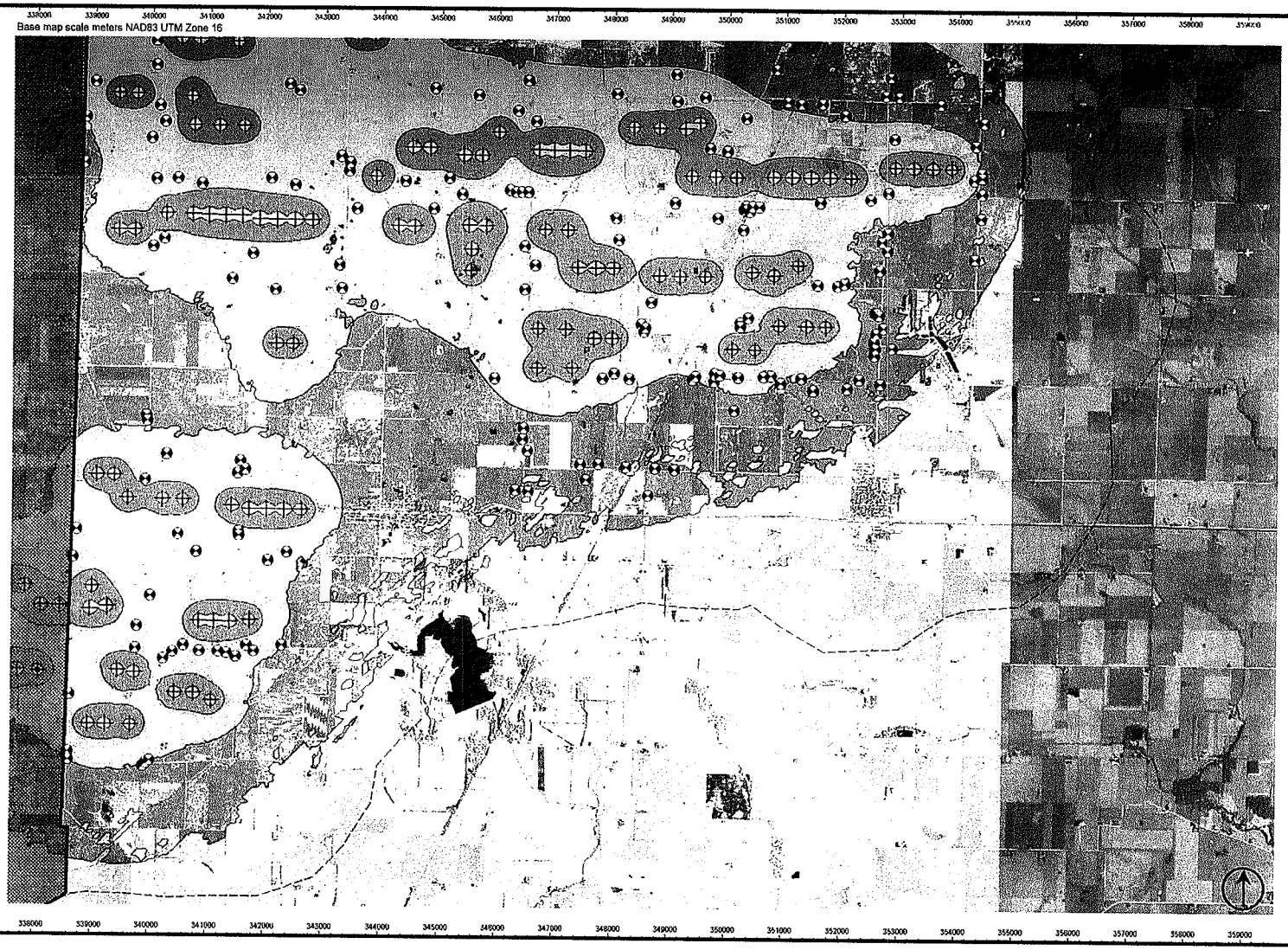
LEE - DeKALB WIND ENERGY CENTER

FIGURE 5A
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

31 Hz

March 2009

TETRA TECH EC



Sound Contour Isopleths

- 49 to 54 dBL
- 54 to 59 dBL
- 59 to 64 dBL
- 64 to 69 dBL
- 69 to 74 dBL
- > 74 dBL

IPCB 31 Hz Limit = 69 dBL

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

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FIGURE 5B
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

31 Hz

March 2009

TETRA TECH EC

Sound Contour Isopleths

- 47 to 52 dBL
- 52 to 57 dBL
- 57 to 62 dBL
- 62 to 67 dBL
- 67 to 72 dBL
- > 72 dBL

IPCB 63 Hz Limit = 67 dBL

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

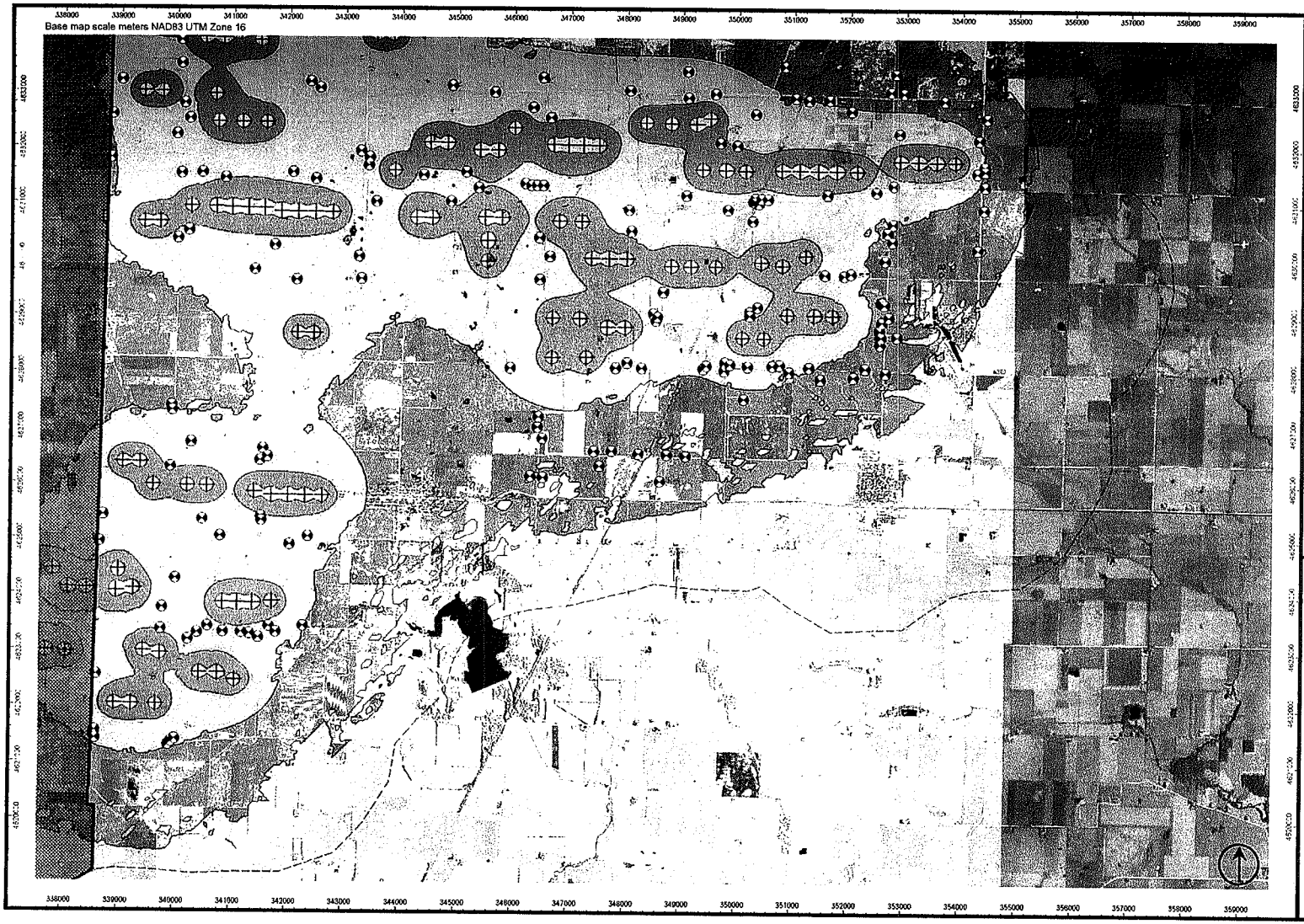
LEE - DeKALB WIND ENERGY CENTER

FIGURE 6A
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

63 Hz

March 2009

TETRA TECH EC



Sound Contour Isopleths

- 47 to 52 dBL
- 52 to 57 dBL
- 57 to 62 dBL
- 62 to 67 dBL
- 67 to 72 dBL
- > 72 dBL

IPCB 63 Hz Limit = 67 dBL

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

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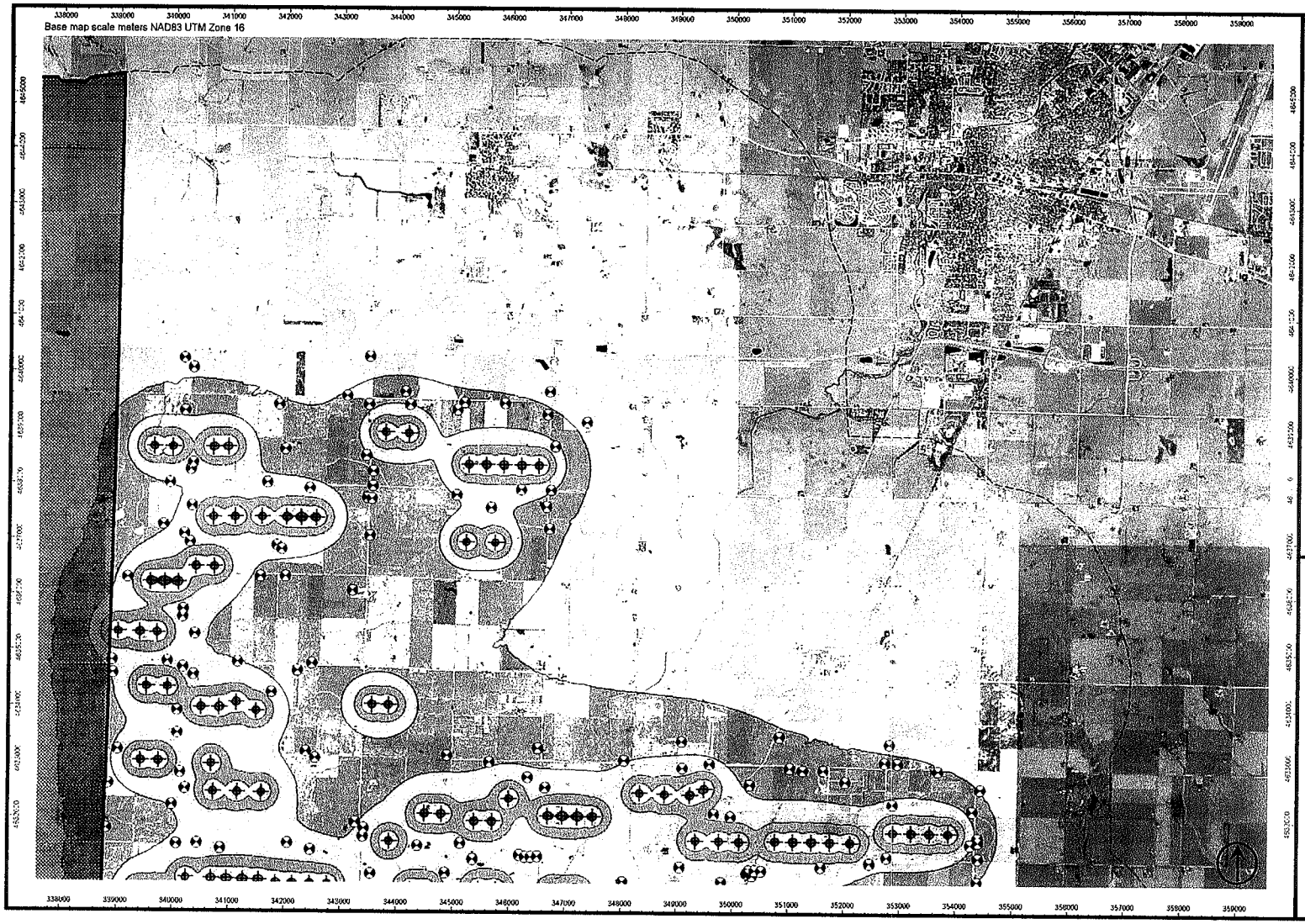
FIGURE 6B
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

63 Hz

March 2009

TETRA TECH



Sound Contour Isopleths

- 42 to 47 dBL
- 47 to 52 dBL
- 52 to 57 dBL
- 57 to 62 dBL
- 62 to 67 dBL
- > 67 dBL

IPCB 125 Hz Limit = 62 dBL

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

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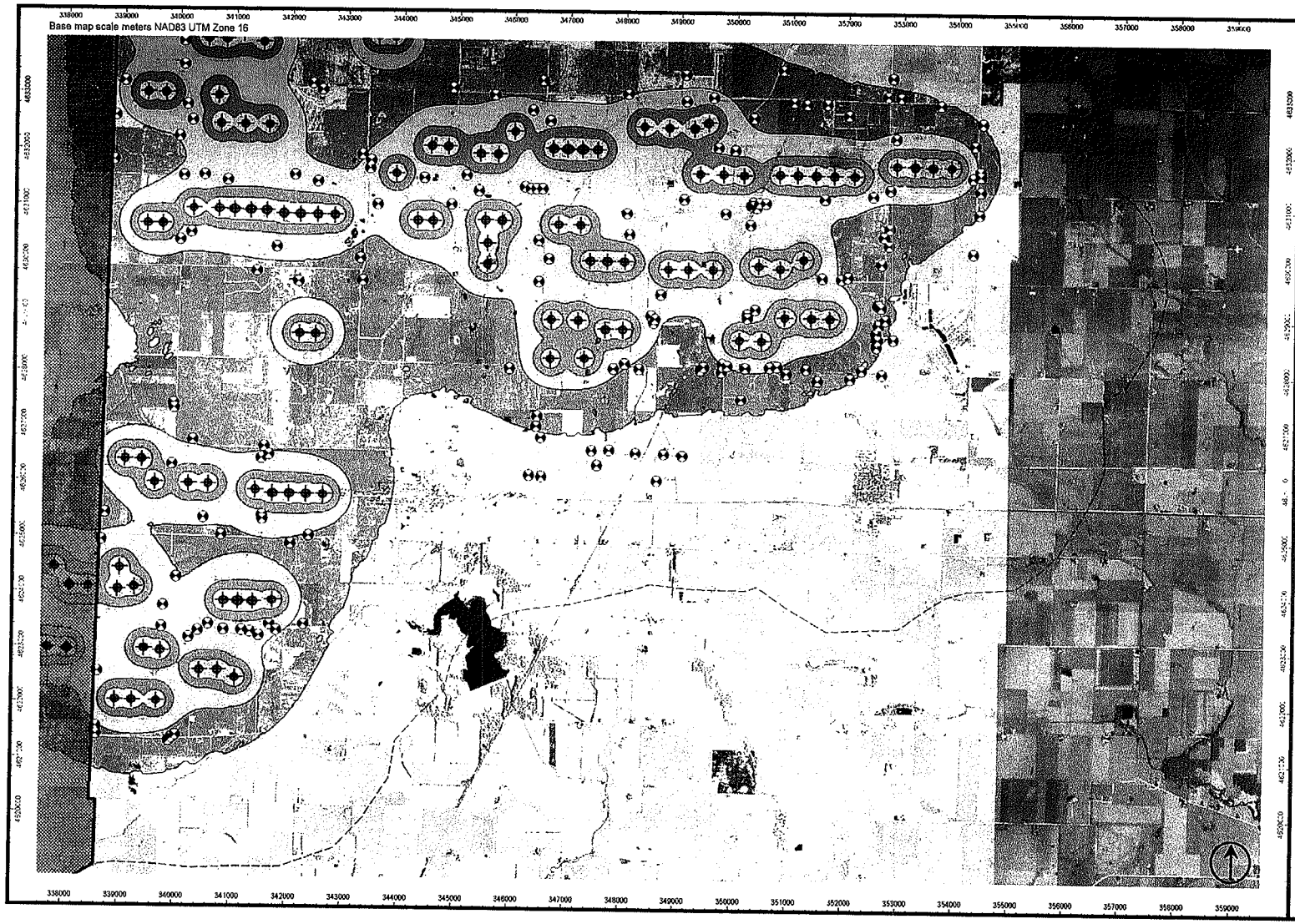
FIGURE 7A
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

125 Hz

March 2009

TETRA TECH EC



Sound Contour Isopleths

- 42 to 47 dBL
- 47 to 52 dBL
- 52 to 57 dBL
- 57 to 62 dBL
- 62 to 67 dBL
- > 67 dBL

IPCB 125 Hz Limit = 62 dBL

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

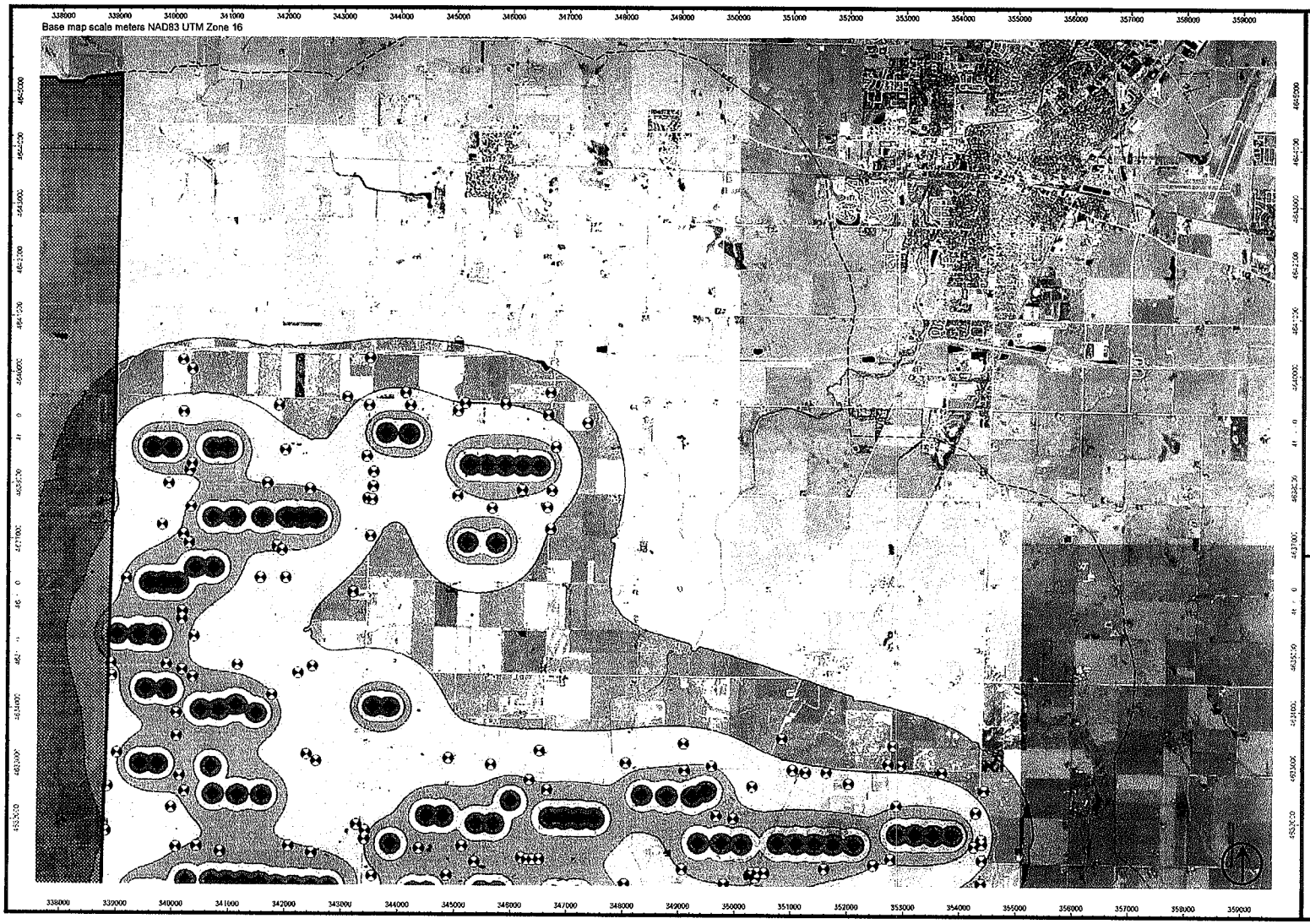
LEE - DeKALB WIND ENERGY CENTER

FIGURE 7B
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

125 Hz

March 2009

TETRA TECH EC



Sound Contour Isopleths

- 34 to 39 dBL
- 39 to 44 dBL
- 44 to 49 dBL
- 49 to 54 dBL
- 54 to 59 dBL
- > 59 dBL

IPCB 250 Hz Limit = 54 dBL

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

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FIGURE 8A
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

250 Hz

March 2009

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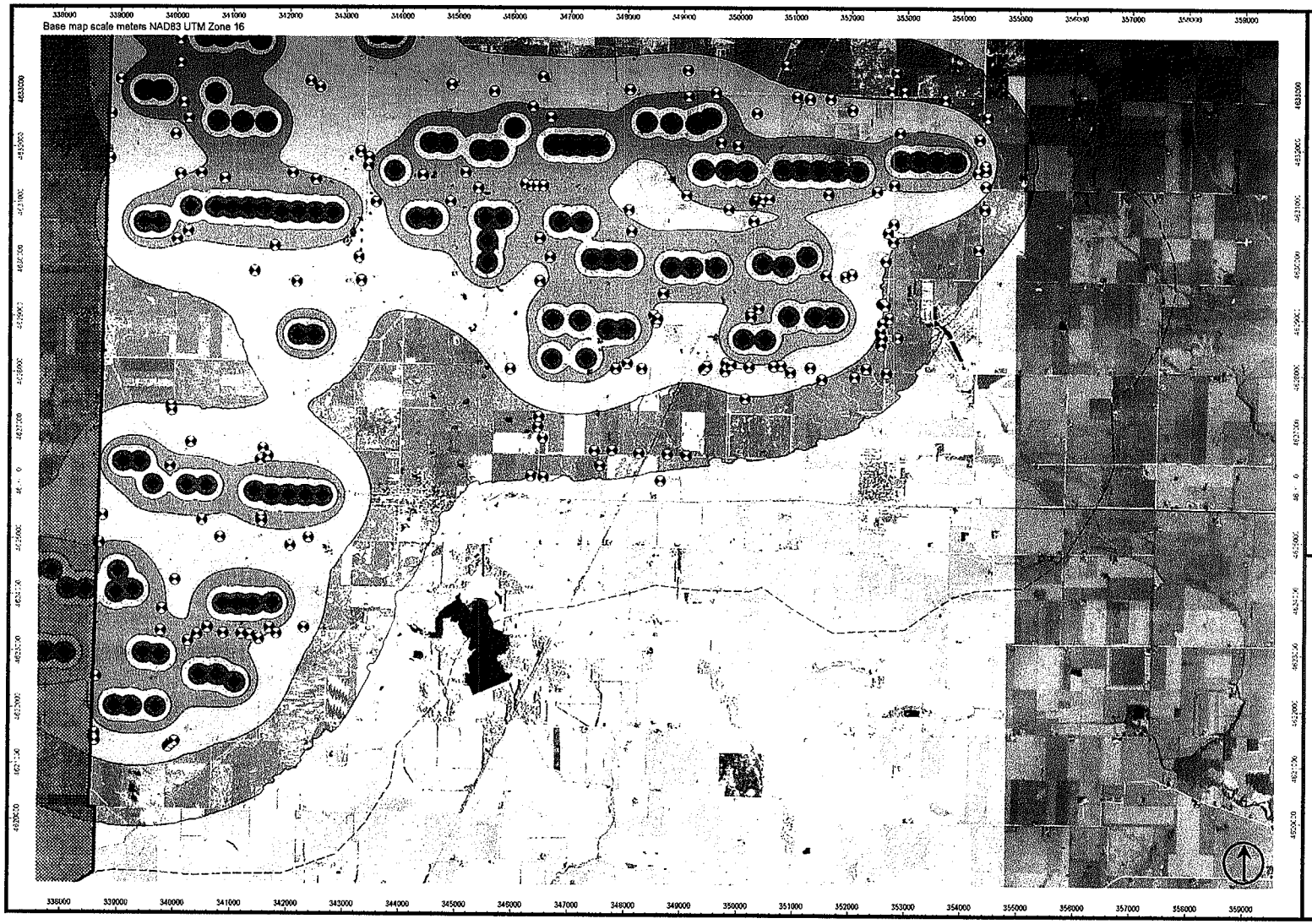


Sound Contour Isopleths

- 34 to 39 dBL
- 39 to 44 dBL
- 44 to 49 dBL
- 49 to 54 dBL
- 54 to 59 dBL
- > 59 dBL

IPCB 250 Hz Limit = 54 dBL

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

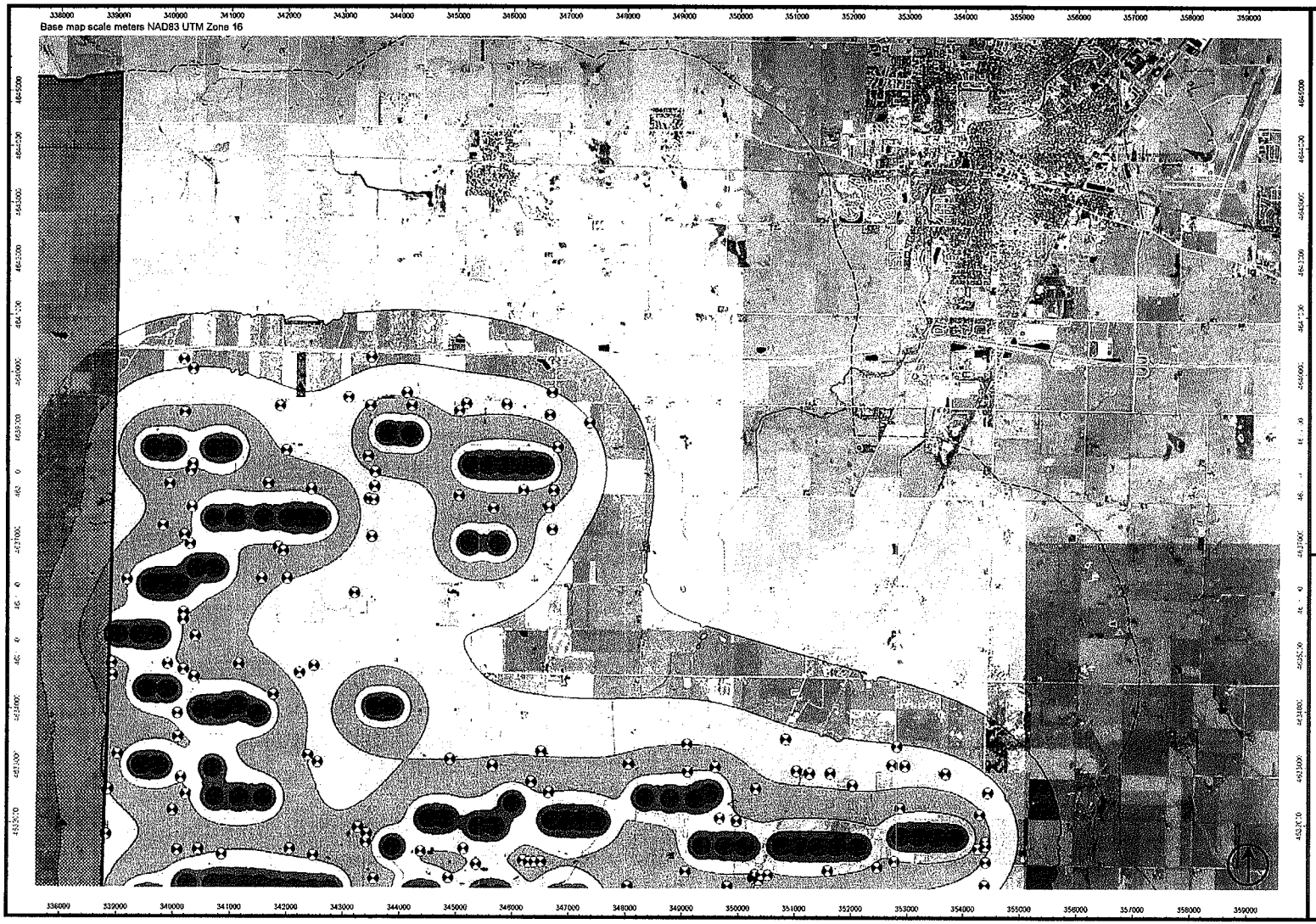
LEE - DeKALB WIND ENERGY CENTER

FIGURE 8B
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

250 Hz

March 2009

TETRA TECH EC



Sound Contour Isopleths

- 27 to 32 dBL
- 32 to 37 dBL
- 37 to 42 dBL
- 42 to 47 dBL
- 47 to 52 dBL
- > 52 dBL

IPCB 500 Hz Limit = 47 dBL

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

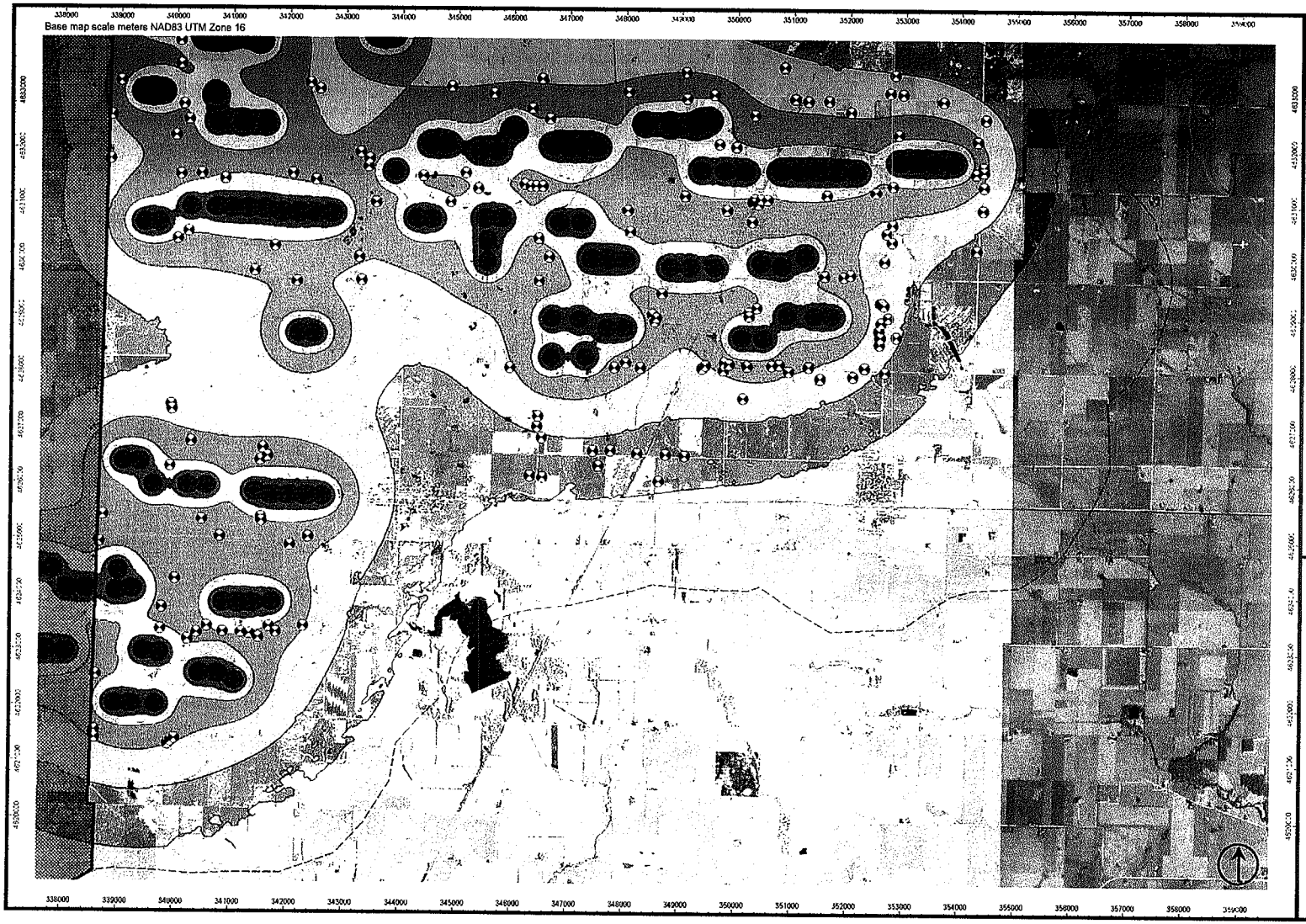
LEE - DeKALB WIND ENERGY CENTER

FIGURE 9A
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

500 Hz

March 2009

TETRA TECH EC



Sound Contour Isopleths

- 27 to 32 dBL
- 32 to 37 dBL
- 37 to 42 dBL
- 42 to 47 dBL
- 47 to 52 dBL
- > 52 dBL

IPCB 500 Hz Limit = 47 dBL

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

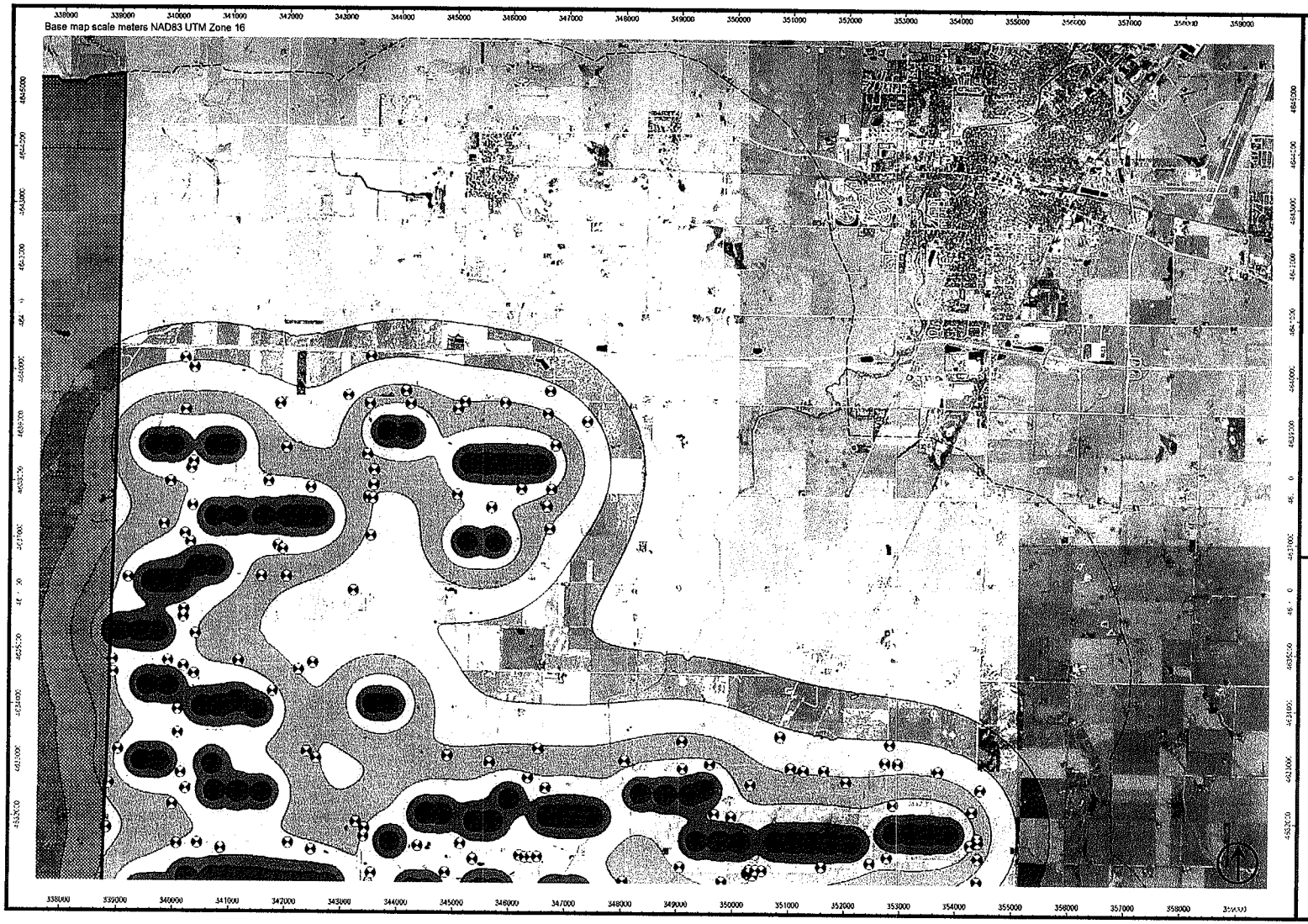
LEE - DeKALB WIND ENERGY CENTER

FIGURE 9B
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

500 Hz

March 2009

TETRA TECH EC



Sound Contour Isopleths

- 21 to 26 dBL
- 26 to 31 dBL
- 31 to 36 dBL
- 36 to 41 dBL
- 41 to 46 dBL
- > 46 dBL

IPCB 1000 Hz Limit = 41 dBL

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

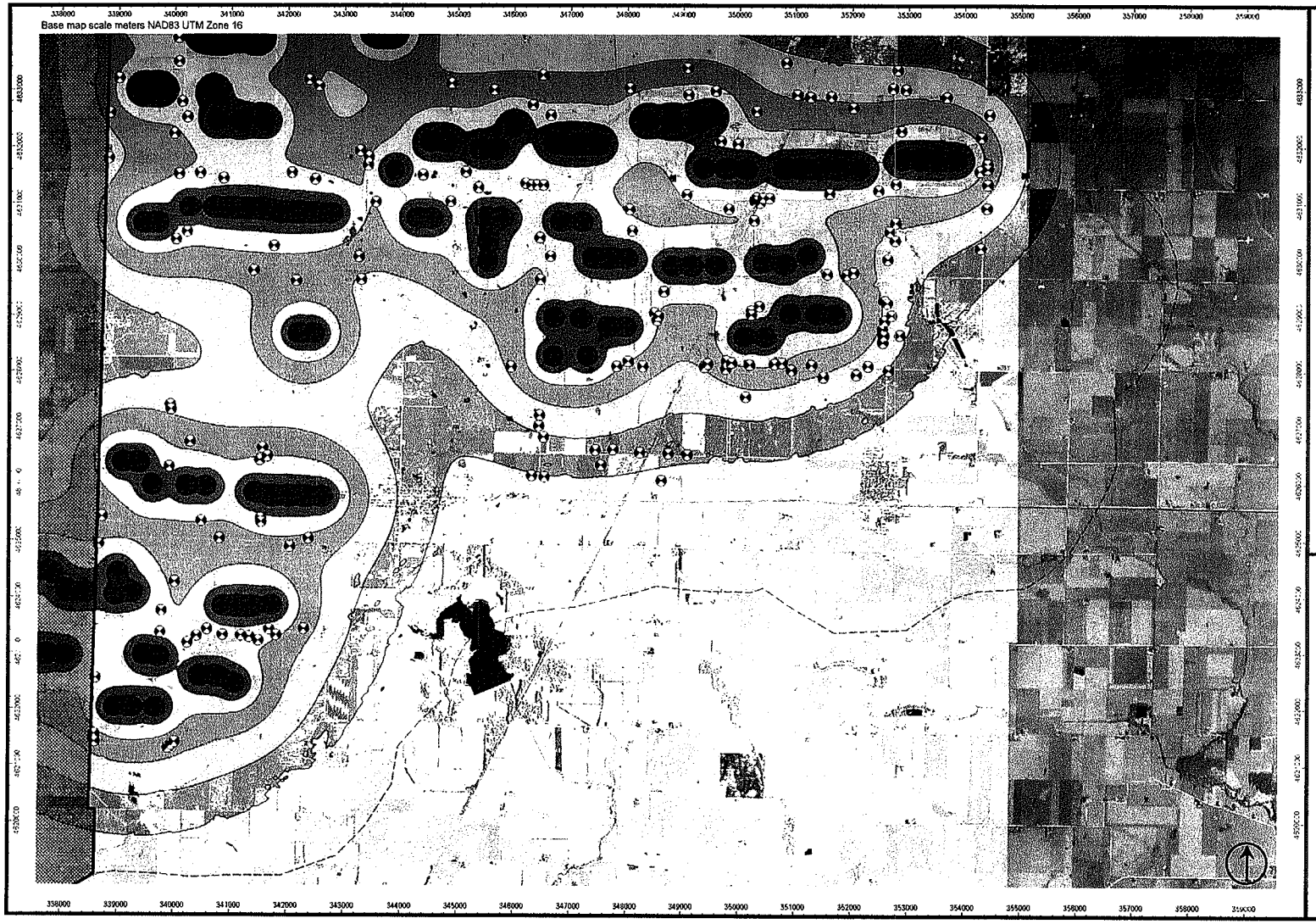
LEE - DeKALB WIND ENERGY CENTER

FIGURE 10A
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

1000 Hz

March 2009

TETRA TECH



Sound Contour Isopleths

- 21 to 26 dBL
- 26 to 31 dBL
- 31 to 36 dBL
- 36 to 41 dBL
- 41 to 46 dBL
- > 46 dBL

IPCB 1000 Hz Limit = 41 dBL

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

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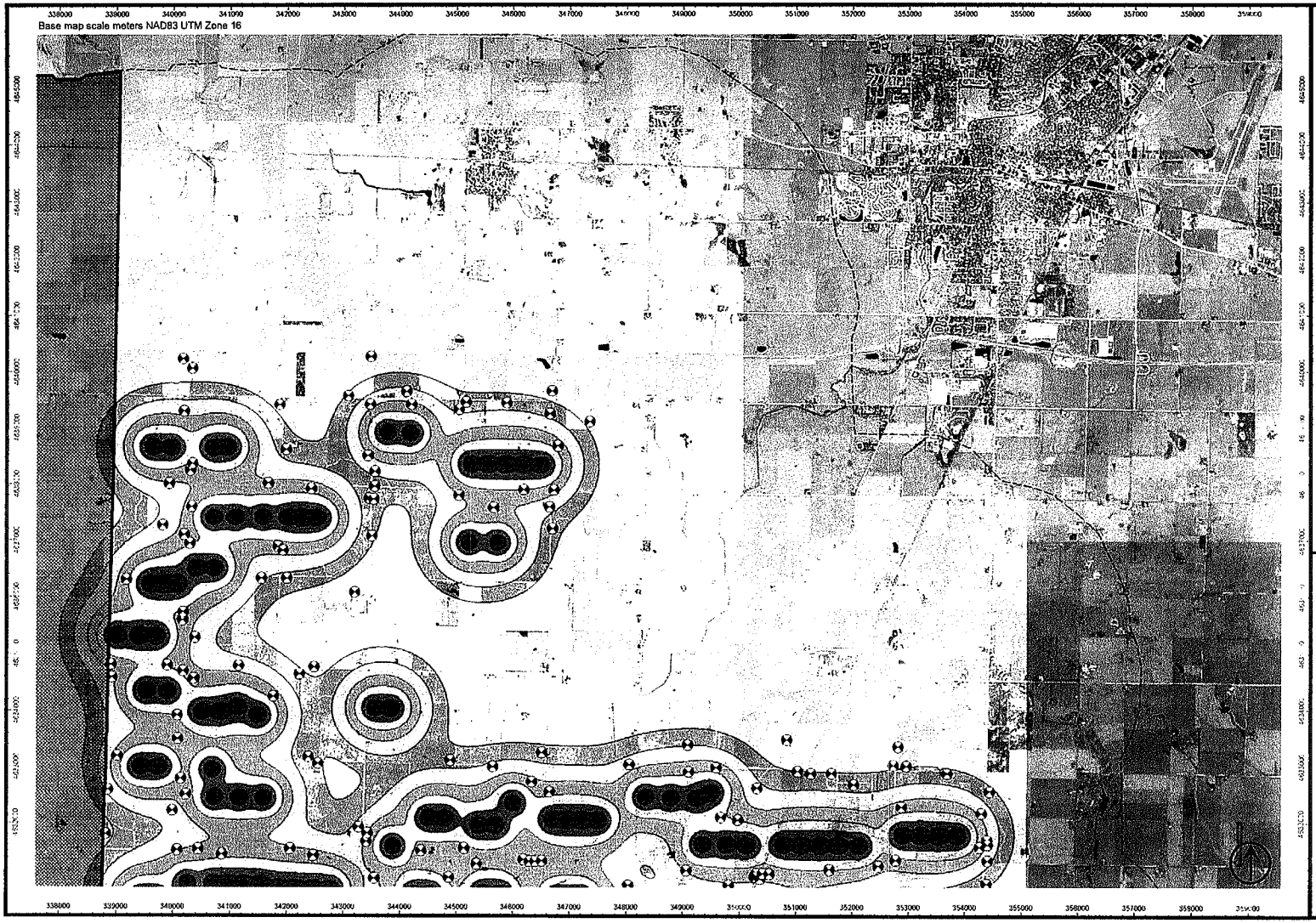
FIGURE 10B
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

1000 Hz

March 2009

TETRA TECH EC



Sound Contour Isopleths

- 16 to 21 dBL
- 21 to 26 dBL
- 26 to 31 dBL
- 31 to 36 dBL
- 36 to 41 dBL
- > 41 dBL

IPCB 2000 Hz Limit = 36 dBL

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

LEE - DeKALB WIND ENERGY CENTER

FIGURE 11A
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

2000 Hz

March 2009

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Sound Contour Isopleths

- 16 to 21 dBL
- 21 to 26 dBL
- 26 to 31 dBL
- 31 to 36 dBL
- 36 to 41 dBL
- > 41 dBL

IPCB 2000 Hz Limit = 36 dBL

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

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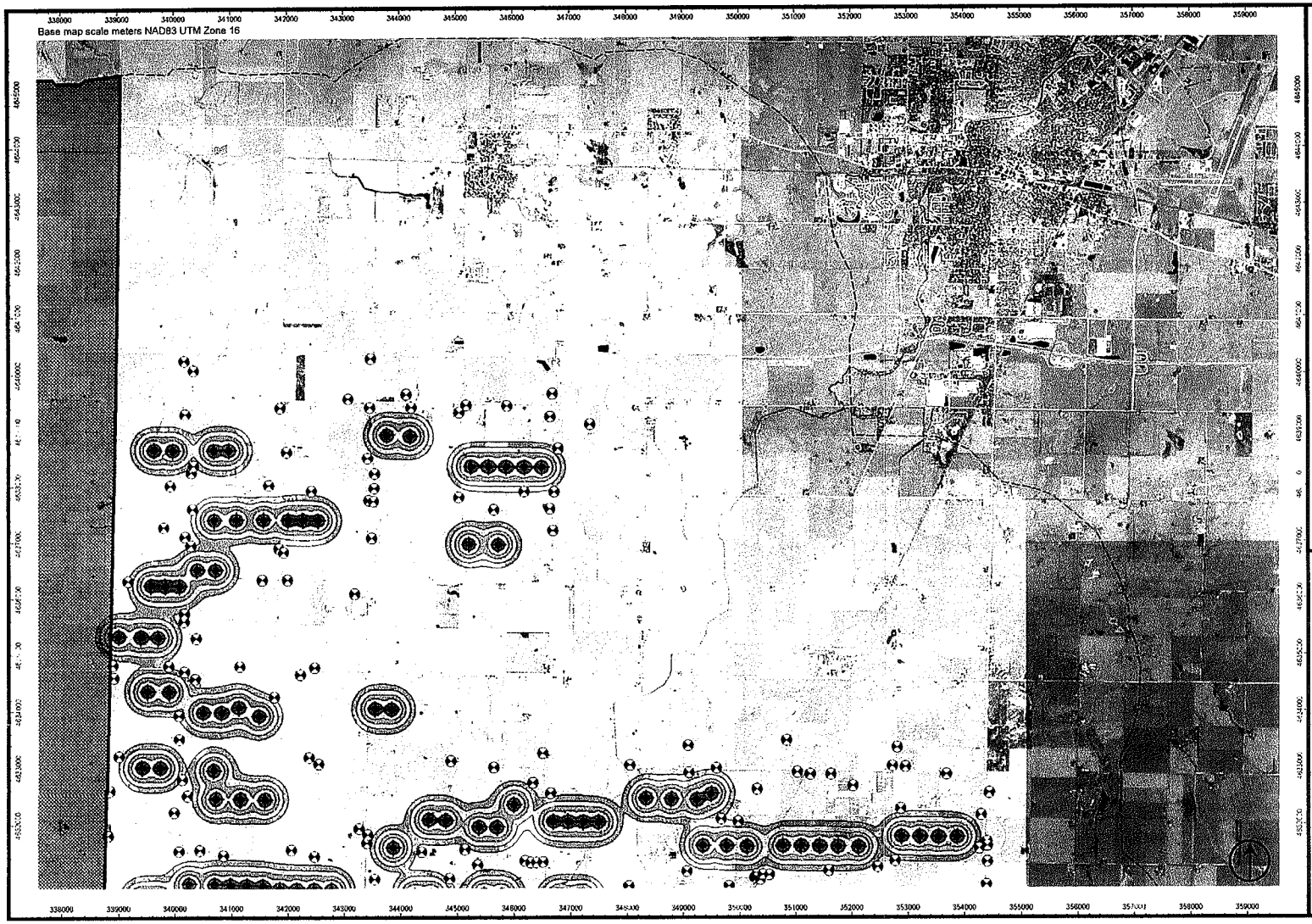
FIGURE 11B
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

2000 Hz

March 2009

TETRA TECH EC



Sound Contour Isopleths

- 12 to 17 dBL
- 17 to 22 dBL
- 22 to 27 dBL
- 27 to 32 dBL
- 32 to 37 dBL
- > 37 dBL

IPCB 4000 Hz Limit = 32 dBL

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

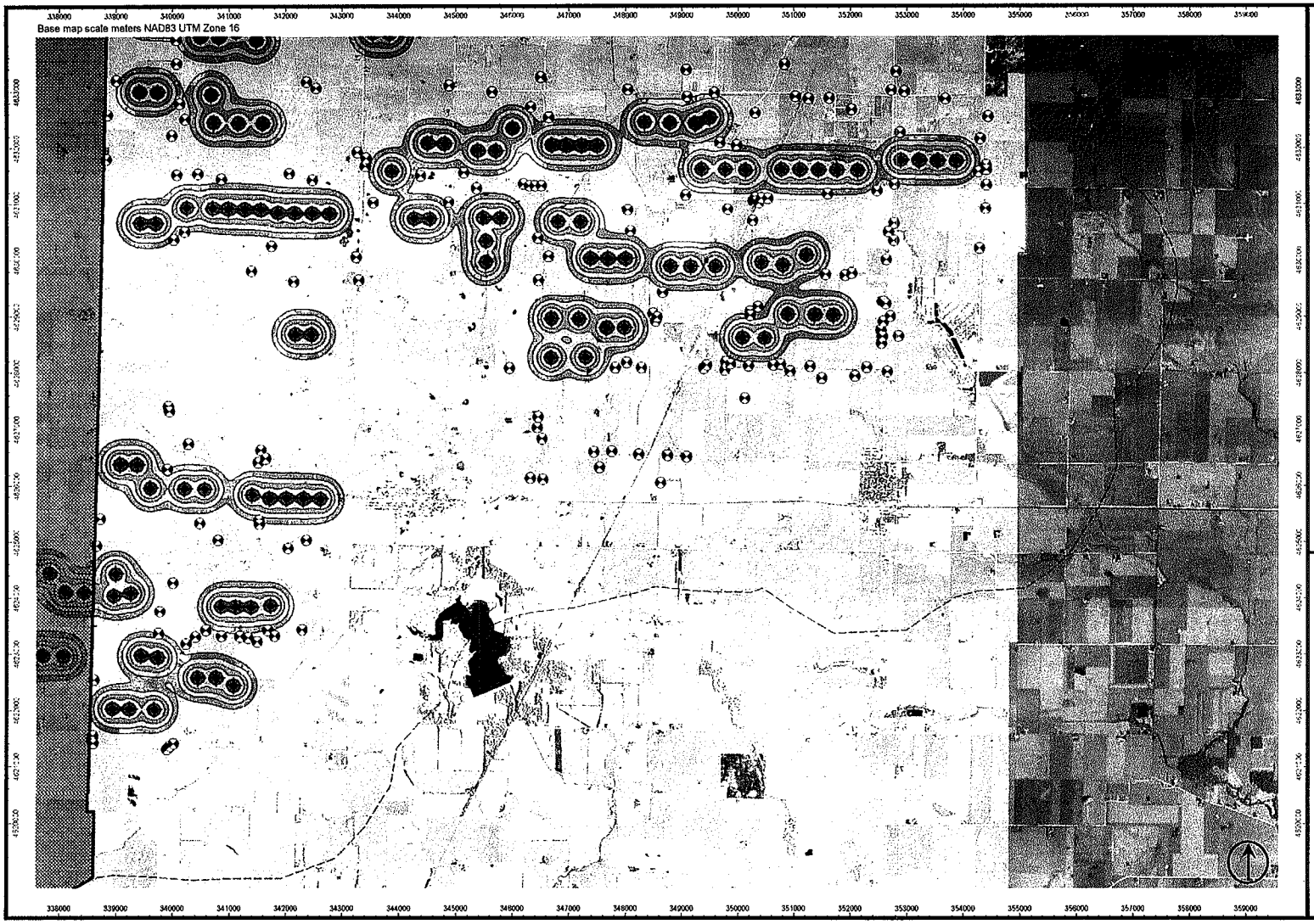
LEE - DeKALB WIND ENERGY CENTER

FIGURE 12A
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

4000 Hz

March 2009

TETRA TECH EC



Sound Contour Isopleths

- 12 to 17 dBL
- 17 to 22 dBL
- 22 to 27 dBL
- 27 to 32 dBL
- 32 to 37 dBL
- > 37 dBL

IPCB 4000 Hz Limit = 32 dBL

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

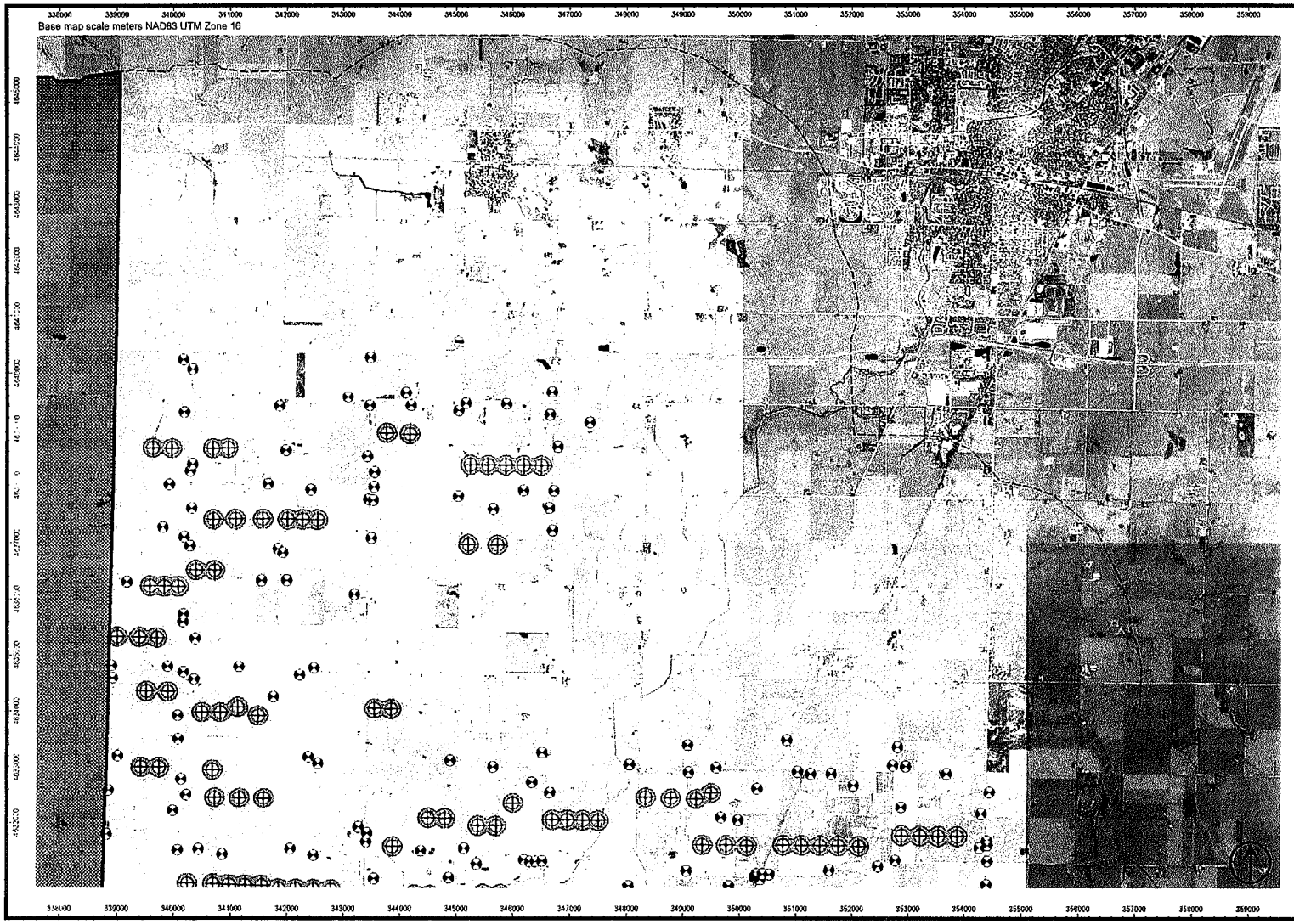
LEE - DeKALB WIND ENERGY CENTER

FIGURE 12B
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

4000 Hz

March 2009

TETRA TECH INC



Sound Contour Isopleths

- 12 to 22 dBL
- 22 to 32 dBL
- 32 to 37 dBL
- > 37 dBL

IPCB 8000 Hz Limit = 32 dBL

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

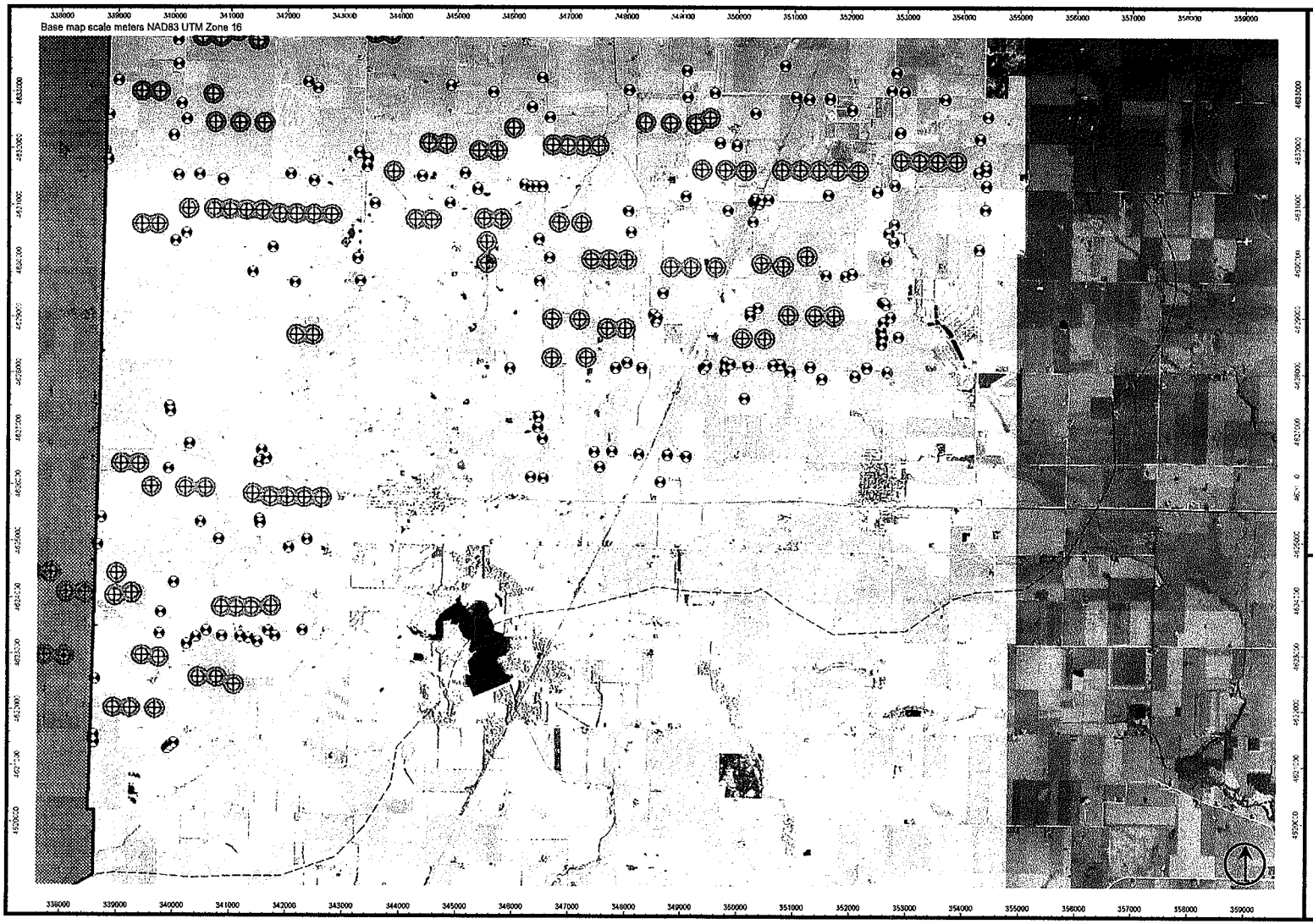
LEE - DeKALB WIND ENERGY CENTER

FIGURE 13A
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

8000 Hz

March 2009

TETRA TECH EC



Sound Contour Isopleths

- 12 to 22 dBL
- 22 to 32 dBL
- 32 to 37 dBL
- > 37 dBL

IPCB 8000 Hz Limit = 32 dBL

- Location of Receptors
- Location of WTGs
- Acoustic Study Area Extents
- DeKalb County Study Area Extents

LEE - DeKALB WIND ENERGY CENTER

FIGURE 13B
RECEIVED SOUND LEVELS
WTGs AT FULL ROTATIONAL

8000 Hz

March 2009

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The resultant sound contour plots are independent of the existing acoustic environment, i.e., the plots represent Project-generated sound levels only. All of these values are downwind of the WTGs; lower sound levels would exist in other directions. The acoustic modeling results were compared to the frequency limits (dBL) and the broadband (dBA) guideline criteria as described in Section 3.0 of this report above, specifically the EPA broadband guideline of 55 dBA L_{dn} (equivalent to a $L_{eq\ (1\text{-hour})}$ of 48.6 dBA assuming continuous 24-hour operation) which was used as a internal Project design goal and the absolute IPCB maximum limits, which vary depending on octave band frequency.

The EPA criteria presented in Section 3.2 are based on a yearly L_{dn}. To compute this, knowledge of future atmospheric conditions across the site over a long period of time would need to be known. The approach used in this screening level analysis uses the L_{max}, or maximum received sound pressure levels representing the highest cumulative noise from the wind farm within the acoustic study area. Results are representative of the worst case in terms of potential received sound levels under the assumption of a sustained wind in a single direction over a continuous 24-hour period. Actual wind speeds and directions will vary. The worst case yearly L_{dn} was then calculated using the following equation, consistent with the EPA guidance:

$$\text{Yearly } L_{dn} \text{ (exterior)} = 10 \cdot \log_{10} [(15 \cdot 10^{(Leq(1)/10)} + 9 \cdot 10^{((Leq(1)+10)/10)} / 24] \text{ dBA}$$

In this equation for calculating environmental noise, the L_{eq} (1) was assigned the value of the Project-generated worst case instantaneous L_{max} for the operating condition under analysis (cut-in or at full rotational speed). The IPCB frequency limits are also based on L_{eq} (1) averaging. Under real world meteorological conditions, received sound pressure levels will fluctuate somewhere between the cut-in and maximum sound levels over the life of the Project. During periods below the cut-in wind speeds when WTGs do not operate, the Project will generate minimal sound. For time varying sources, assessing compliance under the worst case operational condition (L_{max}) will ensure compliance during all other possible future operational conditions, though such conditions are highly unlikely under actual operating conditions.

5.2 Acoustic Regulatory Compliance Determination

The acoustic modeling results were compared to applicable noise limits and voluntary acoustic design goals as developed in Section 3.0 of this acoustic assessment, specifically the IPCB allowable nighttime octave band sound pressure level limits and the EPA noise guidelines. The results of the acoustic modeling analysis were assessed against criteria limits to provide a regulatory compliance demonstration. Table 10, below, summarizes sound modeling results for Project cut-in and maximum rotational operating conditions.

Table 10 Summary of Modeling Results and Comparison to EPA and IPCB Limits

Operating Scenario	Receptor IDs of Potential Exceedances of the EPA Broadband dBA Noise Guideline	Receptor IDs of Potential Exceedances of the IPCB Frequency Dependent dBL Noise Limits
Cut-in	None	None
Maximum	None	None

The Lee-DeKalb WEC Project acoustic modeling analysis in DeKalb County shows compliance with the EPA guideline and overriding IPCB noise limits for all existing residential receptors. Low frequency

sound, generally considered to fall within the frequency range of 20-200 Hz, was previously linked to wind energy operations configured with downwind rotors; however, the modeling results show that the Project is significantly below the prescribed IPCB octave band limits within this range. Similarly, the Project is also in compliance with the higher 4 kHz and 8 kHz octave band limits, which can likely be attributed to the increased effect air absorption has on higher frequency wavelengths. Lastly the human ear is most sensitive in the mid-frequencies ranging from 250 Hz to 2000 Hz, and the Project complies with the all corresponding mid-frequency IPCB octave band limits.

Table 9 also shows that the Lee-DeKalb WEC Project in DeKalb County will be in compliance with the EPA broadband guideline of 55 dBA L_{dn} (equivalent to a $L_{eq\ (1\text{-hour})}$ of 48.6 dBA assuming continuous 24-hour operation) at all existing noise sensitive areas. The Project is expected to also remain at or below the 70 dBA as L_{eq} (24) at all publicly accessible offsite locations, including property lines of non-participants. As shown in Table 9 and the sound contour isopleths plots which are keyed to the color red for the IPCB for each individual nighttime octave band limit, the Project is expected to be in compliance with all applicable criteria under all future WTG operational conditions.

6.0 CONCLUSION

The Lee-DeKalb WEC Project has been designed to comply with IPCB standards, while providing a commercially viable Project capable of producing clean renewable energy for the region. Adjustments have been made to the initial Project layout during the acoustic engineering design phase to ensure compliance with IPCB standards through a comprehensive, iterative modeling process.

Wind turbine sound is produced by air interacting with the turbine blades, which tends to be broadband sound in the 200 Hz to 2000 Hz range. Modern wind turbines are considerably quieter than earlier versions and have been designed not to produce tonal or impulsive sound as per IEC definitions. Furthermore, the generation of low frequency sound emissions commonly referred to as infrasound, a problem characteristic of early wind turbine designs when turbine blades were downwind of the main tower, will not be an issue with this modern upwind GE blade/tower design proposed for this Project as shown in Figure 5 at 31 Hz which includes sound energy extending down into the infrasound range and in Figures 6 and 7 which present results for 63 Hz and 125 Hz, respectively.

Comparatively, acoustic modeling results shown in Figures 12 and 13 for the 4,000 and 8,000 Hz center frequencies, respectively, displays how increased sound energy by air absorption greatly limits propagation over long distances. The human ear is most sensitive in the mid-frequencies ranging from 250 Hz to 2000 Hz, and the Project complies with the all corresponding mid-frequency IPCB octave band limits as shown in Figures 8 through 11.

In conclusion, modeling results even with a number of conservative assumptions demonstrates compliance with the IPCB nighttime limits as calculated at existing residential receptors. In addition, the Project will comply with EPA noise criteria, which serve as useful guidelines to determine the likelihood of adverse community noise impacts. Audible sound from the Project will likely not be deemed excessive or unusually loud and will be consistent with sound generated at similar wind energy projects successfully sited throughout the state of Illinois and the United States employing similar noise criteria limits.

7.0 TECHNICAL REFERENCES

1. DataKustik GmbH, 2005. Computer Aided Noise Abatement Model CadnaA, Version 3.7. Munich, Germany.

2. International Standard, ISO 9613-2, Acoustics – Attenuation of Sound During Propagation Outdoors, Part 2 General Method of Calculation.

3. American National Standards Institute, ANSI S1.26-1995, American National Standard Method for the Calculation of the Absorption of Sound by the Atmosphere, 1995.

4. Anthony Rogers, James Manwell, Sally Wright, "Wind Turbine Noise – A White Paper", Renewable Energy Research Laboratory, University of Massachusetts at Amherst, June 2002, Amended January 2006.

5. International Electromechanical Commission (IEC) 61400-11:2002(E) Wind Turbine Generator Systems – Part 11: Acoustic Noise Measurement Techniques, Second Edition 2002.

6. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), 1989 ASHRAE Handbook—Fundamentals, Atlanta, Georgia, 1989.

7. Federal Highway Administration, FHWA Roadway Construction Noise Model User's Guide, FHWA-HEP-05-054, January 2006.

8. "Highway Traffic Noise Analysis and Abatement, Policy and Guidance", US Department of Transportation, Federal Highway Administration, June 1995.

9. International Electromechanical Commission (IEC) 61400-14:2005(E) Wind Turbine Generator Systems – Part 14: Declaration of Apparent Sound Power Level and Tonality Values. 2005.

10. U.S. Department of Transportation, "Highway Traffic Noise Analysis and Abatement, Policy and Guidance," Federal Highway Administration, June 1995.

11. USEPA, Information on Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety, Publication EPA-550/9-74-004, March, 1974.

12. Bolt, Beranek and Newman, Inc., Power Plant Construction Noise Guide, prepared for the Empire State Electric Energy Research Corporation, Report No. 3321, 1977.

13. Wagner, S., Bareib, R. and Guidati, G., Wind Turbine Noise, Springer, Berlin, 1996..

FINAL REPORT AND ANY INFORMATION
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APPENDIX A

ILLINOIS NOISE REGULATIONS