

# Minnesota Tribal Coalition Tribal Utility Capacity Building Project

DE-FG36GO13118 A000

September 2003 – September 2006

# Minnesota Tribal Coalition Tribal Utility Capacity Building Project

Grand Portage

White Earth

Leech Lake



# Minnesota Tribal Coalition



# Participants

White Earth Band of Chippewa Indians  
Leech Lake Band of Chippewa Indians  
Grand Portage Band of Chippewa Indians  
White Earth Land Recovery Project  
Center for Sustainable Community Development,  
University of Minnesota Duluth

Michael Rivard, Minneapolis, MN  
EAPC Architects Engineers, Grand Forks MN

# Focused on inter-related areas:

Education	educational material distribution, awareness
Assessment	on-reservation energy flow, consumption patterns, potentials for renewable energy resources
Strategic Plan	Tribal energy vision
Model Documents	codes, policies, institutions

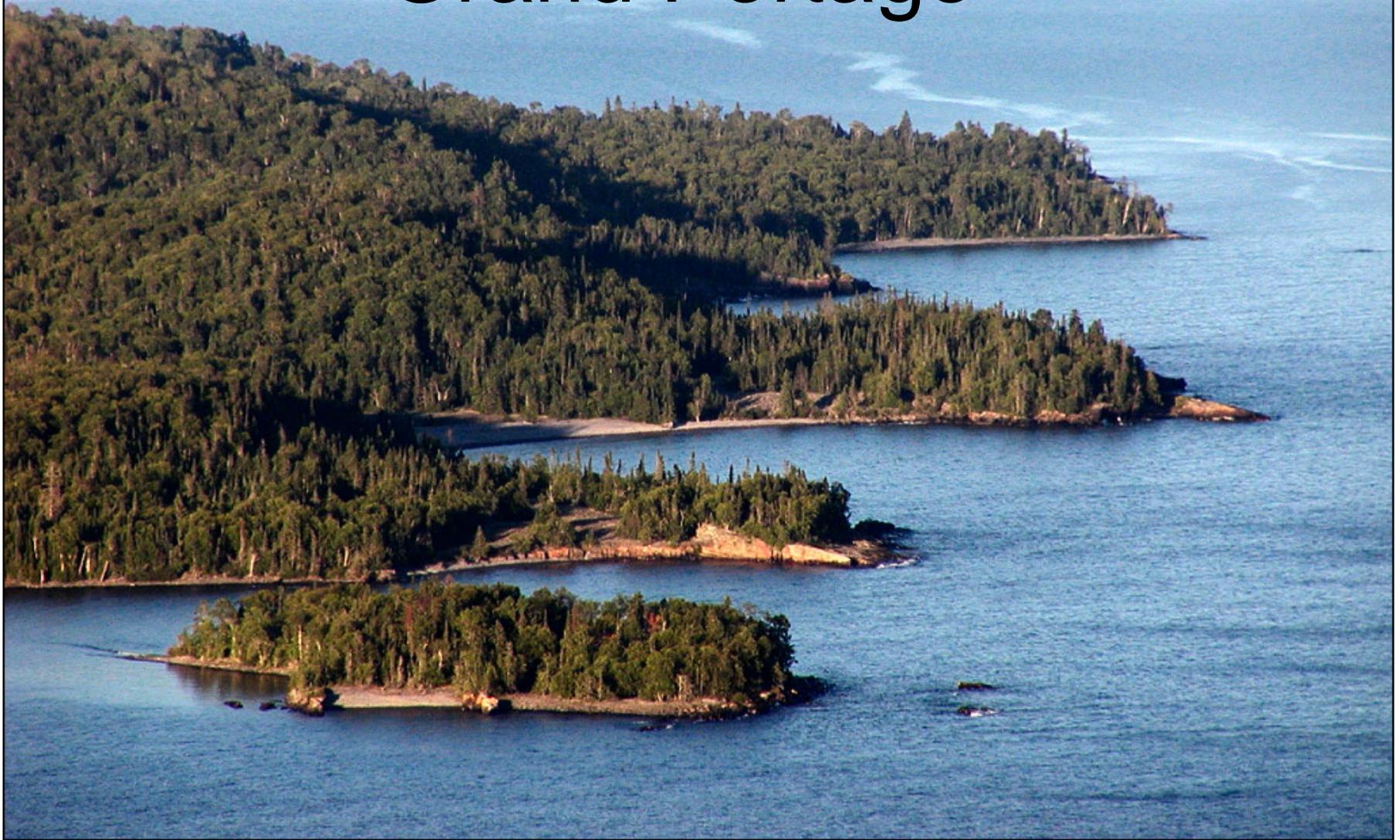
# Tribal Participants

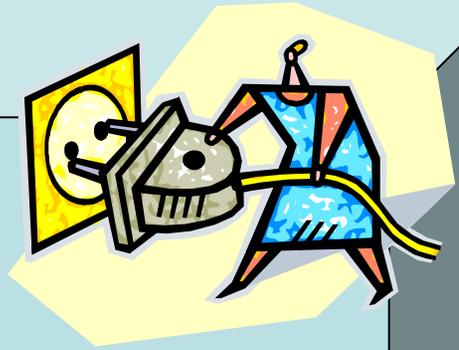
- Michael Triplett, White Earth
- Brandy Toft, Leech Lake
- Shannon Judd, Grand Portage

# Minnesota Tribal Coalition



# Grand Portage





## Total Electricity Consumption:

 Community Center- 840,000 kWh/yr

 Casino/Hotel- 2,200,000 kWh/yr

 Households- 1,440,000 kWh/yr

 Tribal Council Offices- 640,000 kWh/yr

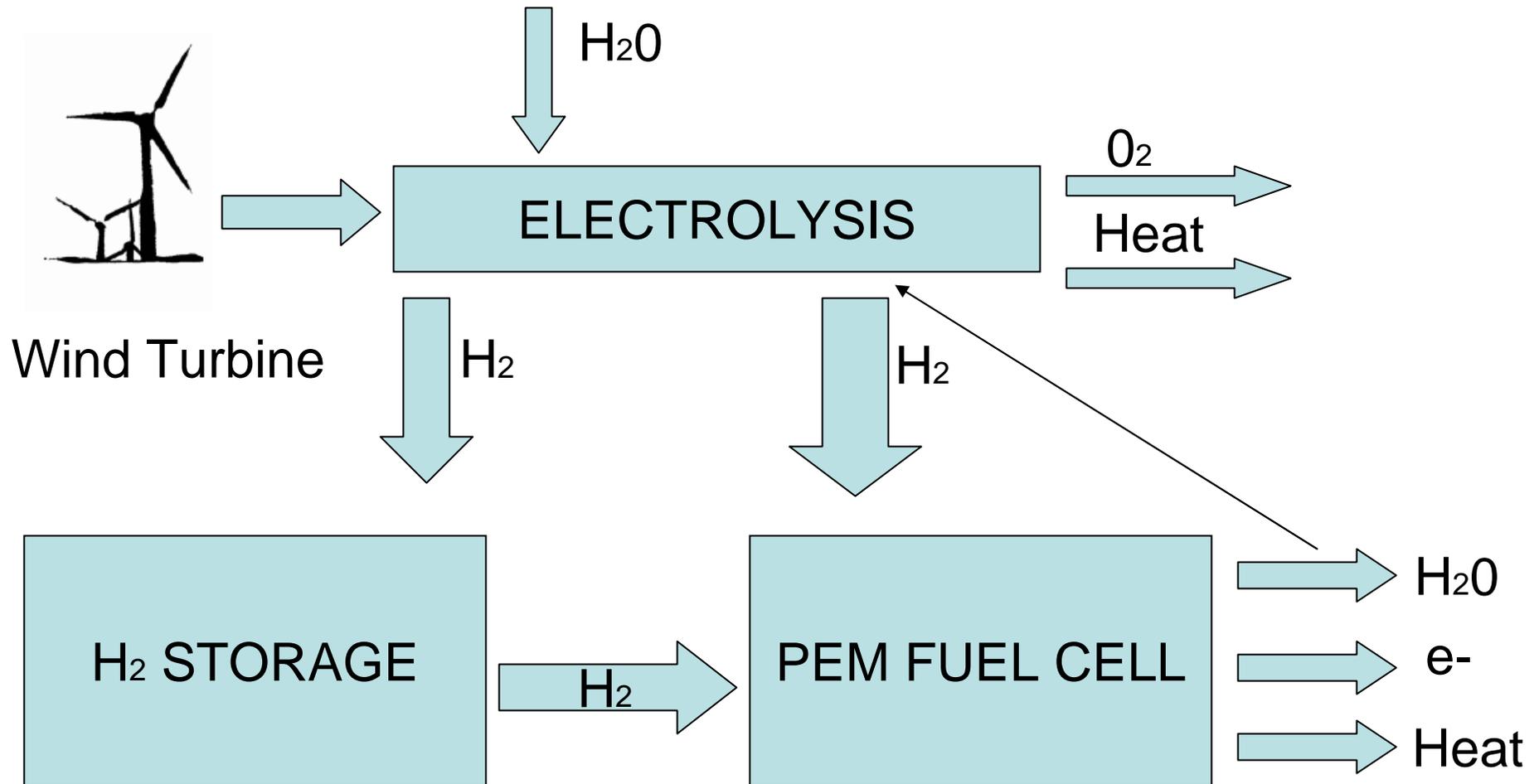
Total Consumption: 5,120,000 kWh/yr

Annual Cost: \$358,400.00

# Proposed Grand Portage Project

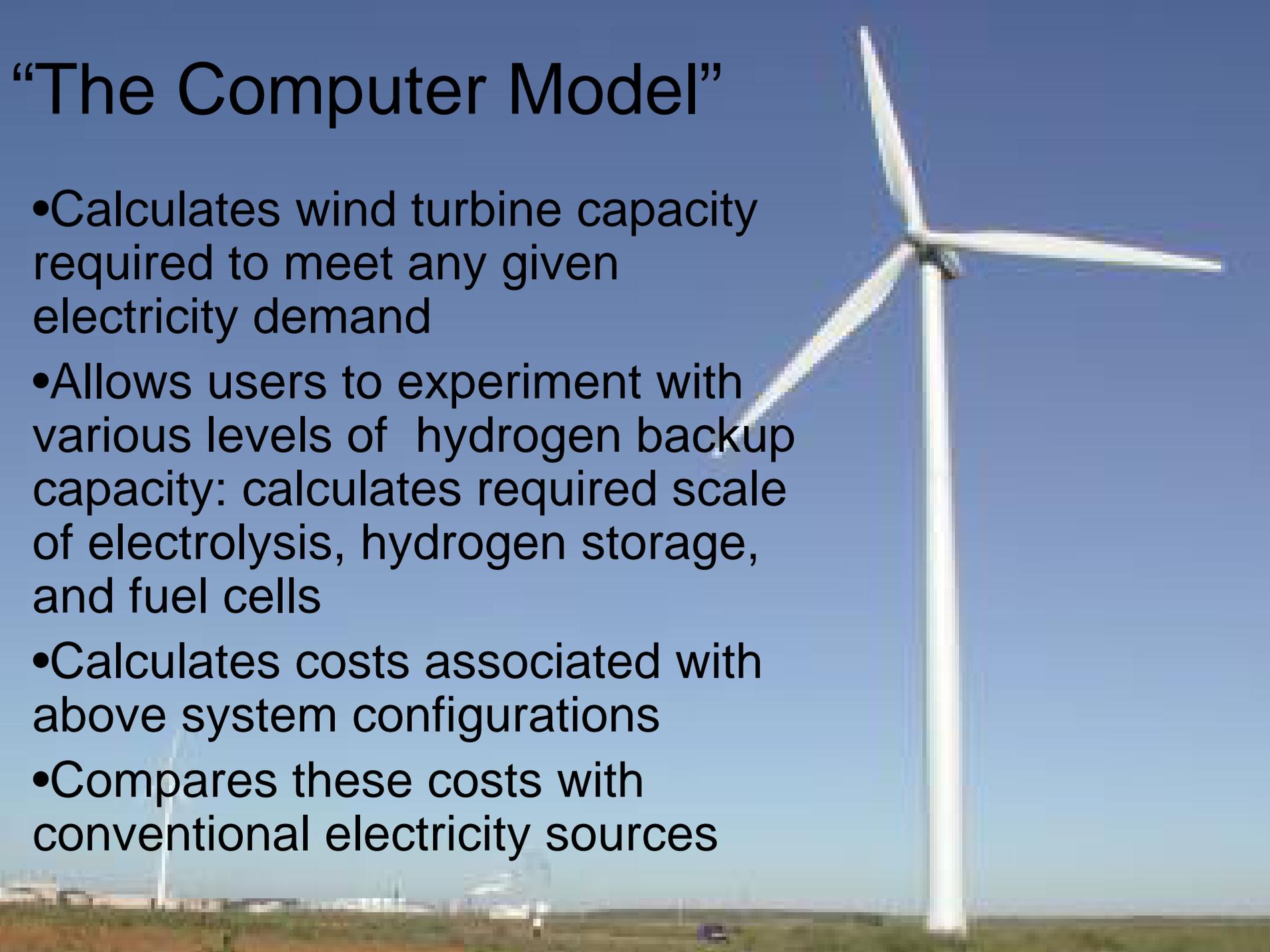
- Approximately 1MW of Wind to power community center and hotel/casino
- 20% Hydrogen backup (electrolysis, hydrogen storage, and fuel cell) located at community center
- All electricity production to be consumed by the reservation
- Community Education

# Storing Wind Generated Electricity With Hydrogen



# “The Computer Model”

- Calculates wind turbine capacity required to meet any given electricity demand
- Allows users to experiment with various levels of hydrogen backup capacity: calculates required scale of electrolysis, hydrogen storage, and fuel cells
- Calculates costs associated with above system configurations
- Compares these costs with conventional electricity sources



# Analysis of Grand Portage Wind Data

- Calculated the daily average wind speed using 365 days of data, and sorted these data points into 'wind bins'.
- Calculated the power density (PD) for each 'wind bin'  $PD = .5 v^3$  (units  $w/m^2$ ).
- Corrected for frequency of occurrence and summed across all 'wind bins'  $PD = 221.22 w/m^2$
- Corrected for hub height and wind shear  
Adjusted  $PD = 442.44 w/m^2$
- Calculated output/ $m^2 = 3875.74 kWh/yr/m^2$

# Wind Resource:

Wind Production:

Turbine Site: Mt.Maud

Wind Data at 60 ft:

MPH-Average 13.8 MPH

Class-5

Capacity Factor-.22

Wind Production:

Turbine Site: Mt.Maud

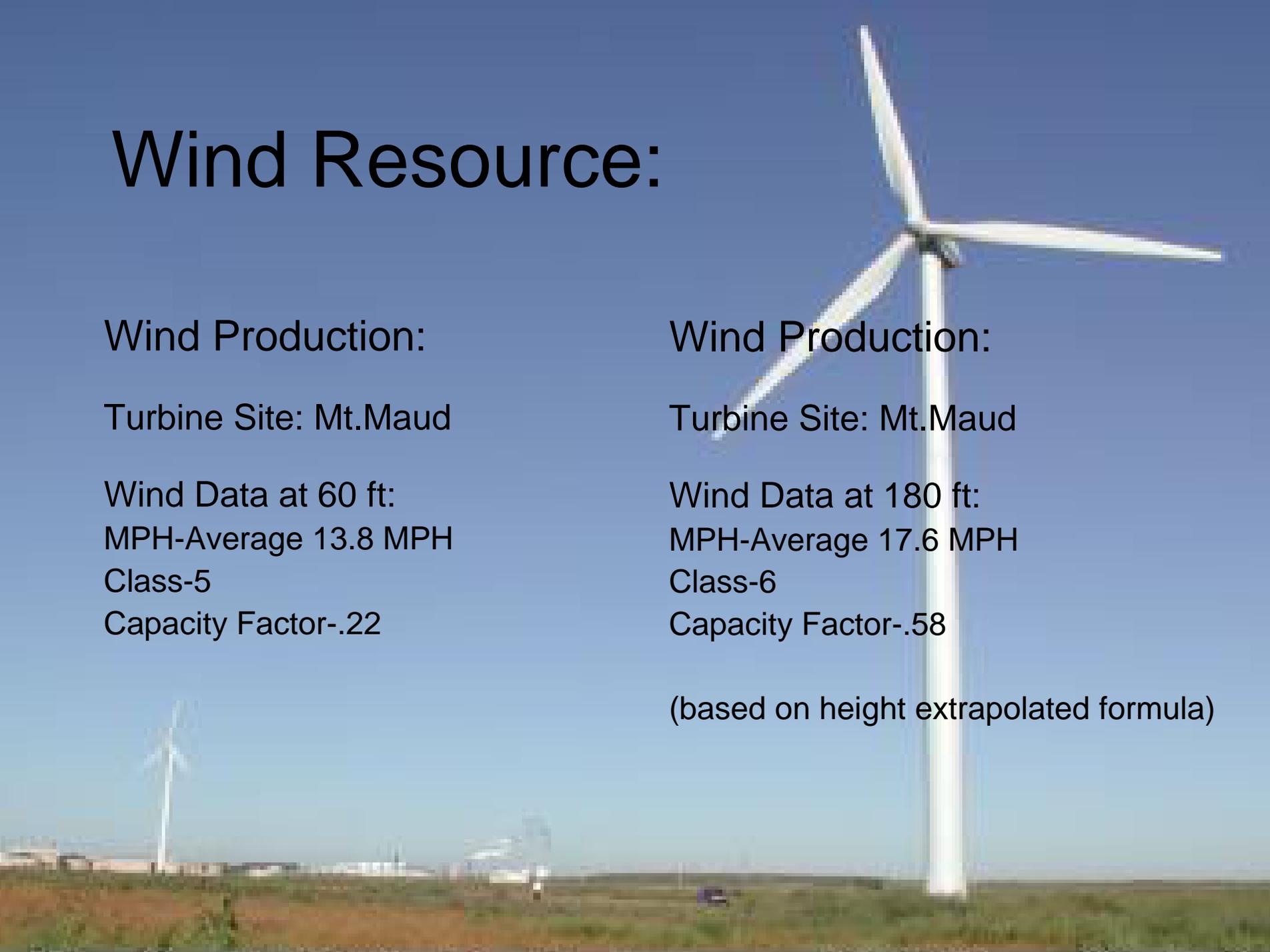
Wind Data at 180 ft:

MPH-Average 17.6 MPH

Class-6

Capacity Factor-.58

(based on height extrapolated formula)



Annual average wind speed=14.2 mph.

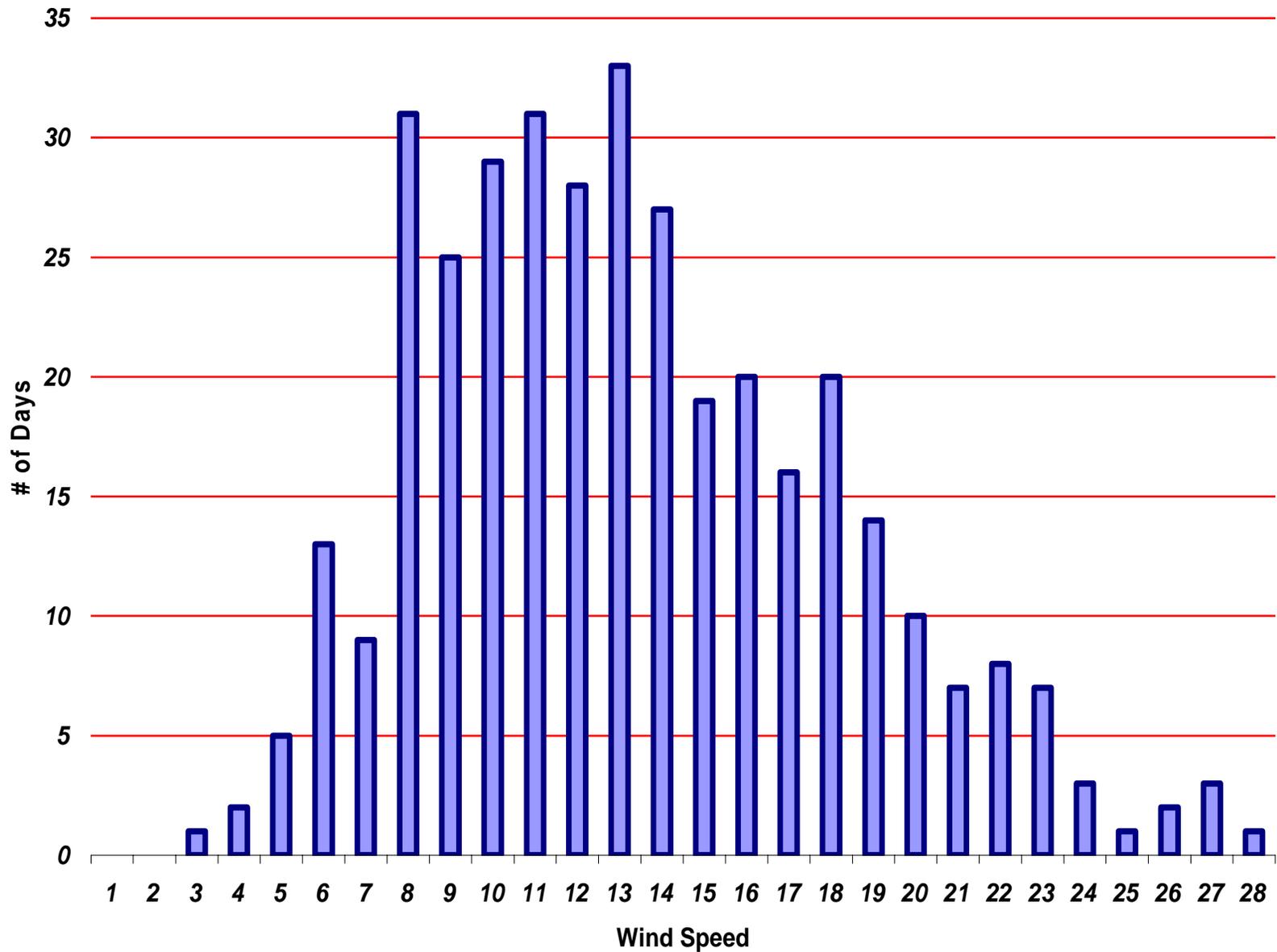
# GP Wind Speed Distribution

GP Wind Distribution



Fig #1. The number of days in each wind speed 'bin'.

# Grand Portage Wind Speed Distribution



# Grand Portage Model Output: 2 Scenarios

## No Hydrogen Backup

	<u>Capacity</u>	<u>Cost</u>
<u>Wind</u>	1000 kW	\$946,959
<u>Electrolysis</u>	0	\$0
<u>Fuel Cell</u>	0	\$0
<u>Total System Cost</u>		\$946,959
<u>Annual Renewable cost</u>		\$66,287
<u>Annual Utility cost</u>		\$121,000

## 20% Hydrogen Backup

	<u>Capacity</u>	<u>Cost</u>
<u>Wind</u>	1095 kW	\$1,041,000
<u>Electrolysis</u>	10.87 Nm3/hr	\$173,950
<u>Fuel Cell</u>	23 kW	\$133,280
<u>Total System Cost</u>		\$1,348,000
<u>Annual Renewable cost</u>		\$108,230
<u>Annual Utility cost</u>		\$121,000

# Estimated Turbine Costs

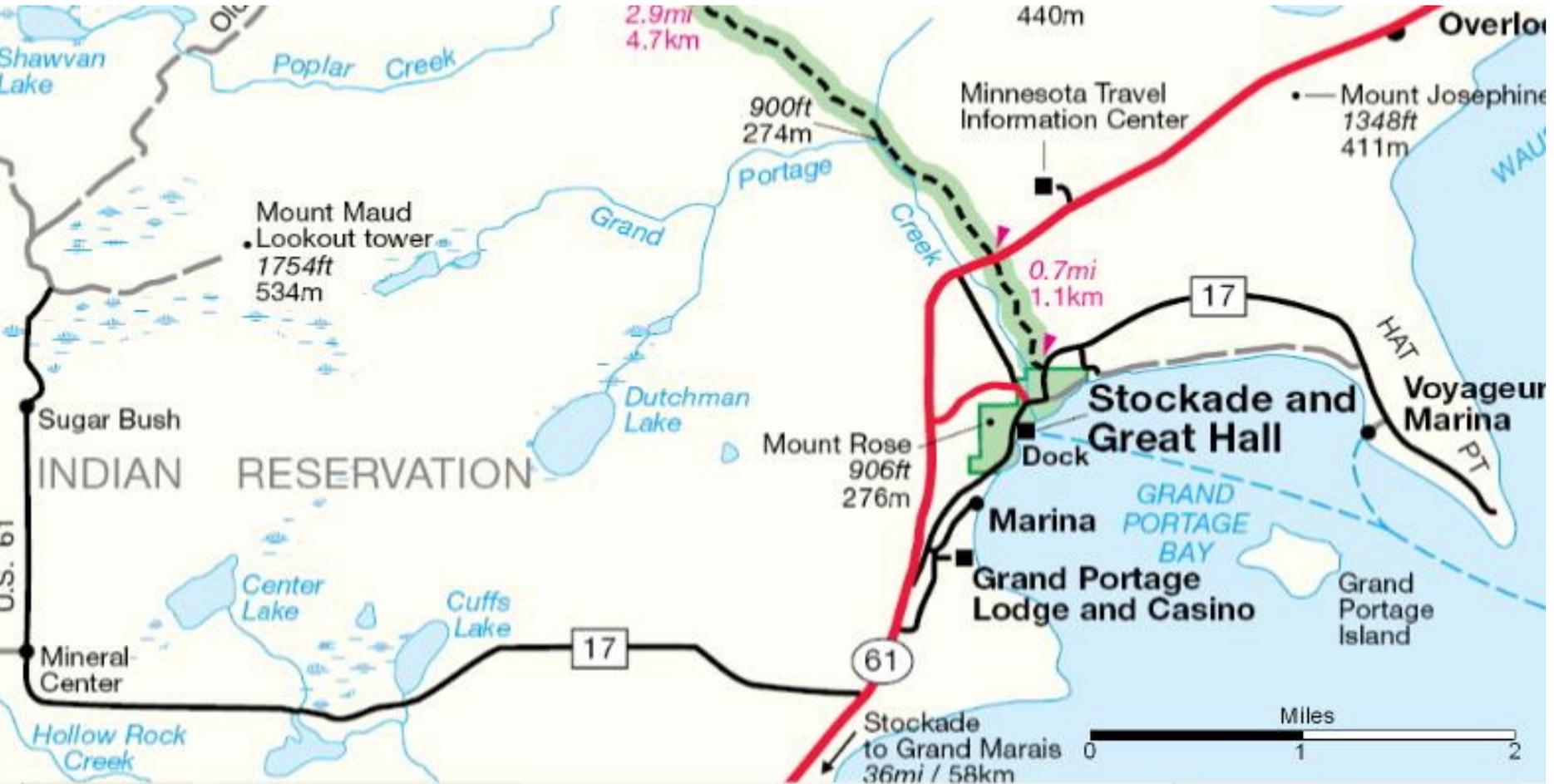
## Fuhrlander FL 1000 (1 MW)

- Turbine, tower, and delivery: \$1.2 million
- Site Preparation:
- Installation: \$400,000.00
  
- Total: \$1.6 million



# Figure 1. Map of Grand Portage

Source: [www.nps.gov/applications/parks/grpo/ppmaps/GRPOmap1.pdf](http://www.nps.gov/applications/parks/grpo/ppmaps/GRPOmap1.pdf)



## Upfront Costs - Suzlon 1.25 MW

Turbine & Tower	\$1,100,000
Shipping	\$50,000
Transformer	\$17,500
New Power Line (\$13/ft x 3 mi. – 6 mi.)	\$200,000 - \$400,000*
Electrical Labor	\$15,000
Concrete & Rebar	\$30,000
Foundation Labor	\$15,000
Tower Imbeds/Bolts	\$100,000 – \$200,000*
Crane	\$30,000
Labor - Erection	\$10,000
Legal	
<b>Total Cost</b>	<b>\$1,582,500 - \$1,882,500</b>

\*cost will be determined by location of site

## Annual Costs

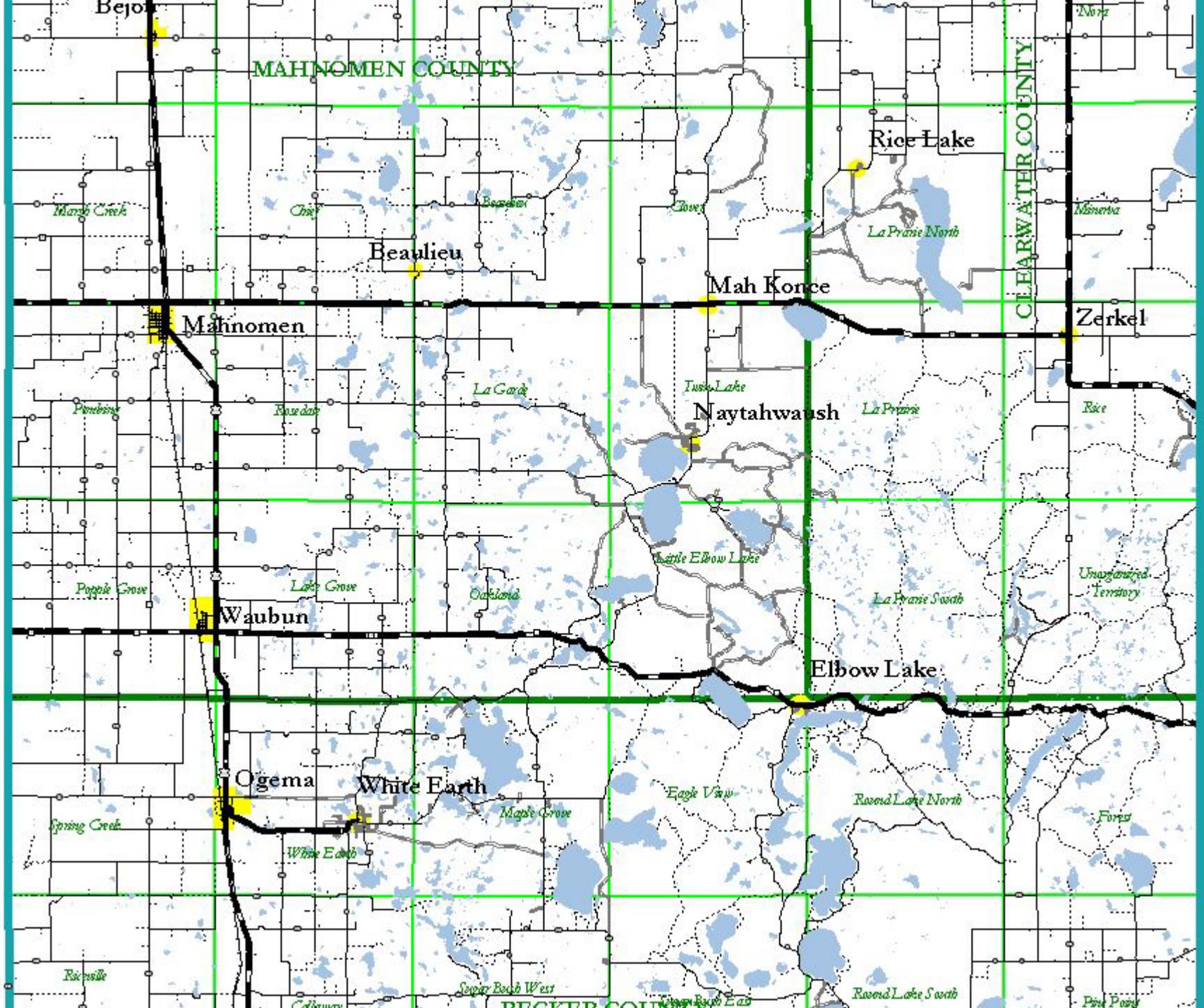
Insurance	\$12,000
Operation & Maintenance	\$40,000
Standby charge (\$1.39/kW/mo)	\$20,850
Finance (\$1.5 million, 6%, 20yrs)	\$129,241
<b>Total</b>	<b>\$202,091</b>

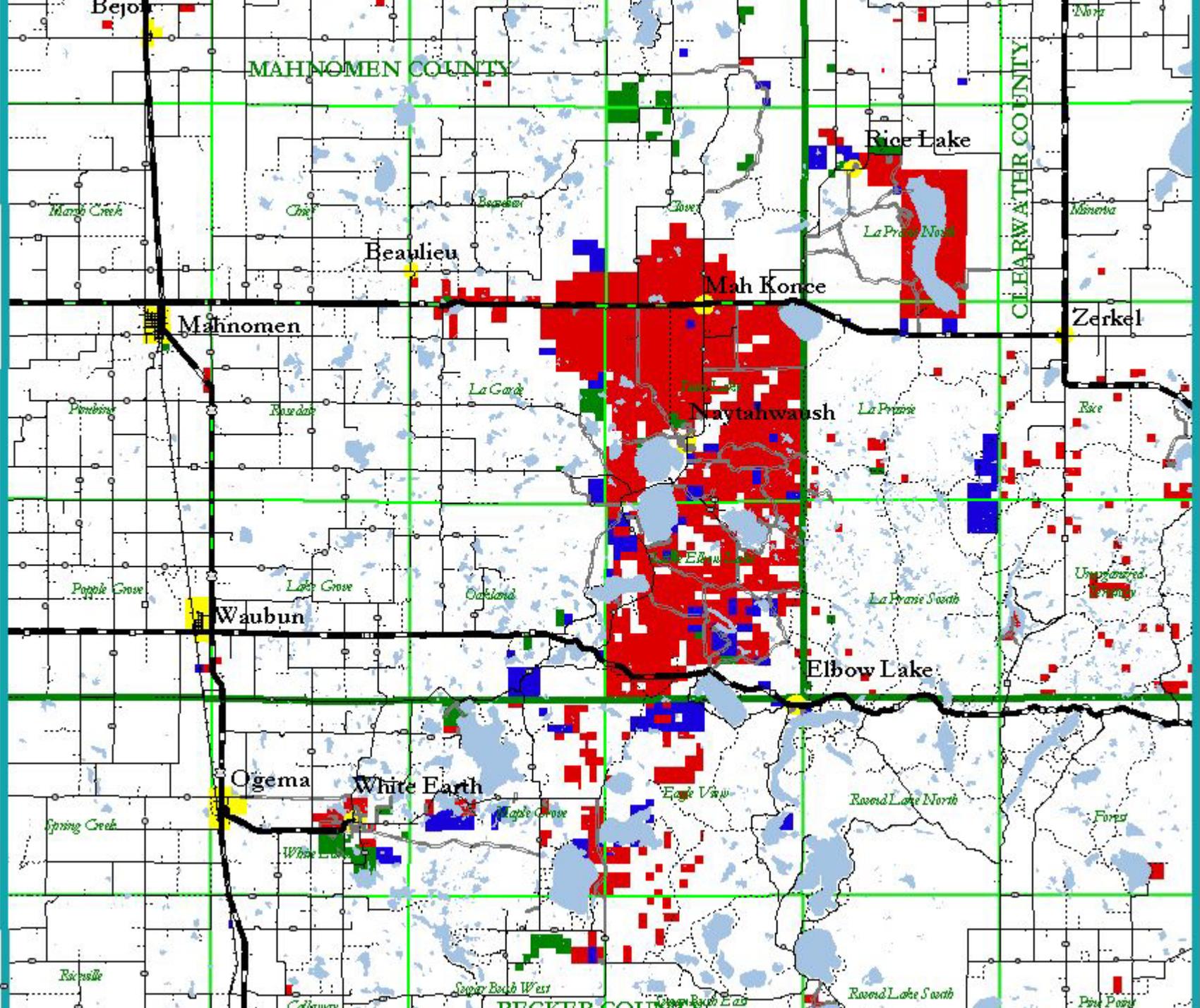
## Table 7. Annual Revenue

Turbine Output: 4 mil kWh/yr @\$.05/kWh	<b>\$200,000</b>
Turbine Output: 4 mil kWh/yr @\$.06/kWh	<b>\$240,000</b>

# White Earth

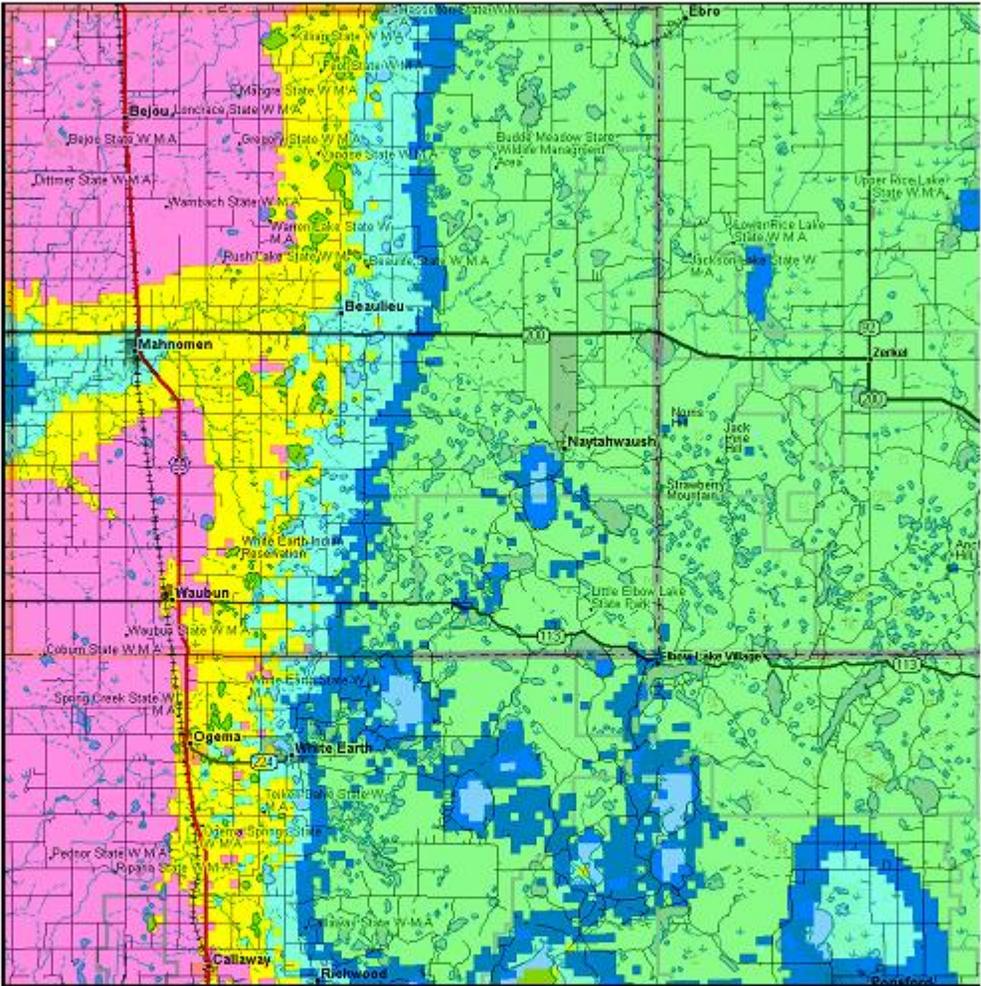






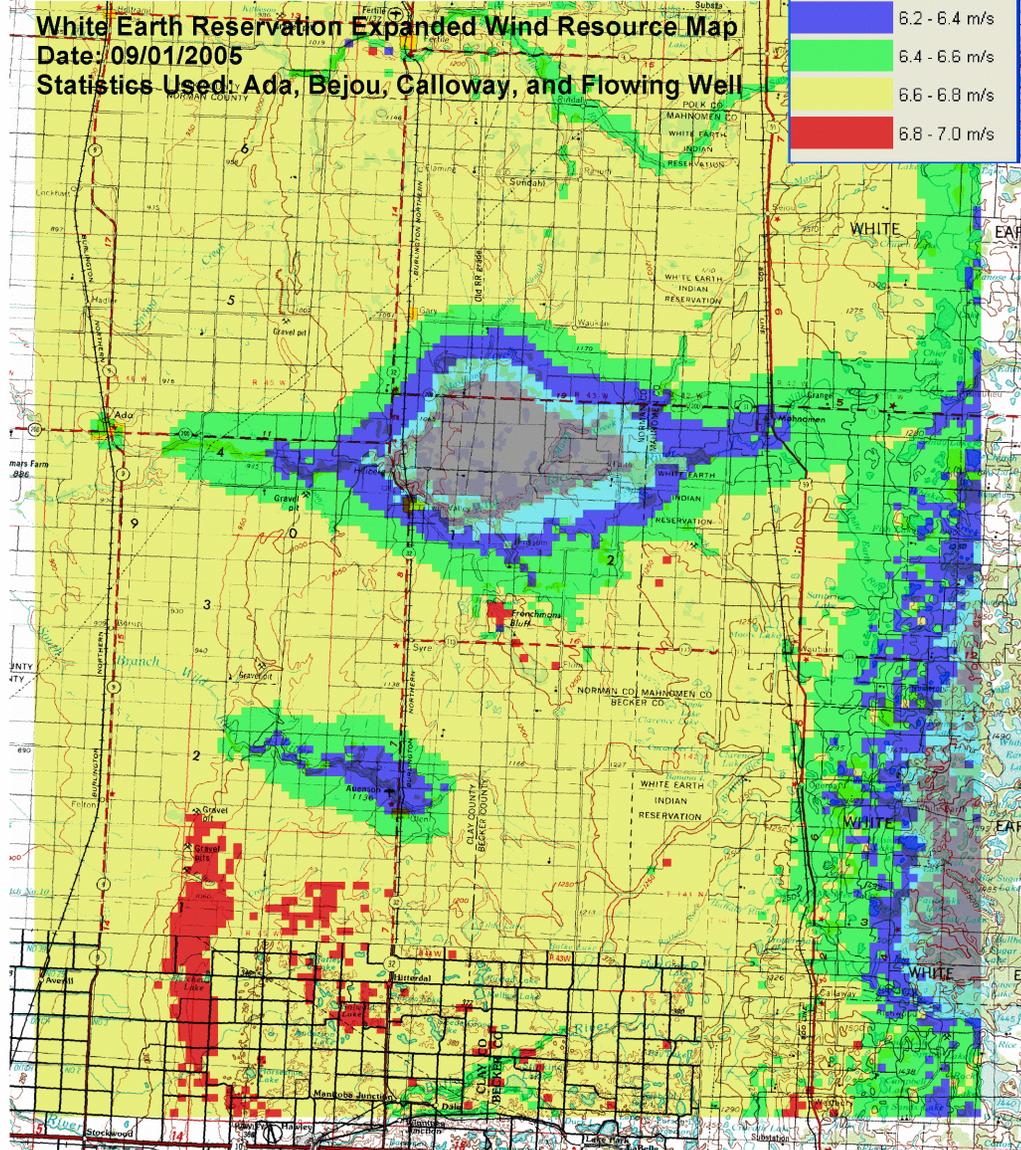
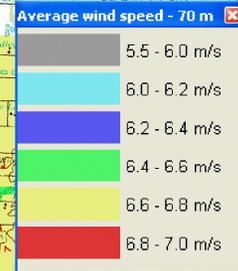


# White Earth Reservation – 70 meter Wind Resource Map

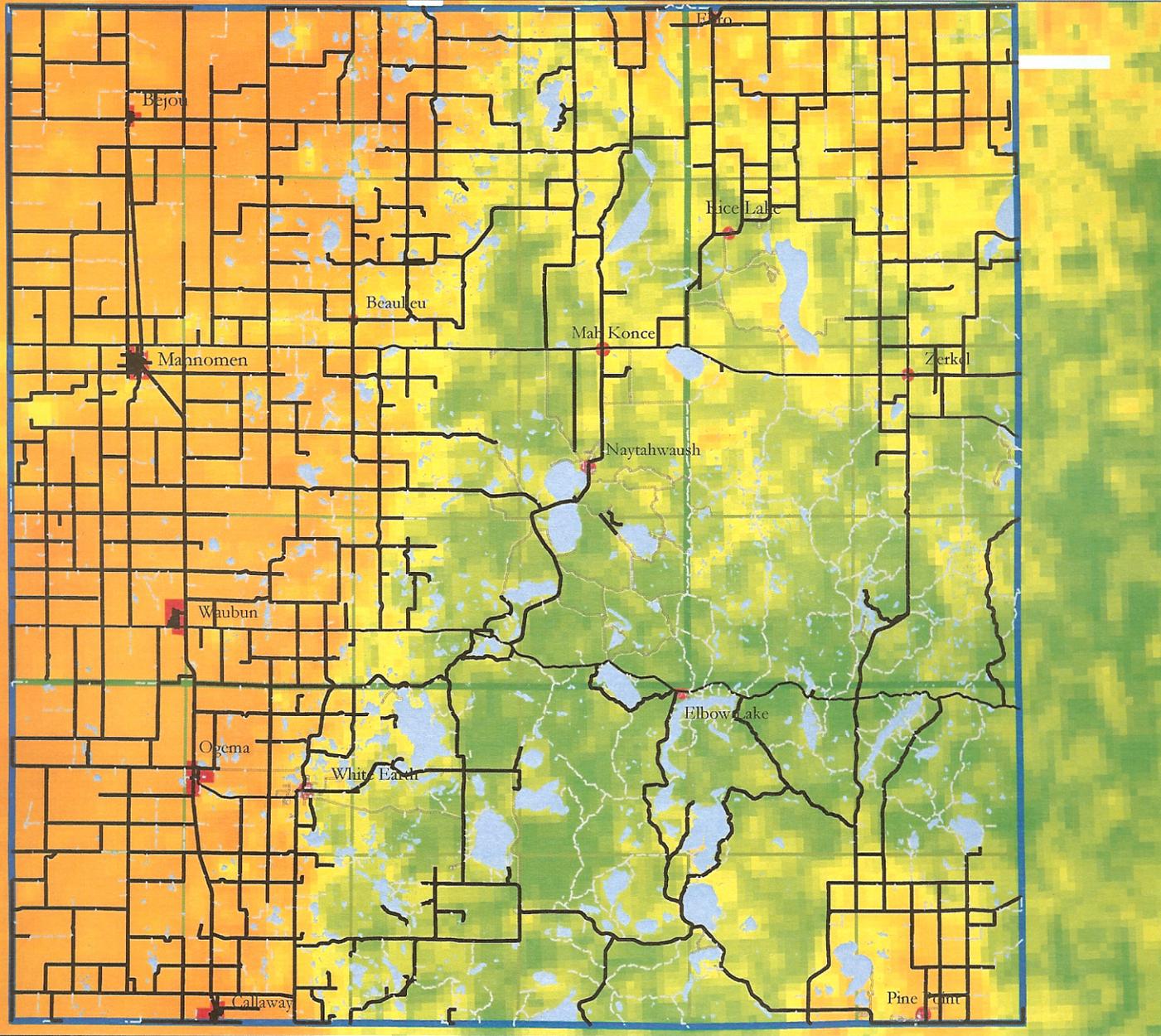


11.41 – 13.42 mph	5.1 - 6.0 m/s
13.42 – 13.87 mph	6.0 - 6.2 m/s
13.87 – 14.32 mph	6.2 - 6.4 m/s
14.32 – 14.77 mph	6.4 - 6.6 m/s
14.77 – 15.21 mph	6.6 - 6.8 m/s

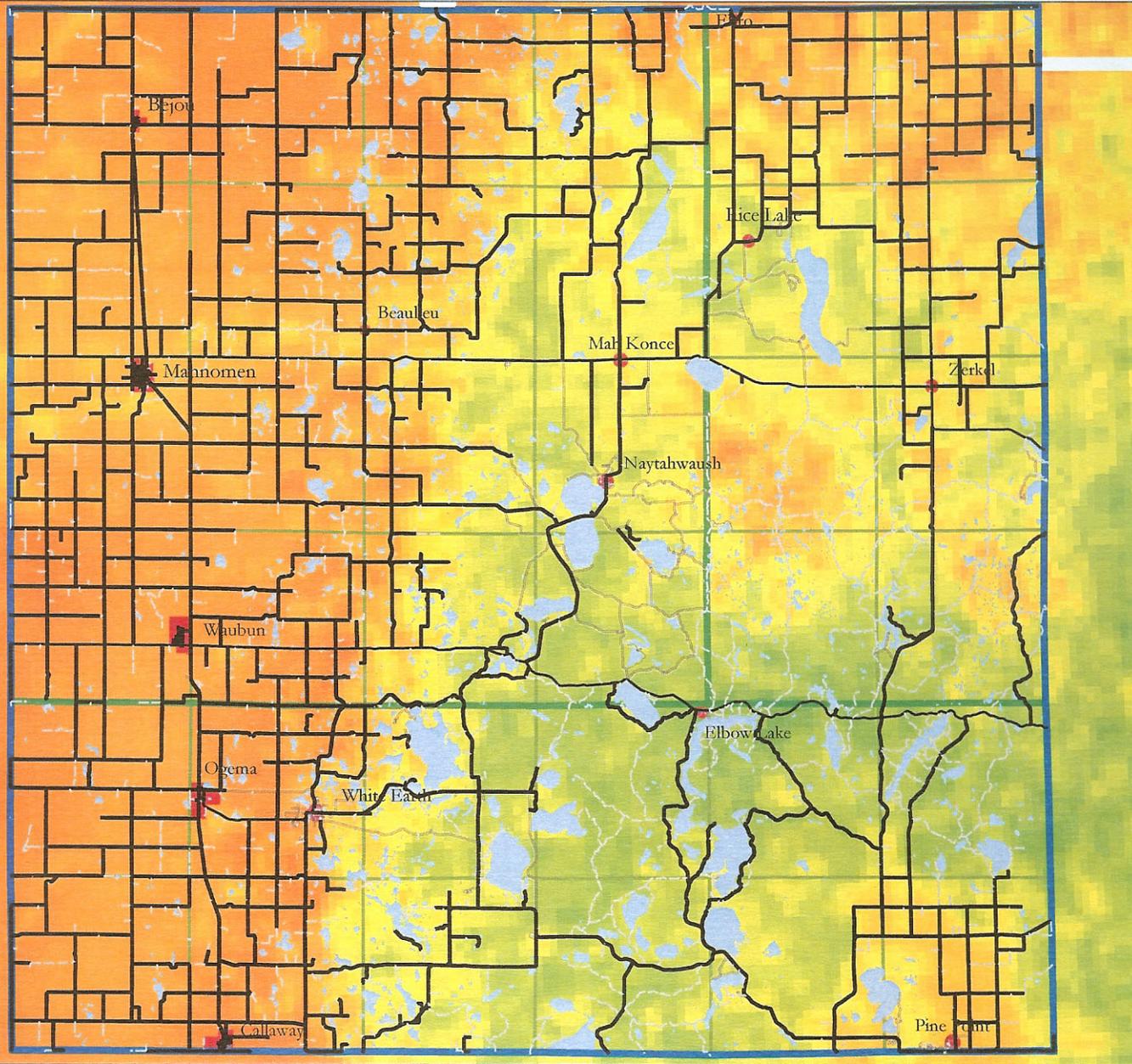
## White Earth Reservation Expanded Wind Resource Map Date: 09/01/2005 Statistics Used: Ada, Bejou, Calloway, and Flowing Well



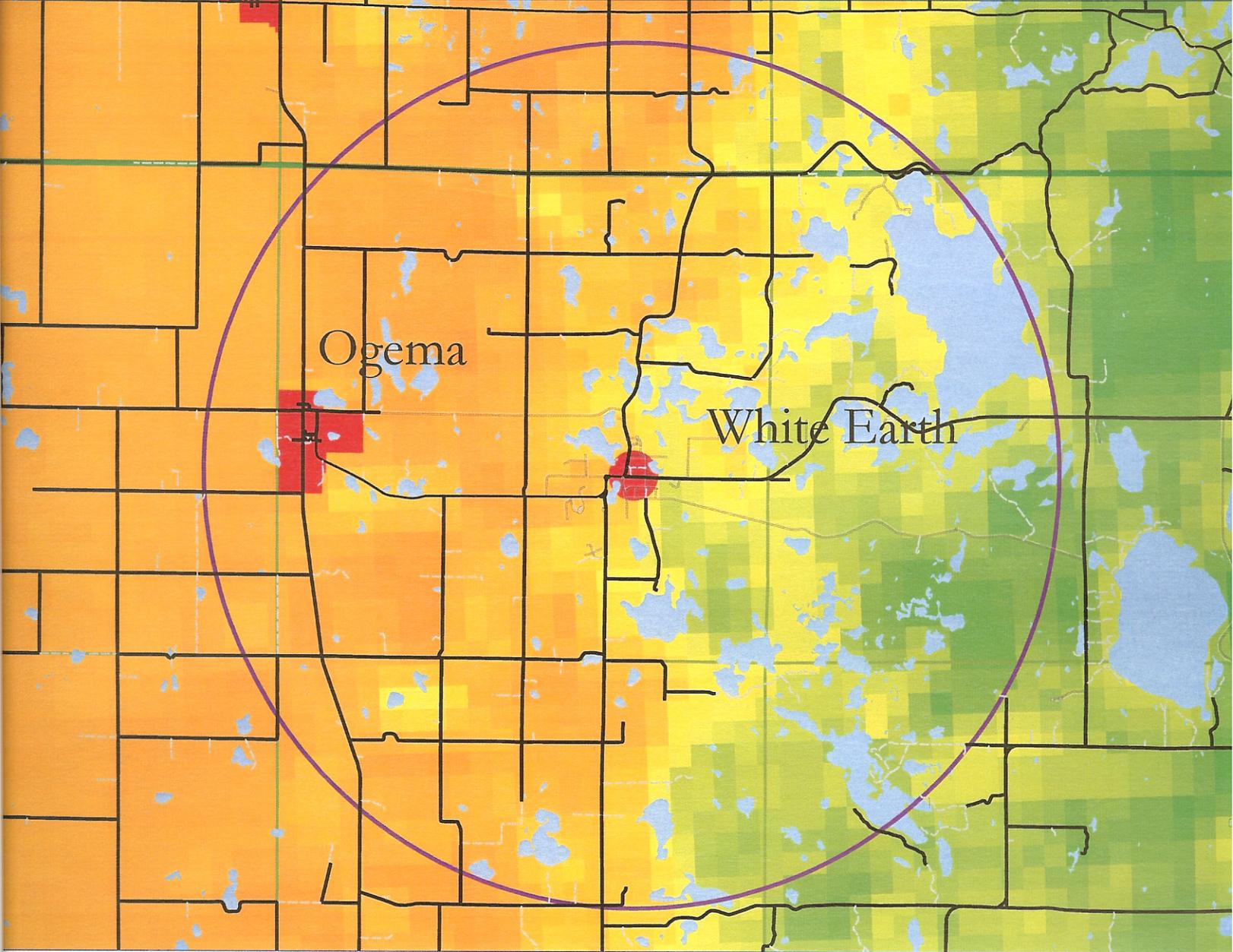
White Earth Reservation - 30 Meter



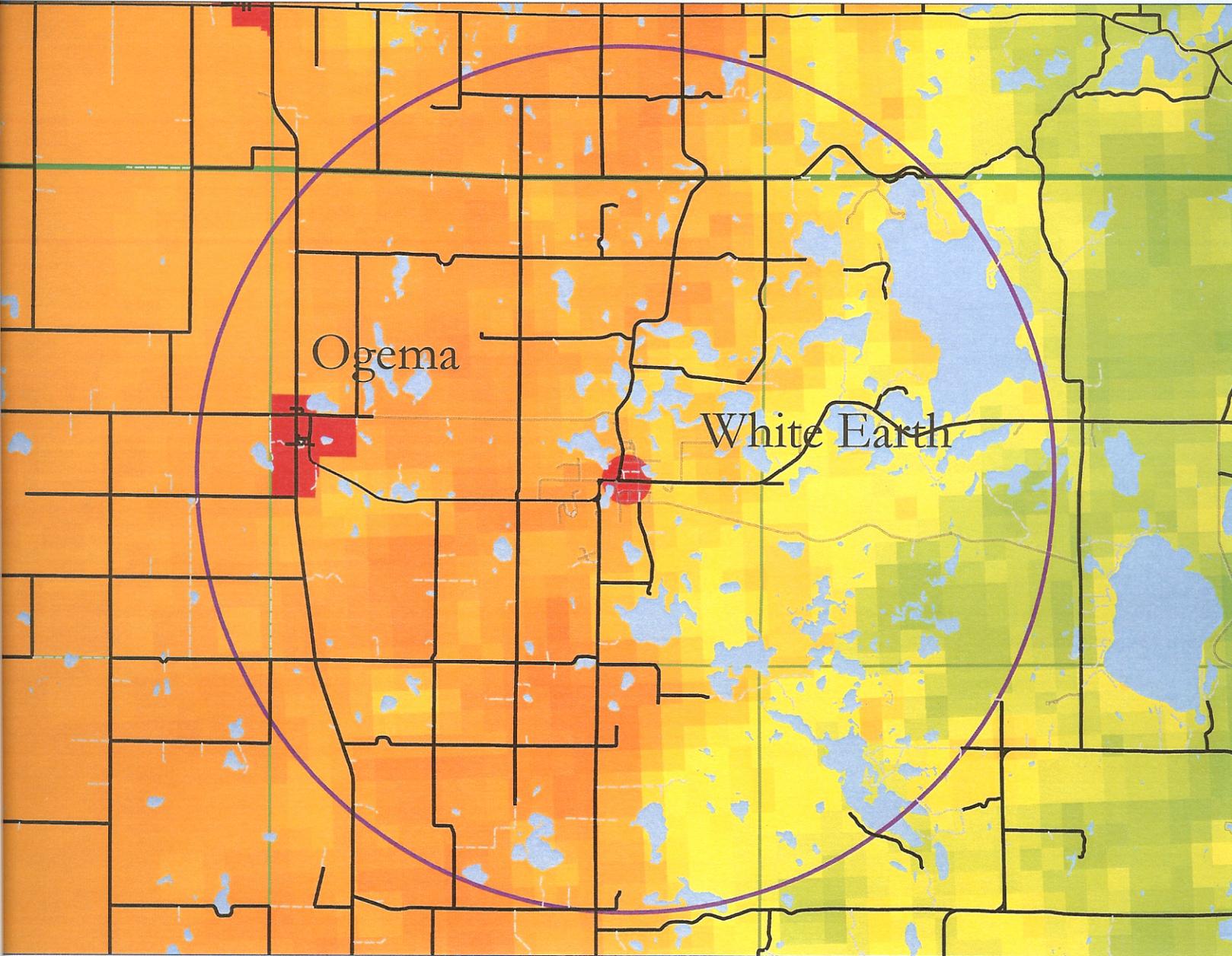
# White Earth Reservation -80 Meter



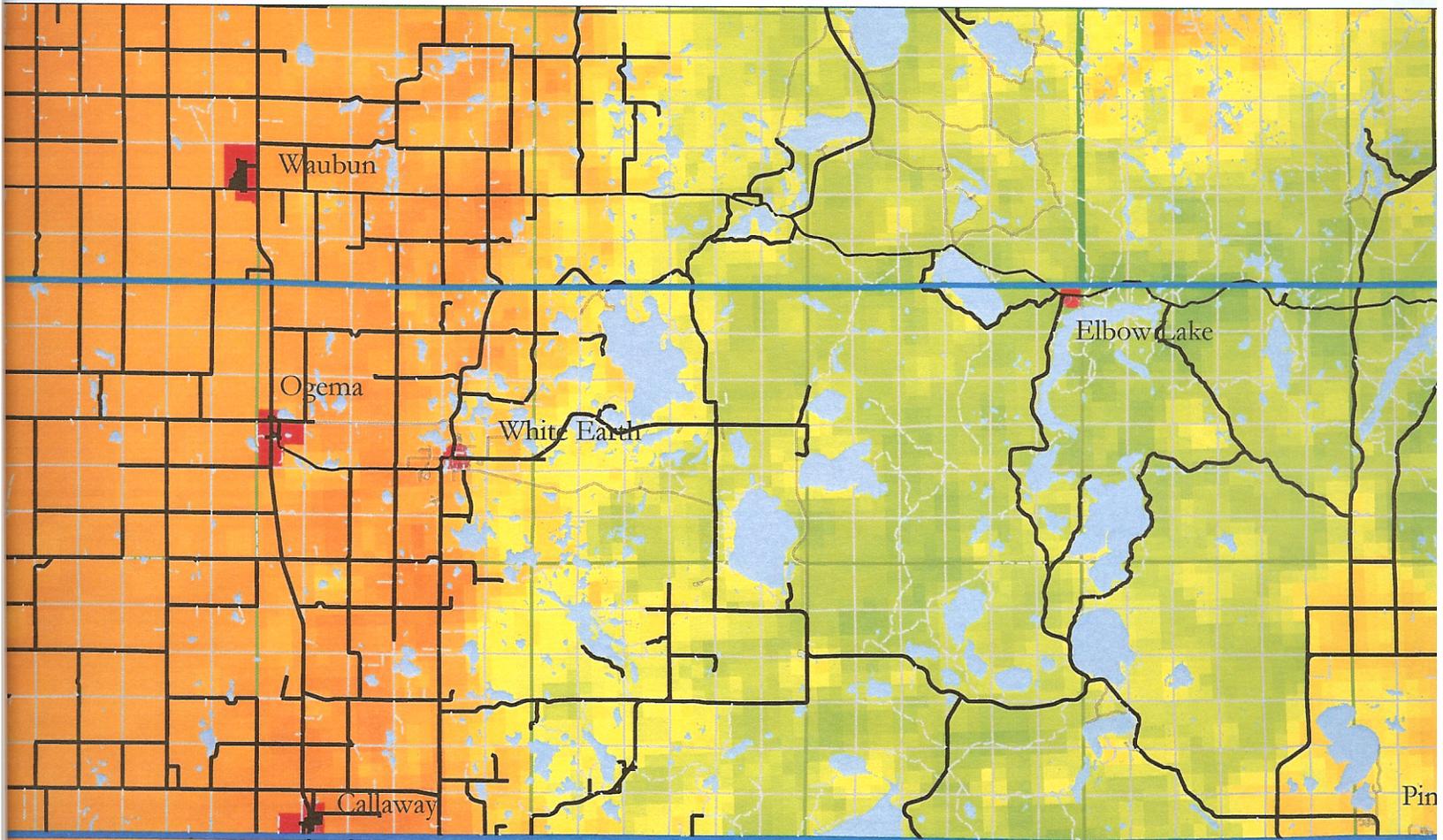
White Earth Village- 30 Meter



White Earth Village- 80 Meter



Becker County -80 Meter



Pin

# Major Electricity Consumers:

 Reservation Tribal Council Bldg. - 477,320 kWh/yr

 Circle of Life School- 464,000 kWh/yr

 Community Center- 300,000 kWh/yr

 Bingo Hall - 265,000 kWh/yr

 Casino - 14,982,000 kWh/yr

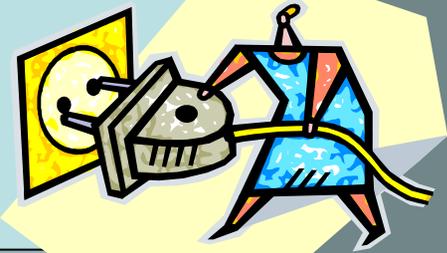
 Casino Sign - 87,000 kWh/yr

 Head Start - 36,000 kWh/yr

 WE Health Center - 1,700,000 kWh/yr (Federal facility)

 Total: 18,311,320 kWh/yr

 Annual Cost: \$732,453.00



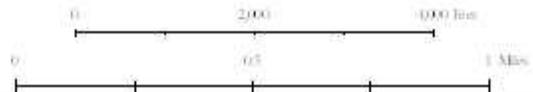
# White Earth Reservation

*White Earth Village*



**Legend**

Roads	Section Lines
US Highway	Lakes
State Highway	
County & Township Road	
BIA	
UIR	



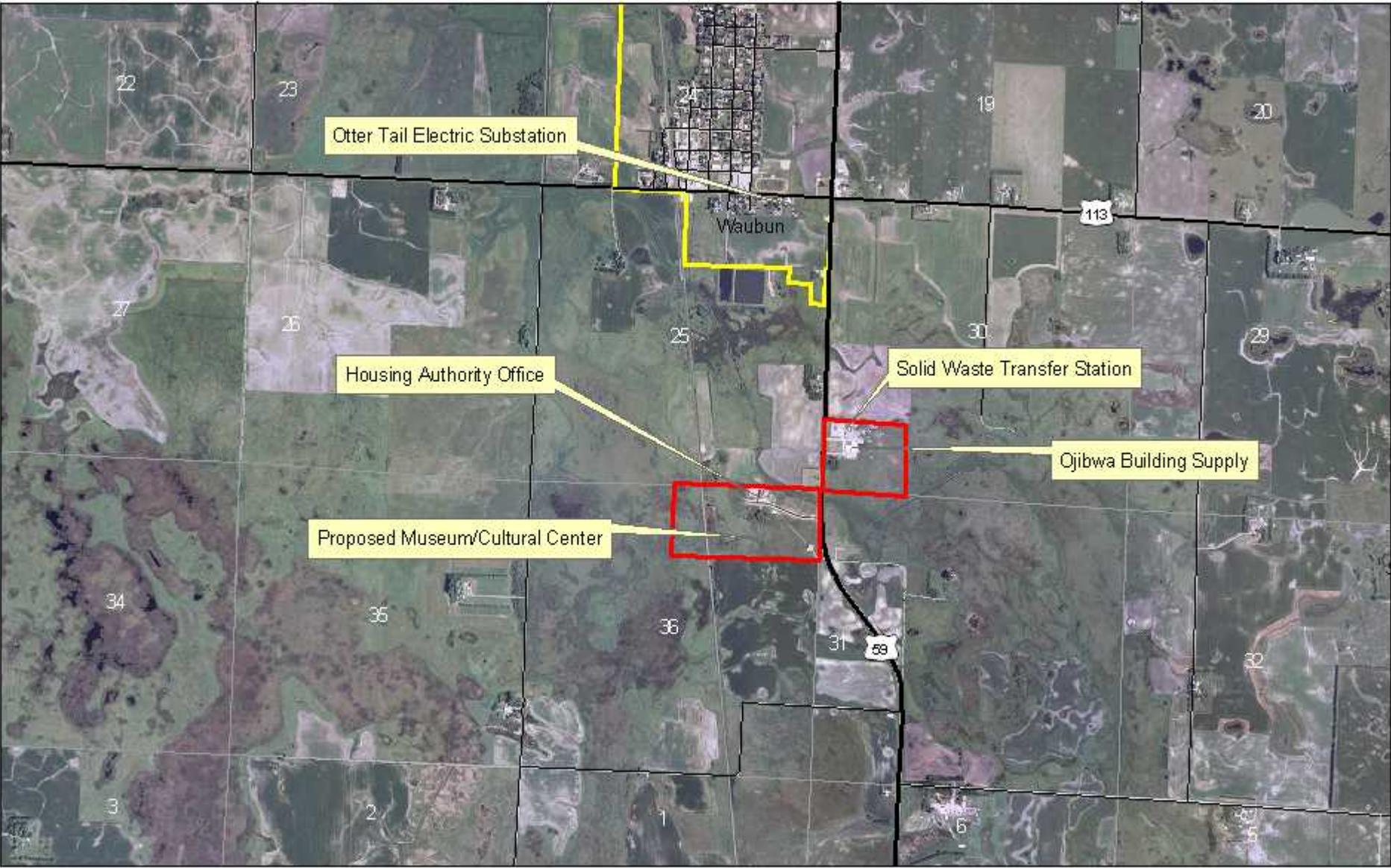
# White Earth Village

Facility	Annual Expenditure ('03-'04)	Location
RTC Building	\$28,799	White Earth
Circle of Life	27,043	White Earth
School	13,135	White Earth
Congregate		White Earth
Housing		White Earth
new Community		White Earth
Center		
new COL School		
new Tribal Adm. Bldg.		

# Waubun

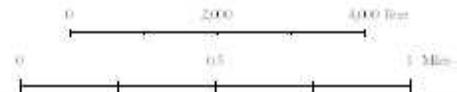
Facility	Annual Expenditure (‘03-’04)	Location
Ojibwa Building	\$10,875	Waubun
Solid Waste	4,900	Waubun
Center	-	Waubun
Housing Authority		

# White Earth Reservation Waubun Area



**Legend**

US Highway	Section Lines
State Highway	City's
County & Township Road	Tribal Land
BIA	
UIP	



# Tribal Ranch

Facility	Annual Expenditure (‘03-’04)	Location
Biology	\$7,011	Ranch
Food Distribution	6,207	Ranch
Land Surveyor	3,355	Ranch
Ranch Buildings	879	Ranch
Garment Factory	785	Ranch
EPA Office		

# Chosen Resource

Wind Production:

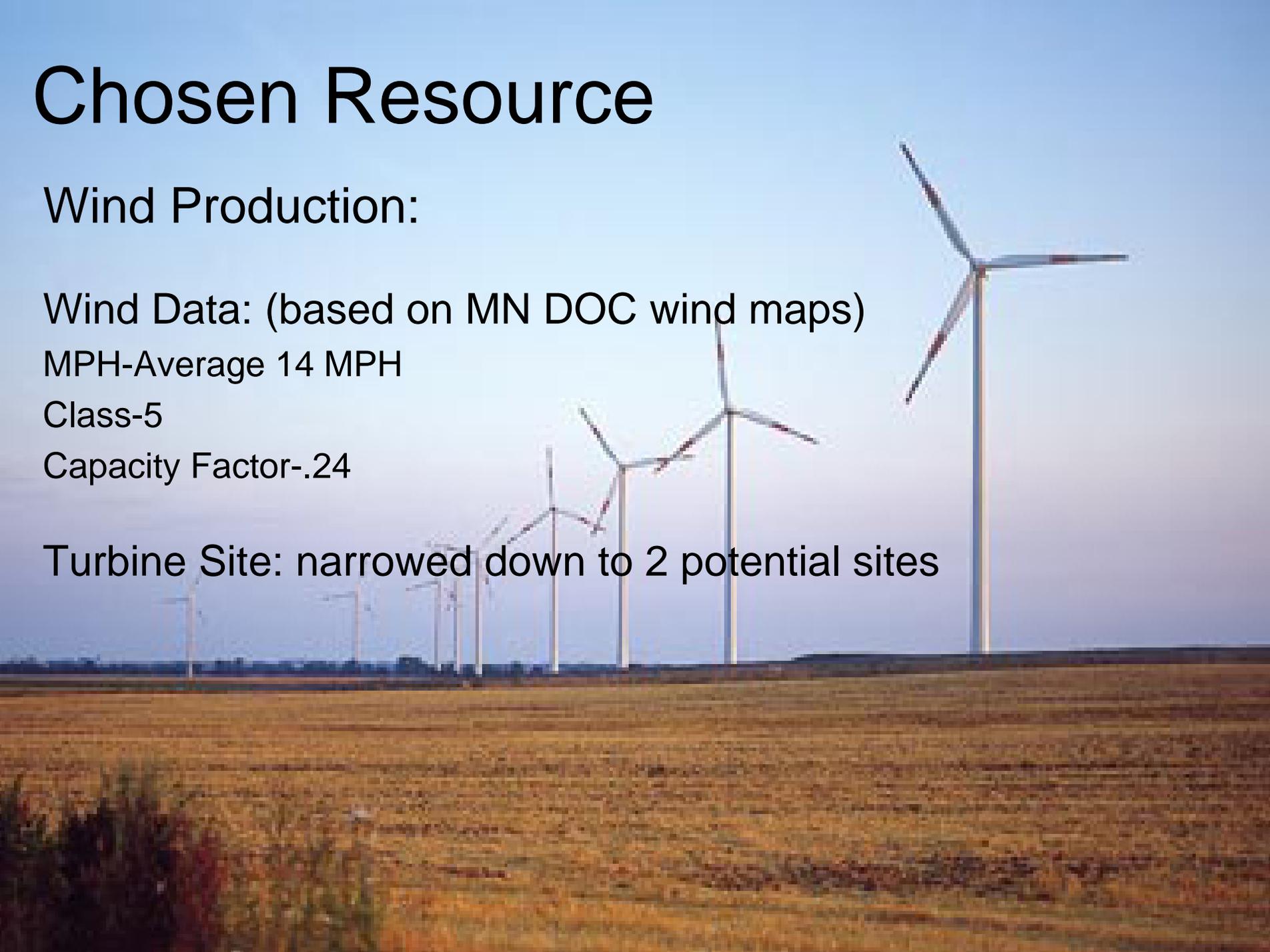
Wind Data: (based on MN DOC wind maps)

MPH-Average 14 MPH

Class-5

Capacity Factor-.24

Turbine Site: narrowed down to 2 potential sites



# Proposed White Earth Project



- Approximately 600 kW of wind to power the new school, tribal offices, and new community center
- 20% hydrogen backup (electrolysis, hydrogen storage, and fuel cell)
- All electricity production to be consumed by the reservation
- Community Education

# White Earth Model Output: 2 Scenarios

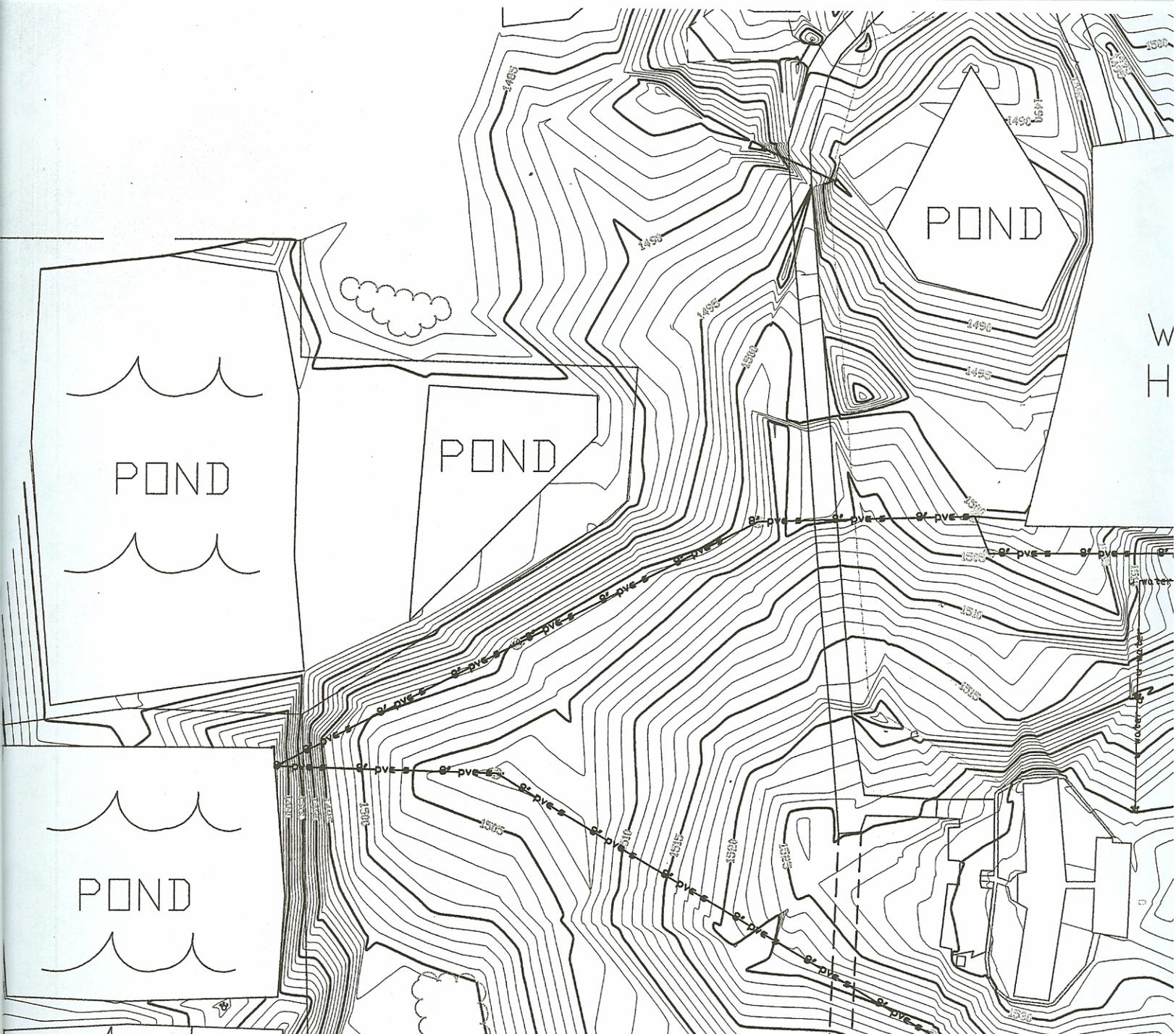
## No Hydrogen Storage

	<u>Capacity</u>	<u>Cost</u>
<u>Wind</u>	516 kW	\$521,643
<u>Electrolysis</u>	0	\$0
<u>Fuel Cell</u>	0	\$0
<u>Total System Cost</u>		\$521,643
<u>Annual Renewable</u>		\$45,471
<u>Annual Utility</u>		\$84,500

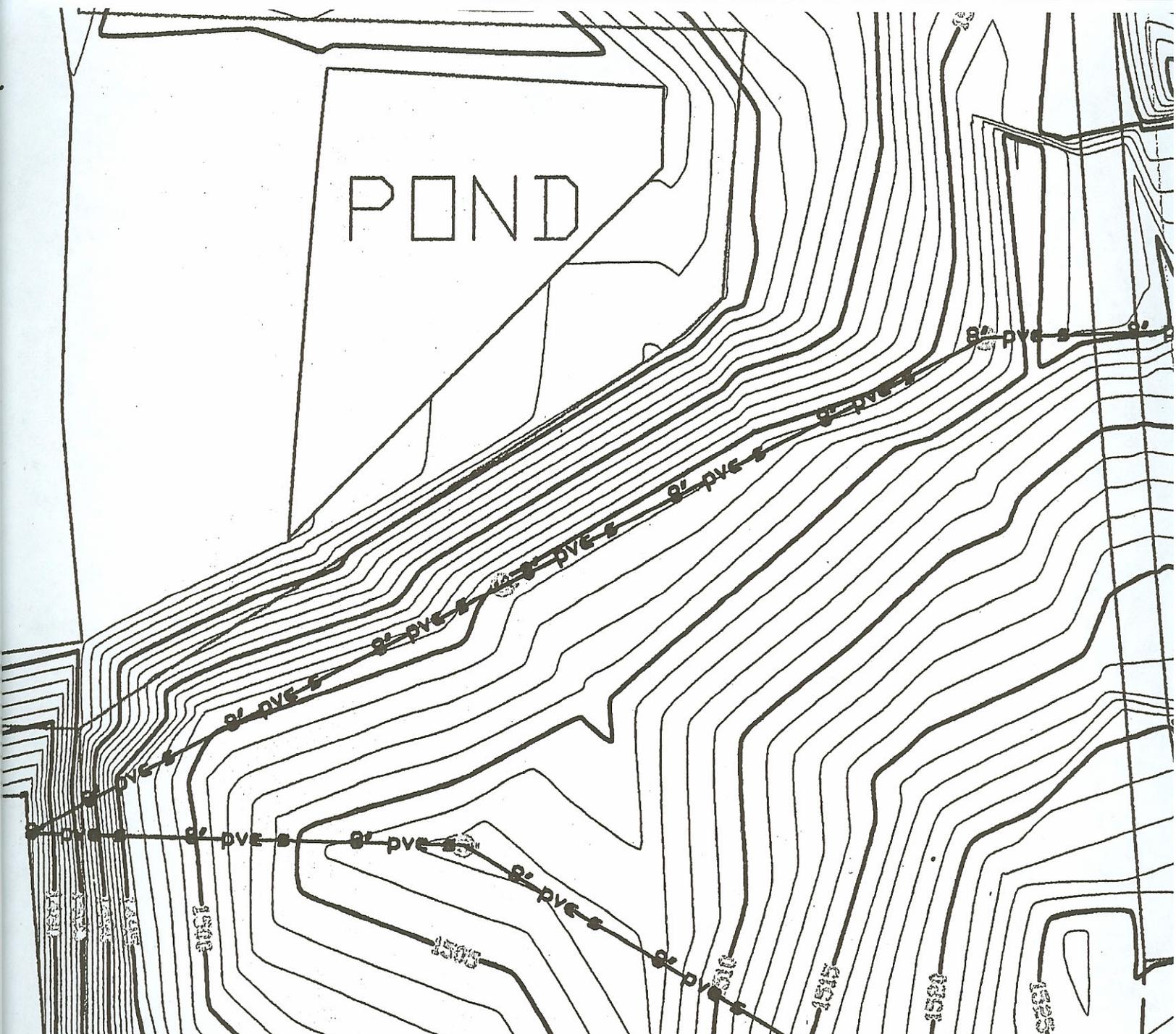
## 20% Hydrogen Storage

	<u>Capacity</u>	<u>Cost</u>
<u>Wind</u>	570 kW	\$687,785
<u>Electrolysis</u>	5.65 Nm <sup>3</sup> /hr	\$90,454
<u>Fuel Cell</u>	11.91 kW	\$71,095
<u>Total System Cost</u>		\$849,334
<u>Annual Renewable</u>		\$66,886
<u>Annual Utility</u>		\$84,500

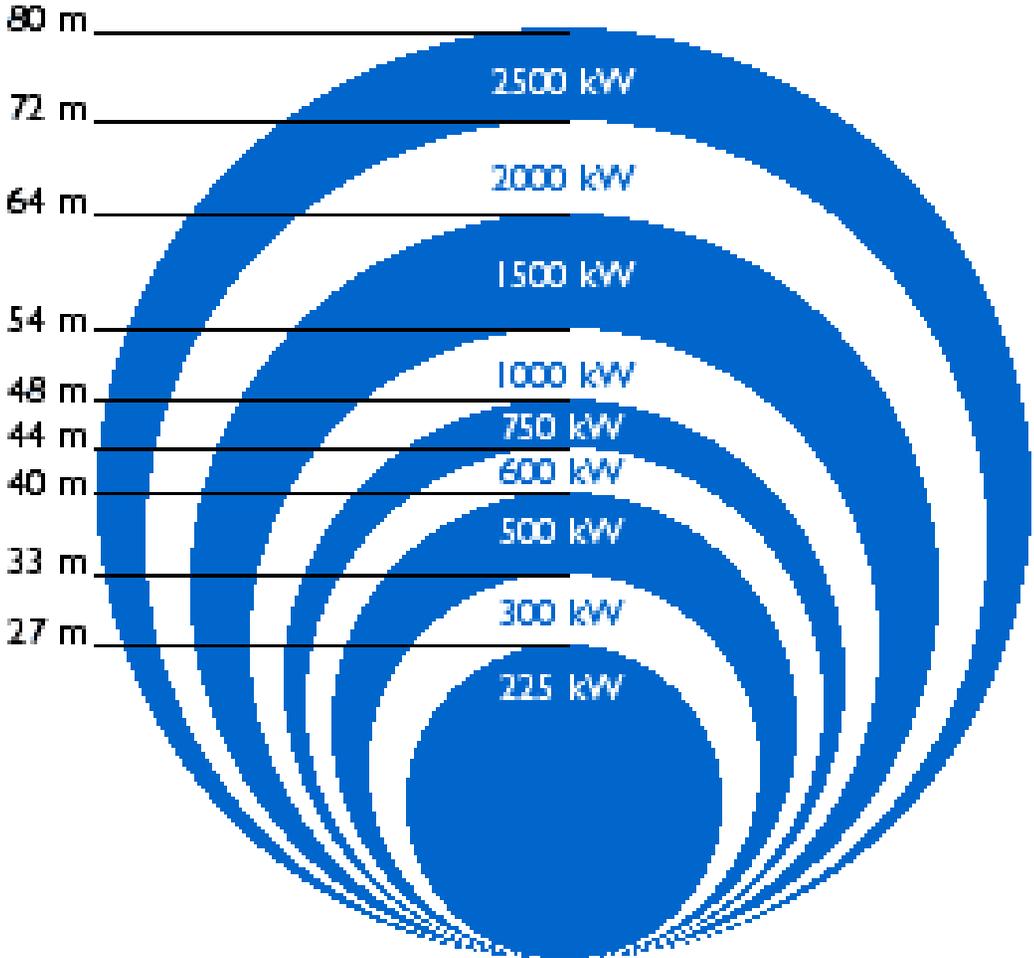




POND



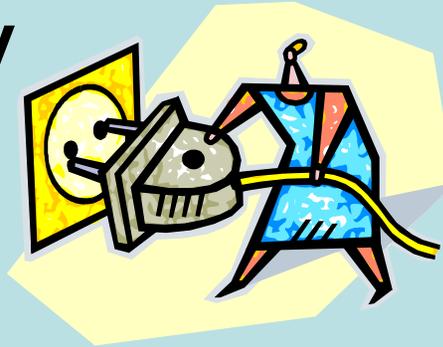
# Figure 2. Swept Area Diagram



# Leech Lake



# Major Electricity Consumer:



Casino: 2002- 6,027,840 kW/H  
2003- 6,427,320 kW/H

Annual Cost: \$385,640.00

# Wind Resource

Wind Production:

Wind Data:

MPH-10

Class-2

Capacity Factor-.08

Turbine Site: Several other potential sites to be explored



# Proposed Project Leech Lake

- Approximately 1MW to power fraction of casino's demand
- Community Education



# Leech Lake Model Output

## No Hydrogen Storage

	<u>Capacity</u>	<u>Cost</u>
<u>Wind</u>	1000 kW	\$951,959
<u>Electrolysis</u>	0	\$0
<u>Fuel Cell</u>	0	\$0
<u>Total System Cost</u>		\$951,959
<u>Annual Renewable cost</u>		\$66,287
<u>Annual Utility cost</u>		\$82,200

Total annual production 1.36 million kWh  
(production lower due to small capacity factor (less wind))

# Accomplishments

Wind resource evaluation

Tribal energy load assessment

Alternative energy application Assessment

Comprehensive strategic plan with implementation  
recommendations

Community-based energy development financing  
proformas

Educational materials

# Grand Portage

Focus on one 1-2 MW turbine or 3 x 660 KW

Mount Maud site – 3-6 mile (\$200,000-\$400,000) power line

Connect behind the meter to offset casino purchases

1.5 MW turbine focus

Funding: loan from Mystic Lake, and green tags from Native Energy

Added Planner to staff project

Application for NREL anemometer

# White Earth

Potential for 500-750 KW turbine – governmental facilities

Potential for several 50 KW turbines – scattered facilities

Received \$990,000 Congressional Earmark

Hiring Project Consultant Team

40 m meteorological tower in place – prime site

Focus on White Earth village

# Leech Lake

Focus on Northern Lights Casino site  
50 m meteorological tower in place at Casino





# Recommendations

- Approve an overall renewable energy standard for the White Earth Reservation, and a set of goals for tribal energy use, including fuel, heating and electricity.

# Recommendations

- Join tribal governments, states, and cities nationally to volunteer to meet the standards set by the Kyoto Accord and mitigate green house gas emissions and global climate change through tribal policy.

# Recommendation

- Establish a tribal energy act and a tribal utility, modeled after tribal utilities nationally.

# Recommendation

- Develop a tribal energy efficiency program aimed at reducing tribal heat, electricity and fuel consumption through use of presently available products distributed through tribal programs and through retail outlets on the reservation.

# Recommendation

- Create a tribal housing initiative which includes passive solar energy and efficiency as a cornerstone of the program, and instill solar heating panels as requested on present tribal homes to increase efficiency.

# Recommendation

- Create a tribal wind energy program aimed at providing electricity for the reservation, and providing wind energy as a significant export economy for the White Earth tribe.

# Recommendation

- Develop a model Tribal Casino efficiency and renewables program utilizing fuel oil, solar panels, hybrid vehicles, energy efficient light bulbs, and wind energy to both offset energy costs of our tribal enterprise, and to be a model of potential tribal and regional self determination.

# Recommendation

- Secure energy efficiency and ethanol based tribal vehicles, as well as bio-diesel vehicles for tribal operations.

# Recommendation

- Join Intertribal Council on Utility Policy to insure our tribe is a part of regional and national policies and development opportunities.

# Recommendation

- Join the White Earth Tribal College with the Northwest Technical College in a training program aimed at preparing a tribal work force to carry out, implement, maintain and create a new energy economy for the White Earth reservation, and subsequently for the region.

# Recommendation

- Investigate bio-fuels opportunities for tribal heating and energy in villages and facilities on the reservation.

# Recommendation

- In a growing renewable energy economy internationally and nationally, seek opportunities for light manufacturing, assembly, and ownership of a solar, wind in an alternative fuels market poised for explosive growth.