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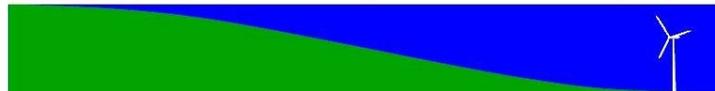
# Meteorological Tower Site Selection

## Washtenaw County, Michigan

April 2007

*Prepared for  
Washtenaw County*

NORTH COAST WIND & POWER, LLC



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# Preface

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The following is a discussion of the Wind Power Washtenaw project, which includes Project Purpose, Project Partners, Project Scope and Timeline, and Project Staff.

# Wind Power Washtenaw

A Collaboration between Washtenaw County, the City of Ann Arbor and the University of Michigan.



## Project Purpose

Promote the development of wind energy in the County by testing local wind resources; assess the data for small and large wind turbine economic feasibility; and provide investment grade information to residents, businesses and energy providers.

## Project Partners

In recognition of the heavy dependence on fossil fuels and associated escalating costs and environmental impacts, the **Washtenaw County Board of Commissioners** passed a resolution in April 2006 directing the Department of Planning and Environment to test the wind resources in the County and examine the feasibility of providing wind generated electricity for county residents and businesses. To help ensure project success, Washtenaw County formed a working partnership with the City of Ann Arbor and the University of Michigan to form the current project team.

The **City of Ann Arbor** has long been a leader in energy policy and alternative energy supply. The City currently produces energy from hydroelectric dams, land fill gas, and biodigesters, and in 2006, the City set a goal of using 30 percent renewable energy in its municipal operations by 2010 and 20 percent community-wide by 2015. Given its commitment to developing alternative sources of energy, the City of Ann Arbor agreed to join the Wind Power Washtenaw collaboration.

The **University of Michigan** has recently rededicated itself to the pursuit of alternative energy, fostering such initiatives as the Phoenix Memorial Laboratory, the Graham Sustainability Institute as well as continuing to fund such programs as the Center for Sustainable Systems and the ERB institute. In line with these initiatives, Professor Gerald Keeler, PhD has developed a course which allows students in Atmospheric Sciences to play a central role in a wind study and do practical research and apply skills that will be high in demand throughout the next decade.

To assist the partners in this project, the county has retained the services of North Coast Wind and Power, a consulting firm specializing in alternative energy development including wind feasibility studies, fatal flaw analysis, investment financing and facility development. Information about this company can be found at <http://www.northcoastwindandpower.com>.

For more information about this project, please contact Tony VanDerworp, Director of Planning and Environment at: [vanderworpa@ewashtenaw.org](mailto:vanderworpa@ewashtenaw.org).

## Project Scope and Timeline

The State of Michigan's state-wide wind maps are imprecise for the purposes of basing a financial model for a turbine located at any particular location. In order to attract development, exact, on-site measurements must be made to allow potential investors to understand payback period and rate of return on investment. This detailed study, if results are as expected, will demonstrate a sufficient economic return on investment that will persuade private sector wind developers to invest in electrical generation projects in our county, helping to fulfill both the local and state vision of being a leader in renewable energy. Further, we hope this collaborative effort will become a model for further collaboration across the state and the nation.

Task	2006			2007						2008		
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Identification of Potential Test Sites												
Fatal Flaw Report on Potential Test Sites												
Final Test Site Selection, Acquisition of Property/ Easements, Instrumentation Procurement												
Construction and Erection of Met Towers												
Wind Study Period												
Publicity, Public Involvement												
Wind Study Results												
Investment Grade Final Report												

## Project Staff

### Washtenaw County

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Joshua Long, Associate Planner

Kerry Sheldon, Management Analyst

### City of Ann Arbor

David Konkle, Energy Coordinator

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### University of Michigan

Gerald Keeler, PhD, A.O.S.S.

Frank Marsik, PhD, A.O.S.S.

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# Executive Summary

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In April 2006, Washtenaw County (County) resolved to examine the feasibility of providing wind generated electricity for Washtenaw County and to provide wind testing and the construction of a Wind Farm to provide additional electricity for the County. In response to this resolution, the County entered into agreement with North Coast Wind & Power to review possible locations for wind farm development and assess their relative quality for the siting of meteorological towers (met towers) in the County.

The following areas within the County were determined to have the highest potential for wind power development based on an initial sites survey which took into account various geographical criteria and available wind resource maps:

- North Manchester Site (Sharon Township)
- Southeast Manchester Site (Bridgewater Township)
- Zeeb Road Site (Lodi Township)
- Chrysler Site (Sylvan Township)

After the initial site survey identified the sites within the County with the highest potential for wind power development computer models were used to determine the best areas to locate met towers that would yield good quality wind data that should be representative of the all of the potential project areas. The computer models determined that a met tower located in any of the four potential sites would likely yield good wind data but areas within the Chrysler or North Manchester Site would likely provide the best data.

# Section 1

## Introduction

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Washtenaw County (County) has entered into agreement with North Coast Wind & Power to review possible locations for wind farm development and assess their relative quality for the siting of meteorological towers (met towers) in Washtenaw County.

Criteria considered for recommending meteorological tower sites include the following:

- Presence of open space
- Absence of forested areas
- Absence of dwellings or other buildings nearby
- Presence of property owned by the County, City of Ann Arbor, or the University of Michigan
- Absence of state recreational areas and other areas with a higher potential of avian concerns
- Proximity of existing overhead power transmission lines
- Relative elevation
- Good access to transportation for future construction
- Distance from public use airports

# Section 2

## Methodology

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Potential tower sites were discussed in a meeting on December 7, 2006, with the Washtenaw County Wind Group (WCWG), which included representatives from Washtenaw County (County), City of Ann Arbor (City), University of Michigan (UM), North Coast Wind & Power (NCWP), and RMT, Inc. (RMT). Based on discussions during the meeting and subsequent phone conversations, the following locations were selected for the initial assessment by NCWP and RMT:

- Areas in the southwestern portion of Washtenaw County that, based on publicly available information, may have higher mean wind speeds than other areas in the County.
- County-owned property, including a materials recycling and composting facility, Washtenaw Community College, and a gravel pit located west of State Highway 52 and north of Pleasant Lake Road.
- Other areas include property near St. Joseph Mercy Hospital and private property located west of Zeeb Road between Scio Church Road and Ellsworth Road.

On December 21, 2006, and December 27, 2006, Daryl Stockburger (NCWP) and Tim Gehring (RMT) conducted an initial field site survey. The initial site survey was conducted for the purpose of determining potential tower site locations that best fit the above criteria and are located in (or near) areas that have potential for the development of a wind power generating facility. The following is a list of sites that were surveyed:

**Table 1  
Washtenaw County Sites Surveyed**

AREA	SITE NAME	GPS COORDINATES	ELEVATION AT GPS COORDINATES
A	North Manchester	42 11 29.09 N 84 02 29.24 W	991
B	Unmarked County Property Located near Farmer Sand & Gravel – appeared to be heavily wooded	42 13 28.99 N 84 02 01.72 W	994
C	Zeeb Road Site	42 14 51.13 N 83 50 16.39 W	1,000
D	Washtenaw Community College	42 15 46.55 N 83 39 36.62 W	863
E	St. Joseph Mercy Hospital	42 16 03.61 N 83 42 44.97 N	796
F	City of Ann Arbor MRF/Landfill Site	42 13 32.95 N 83 42 44.97 W	864
G	City of Ann Arbor west of MRF/south of New Construction	42 13 14.32 N 83 43 09.39 W	845
H	Southeast Manchester	42 07 20.55 N 83 58 02.83 W	849
I	Chrysler Site	42 15 56.12N 84 00 17.05W	925

# Section 3

## Results

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The table on the following page summarizes the findings related to the initial site survey.

**Table 2  
Site Findings**

PROJECT AREA	PRIORITY ORDER OF SITE RANKING*	PRESENCE OF OPEN SPACE	ABSENCE OF FORESTED AREAS	ABSENCE OF DWELLING OR BUILDINGS	POWER DISTRIBUTION POTENTIAL	RELATIVE RANGE OF ELEVATION (FEET)	COMMENTS
A. North Manchester	4	4	4	3 / 4	3	950 – 1,000	Based on reviewed criteria, the only limiting factors for development is the presence of some dwellings and a private airport with a grass landing strip.
B. Unmarked County Property	9	1	1	3 / 4	3	980 – 995	Limited development potential
C. Zeeb Road Site	2	3 / 4	2	3	3	900 – 1,000	Presence of forested areas could limit development
D. Washtenaw Community College	7	1	1	1	3	770 – 810	Limited development potential
E. St. Joseph Mercy Hospital	8	1	2 / 1	1	3	780 – 815	Limited development potential
F. City of Ann Arbor MRF/Landfill Site	5	2	2 / 3	2	3	820 – 850	Limited development potential
G. City of Ann Arbor west of MRF/south of New Construction	6	1	1	1	3	830 – 840	Limited development potential
H. Southeast Manchester	3	4	4	3 / 4	4	830 – 880	Based on reviewed criteria, limiting factors for development include the presence of some dwellings and lower relative elevation of the site. Excellent power distribution potential – 3-phase power lines running the length of the project area.
I. Chrysler Site	1	2 / 3	2	3	3	890 – 950	Good development area

**Ranking of Factors:** 4 – Excellent; 3 – Good; 2 – Fair; 1 – Poor

\* Note: priority order of site ranking ranks the location with highest potential for wind energy development as 1 and other sites in decreasing potential as 2, 3, and 4.

# Section 4

## Discussion of Results

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Based on the initial site survey, four sites were considered for siting of the meteorological tower(s) and/or further investigation to determine the feasibility of siting a utility scale wind power generating facility. Subsequently, RMT utilized computer modeling to generate estimations of average wind speed for the four sites listed above. This data was used to confirm if any of the sites have a relatively better potential for further development (see Appendix H, Meteorological Tower Site Selection Report). Figure 1 shows the location of all four sites. Please note that boundaries were established based on the observation that a high percentage of land in each of these areas is open and undeveloped. Actual construction of wind farms in Washtenaw County could be extended beyond these boundaries. The following is further discussion of the top four ranked sites:

### **4.1 Area A – North Manchester Site (#4 Priority Site Ranking)**

The North Manchester Site is located along State Highway 52 between the City of Manchester and Interstate 94. Figure 3 shows the approximate site boundaries. Appendix A contains a photo log for the North Manchester Site.

This area was initially ranked #1 in the field survey because of its relative elevation (900 to 1,000 feet), significant open space, the proximity to large power transmission lines, relative lack of forested areas, and excellent access to state and interstate highways for heavy equipment transportation. However, the concern for aviation safety evidenced in the FAA response to the application for construction of a met tower reduced the priority ranking to #4. It has also been noted that there is potential for a migratory avian corridor along the Raisin River and “Grassland birds” are common in this area. Therefore, the siting of wind turbines in the North Manchester Area should be as far to the East as is possible and it is recommended that the footprints of the turbine site(s) be minimized (see preliminary avian report in Appendix I).

The North Manchester site boundaries contain approximately 3,942 acres (6.16 square miles). A 100 MW wind farm would require 67 wind turbines at 1.5 MW each or 40 wind turbines at 2.5 MW each. The average construction footprint would be 120 to 200 acres, with most of that being made up of gravel access lanes. Approximately 1,467 to 1600 acres of open space would be required. The probable capital investment for a project of this size would be \$150,000,000 to \$160,000,000.

An FAA application for the installation of an 80 meter (264 feet) Met Tower was submitted at latitude 42 degrees 10 minutes 49.5 seconds N and longitude 84 degrees 2 minutes 7.1 seconds W. The preliminary determination found that any structure over 156 feet above ground level in this location would require further study and public comment prior to approval at the requested height (see Notice of Presumed Hazard in Appendix F). This is an indication that the installation of wind turbines at their full height of 405 feet or more will be an issue of concern to aviation safety in at least part of the North Manchester Area.

## **4.2 Area H – Southeast Manchester Site (#3 Priority Site Ranking)**

The Southeast Manchester Site is located along Braun Road, southeast of the City of Manchester. Figure 4 shows the approximate site boundaries. Appendix B contains a photo log for the Southeast Manchester Site.

This area was observed to have excellent large open spaces, which appear to be ideal candidates for wind turbine construction. Large power lines appear to be accessible the entire length of the designated area. In addition, this location does not contain large forested areas. However, west of Clinton Road, there are county natural areas near the Raisin River and there is a potential migratory corridor along the river (see preliminary avian report, Appendix I).

This area is ranked #3 in the field survey because it is at a lower elevation and access to state and interstate highways is not as convenient as it is in Area A and Area C. The Southeast Manchester site boundaries contain approximately 4,486 acres (7.01 square miles). A 125 MW wind farm would require 83 wind turbines at 1.5 MW each or 50 wind turbines at 2.5 MW each. The average construction footprint would be 150 to 250 acres primarily composed of gravel access lanes. Approximately 1,833 to 2,000 acres of open space would be required. The probable capital investment for a project of this size would be \$187,500,000 to \$200,000,000.

This area was not initially selected for submittal to FAA as a Met Tower site due to its lower average elevation.

## **4.3 Area C – Zeeb Road Site (#2 Priority Site Ranking)**

The Zeeb Road Site is located along Zeeb Road between Pleasant Lake Road and Scio Church Road. Figure 2 shows the approximate site boundaries. Appendix C contains a photo log for the Zeeb Road Site.

The Zeeb Road Site boundaries contain approximately 2,765 acres (4.32 square miles). A 50 MW wind farm would require 33 wind turbines at 1.5 MW each or 20 wind turbines at 2.5 MW each. The average construction footprint would be 60 to 100 acres primarily composed of gravel

access lanes. Approximately 733 to 800 acres of open space would be required. The probable capital investment for a project of this size would be \$75,000,000 to \$80,000,000.

An FAA application for the installation of an 80 meter (264 feet) Met Tower was submitted at latitude 42 degrees 14 minutes 25.2 seconds N and longitude 83 degrees 51 minutes 35 seconds W. A determination of no hazard to air navigation was issued (see attached FAA determination in Appendix F). Paint markings and lighting will be required.

This area ranked high in the field survey because it includes points of high elevation (900 to 1,000 feet), which are of interest for further study in terms of locating large wind power sites in close proximity to the City of Ann Arbor. However, this location was not directly adjacent to power transmission lines and minimal information is available for consideration of avian habitat at this time (see the preliminary avian report, Appendix I).

#### **4.4 Area I – Chrysler Site (#1 Priority Site Ranking)**

The Chrysler Site is located directly east of the Chrysler Proving Grounds. Figure 5 shows the approximate site boundaries. Appendix D contains a photo log for the Chrysler Site.

The Chrysler area boundaries contain approximately 3,507 acres (5.48 square miles). A 75 MW wind farm would require 50 wind turbines at 1.5 MW each or 30 wind turbines at 2.5 MW each. The average construction footprint would be 90 to 150 acres primarily composed of gravel access lanes. Approximately 1,100 to 1,200 acres of open space would be required. The probable capital investment for a project of this size would be \$112,500,000 to \$120,000,000.

An FAA application for the installation of an 80 meter (264 feet) Met Tower was submitted at latitude 42 degrees 16 minutes 15.1 seconds N and longitude 84 degrees 1 minute 12.2 seconds W. A determination of no hazard to air navigation was issued (see FAA determination in Appendix F). Paint markings and lighting will be required.

This area is very similar to Area A, the #4 ranked site. It has excellent access to transportation and power lines. Although it is generally lower in elevation (890 to 950 feet) and was observed to have a somewhat less open area, the wind speed projected by the wind model is slightly better here than in the other top ranked areas. It also appears that wind power development in this area would have less potential impact on avian species than the North and Southeast Manchester Areas. However, minimal information is currently available for this consideration (see Appendix I, Preliminary Avian Report, for more details). This potential development area is highly visible to the public due to its proximity to M-52 and Interstate 94, which are heavily traveled roadways. There is also potential for the DaimlerChrysler proving ground facility to become a service customer.

# Section 5

## Recommendations

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Based on this initial site survey, NCWP and RMT have the following recommendations:

1. Install an 80-meter Met Tower in the Chrysler Area as close as possible to the met tower site identified as site number 8 in the Meteorological Tower Site Selection Report. If the test results are positive after a review of 6 months of data, consider installing additional met towers in the Zeeb Road and/or SE Manchester Areas. Tasks include:
  - Staff contacting property owners for easements
  - RFP for testing equipment
  - Data analysis (UM or Consultant)
  - Preparation of investment grade report (North Coast) at end of the study timeframe

Estimated cost for this phase is \$86,000 for the 80-meter tower, data collection services, and wind resource report or \$150,000 if three met towers are erected. (County staff is discussing reducing costs through use of University testing equipment and analysis of results).

2. During the testing phase, perform the following additional analysis and tasks:
  - Investigate with the FAA the aviation safety status of these locations for ultimate construction of a wind turbine at all selected met tower sites to assure monitoring and additional studies are completed only at developable sites.
  - Complete one year of wind resource monitoring and a wind resource assessment report.
  - Contact private landowners in each area to determine the interest level of having wind turbines located on their property.
  - Conduct a bird and bat study to address any concerns that require further study and/or mitigation.
  - Utilize Wind Farmer and/or other applicable software to develop preliminary layout and design of wind farms in the selected area(s) based on land availability (adjusted for any known zoning permit restrictions, FAA approval, wind resource characteristics, avian habitat considerations, electric interconnection requirements, site access restrictions, equipment transportation, etc.).
  - Consider conducting a noise propagation analysis for proposed wind farm designs.
  - Schedule a pre-application meeting to help identify general interconnection issues with the electric utility or transmission service provider in the top ranked areas. An application to MISO for a feasibility study costs approximately \$10,000.

# Section 6

## Additional Discussion and Recommendations

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### 6.1 Area B – Unmarked County Property

These parcels near the areas found to be of interest for potential wind power development and were originally investigated as a potential meteorological tower site. However, they were observed to be wooded and are not recommended for further consideration.

### 6.2 Area D – Washtenaw Community College and Area E – St. Joseph Mercy Hospital

These areas are located in the 1500 block of E Huron River Drive. No open areas of desired size and sufficient setback from development and trees were deemed adequate for the construction and operation of utility scale wind turbines at these locations. It is suggested that these properties be considered for small turbine distributed wind projects only. There appear to be multiple open spaces that could be suitable for small wind turbines in the 25 to 35 kW capacity range (see Appendix E, PGE 20/25 kW brochure). Additional study is recommended to determine how many units and their economic feasibility.

### 6.3 Area F – City of Ann Arbor MRF Landfill Site and Area G – City of Ann Arbor Property West of MRF/South of New Construction

The City of Ann Arbor Landfill Site has been previously evaluated by the FAA for the construction of wind turbines having a blade tip height up to 405 feet above ground level (see Appendix F for FAA correspondence dated 8/29/2005). This height would be typical of 1.5 MW class utility scale wind turbines. The FAA determined that any height greater than 141 feet above ground level would be a hazard to aviation. Although it may be possible to get approval for increased height with further study, it is suggested that the close proximity of about 1.6 nautical miles to the Ann Arbor Municipal Airport makes it undesirable to do so.

Therefore, any wind turbines considered for installation on the landfill property should have a maximum blade tip height that is less than 141 feet. For example, remanufactured Vestas Model V-17 units with a 90 kW capacity are available on approximately 74-foot tall tubular

towers and would be less than 141 feet in total height (see Appendix G). This size of unit can be individually net metered into adequately sized existing facilities (if available) or networked together into an interconnection with the utility. If 11 of the 90 kW wind turbines were installed, total project capacity for the interconnection would be 990 kW or approximately 1 MW). Additional study of this concept is recommended to determine the actual location and number of units, as well as the financial feasibility.