Slagel Exhibit 9 – Hankard Surrebuttal

Topic 1 for Surrebuttal

[From 4/29/2015, No transcripts available yet]

Hankard: "*He [John Slagel] took his model and predicted at the houses on PR as we did and said "I was within a db so we matched perfectly." Well, he then goes on to really split hairs into tenths and hundreds of a db, so you can't be "I'm accurate within a db" and then I'm gonna go split hairs, you can't do that.*"

Why claim to be only within 1db?

- I testified on 4/13/2015. At that point, the only sound data I had access to was the PR Supplemental Application Table 3-1 which gave the sound predictions for the 4 LNTE siting model *to the nearest decibel.*
- Rounding introduces comparison errors. For example, PR's listed data of 40 could have actually been anywhere from 39.5 to 40.5.
- My actual numbers are listed and compared to PR in Slagel Exhibit 10A. *The average error is actually much less than 1 db.*

New data! PR Exhibit 16B

- Pleasant Ridge Exhibit 16B wasn't posted to the website until the morning of the day of Mr. Hankard's rebuttal (Monday 4/27/2015). This is after I testified.
- PR Exhibit 16B showed the 4, 11, and 24 LNTE configuration's sound estimates <u>to a tenth of decibel</u>.
- That evening was the first time I had heard of this exhibit, as evidenced by my surprise and blurting out a question about it during the hearing that evening.
- After Mr. Hankard questioned the 1 decibel accuracy of my numbers on 4/29/2015, I decided to re-run my model and try to match the tenth of a db numbers, given this new data.

But I couldn't match the new 16B numbers...

- Try as I might, I couldn't match the PR 16B numbers for the 24 LNTE 1.79-100 configuration. I double-checked my formulas, then triple-checked them. I was always about 0.4 db too high.
- Then I decided to take the time to re-verify that my inputs to the formulas matched Stantec's inputs. (I had just assumed that the inputs would be the same.)
- Aha! The inputs had changed...

Changed Inputs from Original & Supplemental App to Exhibit 16B

Original PR Application – GE 1.79-100

Pleasant-Ridge-Livingston-County-Special-Use-Permit_082014_2.pdf - Adobe Reader

of the turbines and receptors within the area of impact, and the propagation of noise from the turbines to the receptors.

3.1 PREDICTED NOISE ANALYSIS METHODOLOGY

The potential impact of sound on receptors within approximately 2,000 meters (1.25 miles) of the Project turbines was estimated using the Decibel module of WindPRO Version 2.9 software and checked using the CadnaA software program by DataKustik. Both models utilized maximum octave band sound power levels provided by the turbine manufacturer (GE), conservative ISO 9613-2 algorithms to estimate sound propagation, and the specific location of each turbine and each residence located within the project study area. Modeling results were compared with maximum allowable noise levels under the IPCB Noise Regulations.

Pleasant Ridge proposes to utilize the GE 1.79-100 or similar model turbine to generate up to 250 MW of power. The analysis described in this summary report was performed using the GE 1.79-100 model turbine with an 80-meter hub height and a 100-meter rotor diameter. If an alternate turbine model is employed, Pleasant Ridge will comply with these same limitations and a new noise study will be produced demonstrating compliance. This analysis utilizes a combination of standard and low-noise trailing edge (LNTE) blades on a total of 137 proposed turbine locations. The analysis results demonstrate compliance with the IPCB regulations.

The modeling analysis input includes octave band sound power levels from 31.5 Hertz to 8,000 Hertz. The A-weighted octave band sound power levels (L_{wa}) for the GE 1.79-100 turbine using both the standard and LNTE blade configurations are given in Table 2.

Table 2 GE 1.79-100 Maximum Octave Band Sound Power Levels (L_{wa})

Octave Band Center Frequency	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
GE-1.79-100 (standard blade)	81.1	90.8	95.7	97.5	100.4	102.7	99.4	90.3	71.3
GE-1.79-100 (LNTE blade)	81.1	90.8	94.8	94.8	96.1	101.0	100.1	91.1	72.5

Sound impact is also dependent on the distance between the source turbine and sound receptor. The location of the wind turbines is based on the current layout of the wind farm provided by Pleasant Ridge. Elevations for turbines and receptors were calculated using the National Elevation Dataset acquired from the U.S. Geological Survey.

Stantec

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PLEASANT RIDGE WIND ENERGY PROJECT
SOUND STUDY

August 17, 2014

PR Exhibit 16B – GE 1.79-100

PR-Ex.-16B-PRW-Summary-of-Sound-Results.pdf - Adobe Reader

Table 3-1 - Pleasant Ridge Sound Analysis MAXIMUM Octave Bands Results Summary (GE 1.79-100 Turbine Model)
11 LNTE Turbines and Substation (500 and 1,000 Hz Bands)

With Substation										
All Values in dB	Octave Band Center Frequency	31.5 Hz	62.5 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
IPCB Daytime		**75.0**	**74.0**	**69.0**	**64.0**	**58.0**	**52.0**	**47.0**	**43.0**	**40.0**
IPCB Nighttime		**69.0**	**67.0**	**62.0**	**54.0**	**47.0**	**41.0**	**36.0**	**32.0**	**32.0**
Max Sound-dBA (Std Blade)		**81.1**	**90.8**	**95.7**	**98.3**	**102.0**	**102.9**	**99.5**	**91.9**	**72.9**
Max Sound dBA (LNTE Blade)		**81.0**	**90.6**	**94.5**	**95.3**	**97.6**	**100.6**	**99.6**	**92.7**	**73.7**
Reference ID	**Participation Status and Results**									
R-005	Non-Participant	63.6	59.8	54.0	48.1	45.4	41.2	31.5	6.3	-75.2
R-006	Non-Participant	63.3	59.5	53.5	47.5	44.5	40.4	31.2	9.4	-58.9
R-007	Non-Participant	63.3	59.4	53.4	47.2	44.0	39.3	28.3	-0.8	-94.1
R-008	Non-Participant	63.4	59.5	53.5	47.4	44.2	39.7	29.6	5.9	-68.5
R-009	Non-Participant	63.5	59.6	53.6	47.3	43.9	39.0	27.1	-4.4	-104.1
R-010	Non-Participant	63.6	59.7	53.6	47.4	44.1	39.3	27.6	-2.8	-98.7
R-011	Participant	63.8	59.9	53.9	47.8	44.7	40.3	29.9	4.4	-76.9
R-012	Non-Participant	63.8	59.9	53.9	47.7	44.6	40.5	30.9	4.9	-78.8
R-013	Participant	64.3	60.4	54.4	48.1	45.0	41.3	32.9	11.6	-57.8
R-014	Participant	63.9	60.0	53.9	47.7	44.5	40.4	31.1	5.6	-78.4
R-021	Non-Participant	63.4	59.6	53.6	47.5	44.4	39.9	29.8	6.5	-66.6
R-022	Participant	64.0	60.2	54.3	48.4	45.5	41.3	31.7	9.0	-60.8
R-023	Participant	63.2	59.4	53.4	47.2	44.0	39.4	29.1	5.0	-70.7
R-027	Non-Participant	62.7	58.8	53.2	47.1	44.4	39.7	29.8	6.8	-55.8
R-028	Participant	63.2	59.3	53.5	47.8	45.2	41.4	33.0	13.0	-49.7
R-038	Non-Participant	63.3	59.4	53.6	47.7	44.9	40.7	30.9	6.4	-72.3
R-039	Non-Participant	62.9	59.0	53.1	47.3	44.5	40.5	31.1	7.1	-71.1
R-041	Non-Participant	59.9	55.9	49.5	42.8	39.3	34.0	21.7	-10.8	-117.4
R-043	Non-Participant	60.9	57.0	50.9	44.9	42.1	38.3	30.0	9.7	-57.0
R-059	Participant	62.8	58.9	53.1	46.6	43.4	39.1	29.1	2.2	-85.3
R-060	Participant	63.6	59.7	53.7	47.6	44.6	41.0	32.8	12.0	-55.0
R-063	Non-Participant	62.8	58.9	52.9	46.8	43.8	39.4	29.7	6.6	-66.0
R-085	Non-Participant	62.9	59.0	52.9	46.8	43.7	39.6	30.0	7.0	-65.1
R-091	Participant	64.1	60.3	54.2	47.9	44.8	40.7	31.5	8.5	-63.8
R-092	Non-Participant	64.1	60.3	54.5	48.4	45.5	41.2	31.5	6.2	-71.8
R-093	Participant	62.9	59.0	53.1	47.1	44.1	39.8	29.6	4.3	-77.9
R-099	Non-Participant	63.3	59.4	53.3	46.9	43.6	39.1	28.6	3.2	-75.8
R-100	Non-Participant	63.2	59.3	53.2	47.0	43.8	39.4	29.5	6.9	-64.9
R-101	Non-Participant	63.4	59.5	53.4	47.0	43.7	39.5	29.9	4.9	-77.3
R-102	Non-Participant	63.7	59.8	53.9	47.8	44.8	40.8	31.8	9.7	-62.1
R-122	Participant	62.5	58.6	52.7	46.8	43.8	39.5	29.1	2.4	-84.1
R-142	Non-Participant	63.4	59.5	53.4	47.1	43.8	39.4	29.2	4.3	-73.0
R-160	Non-Participant	63.0	59.2	53.2	47.3	44.4	40.1	30.4	6.9	-65.8
R-166	Non-Participant	63.2	59.3	53.6	47.8	45.0	40.9	31.2	6.7	-72.2
R-168	Non-Participant	62.9	59.0	53.2	47.3	44.5	40.5	31.3	9.3	-60.3
R-169	Non-Participant	62.1	58.2	52.3	46.4	43.6	39.6	31.1	11.0	-53.8

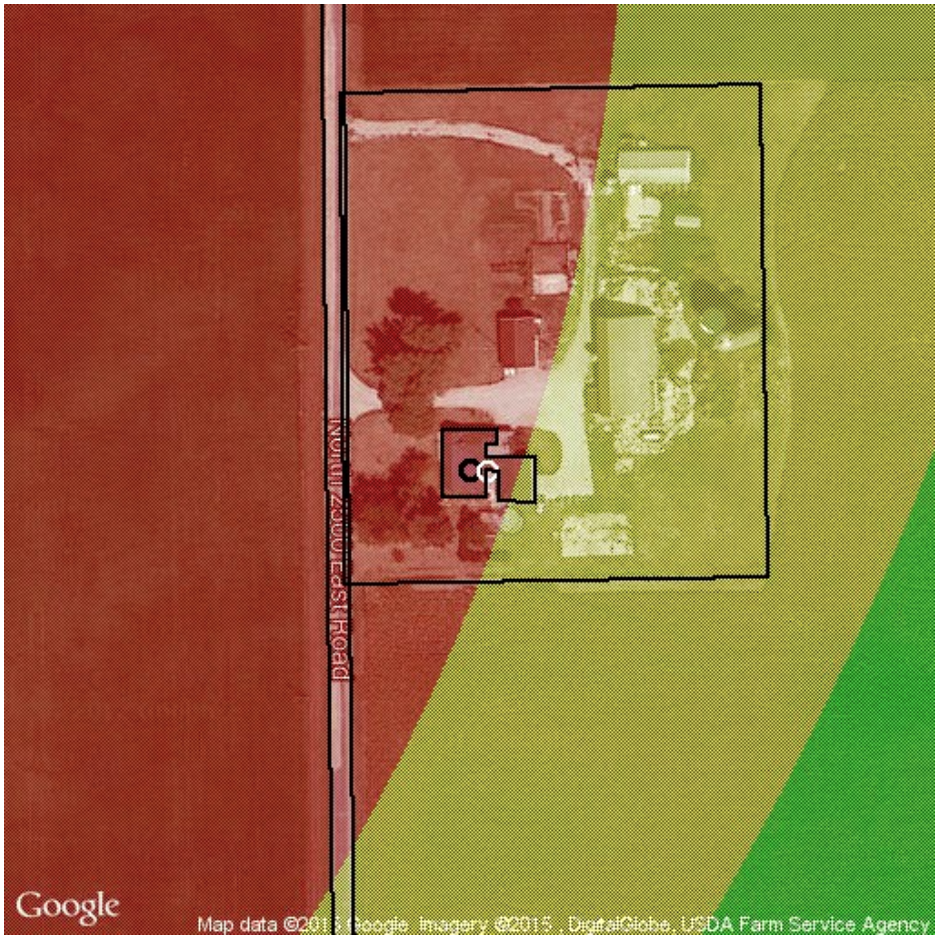
Difference Found

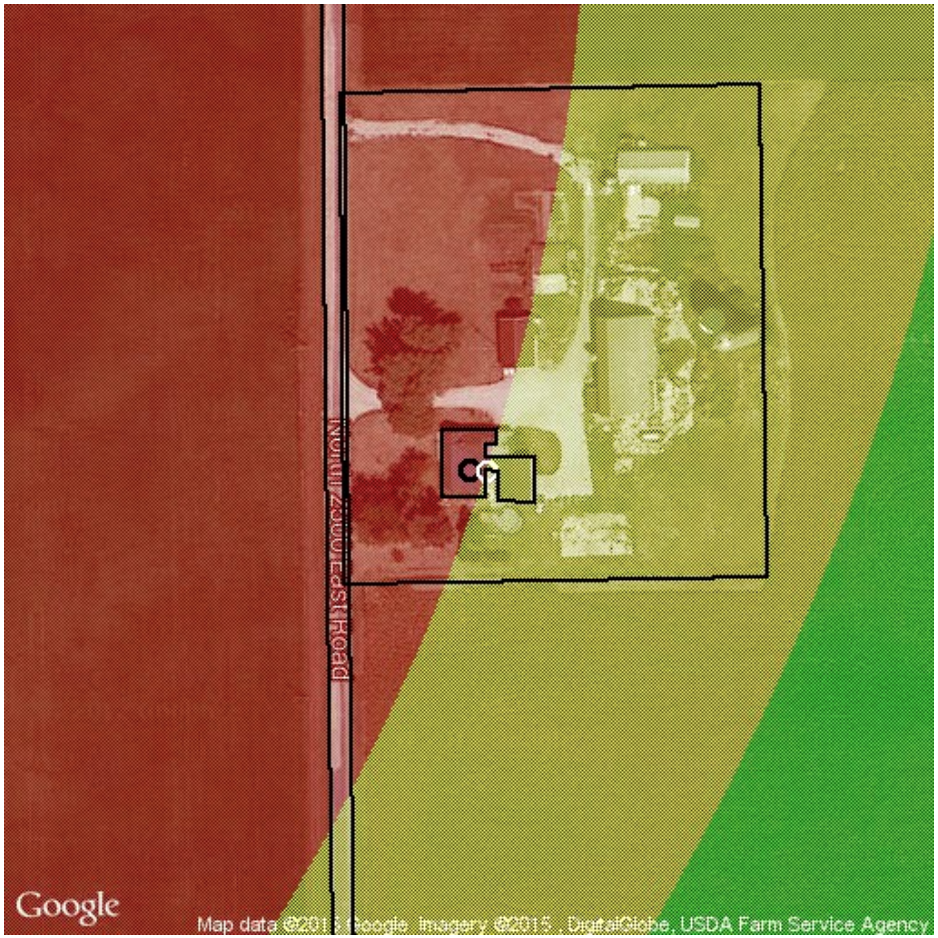
- Between the original and supplemental application and the exhibit 16B, the max power output used for the 1000 hz octave band for the GE 1.79-100 LNTE blades, went from 101.0 down to 100.6. I couldn't find supporting reference documentation or an explanation for this reduction.
- But now, using these new numbers as the input, *my model matches theirs within a tenth of a db*. See Slagel Exhibit 10B for complete details.
- I generated new contour maps to show the differences between the numbers I used when I testified and the new numbers in PR EX 16B. These plots follow.
- I included 18 example properties that show (in one case or the other) IPCB property line noise limits being exceeded in the 1000Hz Octave Band.

Contour Maps

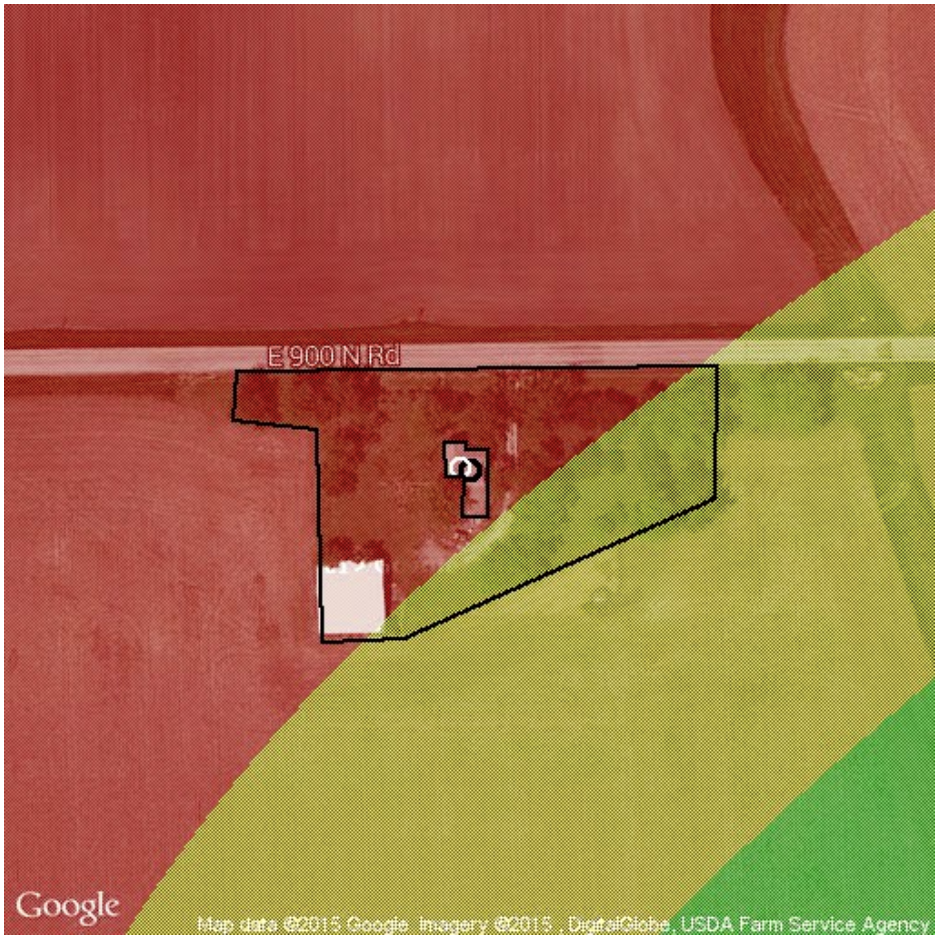
- Red = Over 41 db IPCB nighttime limit @ 1000 Hz
- Yellow = 0-1 db below IPCB nighttime limit @ 1000 Hz
- Green = 1-2 below IPCB nighttime limit @ 1000 Hz
- Black Circle = My Receptor marker (one per home)
- White Circle = PR Receptor marker (one per home)
- Each map is about 760' square, made up of 512x512 pixels. (256x512 point samples)
- Left Side = 24 LNTE GE 1.79-100 configuration using original PR application 1000hz turbine data.
- Right Side = 24 LNTE GE 1.79-100 configuration using the exhibit 16B lowered 1000hz turbine data.

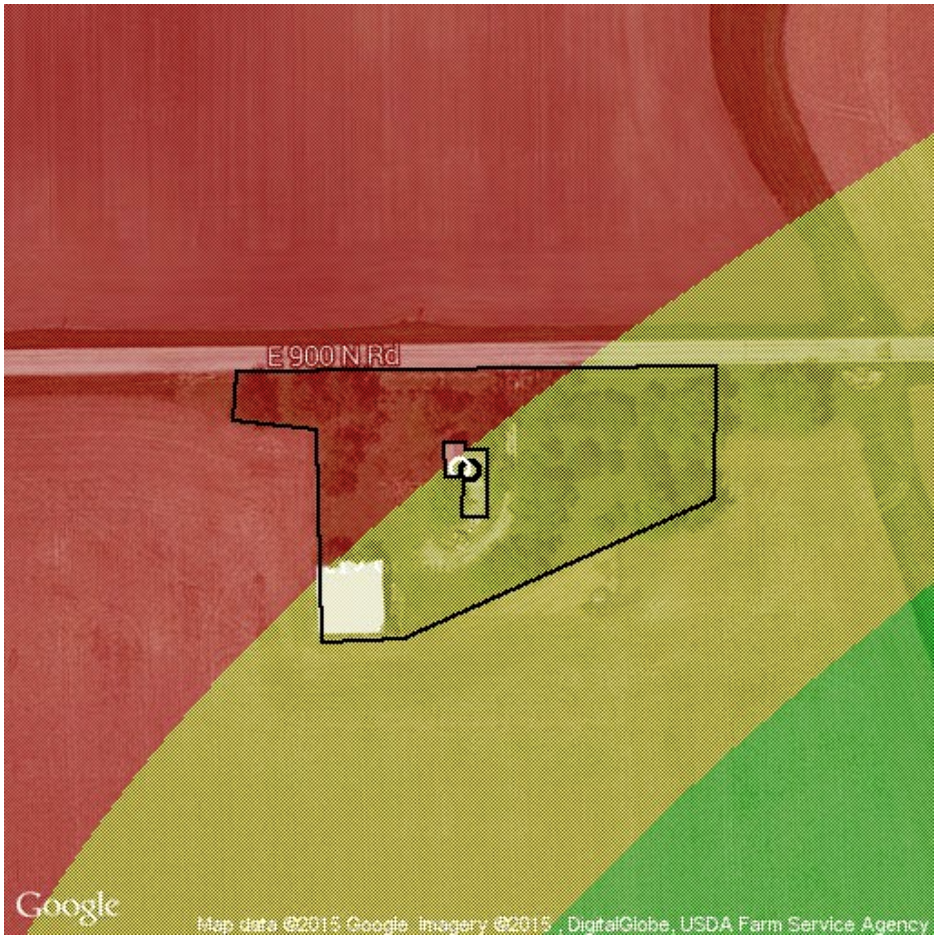
Point 219/R-438



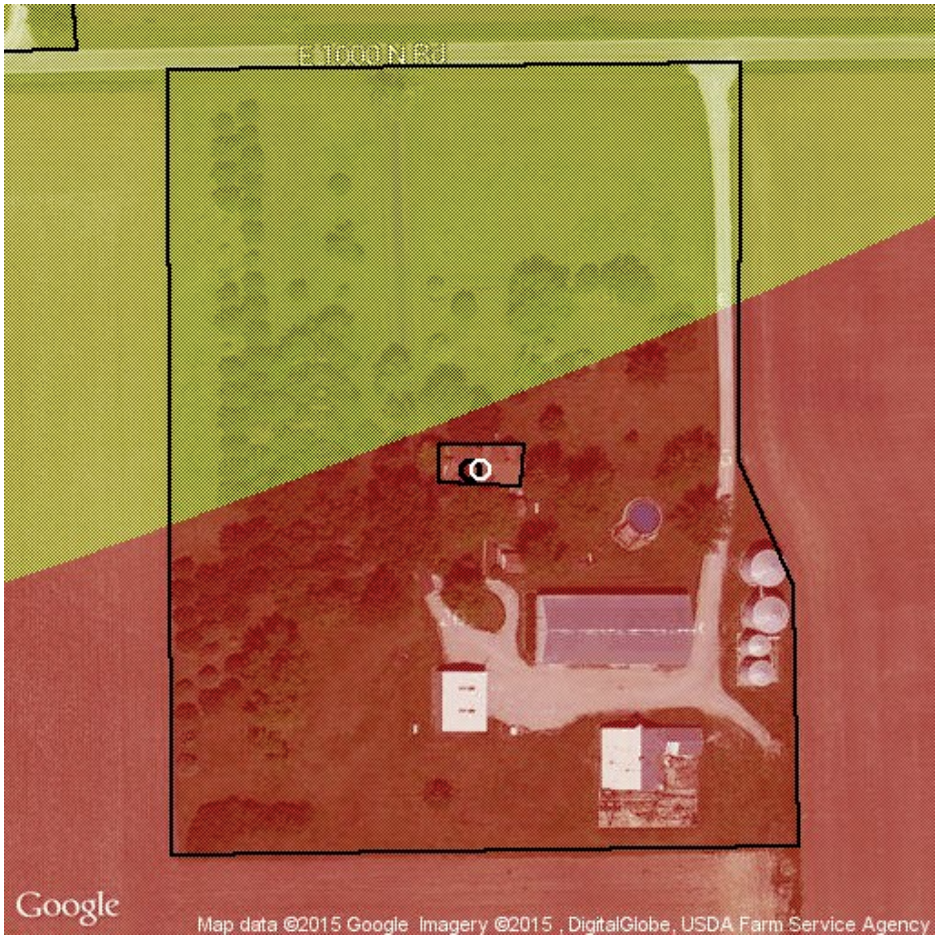


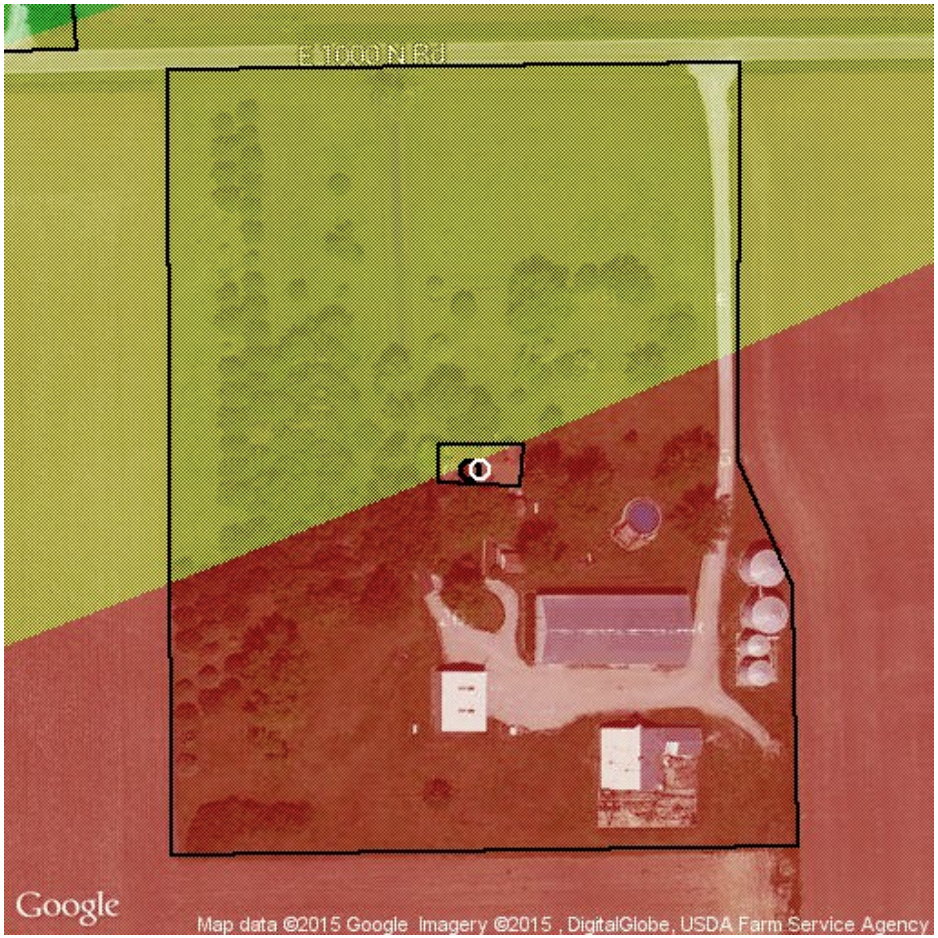
Point 119/R-632





Point 113/R-185



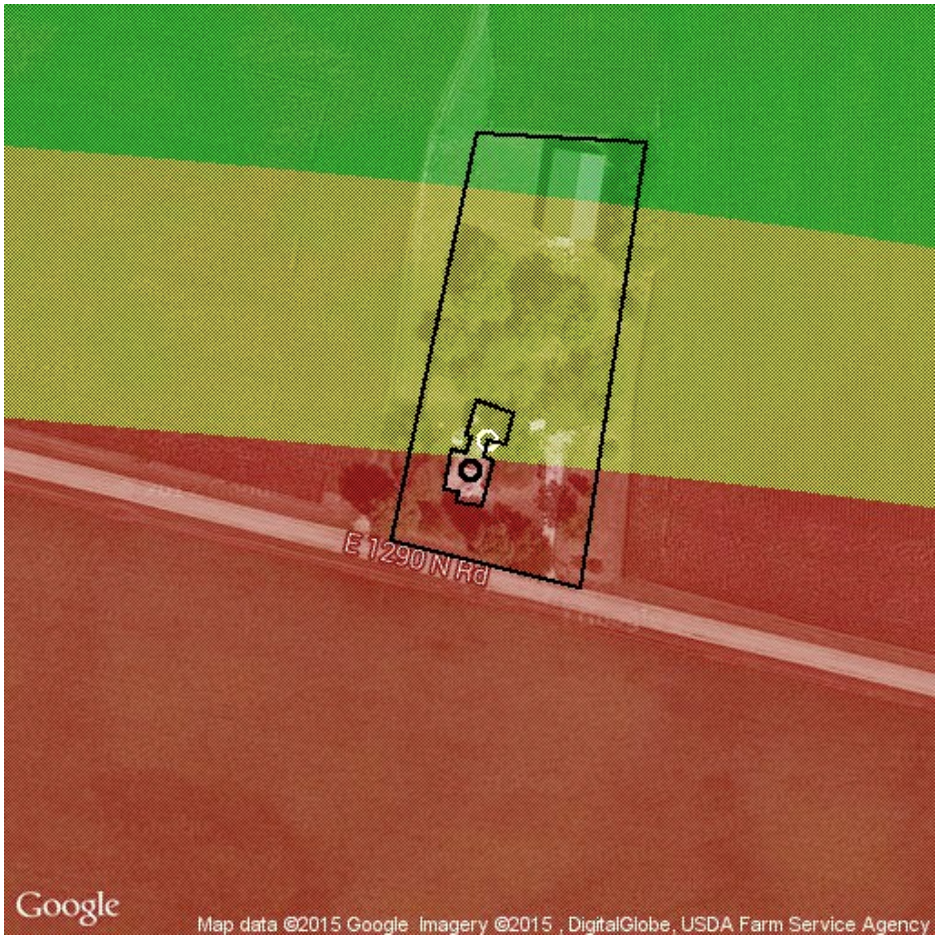


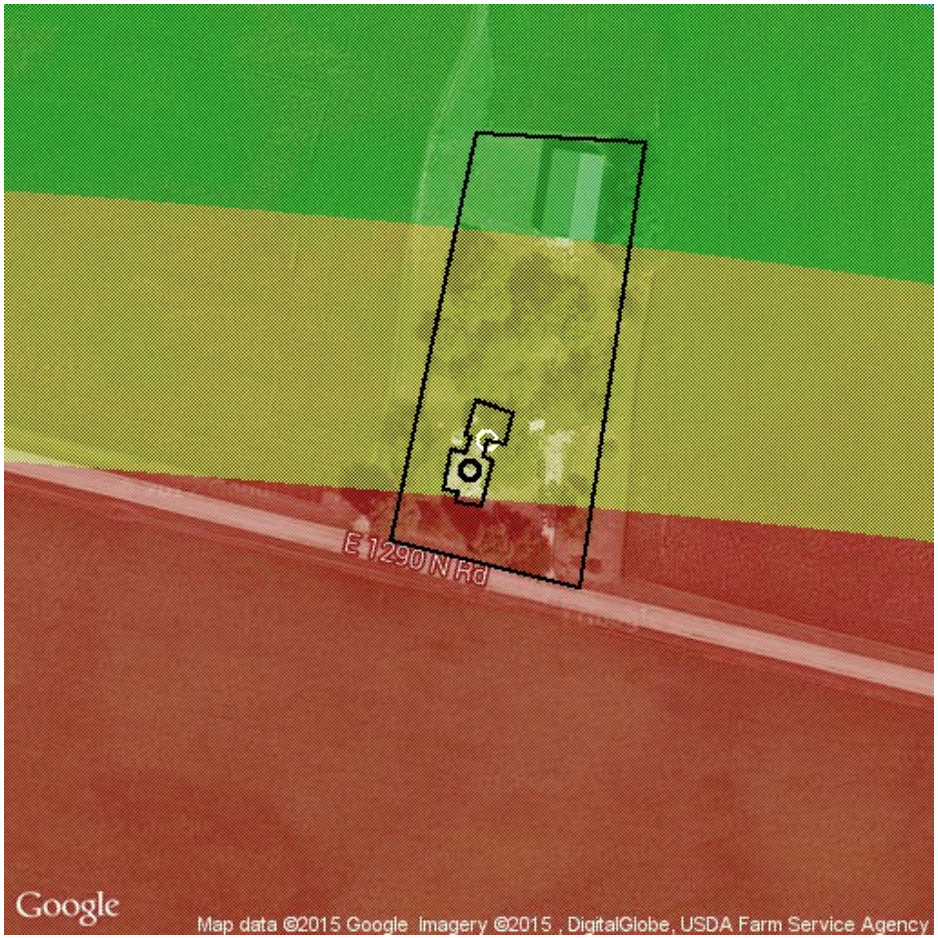
Point 18/R-241

Point 18/R-241

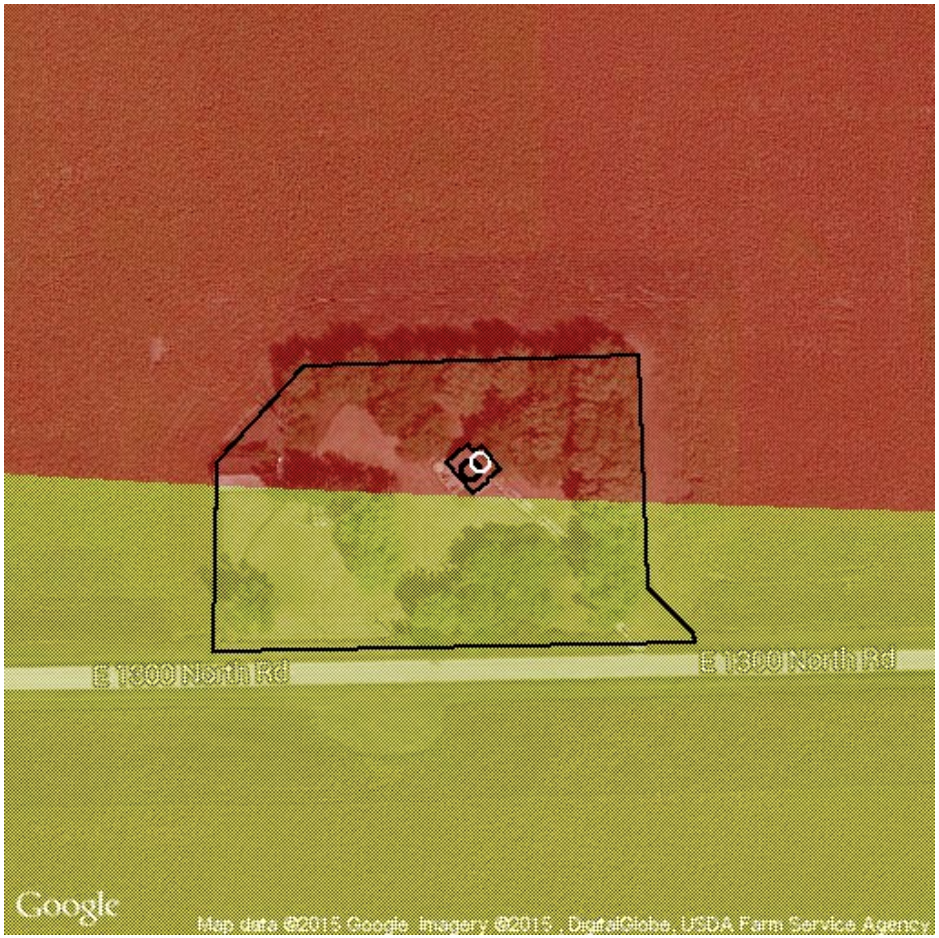
Point 14/R-313

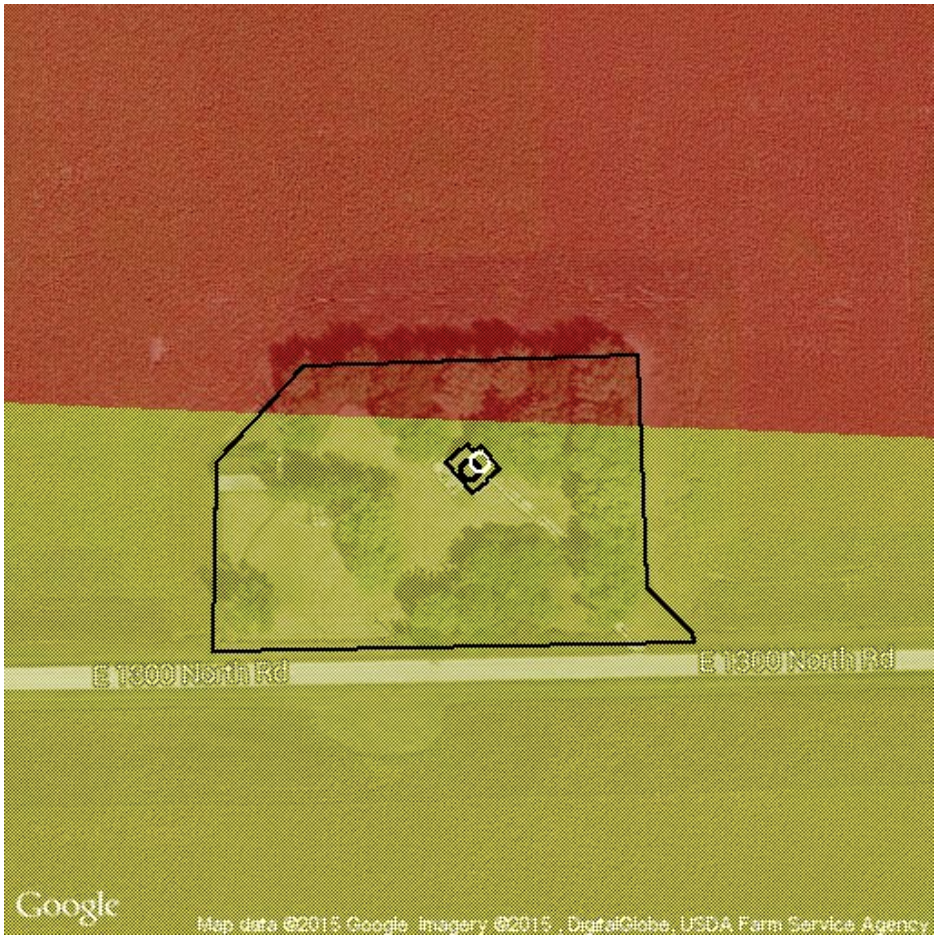
Point 263/R-216





Point 21/R-244

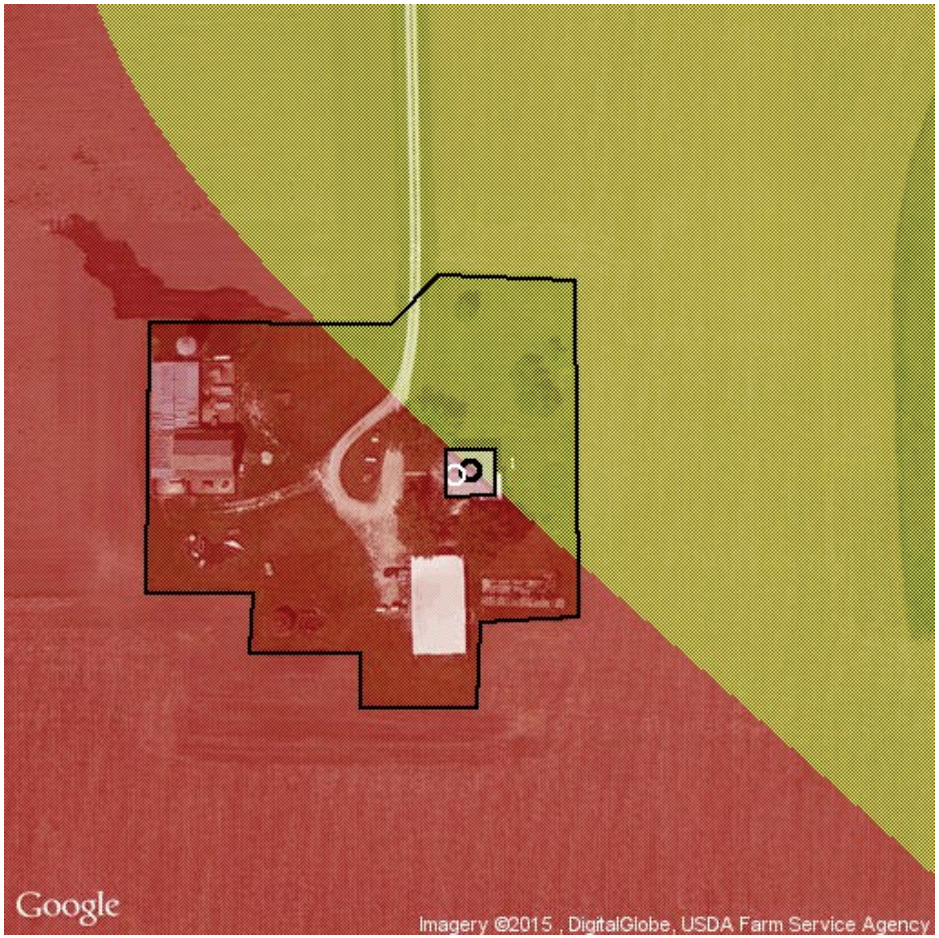


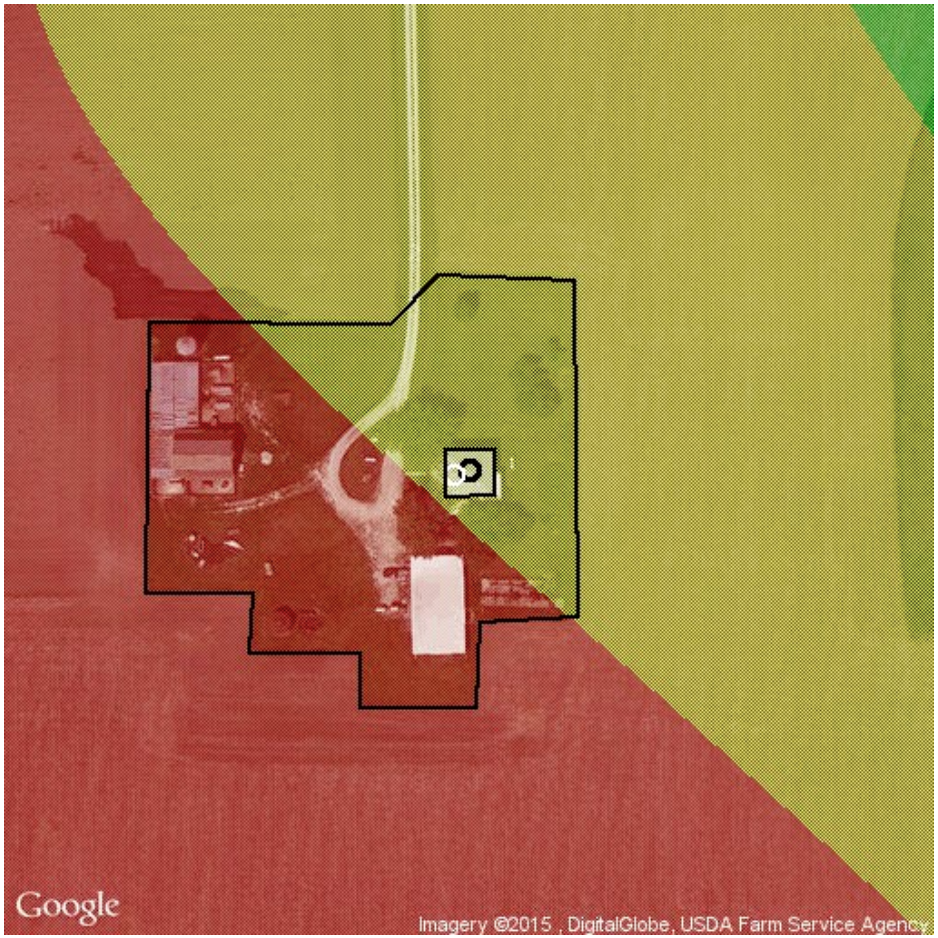


Point 180/R-060

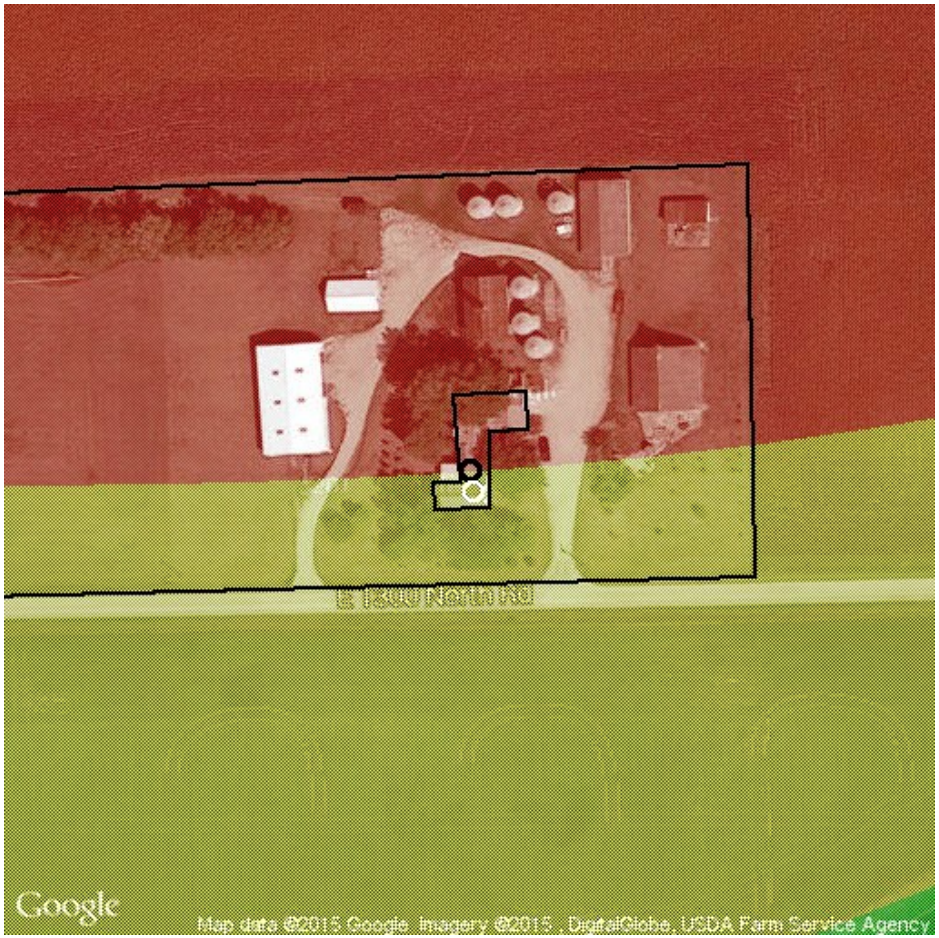
Point 11/R-092

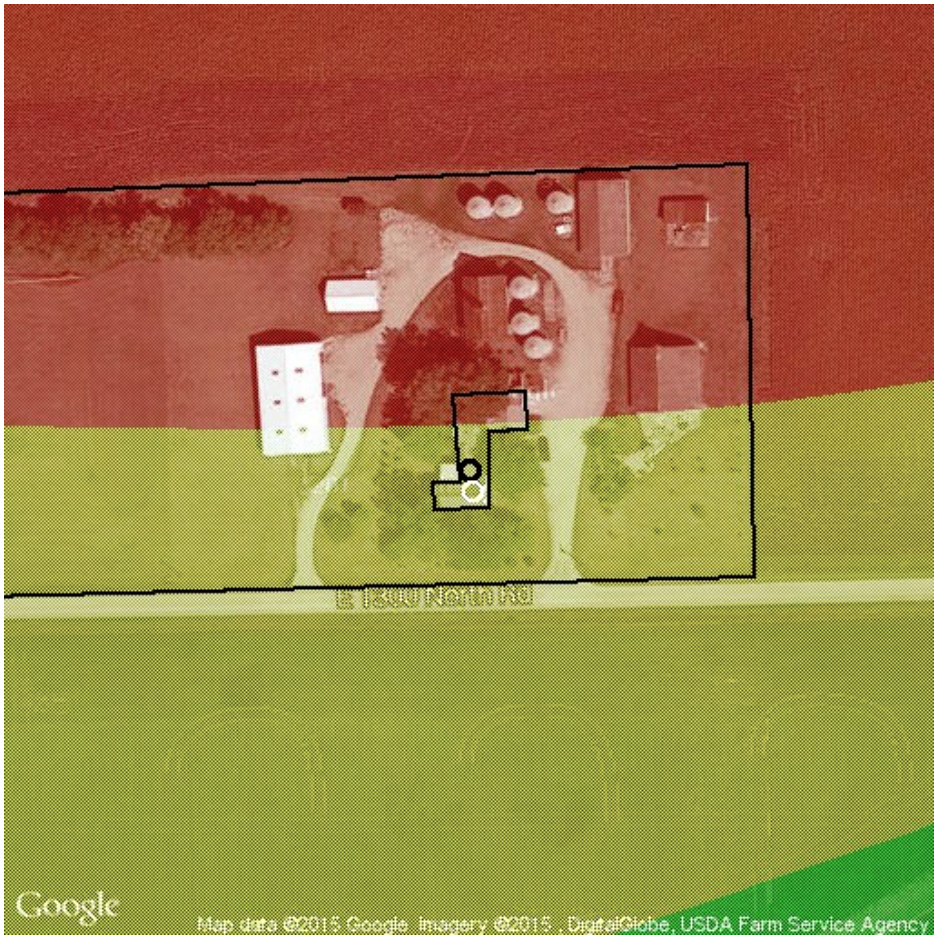
Point 87/R-345



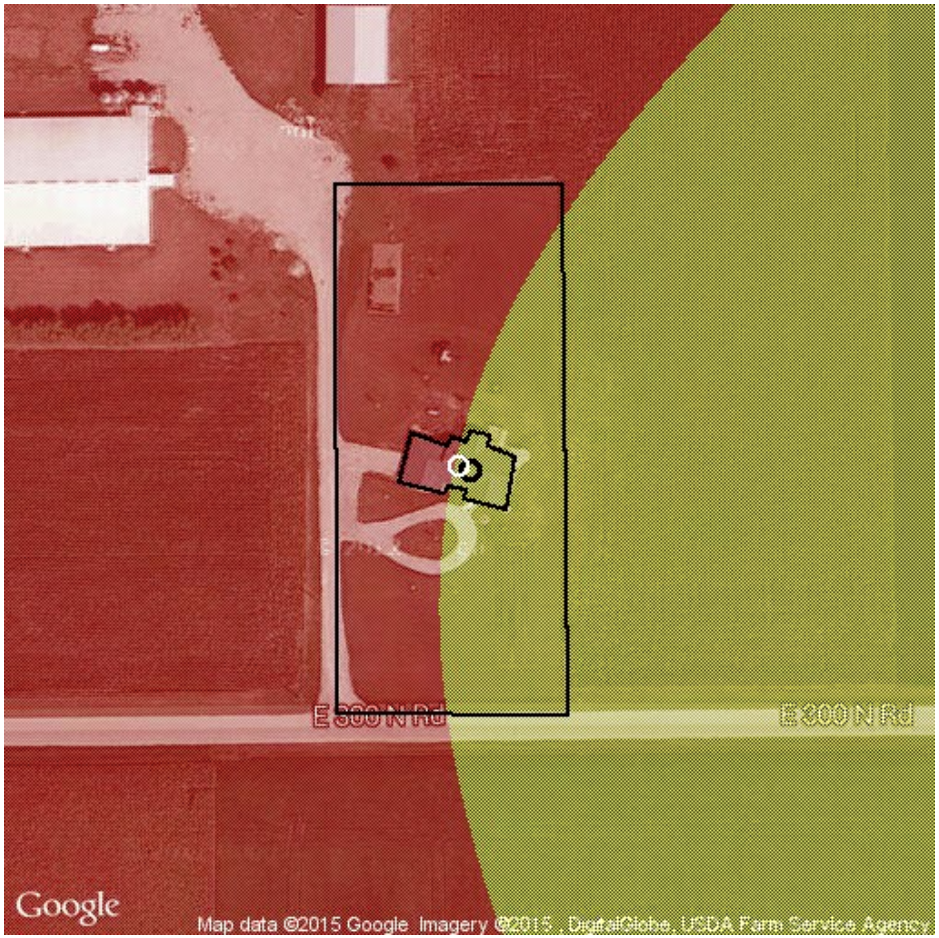


Point 20/R-243

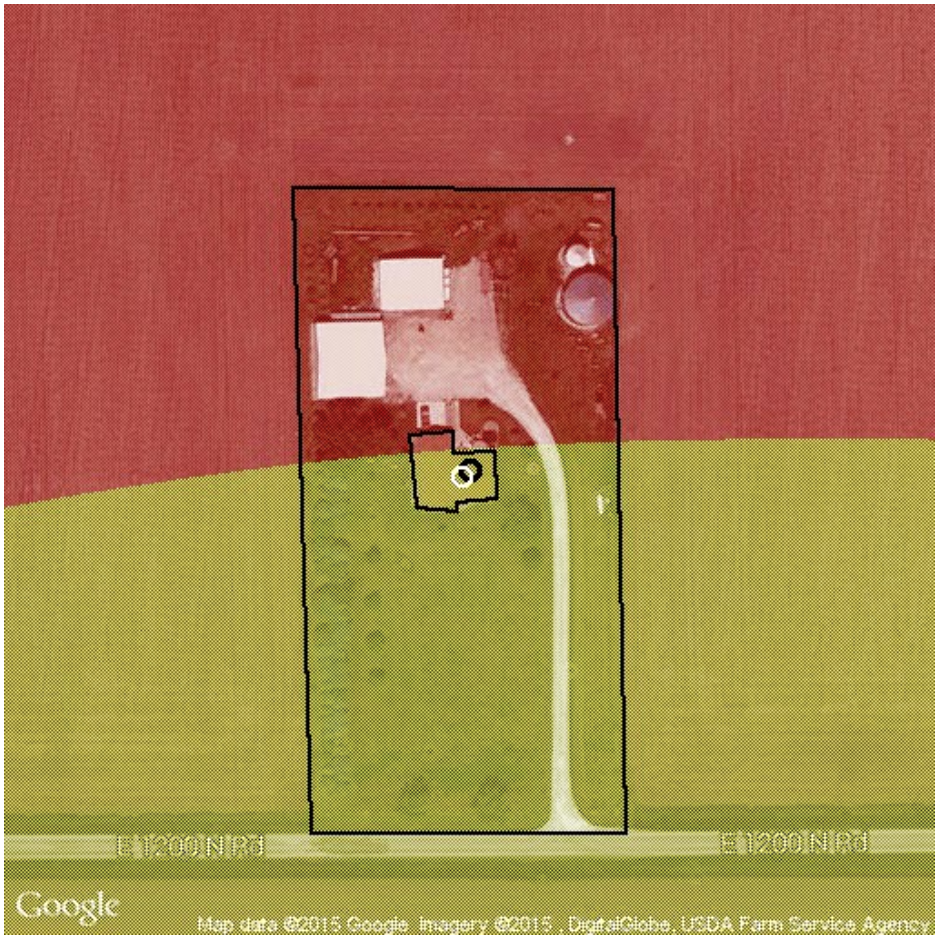




Point 181/R-754



Point 85/R-501



Point 27/R-311

Point 2/R-005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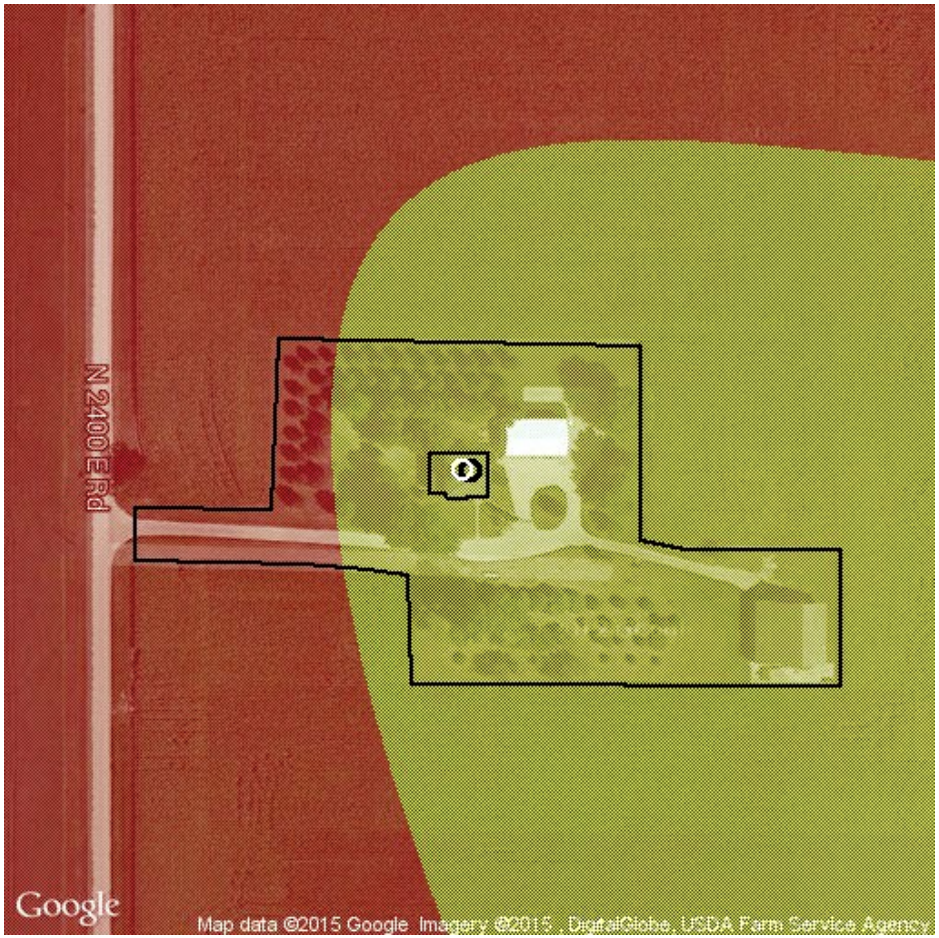
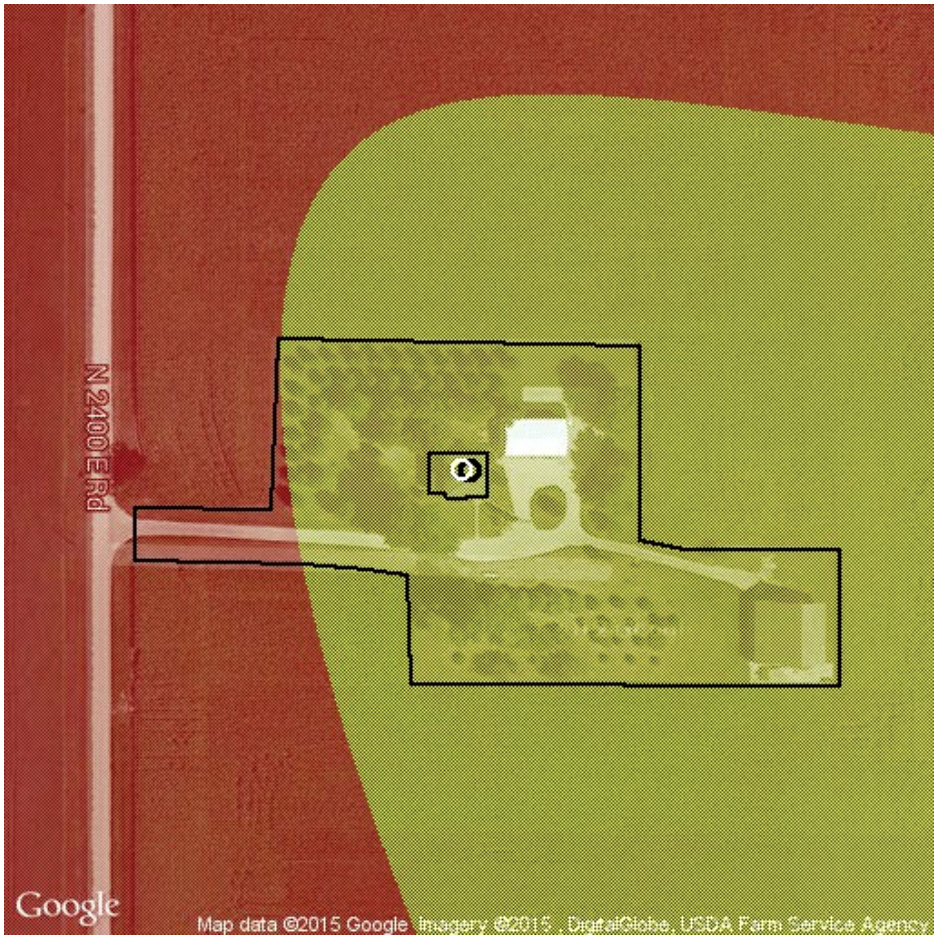
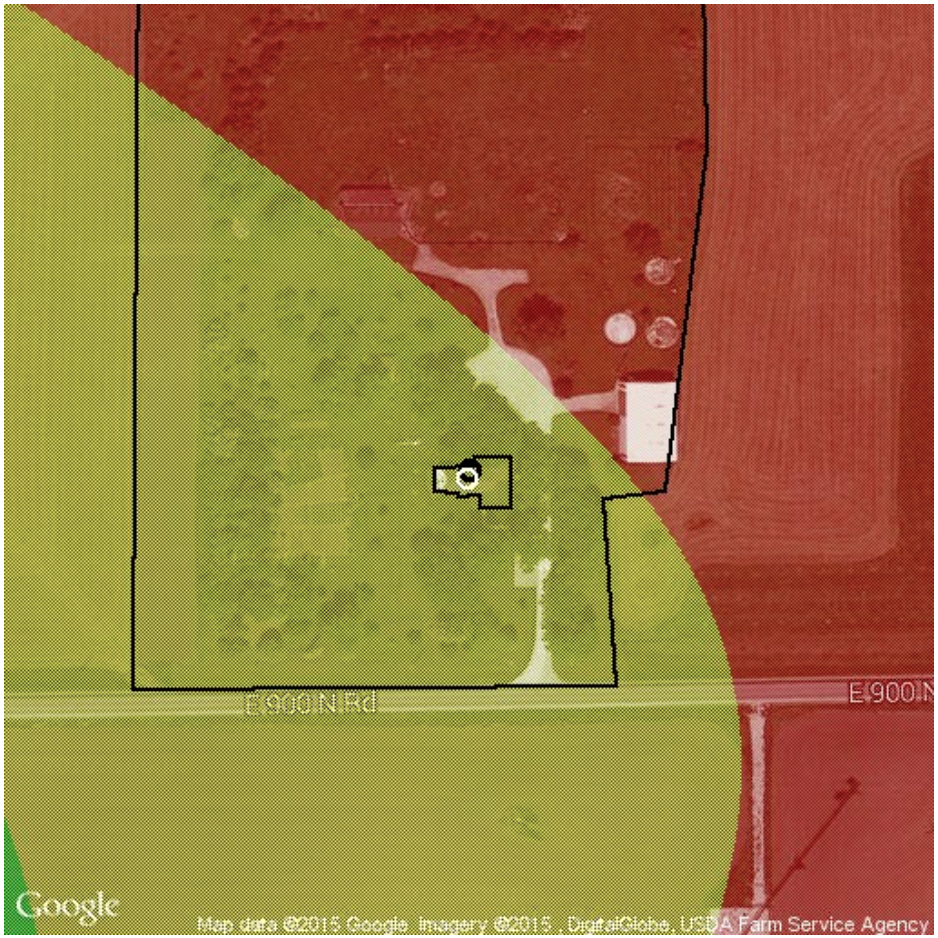
Point 127/R-102

Point 195/R-166





Point 115/R-327



Topic 2 for Surrebuttal - Contours vs Points

[From 4/29/2015, No transcripts available yet]

- Blazer: "*Did you also examine what he [John Slagel] referred to as his contour plots?*"
- Hankard: "*Yes, I did*"
- Blazer: "*Your model is what is called 'point model', is that correct?*"
- Hankard: "*Yes, that's correct, we predict at individual points*"
- Blazer: "*Which is more accurate? Contour or point modeling?*"
- Hankard: "*The point model. The contour model you predict at a bunch of points and then you have to draw a line between and interpolate, and so for me I prefer to rely on the point model verses contour.*"

No Interpolation

- My contour maps are generated out of a 512x512 pixel overlay on top of the Google map for the region. (Note: For my previous testimony with no Google map, I used a 2048x2048 pixel region.)
- For every-other-pixel I do a point model prediction. Each pixel is modeled exactly, and as accurately, as the single point in the single point model. There is absolutely no interpolation. No lines being drawn.
- This means that for each receptor/home in question, I generate over 131,000 points of data verses the PR “1 point per receptor” model.
- How is just one data point superior in any way to multiple data points?

Example Contour Zoomed

You can now see the individual sample points (pixels)

Summary

- I showed that PR lowered the input data in Exhibit 16B from the original application before demonstrating final compliance to IPCB standards at their chosen receptors for the 1000 Hz octave band. The sound levels didn't just get lower by adding more LNTE turbines, they also got lowered by changing the numeric inputs. With the new numbers, if you round each receptor to the nearest tenth, no receptors are over 41.0db. Just adding the 24 new LNTE turbines alone couldn't do this, as my previous testimony showed.
- My ISO-9613 model correlates very closely to the PR/Stantec ISO-9613 model at their chosen receptors with their chosen inputs.
- I then took it one step further by providing contour maps for both sets of numbers, showing an order of magnitude more information than the PR/Stantec sound study shows.
- This extra data helps demonstrate that there are more areas to examine for compliance than just the center of each home. Even using their new lower numbers, there are homes still over the legal limits and a lot of the properties I showed are also still over the limit.
- Thanks for listening!