BEFORE THE SOUTH DAKOTA PUBLIC UTILITIES COMMISSION

DOCKET EL19-003

IN THE MATTER OF THE APPLICATION OF CROWNED RIDGE WIND LLC FOR A PERMIT OF THE CROWNED RIDGE WIND FARM IN CODINGTON AND GRANT COUNTIES, SOUTH DAKOTA

Direct Testimony of David M Hessler
On Behalf of the Staff of the South Dakota Public Utilities Commission
May 10, 2019

**Q. Please state your name and business address.**

A. My name is David M. Hessler. The address of my company's administrative offices is 38329 Old Mill Way, Ocean View, Delaware 19970, and my personal office is located at 1012 W Las Colinas Dr., St. George, Utah 84790.

**Q. Mr. Hessler, by whom are you employed and in what capacity?**

A. I have been employed for over 28 years by Hessler Associates, Inc., as Vice President and a Principal Consultant. Hessler Associates, Inc. is a family run engineering consulting firm that specializes in the acoustical design and analysis of power generation and industrial facilities of all kinds, including wind energy projects.

**Q. Please describe your educational background and your professional experience?**

A. I received a Bachelor of Science degree in Mechanical Engineering in 1997, *Summa cum Laude*, from the A. James Clark School of Engineering, University of Maryland, College Park, Maryland, and a Bachelor of Arts degree, 1982, from the University of Hartford, Hartford, Connecticut. I am a registered Professional Engineer (P.E.) in the Commonwealth of Virginia and I am a member of the Institute of Noise Control Engineering (INCE). My professional specialization is the measurement, analysis, control and prediction of noise from both fossil fueled and renewable power generation facilities. I have been the principal acoustical designer and/or test engineer on hundreds of power station projects all over the

world and on roughly 70 industrial scale wind energy projects. I wrote the chapter on measuring and analyzing wind turbine noise in the book "Wind Turbine Noise"[1], which was published in 2011. I also drafted a set of best practices guidelines[2] for siting new wind turbine projects and testing them once completed for the National Association of Regulatory Utility Commissioners (NARUC). My resume, which contains a list of the cases where I have testified as an expert witness, is also attached for reference as Exhibit DMH-1.

**Q. What is the purpose of your testimony in this case?**

A. I have been asked by the Staff of the South Dakota Public Utilities Commission to review and independently evaluate the adequacy of the noise assessment study carried out by EAPC Wind Energy in support of the Crowned Ridge Wind Farm Project.

**Q. What materials have you reviewed in this matter?**

A. I have reviewed Section 13.3 of the permit application submitted to the Public Utilities Commission on January 30, 2019 and the underlying sound study dated January 22, 2019, designated as Appendix H, which was carried out by EAPC Wind Energy. In addition, I have reviewed the updated sound modeling, which takes into account certain changes in participation status, that was subsequently submitted by EAPC on February 19, 2019. I have also reviewed the direct

[1] Bowdler, D., and Leventhall, G., Editors, "Wind Turbine Noise", Multi-Science Publishing Company, Brentwood, Essex, UK, 2011.

[2] Hessler, D., "Assessing Potential Impacts from Proposed Wind Farms & Measuring the Performance of Completed Projects", National Association of Regulatory Utility Commissioners, U.S. Department of Energy, October 2011.

testimony of Jay Haley, who was author of both the original and updated sound studies. Lastly, I have reviewed the proposed noise conditions submitted by the Intervenors.

**Q. Can you please summarize your overall opinion of the noise analysis study submitted on behalf of the project?**

A. In general, the quality of the work and noise modeling is perfectly satisfactory and consistent with good industry practice. I agree with the modeling methodology and believe that the predictions are realistic, if not somewhat conservative because an explicit 2 dB uncertainty factor was added to the maximum turbine sound power level. However, I would fault the study for focusing exclusively on regulatory compliance and failing to evaluate or assess the potential noise impact of the project on the community. For example, it is common, but by no means universal, industry practice to perform one or more baseline sound surveys of the existing conditions within the site area and then compare the expected project sound levels at residences to this pre-existing sound level under comparable wind conditions. The amount by which the project sound level exceeds the background level generally determines the project's perceptibility and potential impact and it is good practice to attempt to minimize this differential. A 5 dBA increase above the baseline background level is often used as an ideal design goal because it limits the prominence and audibility of the project relative to the natural environmental sound level. Such a relative,

ambient-based approach can, and often does, lead to an ideal design target that is lower than the applicable absolute regulatory limit(s).

**Q. Does that mean you believe a survey should have been done?**

A. A survey and a subsequent impact analysis, while not absolutely essential in all cases, would have demonstrated a concern for the community's welfare and acceptance of the project. Importantly, this approach is often combined with optimization modeling where turbines are iteratively moved or eliminated early in the design process when significant changes are still practical in an effort to minimize the community noise impact and realize the ambient-based design target, if lower than the regulatory limit. It is in everyone's best interest, including the project owner/operator, to minimize the potential for noise issues irrespective of any regulatory noise limits.

**Q. Be that as it may, do you believe that the project will at least meet the noise limits imposed by Codington and Grant Counties?**

A. Yes. The modeling indicates that the Codington County noise limit of 50 dBA at non-participating property lines will be met and that the Grant County noise limits of 45 dBA at non-participating residences and 50 dBA at participating residences will also be met, although without much margin in a number of cases.

**Q. Do you believe compliance with the Codington and Grant County noise regulations, in this case, is sufficient in and of itself to ensure that project noise will be considered acceptable to everyone?**

A. No. Based on my experience, any time wind turbine sound levels higher than about 40 dBA are predicted at residences I would anticipate complaints - with the number and severity increasing exponentially as the sound level approaches 50 dBA.

**Q. In Docket EL18-026, you recommended that the Commission include a noise limit for the Prevailing Wind Park facility at what you consider an ideal design goal of 40 dBA because there was obvious opposition to the project *and* such a level was reasonably, and unusually, achievable with fairly minor modifications to the project layout. Do you believe a similar limit for non-participants near this project is warranted and achievable?**

A. After carefully reviewing the updated sound contour plots, I believe a strict permit condition of 40 dBA at all non-participating residences would be overly onerous to the project; however, it appears to me, based on my experience doing optimization modeling for new wind projects, that the sound levels at many of the closest non-participating residences, currently with sound levels in roughly the 42 to 45 dBA range, could be significantly reduced to the point of nearly achieving an ideal performance of 40 dBA by relocating a relatively small number of turbines. More specifically, I estimate that the sound level at all non-participants could be reduced to no more than about 41 or 42 dBA if 16 of the primary units

were relocated to any of the 17 sites currently identified as alternate locations in Figure 2, titled “Project Map and Facilities”, of Appendix A of the Application. The 16 units that I believe are unduly and unnecessarily affecting non-participating residences are circled in black in Exhibit DMH-2, which is a mark-up of the latest sound contour plots.

**Q. So you’re saying that all of the alternate turbine site locations are more favorably located and further from non-participating properties than the 16 primary units that you have identified in your mark-up?**

A. Yes. Simply utilizing those alternate locations and eliminating the units that are currently located fairly close to non-participants would substantially reduce the potential noise impact from the project - presumably without affecting the total power production or economics of the project.

**Q. Is there a specific permit condition on noise that you would advance for the Commission’s consideration?**

A. Yes. I think that at a bare minimum the sound emissions from the entire project, in both counties, should be limited to the Grant County Ordinance level of no more than 45 dBA at all non-participating residences. In addition, I believe that the relocation of the 16 primary units indicated in Exhibit DMH-2 to 16 alternate sites should be made a precondition of the permit, or the Applicant must provide the Commission with a satisfactory justification as to why certain units cannot be moved.

**Q. You indicated earlier that you have reviewed the noise conditions proposed by the Intervenors to the project?**

A. Yes. There are four specific requests.

**Q. What is the first request?**

A. The first condition asks for a pre-construction sound survey to be carried out by a third party chosen by the PUC that includes an assessment of infrasound and an "analysis of non-participating properties, outside and inside the principle structure."

**Q. Do you agree with the request for a pre-construction sound survey?**

A. No. I mentioned earlier that I would have had a much more favorable opinion of the Applicant's sound study if they had carried out a survey of existing conditions and used the results to establish an ambient-based design target for the project, because such an approach would have demonstrated a desire to make project noise as unobtrusive and acceptable to the community as possible. That ship has now sailed.

**Q. What about the infrasound component of the requested survey?**

A. The infrasound aspect of the wind turbine noise occurs at a frequency of about 1 Hz, which cannot be measured even with most sophisticated and expensive frequency analyzers normally used for this type of work. Consequently, it is not

practical to test for infrasound as a part of a pre-construction ambient survey. Even operational infrasound can only be detected with great difficulty using exotic and highly specialized equipment.

**Q. What about the indoor/outdoor measurements that have been requested?**

A. Indoor measurements are never taken in the course of a pre-construction survey of existing exterior environmental sound conditions, nor would they serve any real purpose. This kind of testing only occurs in rare instances, such as in response to a severe complaint situation at a complainant's residence.

**Q. What is the second condition proposed by the Intervenors?**

A. That the sound emissions from the project be measured "during construction, operation, maintenance, decommissioning to record the applicant is in compliance."

**Q. Do you agree with this condition?**

A. For the most part, no. Construction noise is unavoidable, cannot be easily controlled to any specific sound level at a given receptor point and is therefore normally exempted from most ordinances and noise regulations. Consequently, I don't believe construction noise monitoring is warranted, nor would it be practical to do over a period of months. Similarly, it would be highly unusual to attempt to measure the sound emissions from maintenance and decommissioning activities. I do agree, however, that a sound survey of normal operational sound should be

carried out if noise from the project generates community complaints to determine if the project is meeting its permit conditions at the complaint location(s).

**Q. What is the third noise condition proposed by the project Intervenors?**

A. In essence, the third condition would impose a noise limit of 40 dBA L10 on the project and require annual indoor and outdoor testing at every non-participating residence within 2 miles of the project footprint.

**Q. Do you agree with this condition?**

A. No. Although I would certainly like to see a sound level of no more than 40 dBA at every non-participant, I think it will only be reasonably feasible in this case to get close to that performance – i.e. generally in the 41 to 42 dBA range – after the turbine relocations I described above. Complete compliance with a strict 40 dBA limit would require the elimination of a number of units, which I believe would be disproportionately onerous to the project compared to an essentially imperceptible decrease in sound level of 1 to 2 dBA. Moreover, I do not agree with the L10 statistical measure associated with the 40 dBA limit. The L10 captures the near-maximum sound level occurring during a given measurement interval and, in a real-world test situation, would largely quantify contaminating noise events, such as leaf rustle and traffic noise rather than the underlying, essentially steady-state, project sound level. If any particular statistical measure

must be appended to the allowable sound level, it should be the equivalent average sound level, or Leq.

**Q. What about the recurring, annual nature of the testing?**

A. I do not agree that the project must be tested on an on-going basis. One test carefully done under appropriate wind conditions is sufficient to determine if the project is compliant or not.

**Q. What is the final noise condition proposed by the Intervenors?**

A. It is to limit the project's sound emissions to no more than 40 dBA L10 at all non-participating property lines within 2 miles of the boundary footprint.

**Q. Do you agree with this condition?**

A. No. The point of applicability for any noise limit, whatever the actual level may be, should be at residences because the most common issue with wind turbine noise is sleep disturbance.

**Q. Does this conclude your testimony?**

A. Yes.

CURRICULUM VITAE

# DAVID M. HESSLER

| | |
|---|---|
| Title: | Principal Consultant, Vice-President<br>Hessler Associates, Inc. |
| Professional Affiliations: | Professional Engineer (P.E.), Commonwealth of Virginia<br>Member Institute of Noise Control Engineering (INCE) |
| Education: | Bachelor of Science in Mechanical Engineering (B.S.), 1997<br>*Summa cum Laude*<br>A. James Clark School of Engineering<br>University of Maryland, College Park, MD<br><br>Bachelor of Arts (B.A.), 1982<br>University of Hartford, Hartford, CT |
| Employer: | Hessler Associates, Inc.<br>38329 Old Mill Way, Unit 8<br>Ocean View, DE 19970<br><br>Years in present position: 28 |
| Office Location: | St. George, UT |
| Current Job Description: | Acoustical engineer specializing in the prediction, assessment and mitigation of environmental noise from new and existing power generation and industrial facilities. Typical tasks include:<br><br>• Field measurement studies of existing ambient sound levels in the vicinity of proposed project sites<br>• Computer noise modeling of new facilities prior to construction<br>• Environmental impact assessments for new projects<br>• Noise mitigation design studies of new facilities<br>• Verification measurements of completed facilities<br>• Diagnostic studies of facilities with existing noise problems<br>• Design and specification of noise mitigation measures<br>• Educational lectures on noise issues for private corporations<br>• Expert witness testimony |
| General Experience: | As an outside consultant to nearly all the major power industry EPC contractors, developers and OEM's, I have been the principal acoustical designer of over 400 power plants and industrial facilities worldwide ranging from a 3900 MW power station in Saudi Arabia to numerous combustion turbine combined cycle plants to refineries and wind turbine projects. Typically, the focus of the work on these projects was to anticipate potential noise impacts at sensitive receptors near the project and recommend practical noise abatement measures to avoid them. In addition, extensive verification measurements in and around the completed power plants and wind farms have been performed to confirm that the design recommendations have been successfully executed. |

Wind Turbine Experience:

Over the past 16 years I have performed noise impact evaluations and siting optimization studies for roughly 70 large wind turbine projects in the United States, Canada and the Caribbean, involving nearly all current makes and models of wind turbines. I have developed test protocols and conducted long-term field measurement surveys of numerous newly completed wind projects to evaluate compliance with applicable permit conditions, to investigate complaints and/or to verify the accuracy of pre-construction noise modeling. I have carried out field tests of wind turbine sound power level in strict accordance with the IEC 61400-11 test methodology. I have carried out field measurement studies of operating wind turbines to evaluate their low frequency sound emissions, nacelle noise sources and radial directivity characteristics. I have testified as an expert witness at permitting hearings for proposed wind projects. I have attended six bi-annual Wind Turbine Noise conferences organized by INCE Europe.

Representative Papers and Publications:

"Wind Turbine Noise", Chapter 7 *Measuring and Analyzing Wind Turbine Sound Levels*, Multi-Science Publishing Co., Brentwood, Essex, UK, Jan. 2012. Comprehensive book on all aspects of wind turbine noise. Each chapter written by a recognized expert in that subject.

Teleseminar "Wind Turbine Siting and Best Practices", National Regulatory Research Institute (NRRI), Invited speaker, Jan. 2012.

"Best Practices Guidelines for Assessing Sound Emissions from Proposed Wind Farms and Measuring the Performance of Completed Projects", Prepared for the Minnesota Public Utilities Commission under the auspices of the National Association of Regulatory Utility Commissioners (NARUC), Oct. 2011.

"Accounting for Background Noise when Measuring Operational Noise from Wind Turbines", Fourth International Meeting on Wind Turbine Noise, Rome, Italy, Apr. 2011.

"Recommended noise level design goals and limits at residential receptors for wind turbine developments in the United States", *Noise Control Engineering Journal*, J.59 (1), January-February 2011.

"Wind tunnel testing of microphone windscreen performance applied to field measurements of wind turbines", Third International Meeting on Wind Turbine Noise, Aalborg, Denmark, June 2009.

"Experimental study to determine wind-induced noise and windscreen attenuation effects on microphone response for environmental wind turbine and other applications", *Noise Control Engineering Journal*, J.56, July-August 2008.

Expert Witness Cases:

Before the Washington State Energy Facilities Siting Board (EFSEC) on behalf of Bechtel and the Cherry Point Cogeneration Project, Bellingham, WA, 2003. Permitting support for a proposed combined cycle power plant facility.

Before the Public Service Commission of West Virginia on behalf of the Longview Power Project near Morgantown, WV, 2006. Permitting support for a proposed coal-fired power plant facility.

Before the Pennsylvania Department of Environmental Protection on behalf of Waste Management and the Alliance Sanitary Landfill in Taylor, PA, 2006. Support in defending against a Class Action Lawsuit brought by neighbors of the landfill.

Before the Office of the Attorney General of New York on behalf of the Hudson Valley Community College Cogeneration (Diesel) Plant. Support in defending against a Class Action Lawsuit brought by neighbors.

Before the Hanover County (VA) Board of Supervisors on behalf of Martin Marietta Materials and the Doswell Quarry, 2008. Permitting support for a proposed quarry expansion.

Before the New Hampshire Site Evaluation Committee on behalf of Granite Reliable Power, LLC, 2008. Docket No. 2008, July 2008. Permitting support for a proposed wind turbine project in Northern New Hampshire.

Before the Public Utilities Commission of Ohio, Ohio Power Siting Board on behalf of EverPower Renewables and the Buckeye Wind Project, 2008. Permitting support for a proposed wind turbine project in Ohio.

Before the Wisconsin Public Service Commission on behalf of Clean Wisconsin with regard to the proposed Highland Wind Farm in Forest, WI. Docket No. 2535-CE-100. Engaged as an independent expert to evaluate the Applicant's sound studies and the testimony of opposition groups.

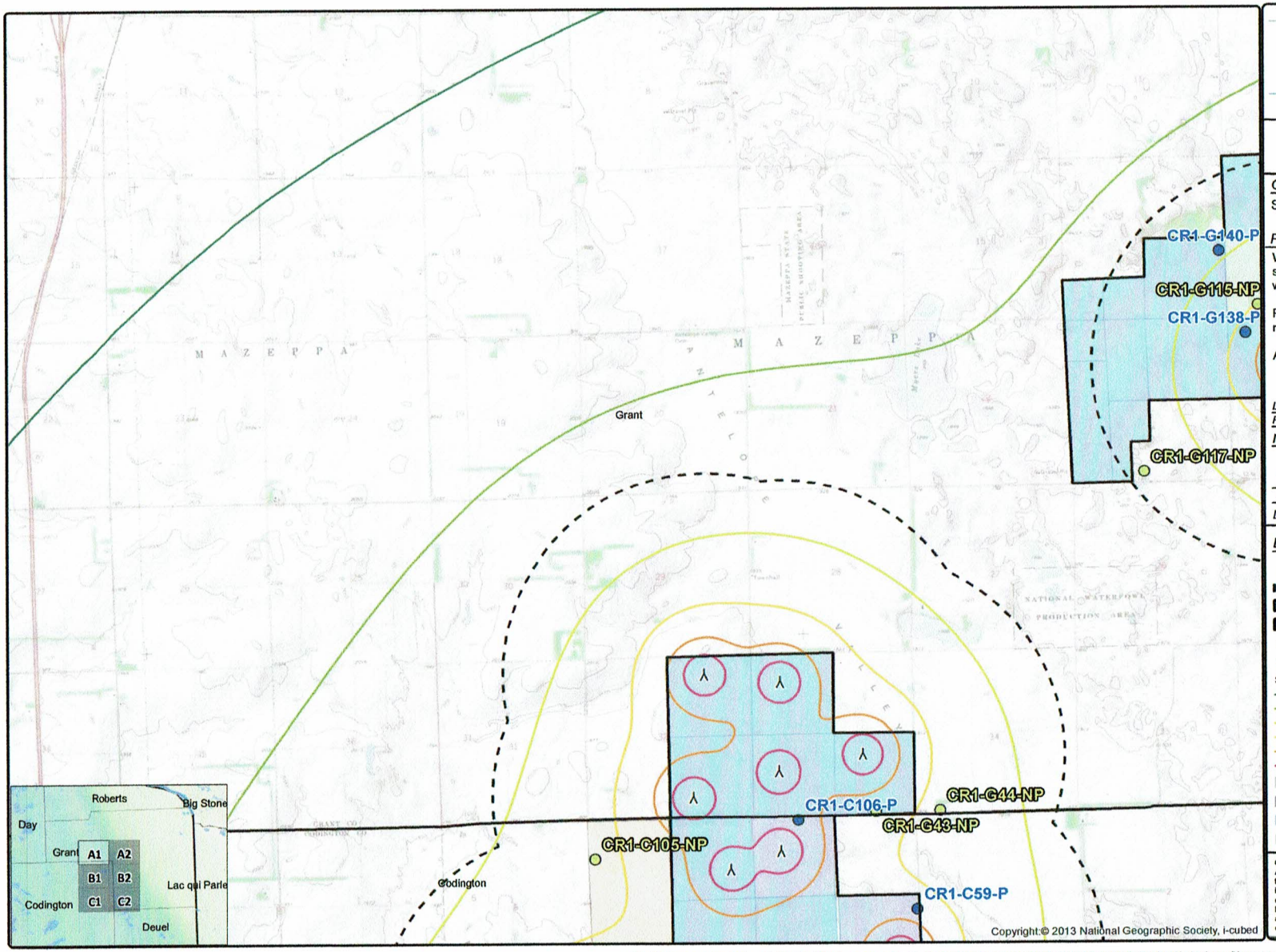
Before the Public Utilities Commission of Ohio, Ohio Power Siting Board on behalf of EverPower Renewables and the Buckeye II Wind Project, 2012. Permitting support for a proposed wind turbine project in Ohio.

Before the Maine State Government Energy, Utilities and Technology Committee on behalf of Patriot Renewables and the Beaver Ridge Wind Project, 2014. Peer review of operational sound testing by others.

Before the South Dakota Public Utilities Commission, serving as an outside expert to the PUC Staff reviewing the noise aspects of the Dakota Range Wind permit application, Docket EL 18-003, June 2018.

Before the South Dakota Public Utilities Commission, serving as an outside expert to the PUC Staff reviewing the noise aspects of the Prevailing Wind Park permit application, Docket EL 18-026, October 2018.

Before the Rhode Island Energy Facility Siting Board, serving as an outside expert to the Town of Burrillville, RI reviewing the noise aspects of the Clear River Energy Center permit application, Docket SB-2015-06, December 2018.

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**Crowned Ridge Wind Farm**
**Sound Pressure Iso-Lines**

*Client*
SWCA Environmental Consultants

*Project Description*
Wind turbine layout with occupied structures and parcel boundaries within 2 km.

Predicted sound pressure levels at existing residences and land parcel boundaries.

Additional 2 dBA added.

*Location: Watertown, SD*
*Project #: 20174431*

*Issue Dates*

| # | Description | Date |
|---|---|---|
| 1 | Original | 2019.02.15 |

*Drawn By: AS* *Checked By: JH*

*Legend*
- Crowned Ridge Turbines
- 2 km Turbine Buffer
- County Lines
- CR1 Project Boundary
- Non-Participants
- Participants

**Sound Pressure (dBA)**
- 25
- 30
- 35
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- 50

- Participating Codington Parcels
- Non-Part. Codington Parcels
- Participating Land Parcels
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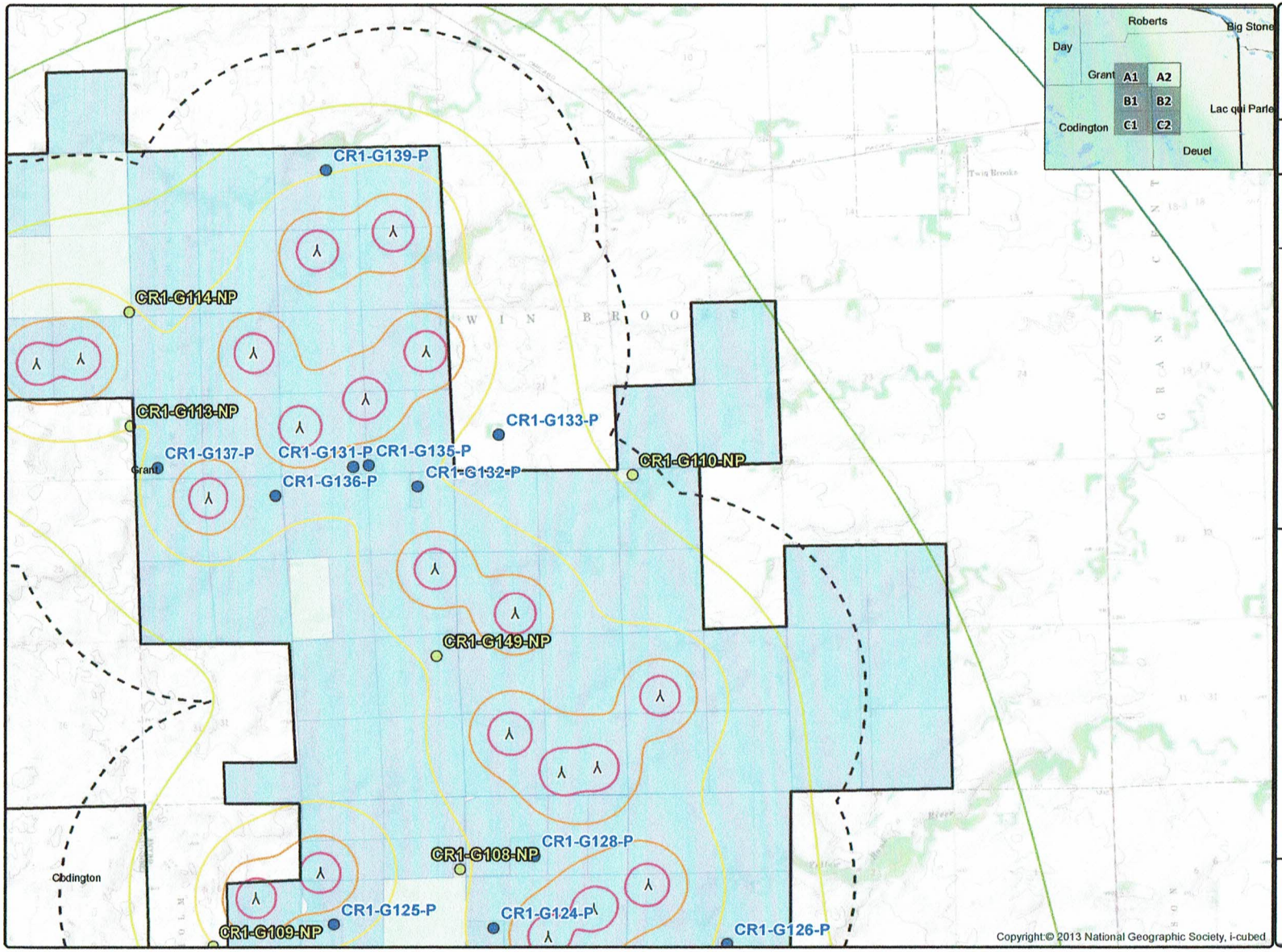


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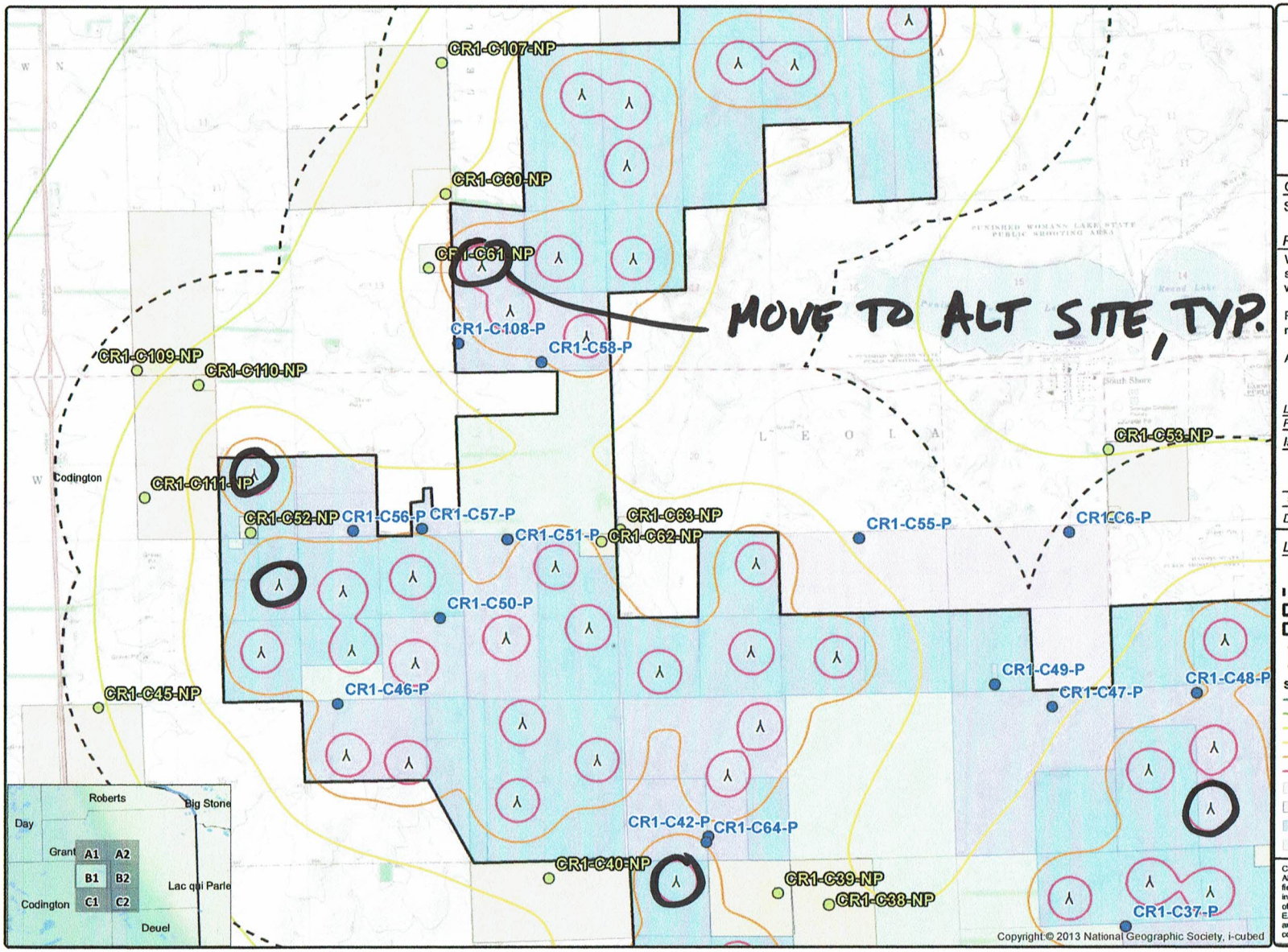


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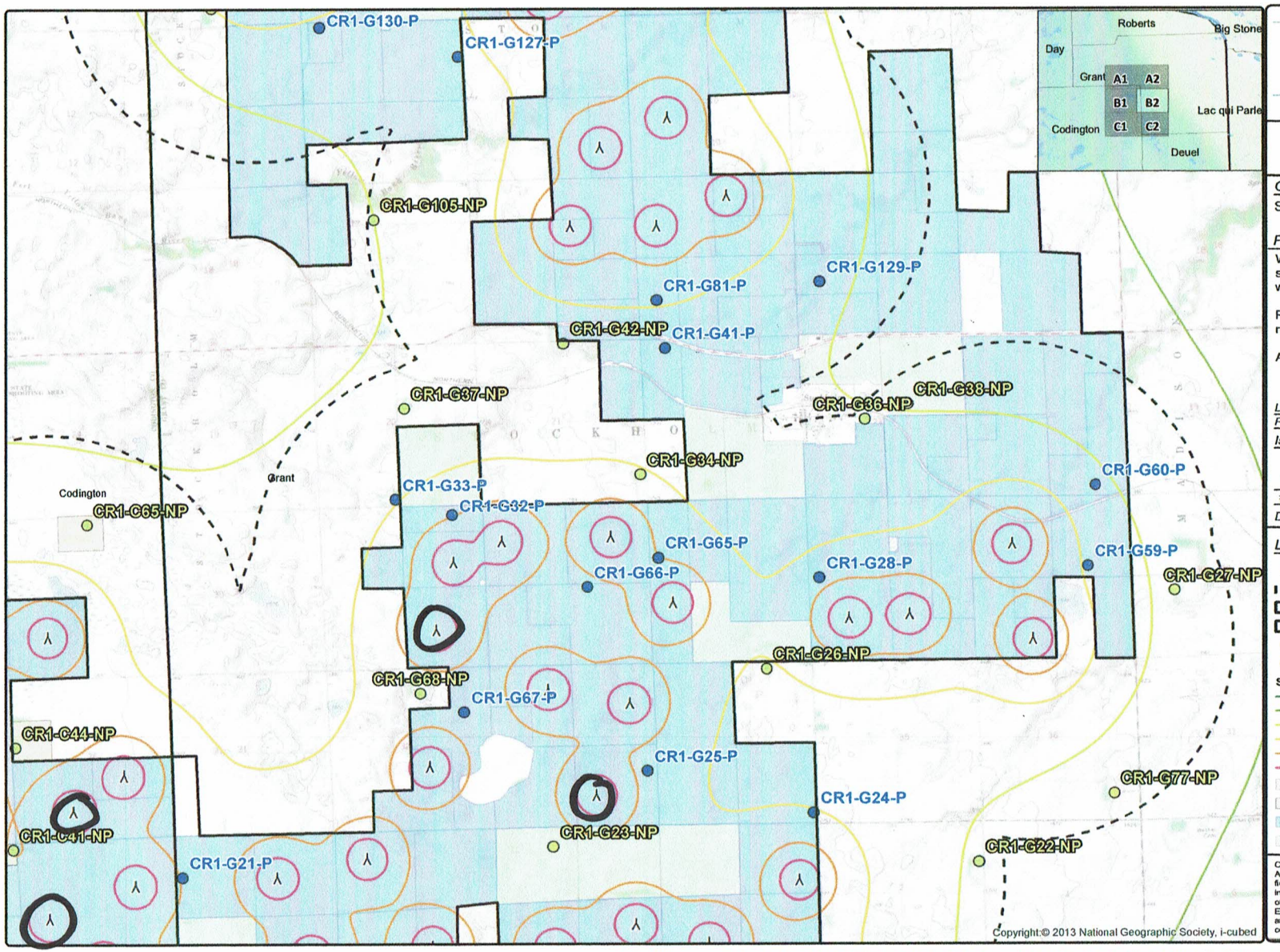


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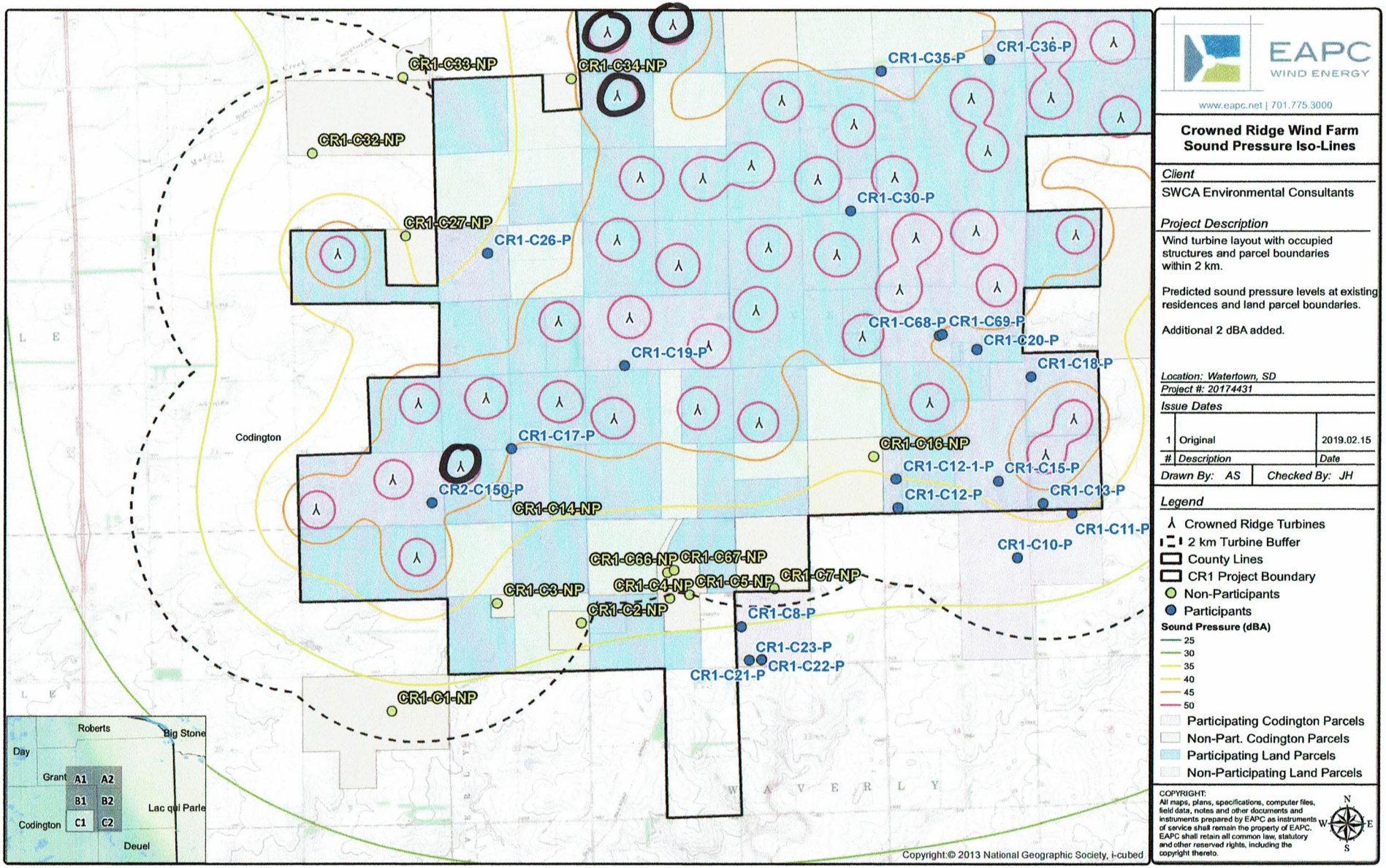


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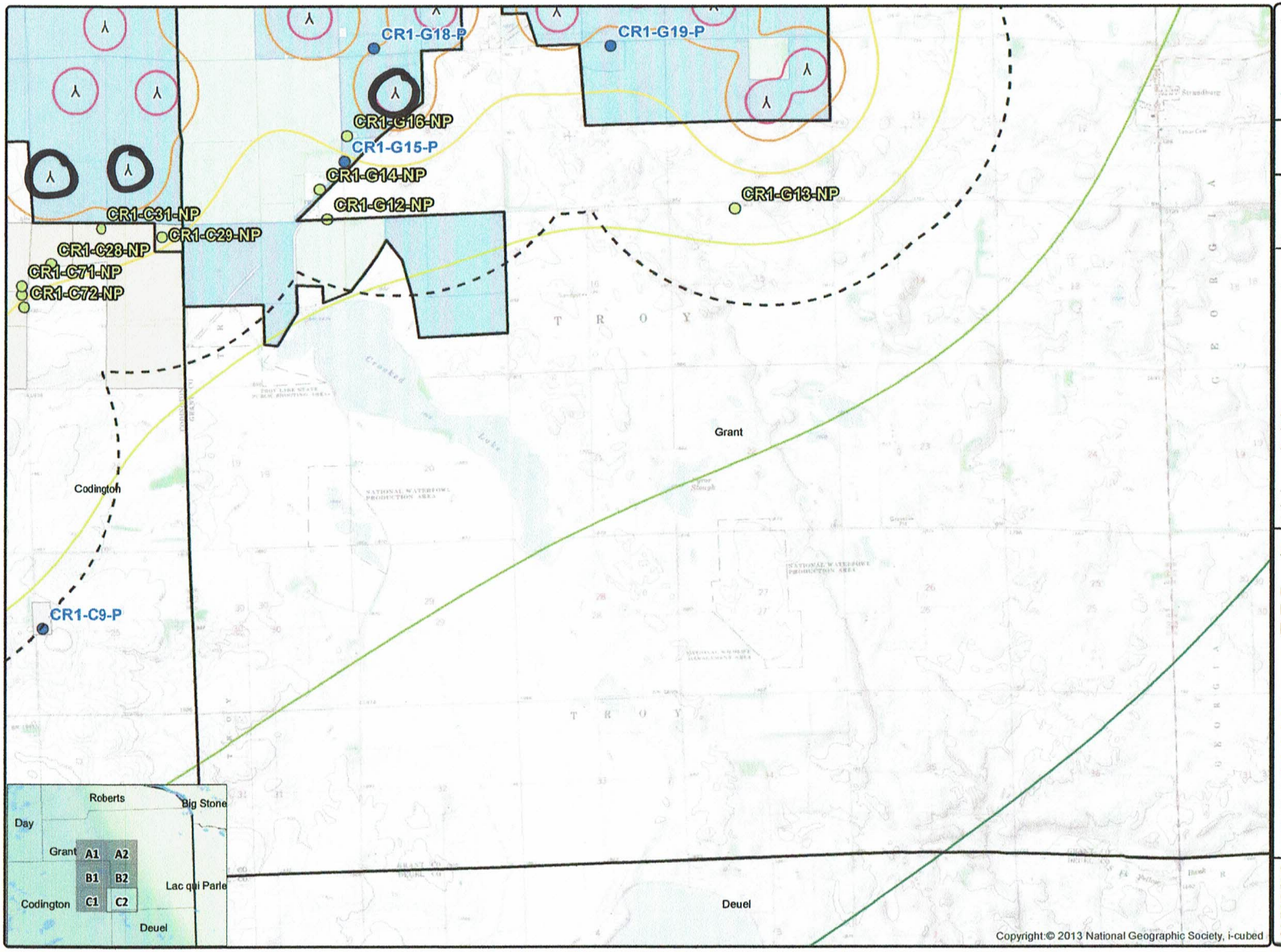


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