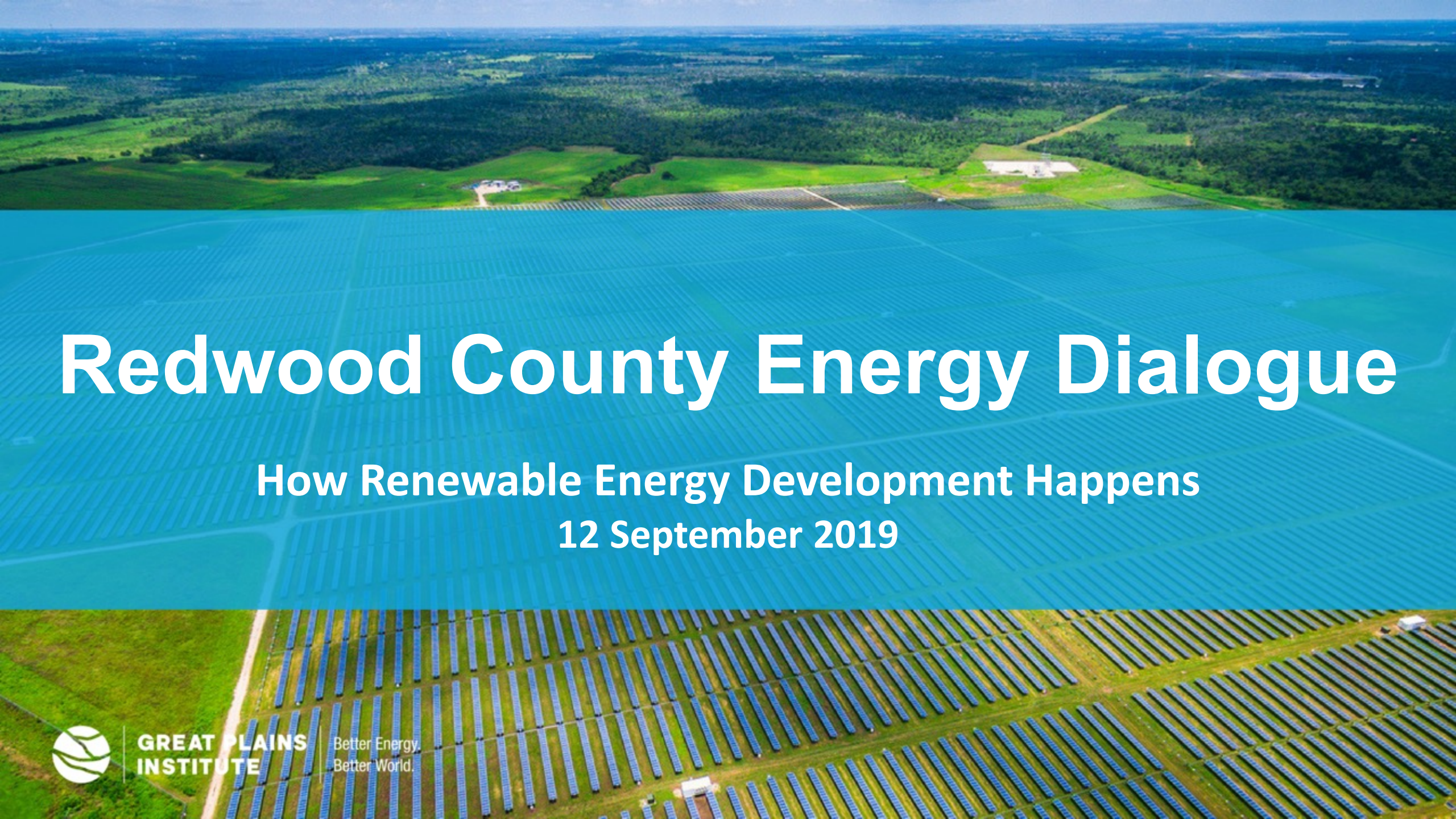
Redwood County Energy Dialogue

How Renewable Energy Development Happens

12 September 2019



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Agenda

- Introduction to Wind and Solar Technologies and Markets
- Policy, Regulatory, and Economic Context
- Actor Map and Scenario Example
- Resource Data

TRANSFORMING THE ENERGY SYSTEM TO BENEFIT THE ECONOMY AND ENVIRONMENT.

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Scope of "Utility-Scale"

Utility-Scale Solar

What it is:

- Solar PV, typically 1MW or greater (10MW for transmission asset)
- Owned and operated by utility
- Can be a community solar garden

What it is *not*:

- Less than ~1MW
- Rooftop solar
- Alternative solar energy systems (water heating, etc.)
- Small-scale ground-mounted solar

Utility-Scale Wind

What it is:

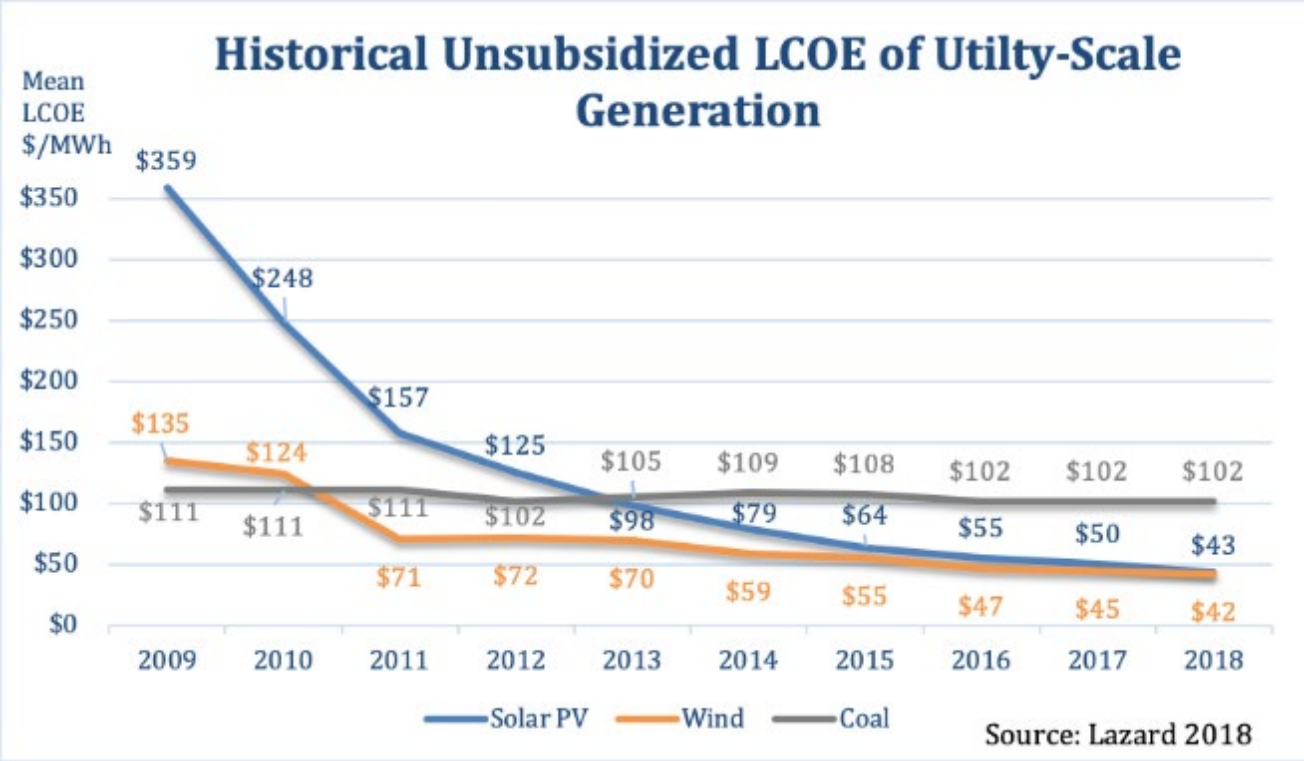
- Turbine generation capacity *typically* equivalent to 1MW or greater (25MW for jurisdictional authority designation)
- Multiple turbines

What it is *not*:

- A single turbine
- Alternative wind technologies (wind mill)

Market Forces

- Renewable energy technologies have an increasingly prominent role in energy systems
- Utility-scale **wind** energy is the cheapest form of electric generation in the world, and the cost continues to go down
- Utility-scale solar energy is expected to achieve parity with wind in the next couple of years, among the cheapest forms of electricity in the world



Source: Advanced Energy Economy, “The numbers are in and Renewable are Winning On Price Alone” https://blog.aee.net/the-numbers-are-in-and-renewables-are-winning-on-price-alone

Utility Resource Plans

- **2018 - Xcel Energy** announces a plan to reduce carbon emission by 80% carbon-free by 2030, and to be 100% carbon free by 2050
- **2019 – other utilities** make similar announcements for 80 -100% carbon free electric generation by 2050
- **Eight States** have passed laws committing to 100% carbon-free electric generation by 2050. Minnesota

Source: Union of Concerned Scientists, https://blog.ucsusa.org/jeff-deyette/states-march-toward-100-clean-energy-whos-next

Lowering cost of solar and wind energy

effects long-term planning for

- Solar & Wind Developers
- Local Governments
  - Land Use Considerations
  - Maximizing community benefits
- Utilities

More proposed projects are going to be coming to your community.

If you remember one thing…

Renewable energy development is a significant growth industry that will play an increasing role in your county's land use and economic development decision making.

Photo credit: Brian Ross

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If you remember two things…

Renewable energy development is a land use and economic choice, like any other type of development

- ✓ Investment in the community with economic returns; taxes, rents, jobs
- ✓ Development option that is part of the bundle of property rights
- ✓ Creates synergies or conflicts with other land uses and local resource opportunities
- ✓ It's not a yes or no decision: The community can shape siting and site design decisions to maximize benefits and minimize risks

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Photo credit: NREL InSPIRE, Flickr

How Projects Happen: Siting Authority and Minnesota Context

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Statutory Context

Renewable Energy

The Minnesota Legislature passed renewable energy objectives, requiring 25% of total retail electricity sales to be generated by renewable energy sources by 2025.

In 2018, wind energy provided 18% of electric generation, all renewables produced 24%.

Photo credit: Brian Ross

Siting Authority - Solar

	FEDERAL, STATE & LOCAL ROLES	STATE	LOCAL
Solar	Regulating authority for access to direct sunlight for solar energy systems		X
	Environmental review for solar systems equal to or greater than 50 MW*	X	
	Permitting for solar systems less than 50 MW		X

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[1] Minnesota State Statute 462.357 and 394.25
[2] MN Department of Commerce (https://mn.gov/commerce/industries/energy/eera/; https://www.revisor.mn.gov/rules/4410.4600/) https://mn.gov/puc/permitting/

Photo credit: Brian Ross

Siting Authority - Wind

FEDERAL, STATE & LOCAL ROLES		STATE	LOCAL
Wind	Permitting for facilities between 5 MW and 25 MW	X	X
	Permitting authority for large wind facilities over 25 MW	X	
	Expansion of wind system greater than 5 MW	X	
	Siting authority for small wind energy systems		X

Counties in Minnesota have land use authority and approval control for all wind energy projects with a total energy capacity of five (5) MW (between 2 and 4 utility-scale turbines).

Counties can choose to expand their land use authority for wind projects up to 25 MW in capacity (projects with 10-15 turbines).

Case Study Example

Developer “WindPerson” approaches Ms. Landowner about developing a **utility-scale** wind farm on her property. What happens next?

1. Ms. Landowner needs to decide whether to move forward with the development on her land

2. Developer applies for land use permit – *if over 25 MW, at state level. If under 25 MW, at Redwood Co. level*

3. County or State deliberates land use permit – including public meetings and comments

Case Study Example

Developer “WindPerson” approaches Ms. Farmer about developing a **utility-scale** wind farm on her property. What happens next?

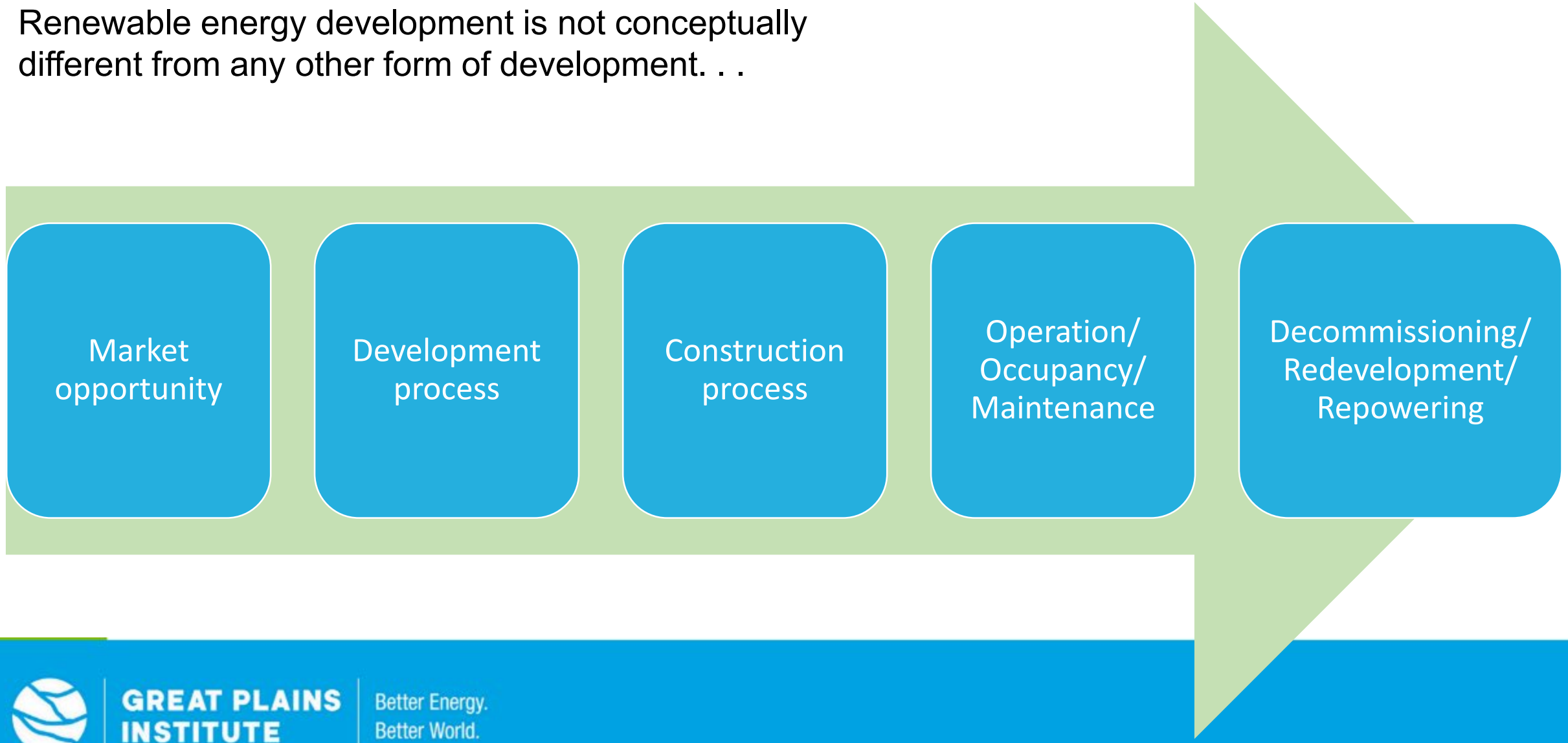
4 County or State considers land use considerations – prime farmland, community character, etc.

5 Environmental Review and other permits considered – including public comments

6 Decision to grant land use permit

Lifecycle of Development

Renewable energy development is not conceptually different from any other form of development. . .



Lifecycle of Development

Renewable energy development stakeholders are not conceptually different from any other form of development. . .

1. Financier
2. Developer
3. Regulators (state and/or local)
4. Contractor (EPC)
5. Owner/Manager 1
6. Market participants (products/services)
    7. Owner/Manager 2
    8. Market participants (products/services)
        9. Owner/Manager 3 . . .

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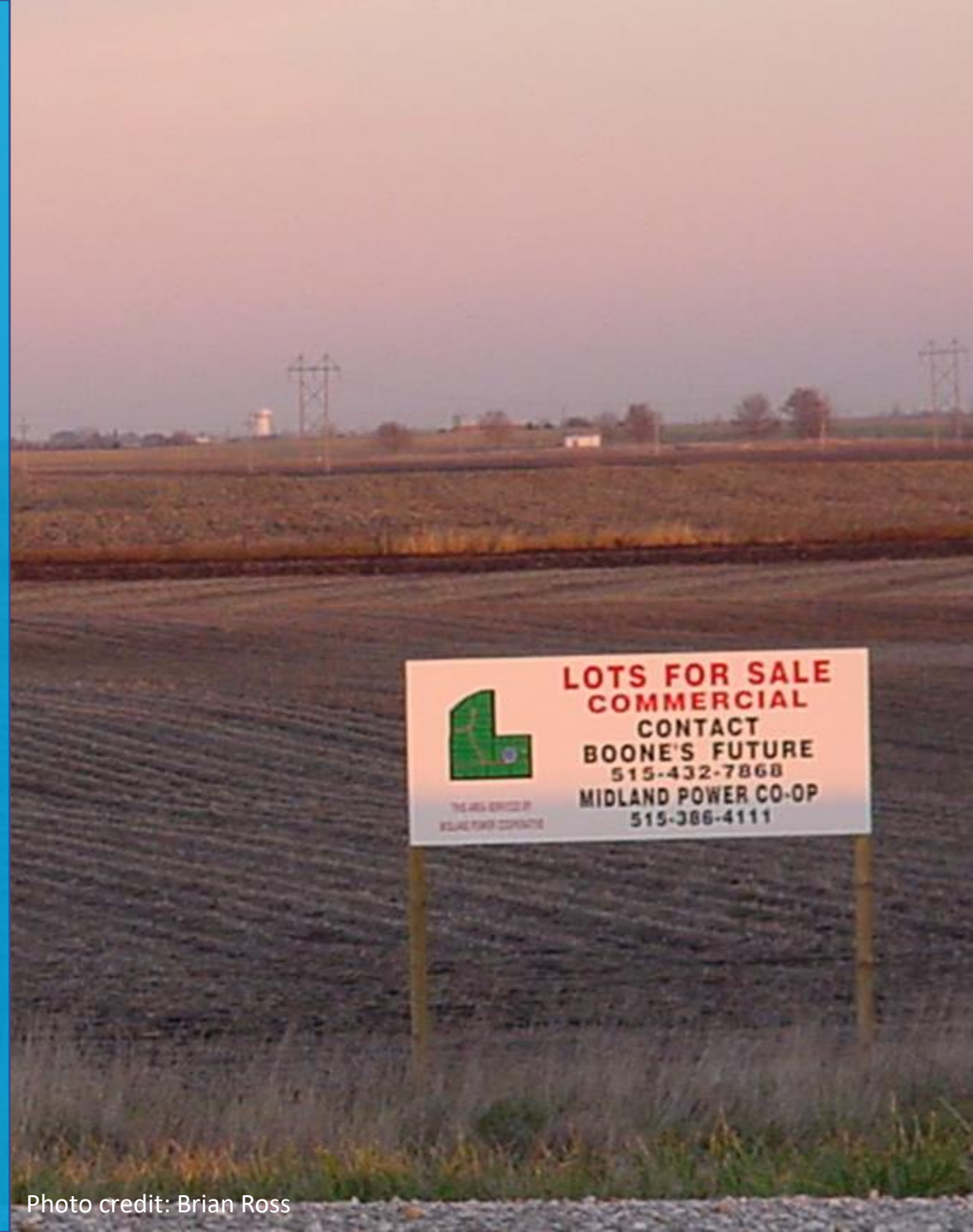
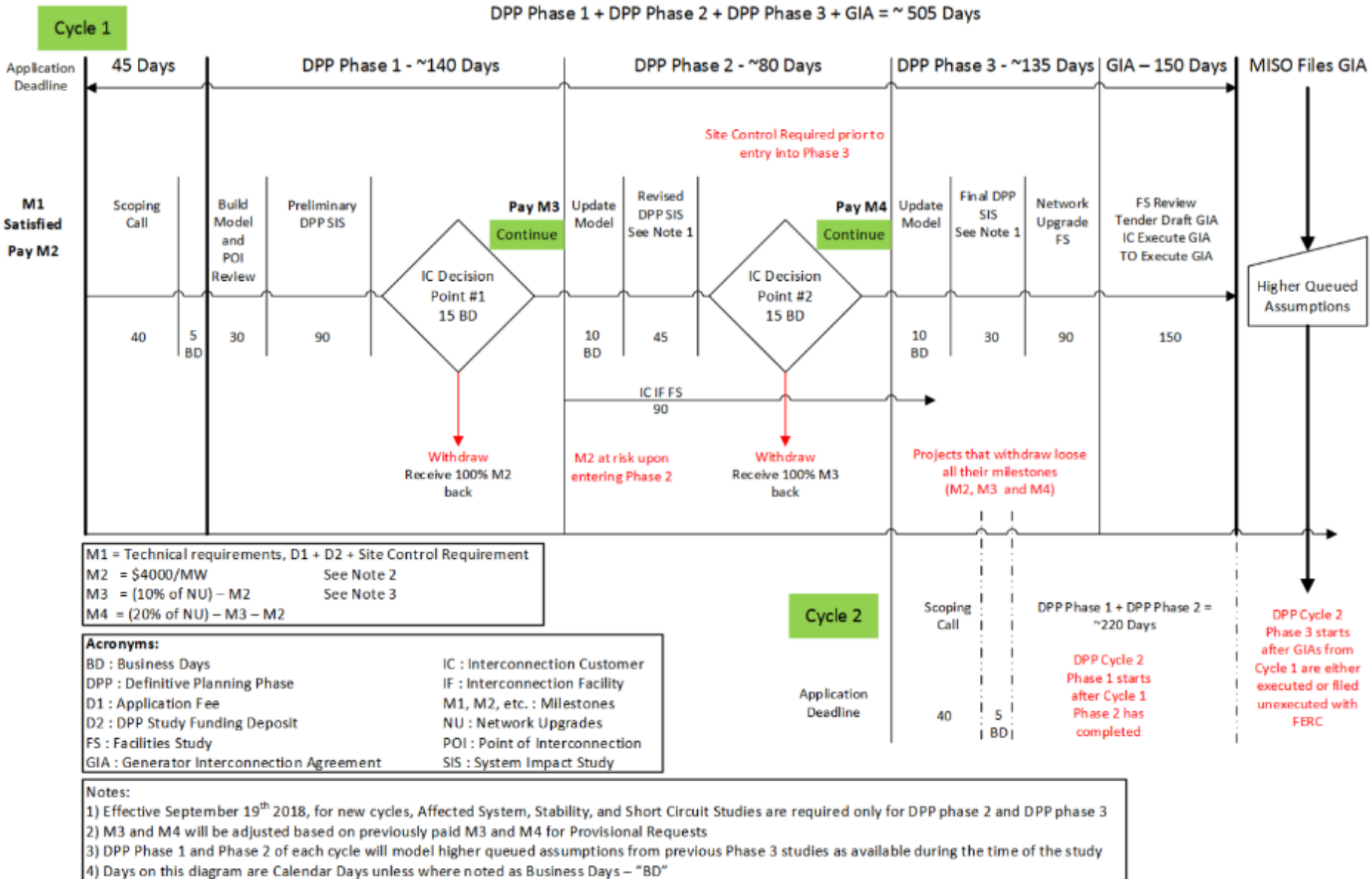


Photo credit: Brian Ross

Midcontinent Independent System Operator (MISO) General Interconnection Process

All utility-scale energy projects (10 MW or greater) must get MISO approval before proceeding…



Source: https://www.misoenergy.org/api/documents/getbyname/GI%20Process%20Flow%20Diagram.pdf

Understanding The Resource Market

- ✓ Wind Resource
- ✓ Solar Resource
- ✓ Existing Solar and Wind Development
- ✓ Prime Farmland
- ✓ Transmission Lines
- ✓ Habitat and Environmental Considerations
- ✓ Population Density
- ✓ Project Development (MISO) Queue

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Existing Resource

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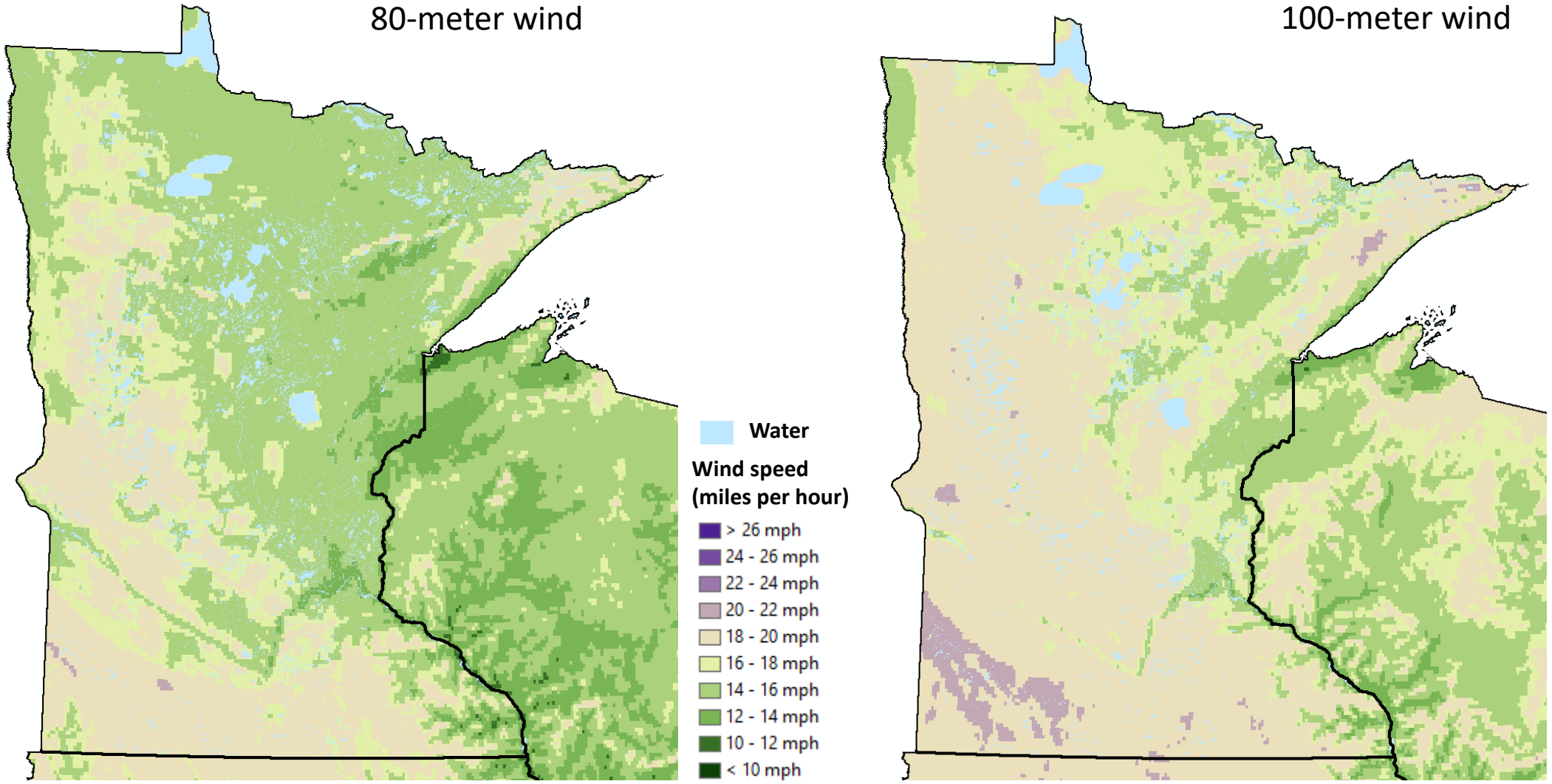
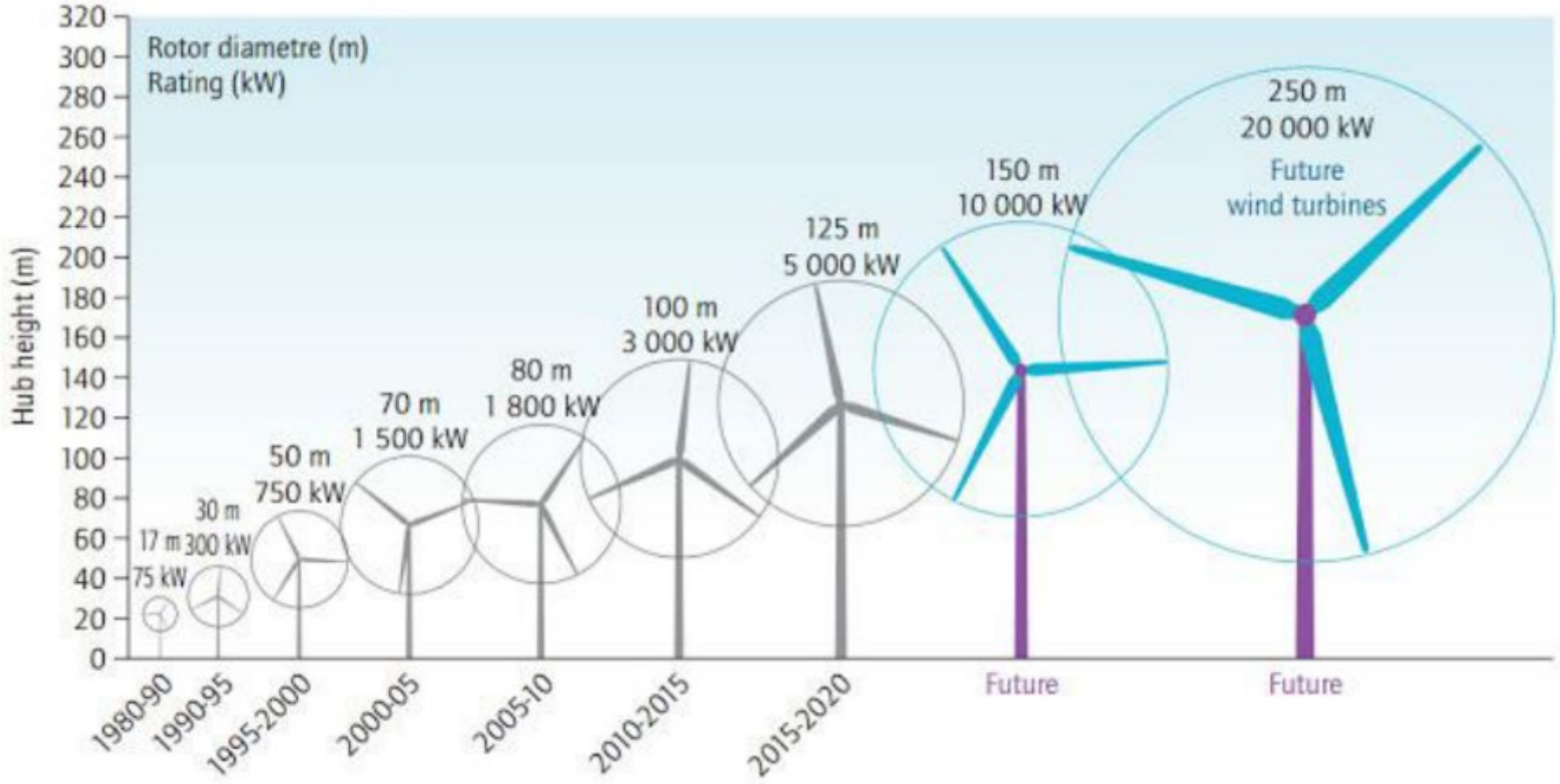
Wind Resource



Data source: National Renewable Energy Lab (NREL) national wind speed data, 2006 - 2013

Wind Resource is three dimensional

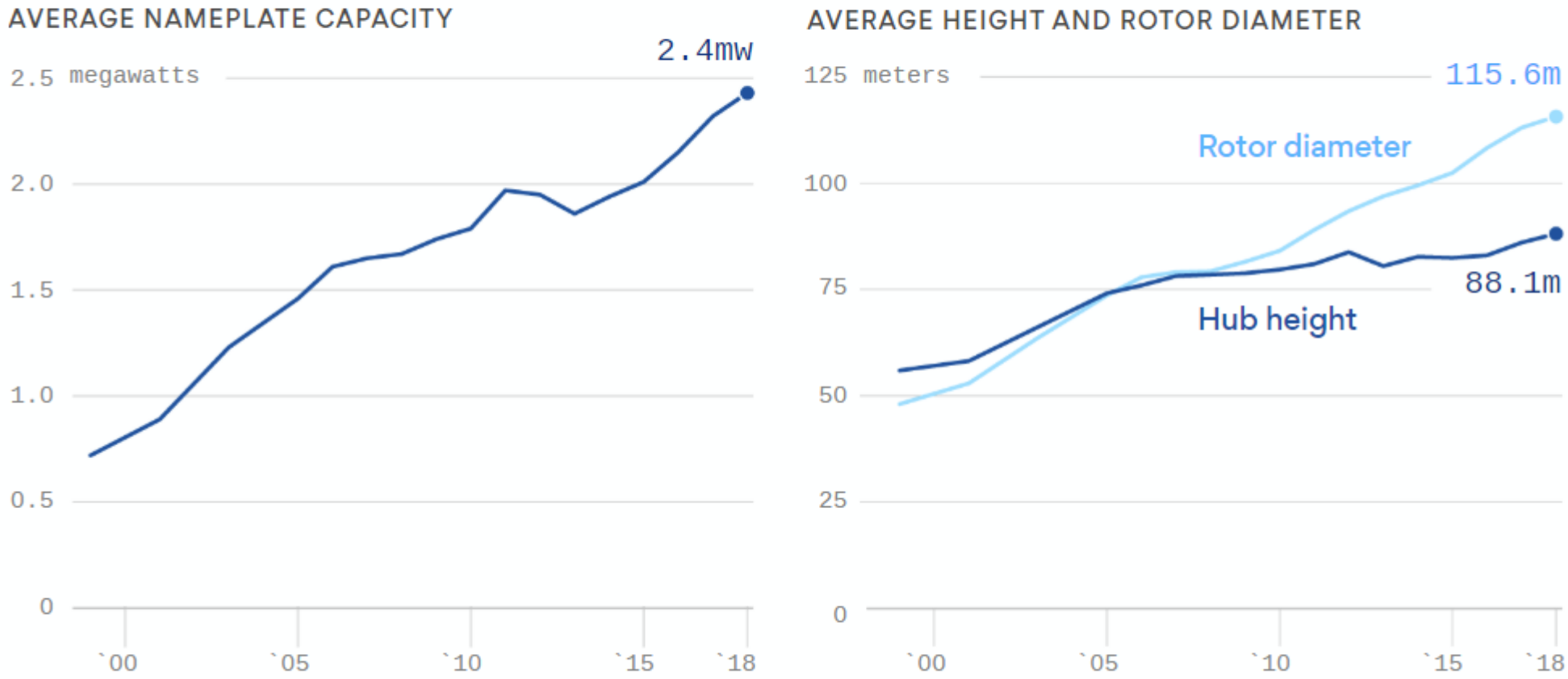


Source: adapted from EWEA, 2009.

Source: "Figure 14: Growth in size of wind turbines since 1980 and prospects" in *Technology Roadmap: Wind Energy, 2013 edition*, International Energy Agency (IEA), 2013 copyright OECD/IEA, page 27, adapted from European Wind Energy Association, 2009. Accessible at: https://webstore.iea.org/technology-roadmap-wind-energy-2013

Wind Resource is three dimensional

Average turbine capacity, hub height, and rotor size for land-based wind projects, 1998-99 to 2018



Data: U.S. Department of Energy; Chart: Axios Visuals

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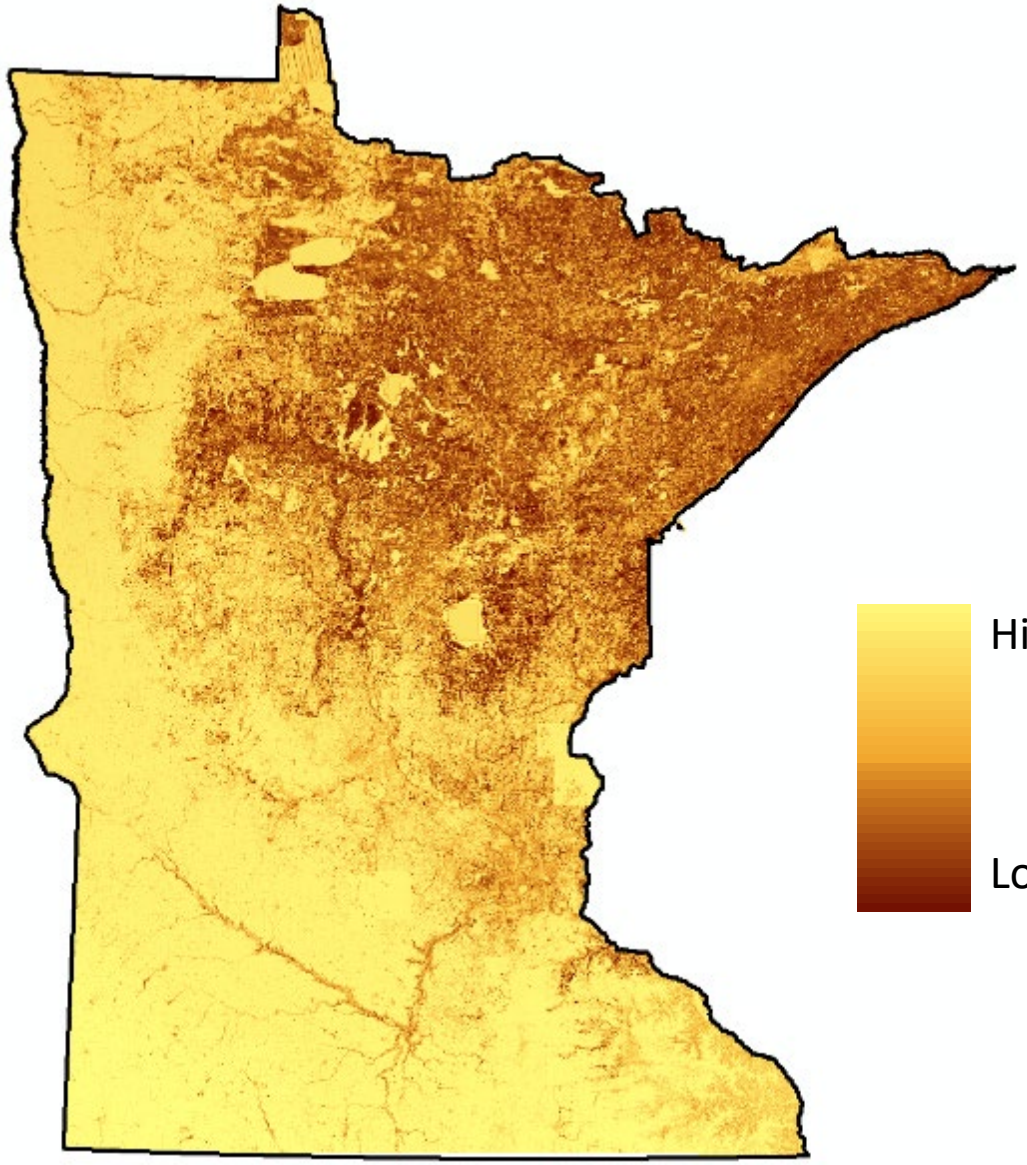
Source: "Average turbine capacity, hub height, and rotor size for land-based wind projects, 1998-99 to 2018", U.S. Department of Energy and Axios. Accessible at: https://www.axios.com/wind-power-renewable-energy-donald-trump-888ec2bc-4f99-4fb1-b2f4-b31160a938e6.html

Solar Resource



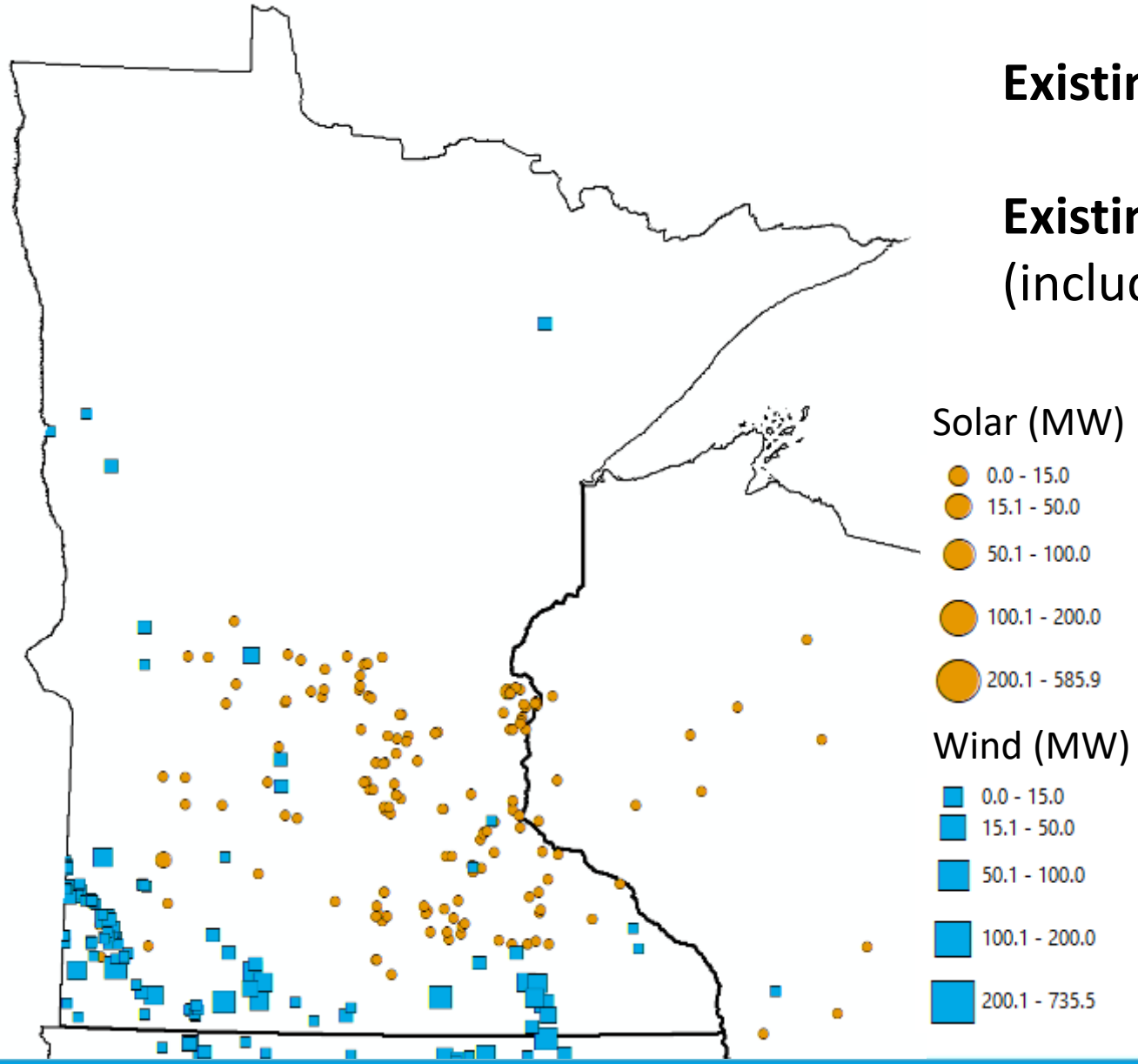
Climate-related factors (clouds, humidity) affect solar resources only about 15%. The solar resource shown here is primarily defined by shading, which is in turn defined by local land uses (buildings, trees).

High solar resource

Low solar resource

Data source: University of Minnesota, Uspatial Solar Insolation Raster Data, 2007 - 2013

Existing Wind and Solar



Existing Wind Capacity – 3,694 MW

Existing Solar Capacity – 1,100 MW
(includes distributed solar)

Data source: EIA-860 Form national power dataset, 2018

Considerations that Impact Resource Use

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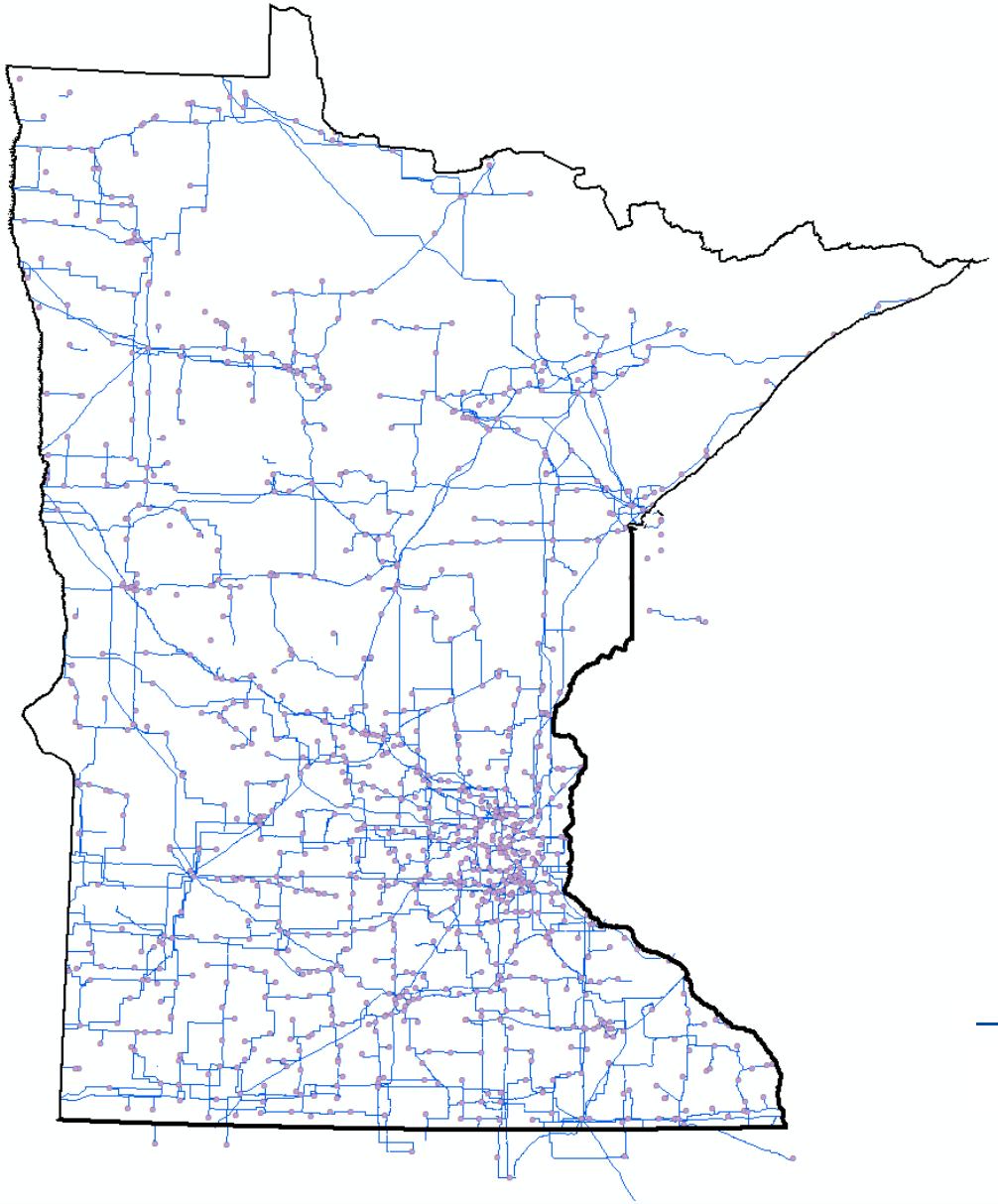
Electricity Transmission



Importance of Interconnection

Solar and wind development is greatly dependent on opportunities to interconnect to the transmission or distribution grid:

- **Utility scale** wind and solar are connected to the transmission grid (**shown here**)
- **Community scale solar** is typically connected to the distribution grid. The distribution grid is must more granular and disperse.

— TRANSMISSION LINES

■ SUBSTATIONS

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Data source: Homeland Infrastructure Foundation-Level Data (HIFLD) from the Federal Geographic Data Committee, Last updated 10/19/18

Weblink: https://hifld-geoplatform.opendata.arcgis.com/datasets/electric-power-transmission-lines?geometry=-77.689%2C44.31%2C-75.105%2C44.994

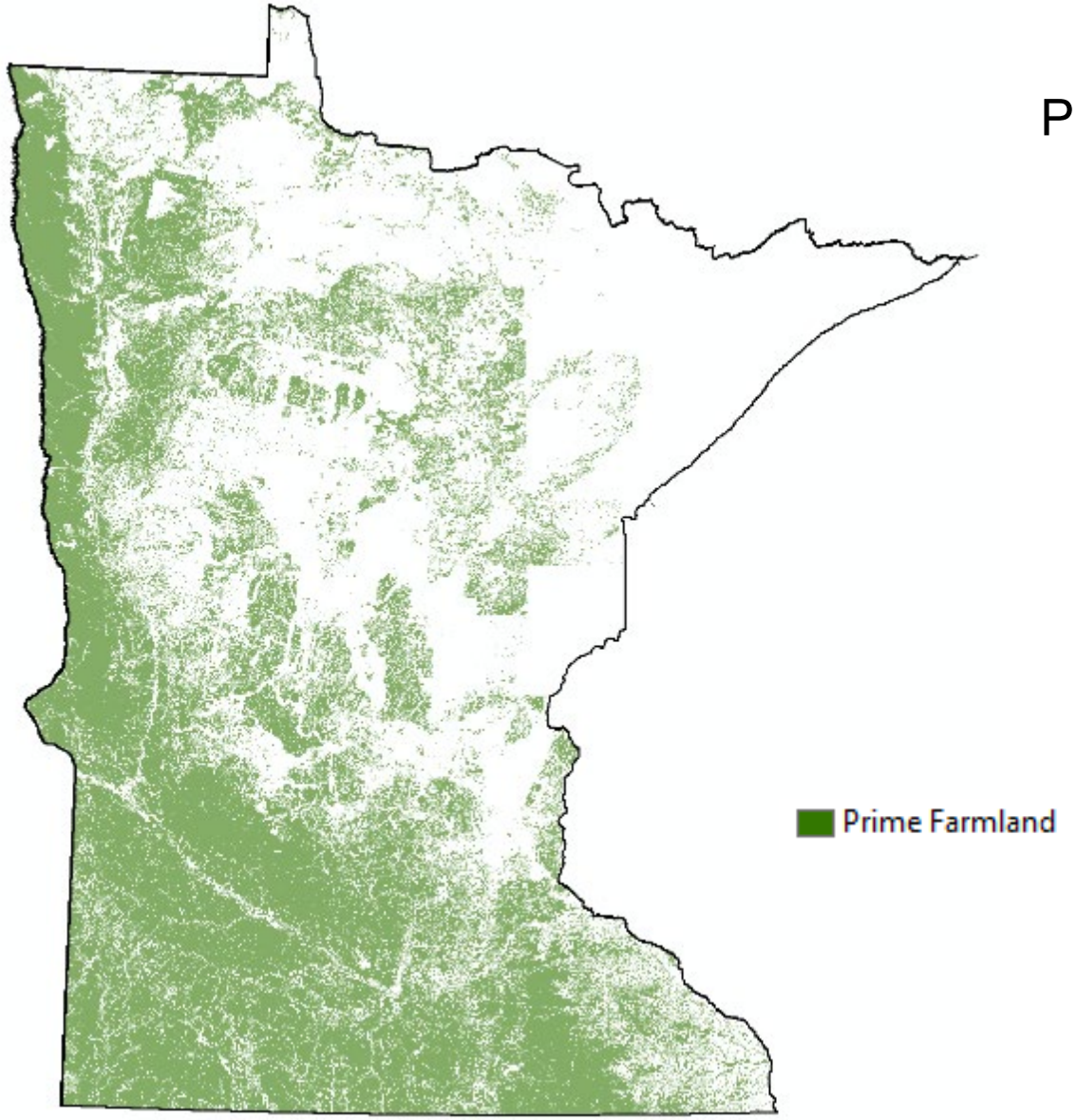
Agricultural Preservation Goals

Prime Farmland Exclusion (Minnesota Administrative Rules, 7850.4400)

Subp. 4.
Prime farmland exclusion.
No large electric power generating plant site may be permitted where the developed portion of the plant site, excluding water storage reservoirs and cooling ponds, includes more than 0.5 acres of prime farmland per megawatt of net generating capacity, or where makeup water storage reservoir or cooling pond facilities include more than 0.5 acres of prime farmland per megawatt of net generating capacity, unless there is no feasible and prudent alternative. Economic considerations alone do not justify the use of more prime farmland. "Prime farmland" means those soils that meet the specifications of Code of Federal Regulations 1980, title 7, section 657.5, paragraph (a). These provisions do not apply to areas located within home rule charter or statutory cities; areas located within two miles of home rule charter or statutory cities of the first, second, and third class; or areas designated for orderly annexation under Minnesota Statutes, section 414.0325.

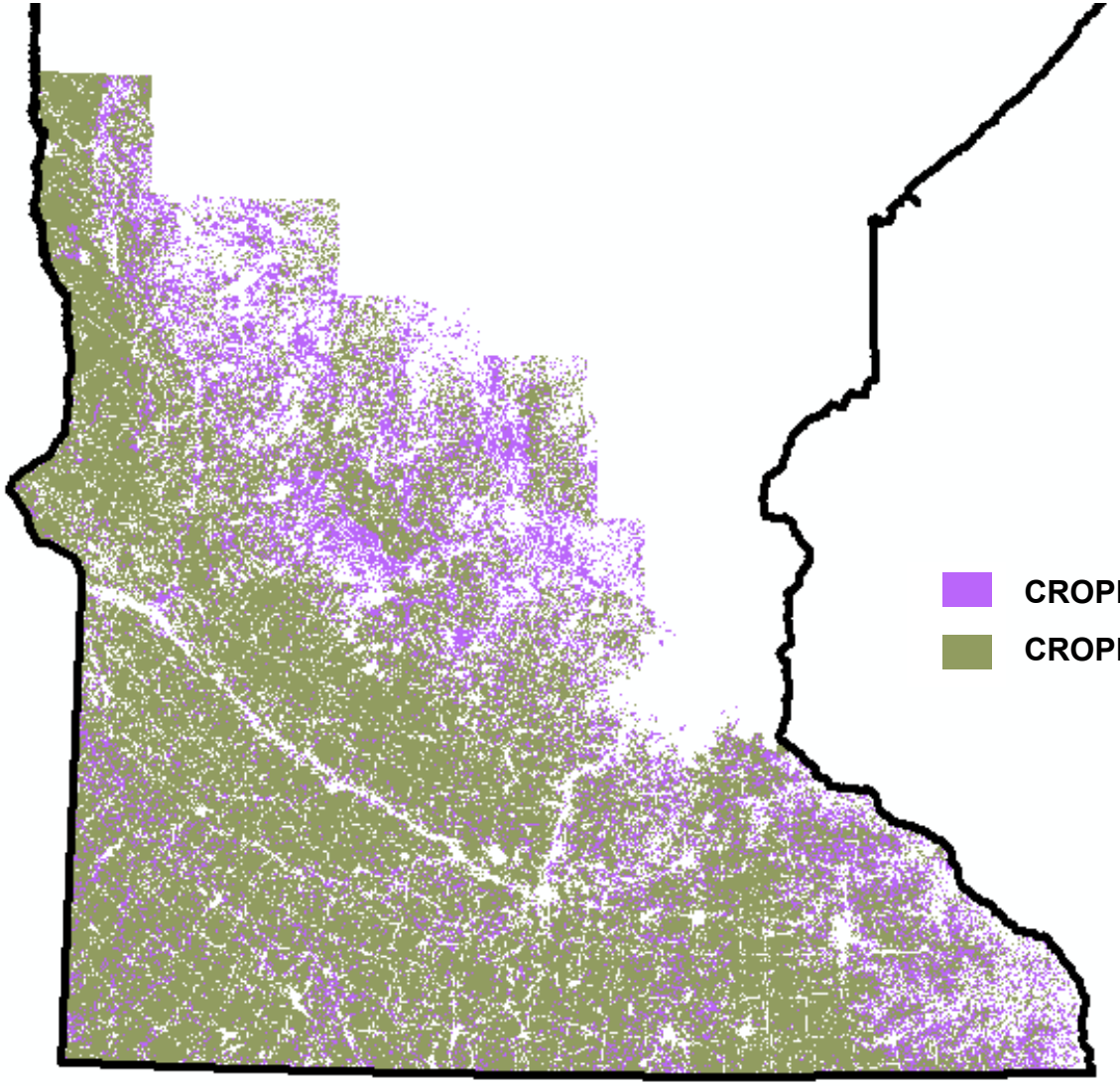
Prime Farmland

Prime Farmland as a **Natural Resource**



Data source: NRCS / USDA prime farmland, ArcGIS Living Atlas Online Layer, 2018

Prime Farmland currently in Cropland



Minnesota Department of Agriculture

Prime Farmland Defined in State Rule

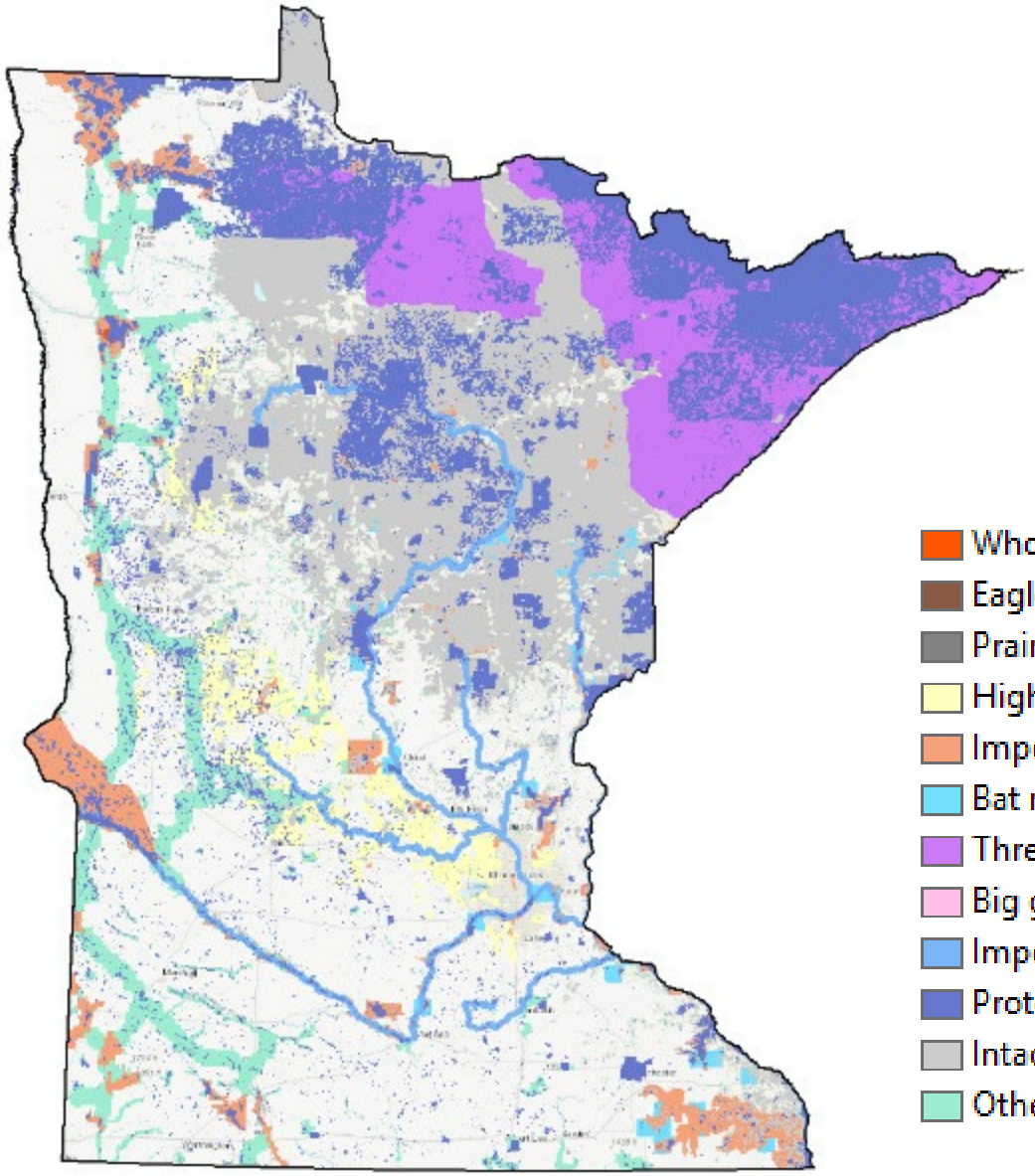
CROPLAND NOT ON PRIME FARMLAND

CROPLAND ON PRIME FARMLAND

Data source: MDA Prime Farmland dataset (aggregated with NRCS Soils dataset), and USDA 2017 Cropland Data

Habitat Consideration

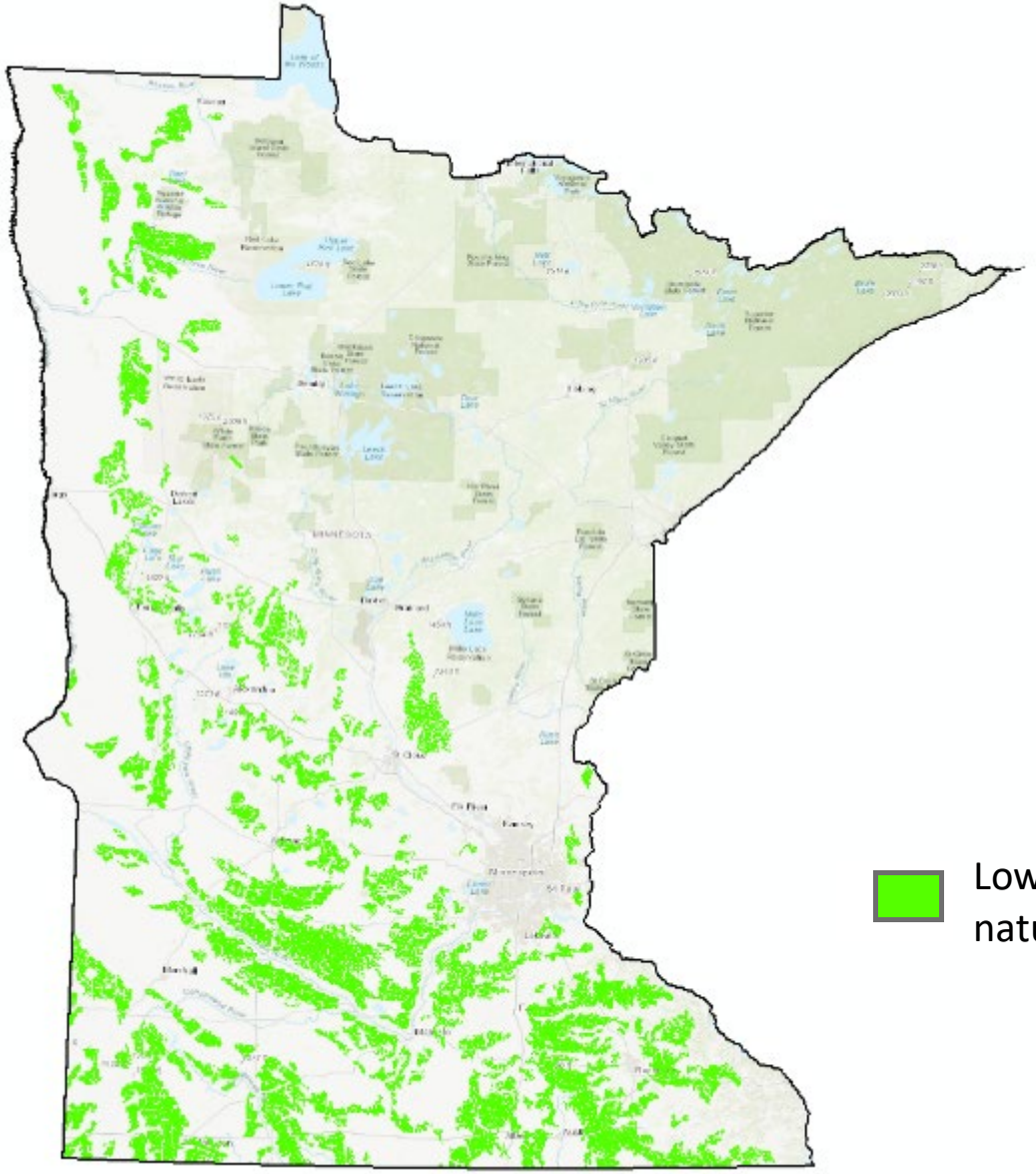
The Nature Conservancy
"Site Wind Right" Project



- Whooping crane stopover sites
- Eagles / other raptors
- Prairie grouse
- High waterfowl breeding density
- Important bird areas
- Bat roosts
- Threatened / endangered species
- Big game
- Important wetlands / rivers
- Protected / managed lands
- Intact natural habitats
- Other biodiversity significance

Data source: The Nature Conservancy, Site Wind Right Analysis, July 2019

Low-Risk Wind Analysis



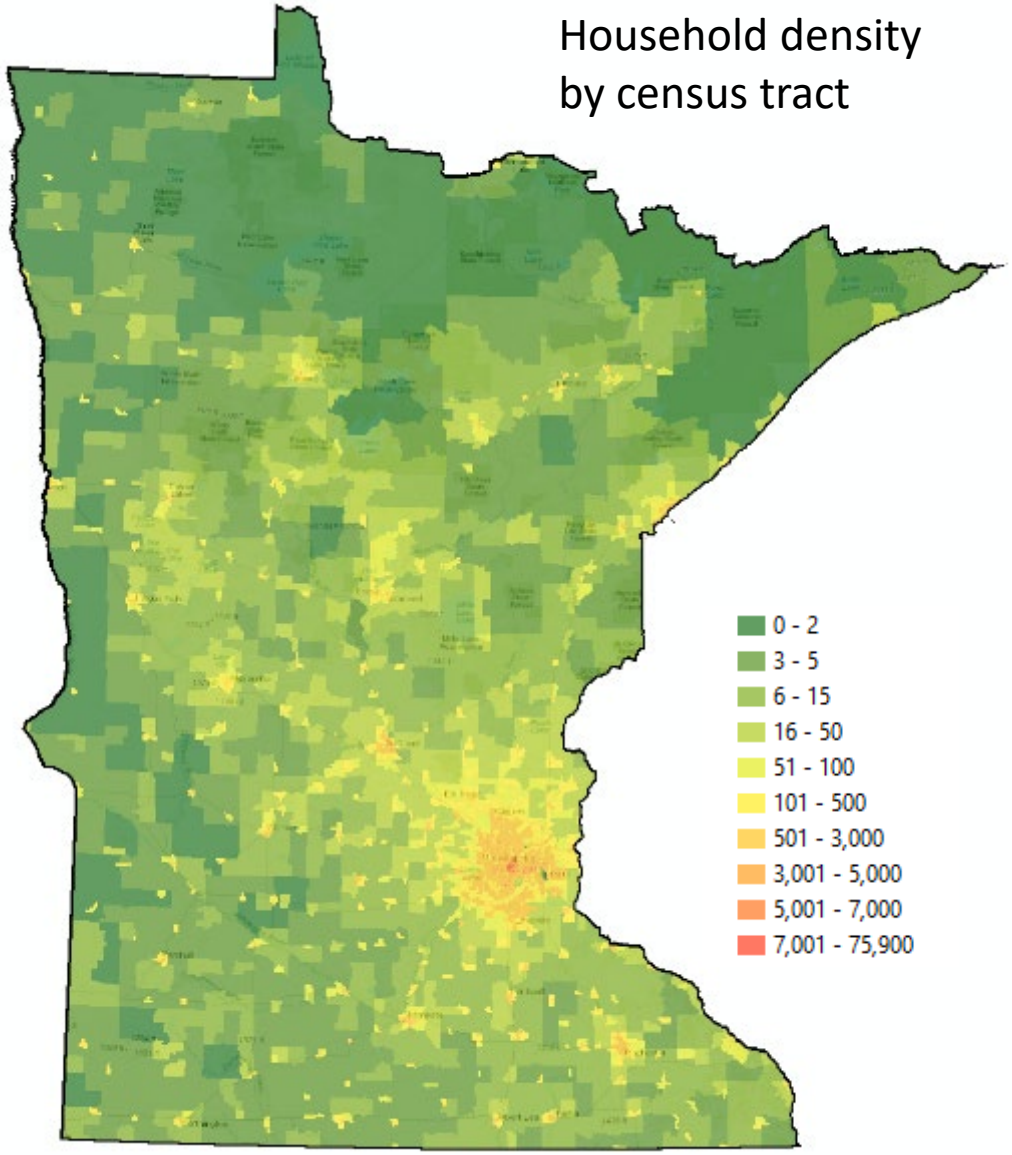
The Nature Conservancy
"Site Wind Right" Project

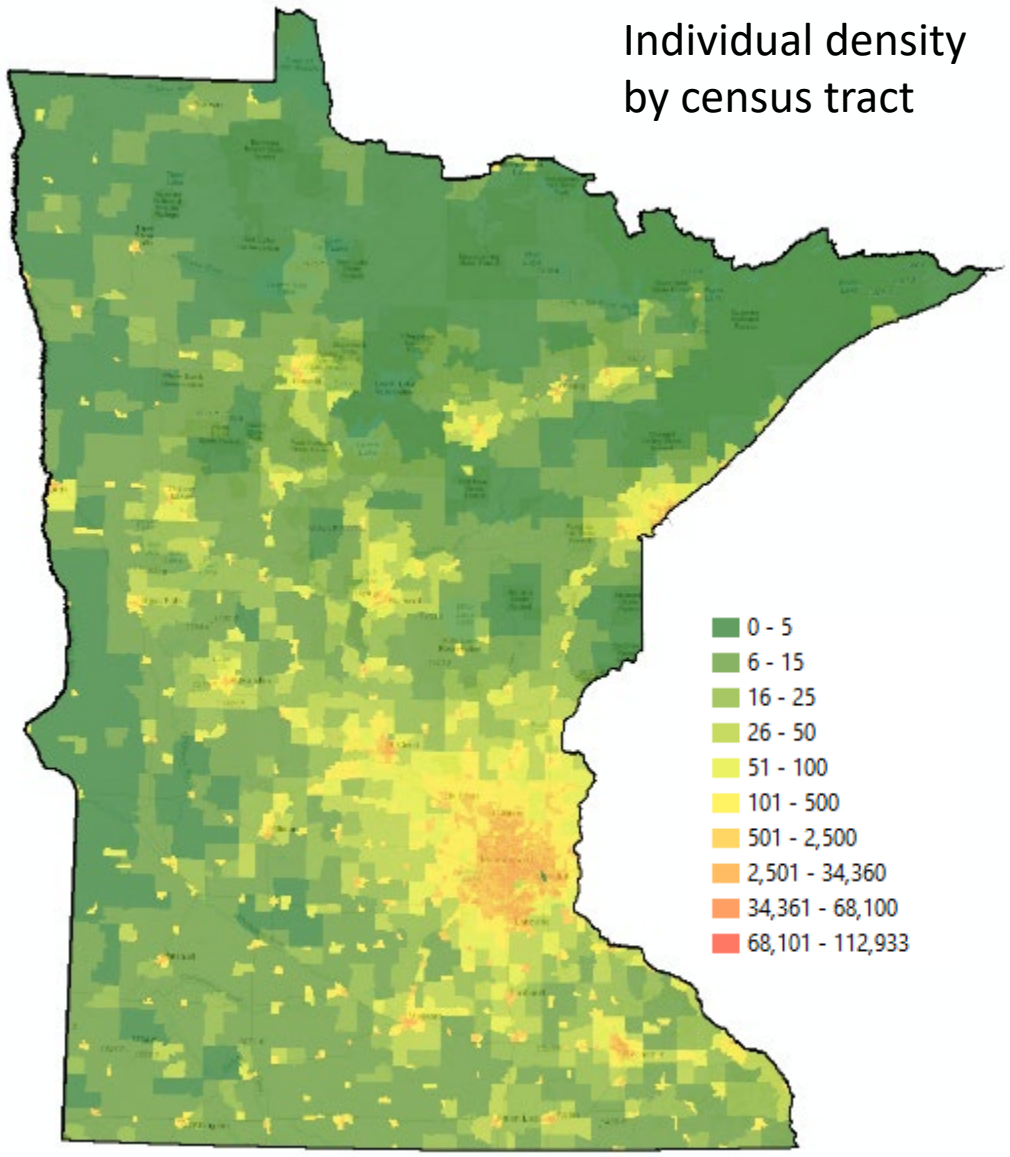
Low-Risk Wind Siting from a habitat and natural areas perspective

**Representation, NOT go, no-go*

Data source: The Nature Conservancy, Site Wind Right Analysis, July 2019

Population Density





Data source: United States American Community Survey Data, 5-year Summaries (2013 – 2017)

Prospective Considerations

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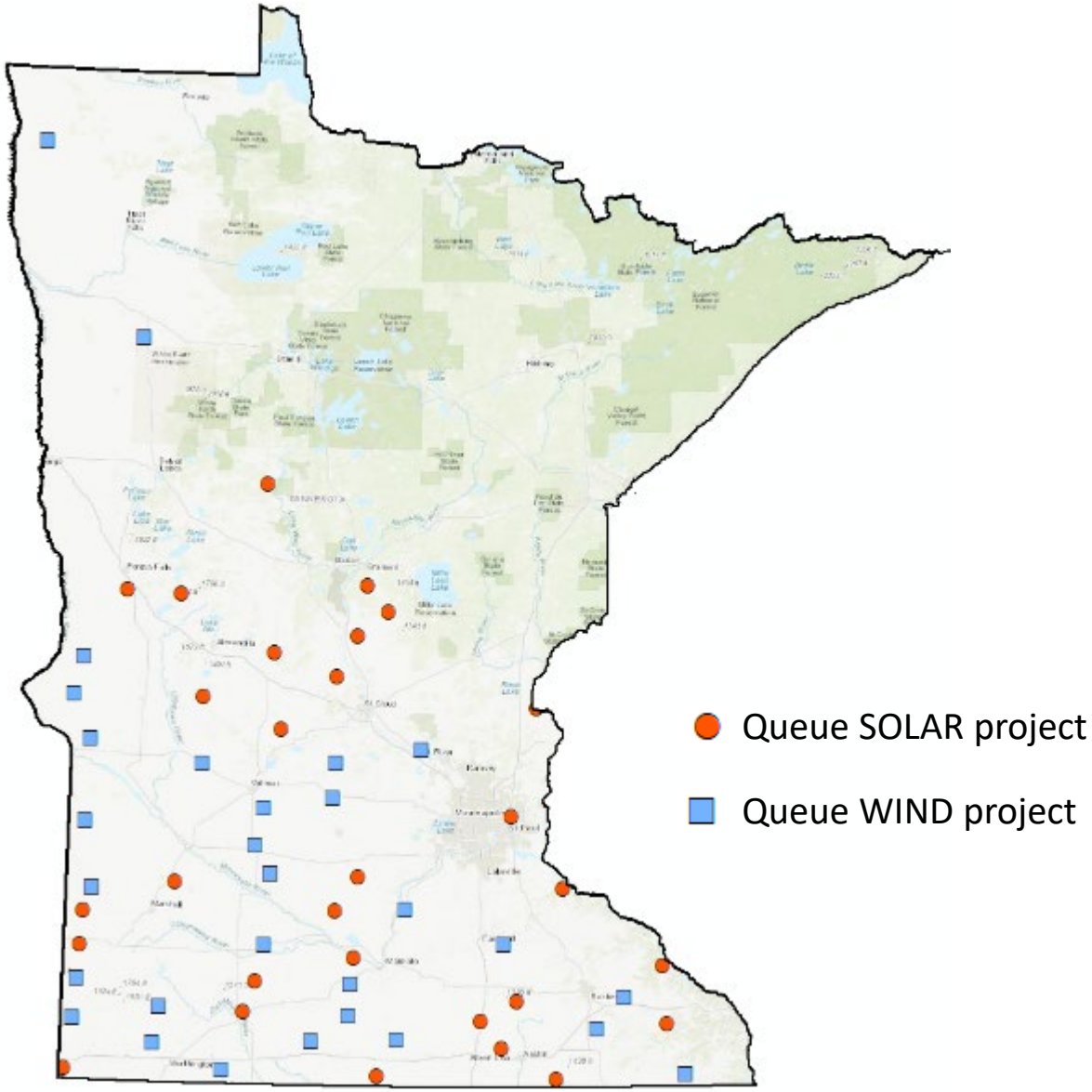
MISO Queue



Total Solar Capacity in the Queue (MN, Sept 2019): 4,500 MW

Total Wind Capacity in the Queue (MN, Sept, 2019): 3,550 MW

Data source: MISO Interconnection Queue, January 2019 (for map), Sept 2019 (for MW capacity)

Redwood County Solar and Wind Resources

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Redwood County: Existing Resource

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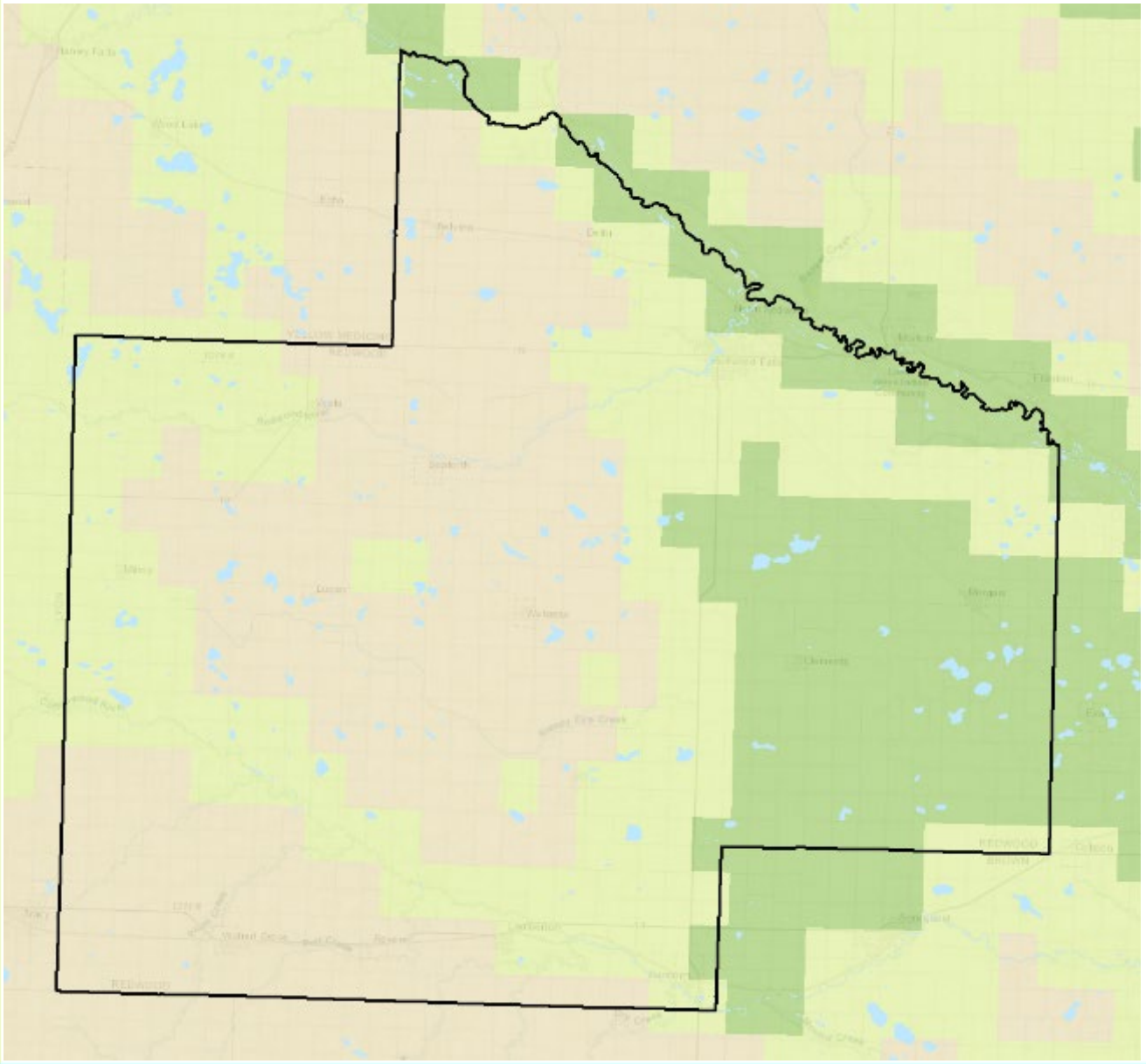
Wind Resource



80-meter wind

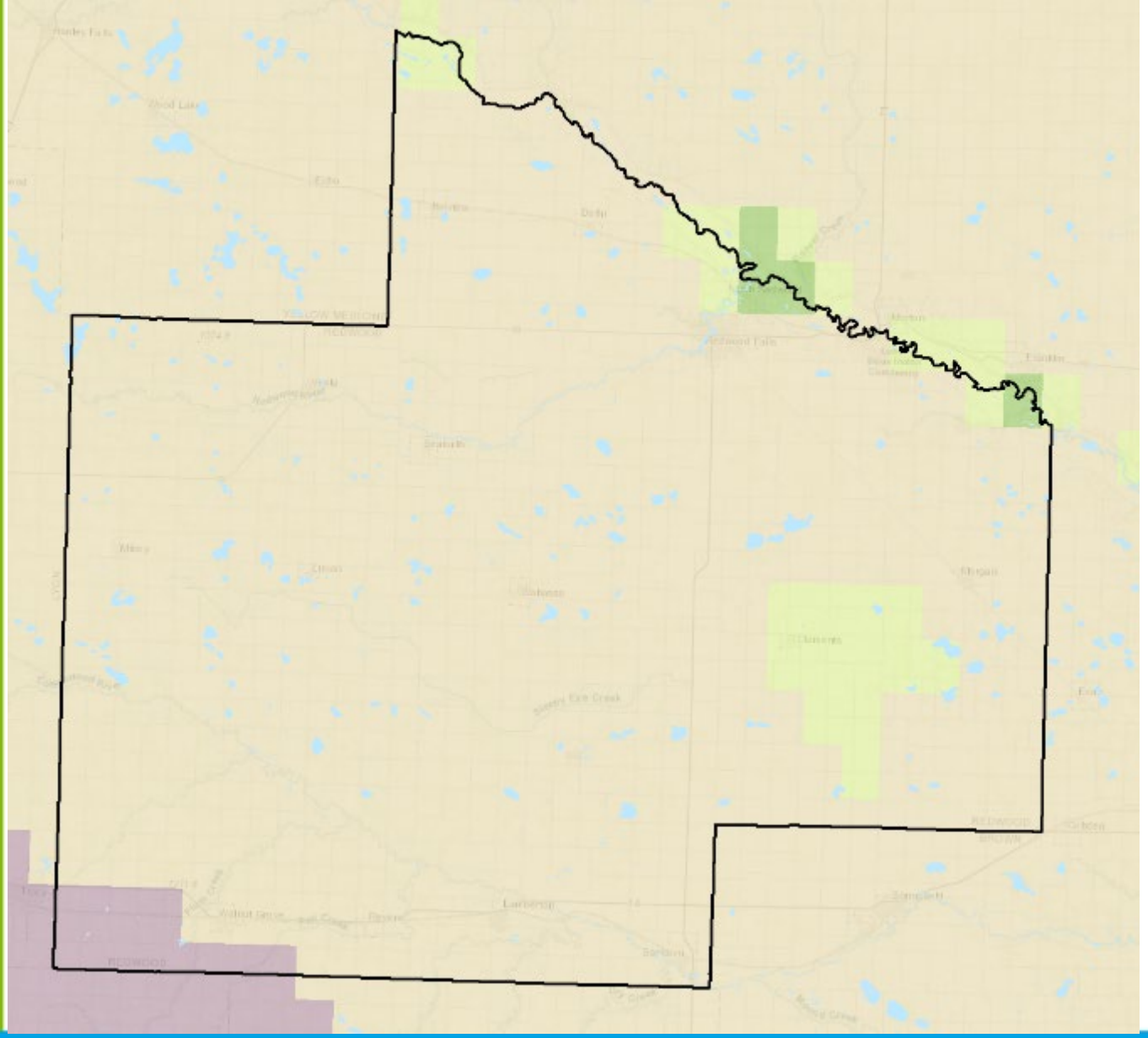
Water

Wind speed (miles per hour)

- > 26 mph
- 24 - 26 mph
- 22 - 24 mph
- 20 - 22 mph
- 18 - 20 mph
- 16 - 18 mph
- 14 - 16 mph
- 12 - 14 mph
- 10 - 12 mph
- < 10 mph

Data source: National Renewable Energy Lab (NREL) national wind speed data, 2006 - 2013

Wind Resource



100-meter wind

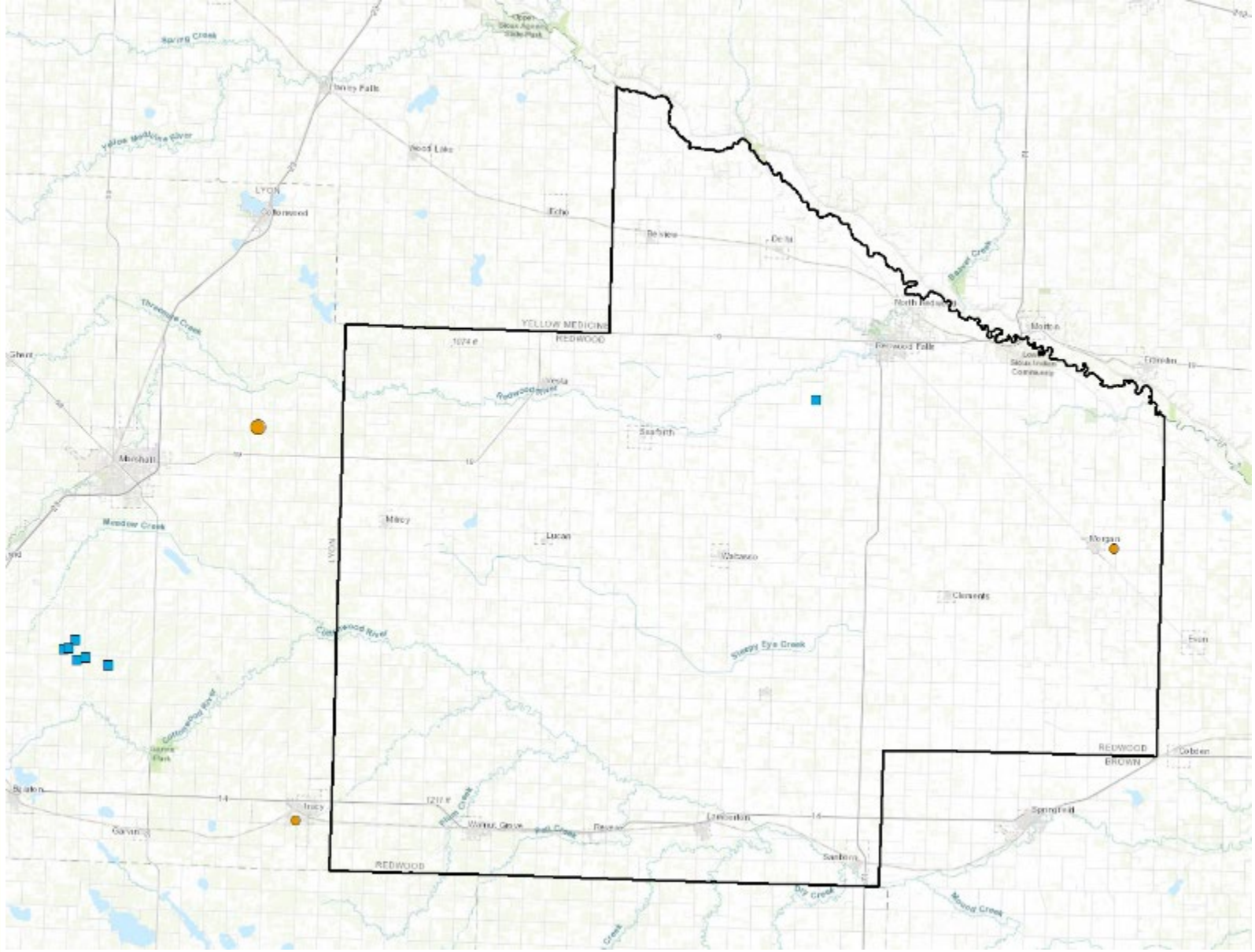
Water

Wind speed (miles per hour)

- > 26 mph
- 24 - 26 mph
- 22 - 24 mph
- 20 - 22 mph
- 18 - 20 mph
- 16 - 18 mph
- 14 - 16 mph
- 12 - 14 mph
- 10 - 12 mph
- < 10 mph

Data source: National Renewable Energy Lab (NREL) national wind speed data, 2006 - 2013

Existing Wind and Solar



Redwood currently has 3.4 MW of wind installed and 2.7 MW of solar installed

Solar (MW)	Wind (MW)
0.0 - 15.0	0.0 - 15.0
15.1 - 50.0	15.1 - 50.0
50.1 - 100.0	50.1 - 100.0
100.1 - 200.0	100.1 - 200.0
200.1 - 585.9	200.1 - 735.5

Data source: EIA-860 Form national power dataset, 2018

Redwood County: Considerations that Impact Resource Use

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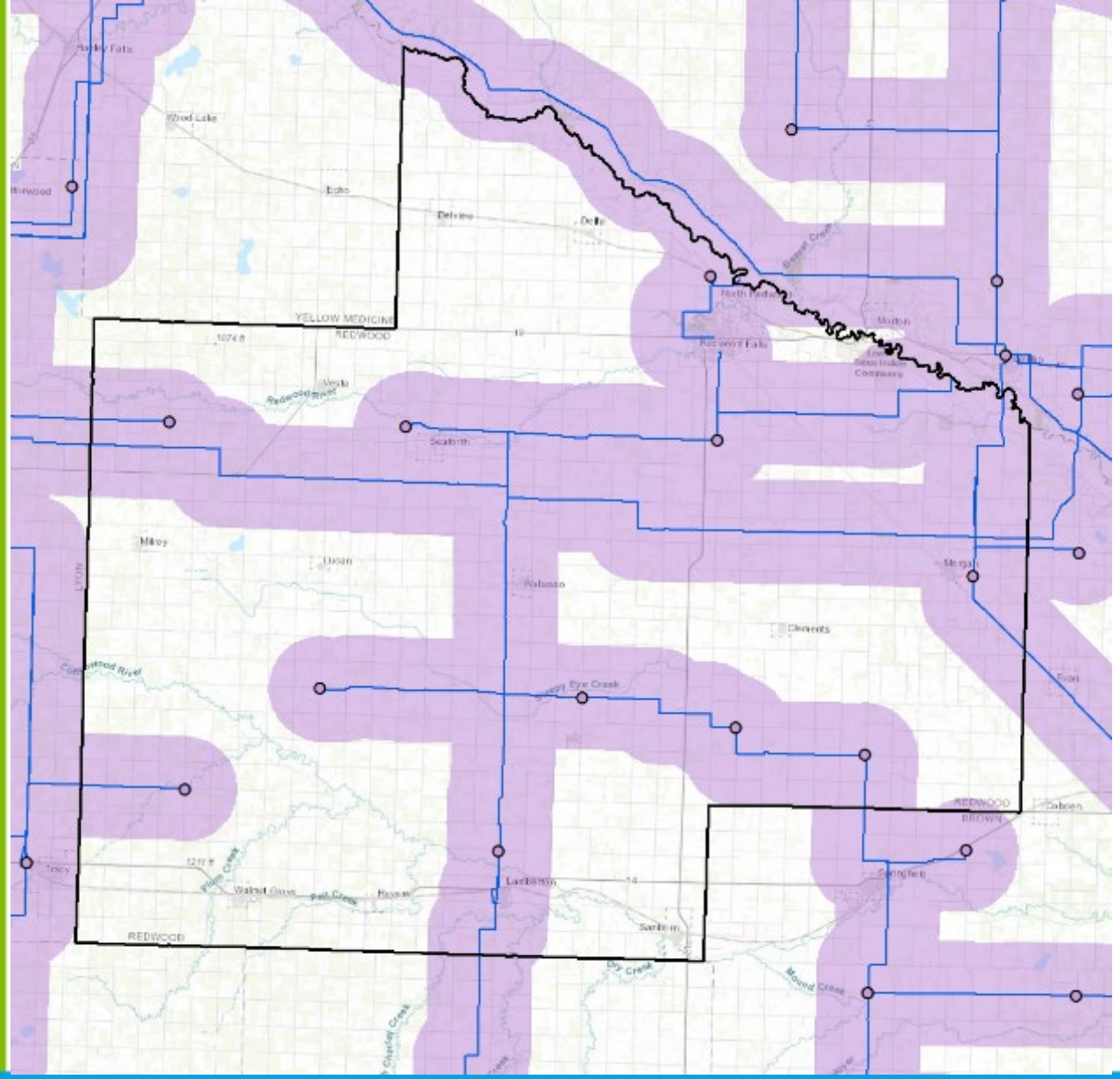
Electricity Transmission



— TRANSMISSION LINES

● SUBSTATIONS

▨ 2-MILE BUFFER – ZONE OF CONSERVATIVE COST FEASILIBITY

Preservation Goals

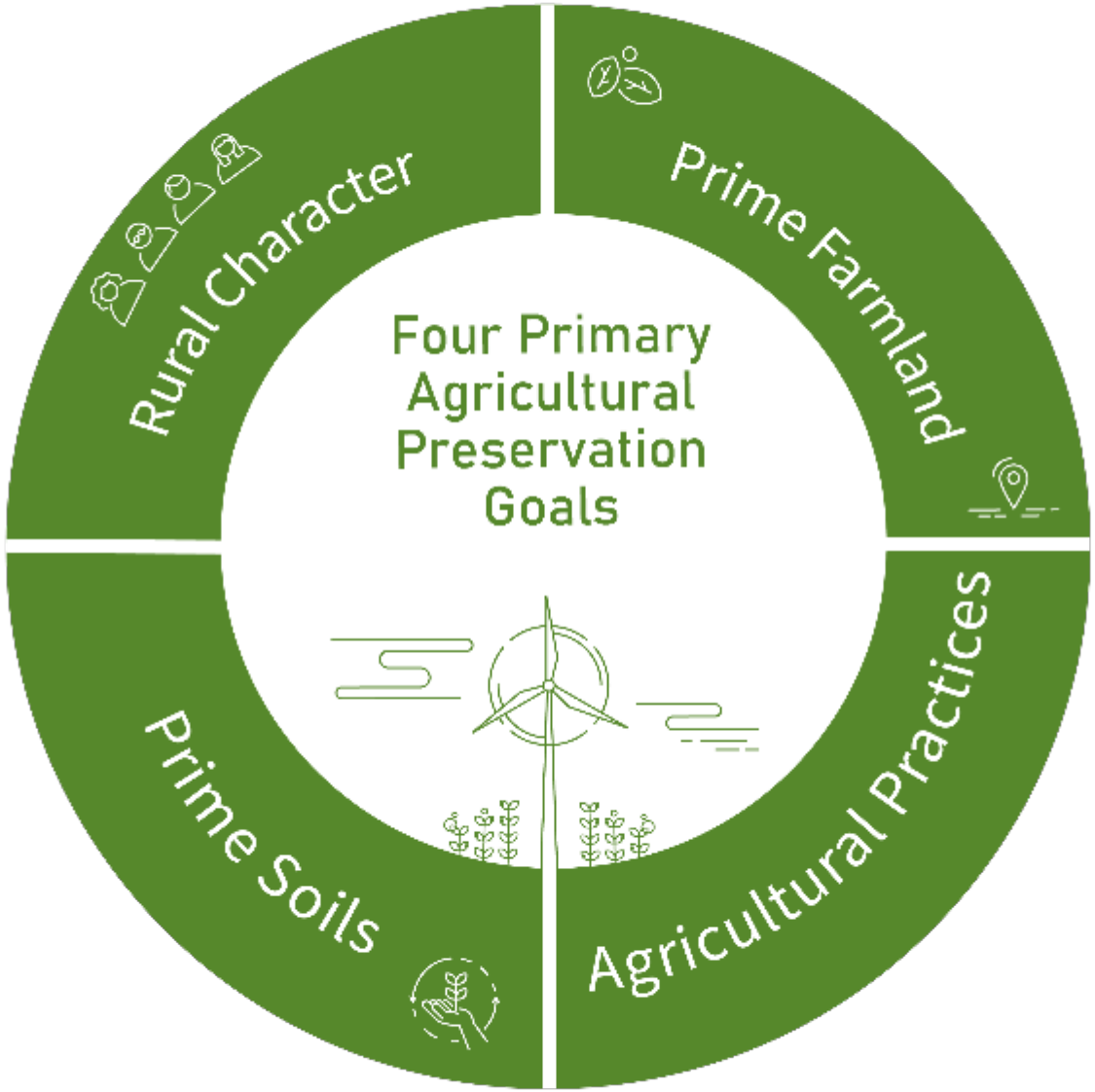
Redwood County
Example of Agricultural Goals

Objective No. 1: Protect the rural, agricultural character of Redwood County.

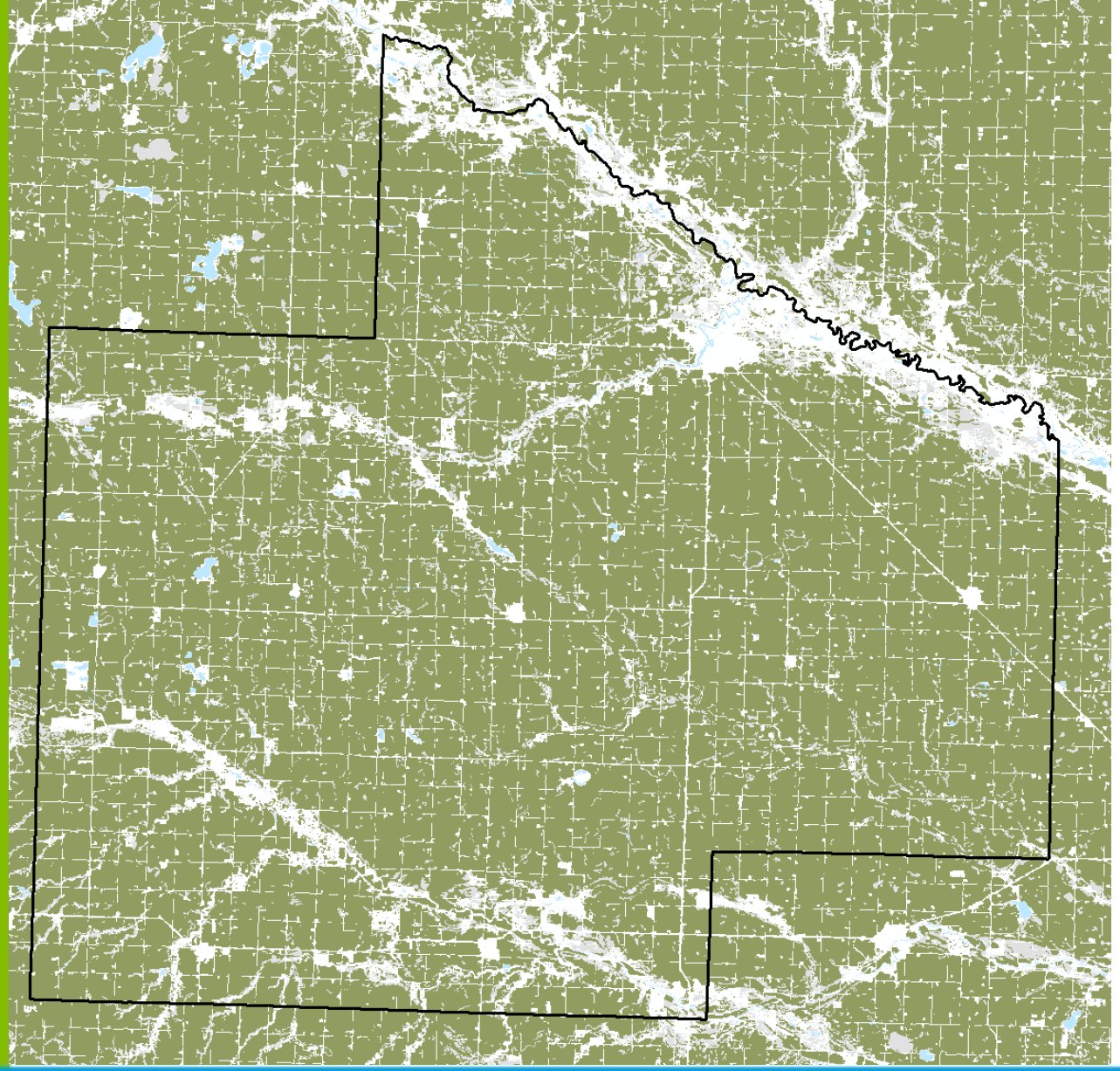
Objective No. 2: Encourage ag-related commercial and non-traditional agricultural development.

Objective No. 5: Establish land use patterns that preserve and protect the natural qualities and existing rural character of the landscape.

Objective No. 6. Preserve open space and wildlife habitat and protect natural resources.



Prime Farmland

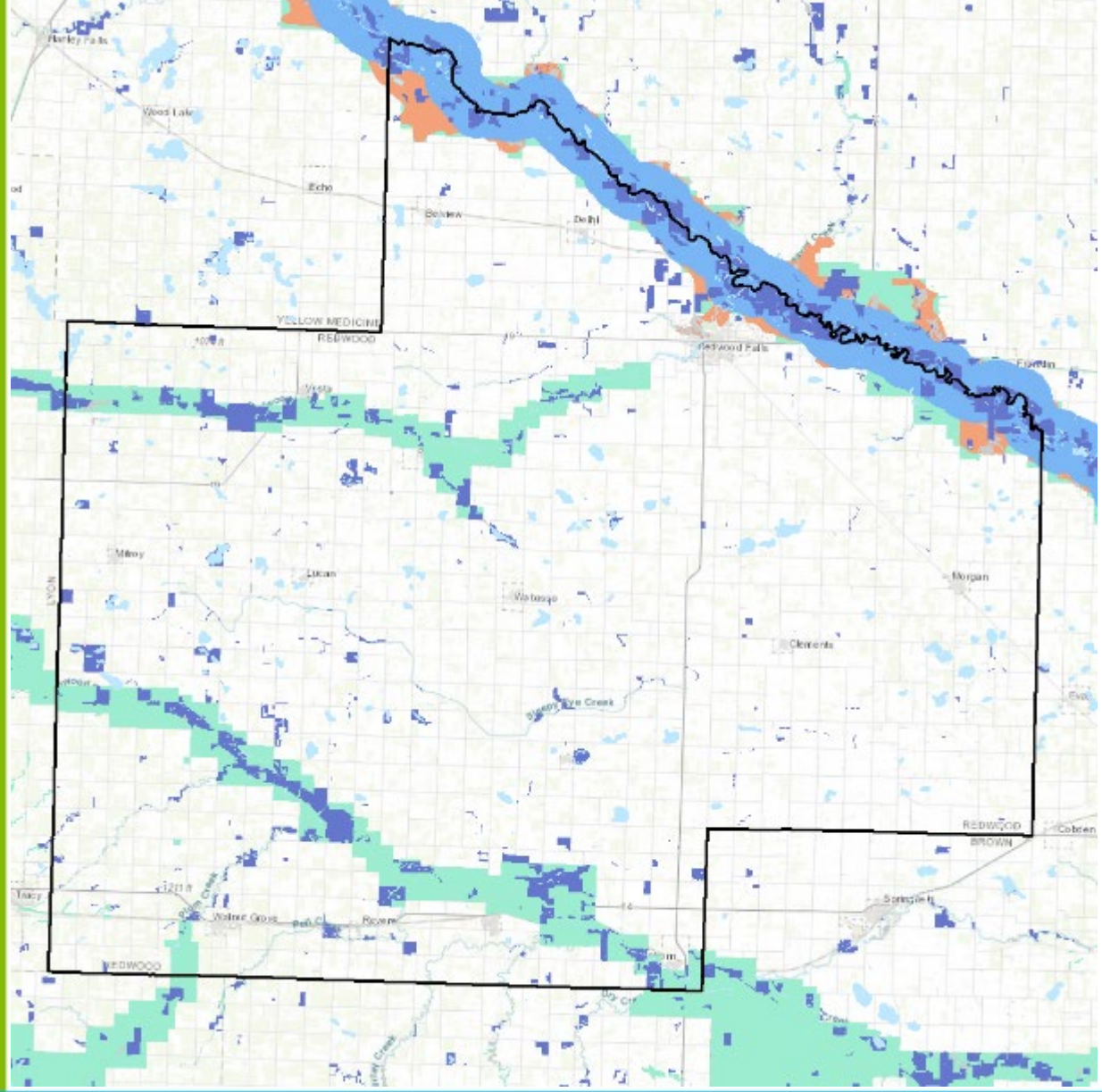


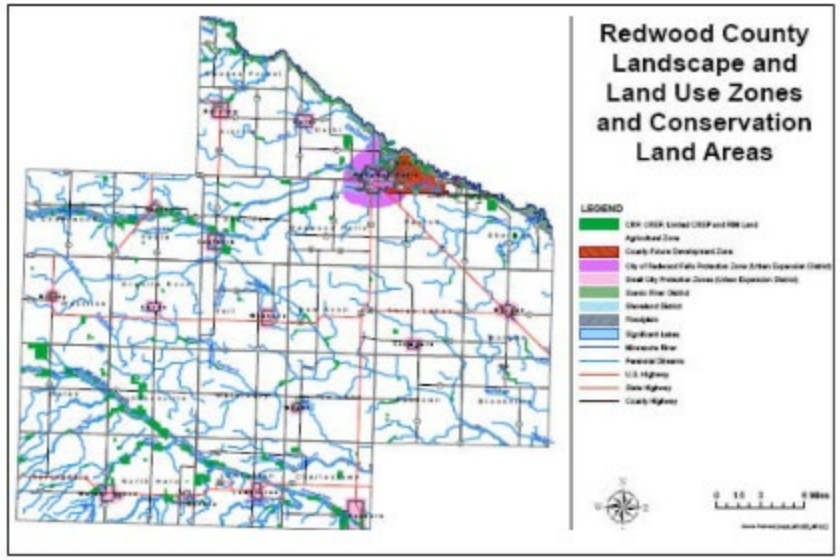
All Cropland (2016) *as Prime or Not*

- Not Prime Farmland
- Prime Farmland
- **Water**
- Neither prime farmland nor in cropland

Data source: NRCS / USDA prime farmland, ArcGIS Living Atlas Online Layer, 2018; Redwood County Comprehensive Plan, Map of Prime Farmland, 2017

Habitat Consideration

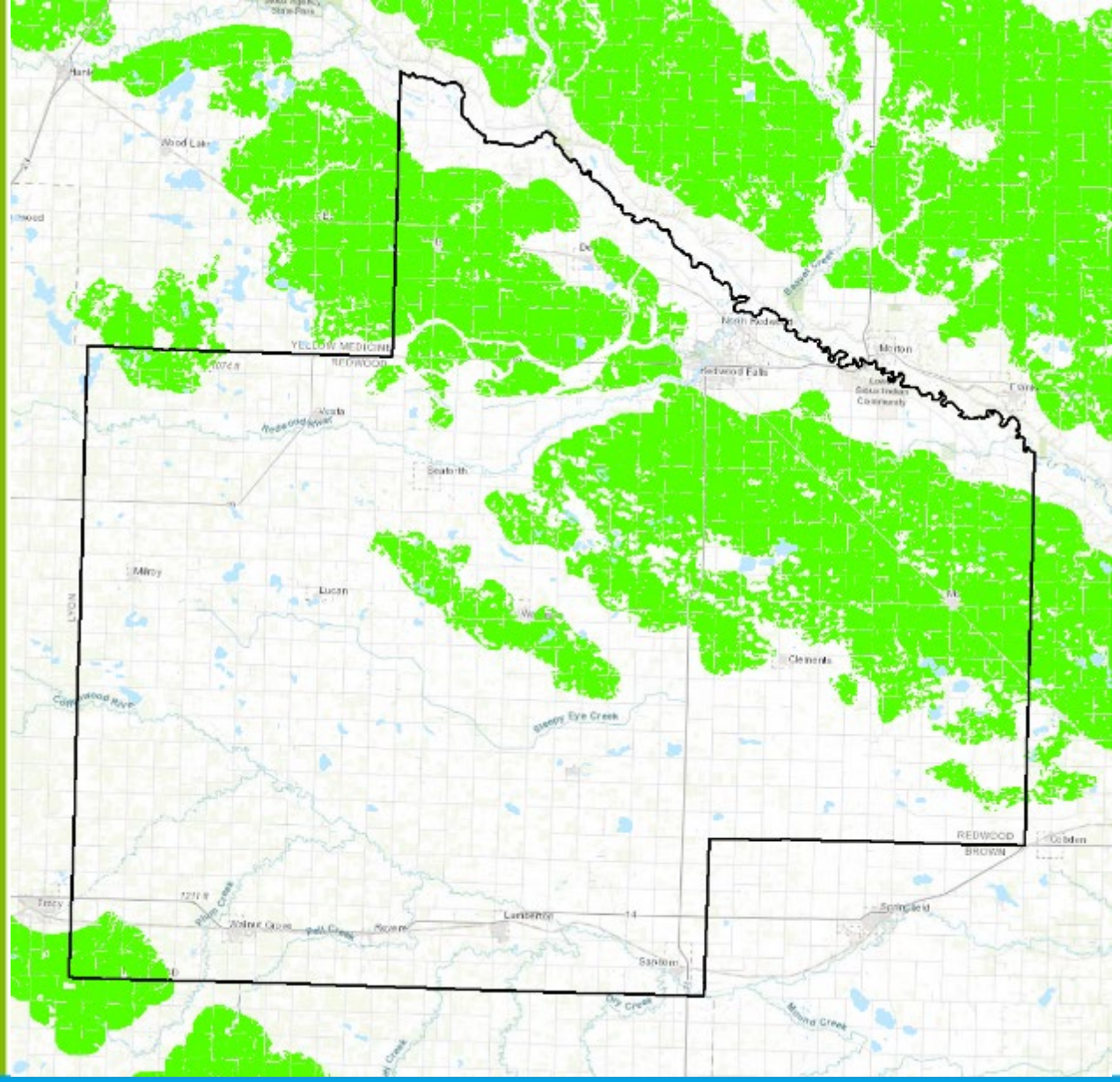




- Whooping crane stopover sites
- Eagles / other raptors
- Prairie grouse
- High waterfowl breeding density
- Important bird areas
- Bat roosts
- Threatened / endangered species
- Big game
- Important wetlands / rivers
- Protected / managed lands
- Intact natural habitats
- Other biodiversity significance

Data source: The Nature Conservancy, Site Wind Right Analysis, July 2019 AND Redwood County Comprehensive Plan, Landscape and Land Use Zones and Conversation Land Areas Map, 2017

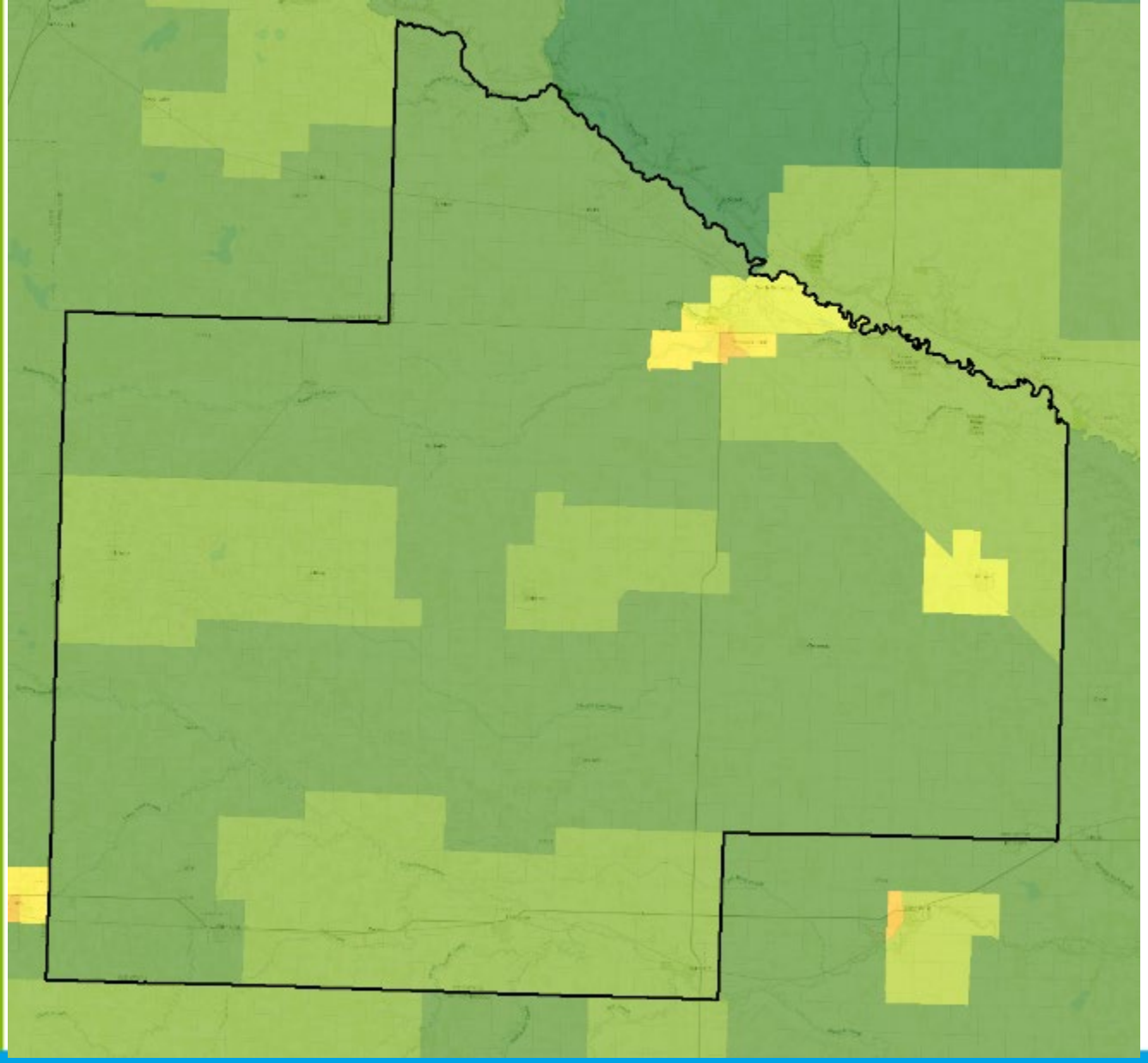
Low-Risk Wind Analysis



Low-Risk Wind Siting from a habitat and natural areas perspective

Data source: The Nature Conservancy, Site Wind Right Analysis, July 2019

Population Density

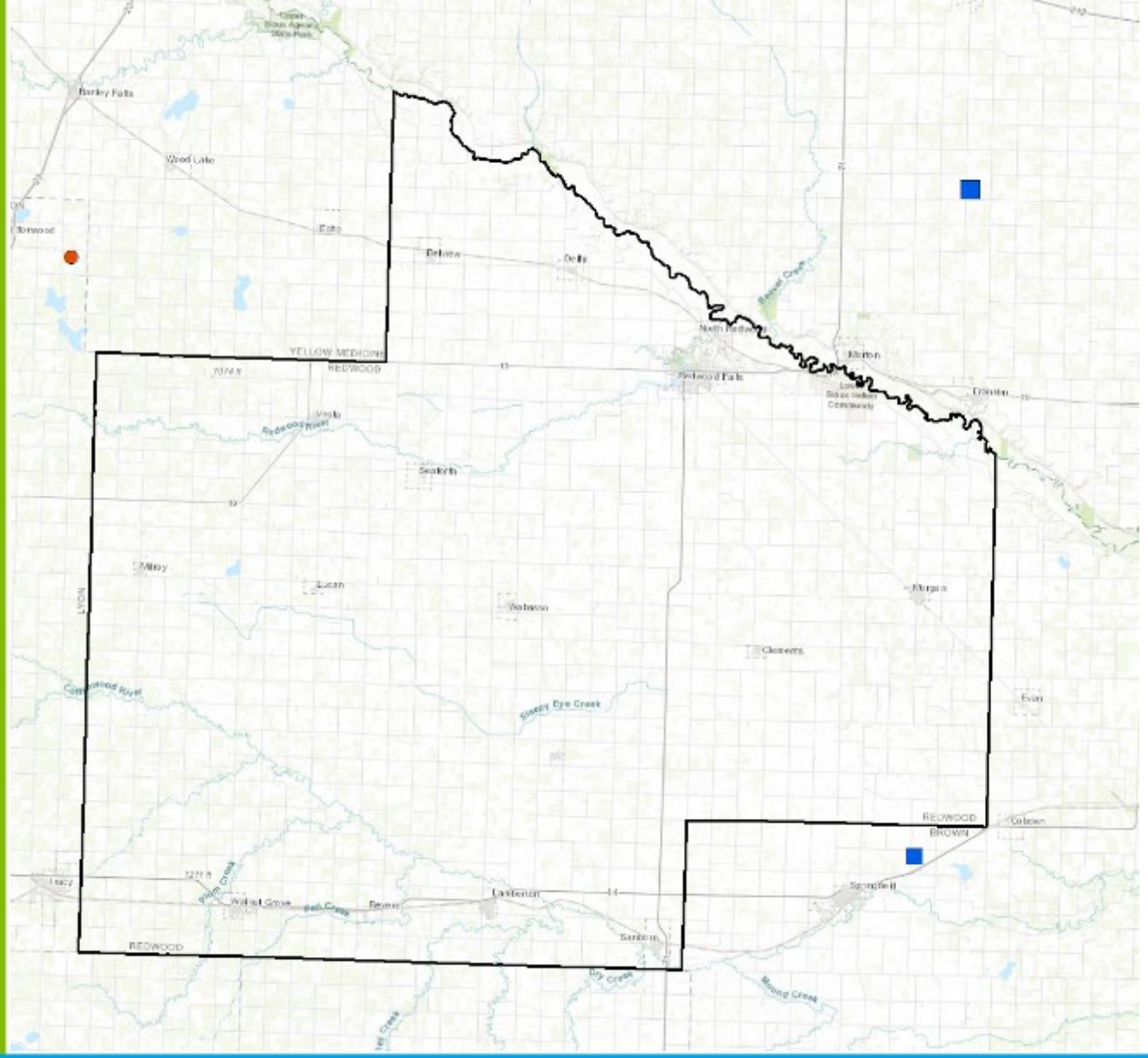


Household density
by census tract

- 0 - 5
- 6 - 15
- 16 - 25
- 26 - 50
- 51 - 100
- 101 - 500
- 501 - 2,500
- 2,501 - 34,360
- 34,361 - 68,100
- 68,101 - 112,933

Data source: United States American Community Survey Data, 5-year Summaries (2013 – 2017)

MISO Queue



**As of September 2019, two wind projects are seeking interconnection (616 MW), no solar projects in the queue*

**Shown on the map, In adjacent counties, there is 230 combined MW of wind, and 32.5 MW of solar*

Queue WIND Projects (MW)

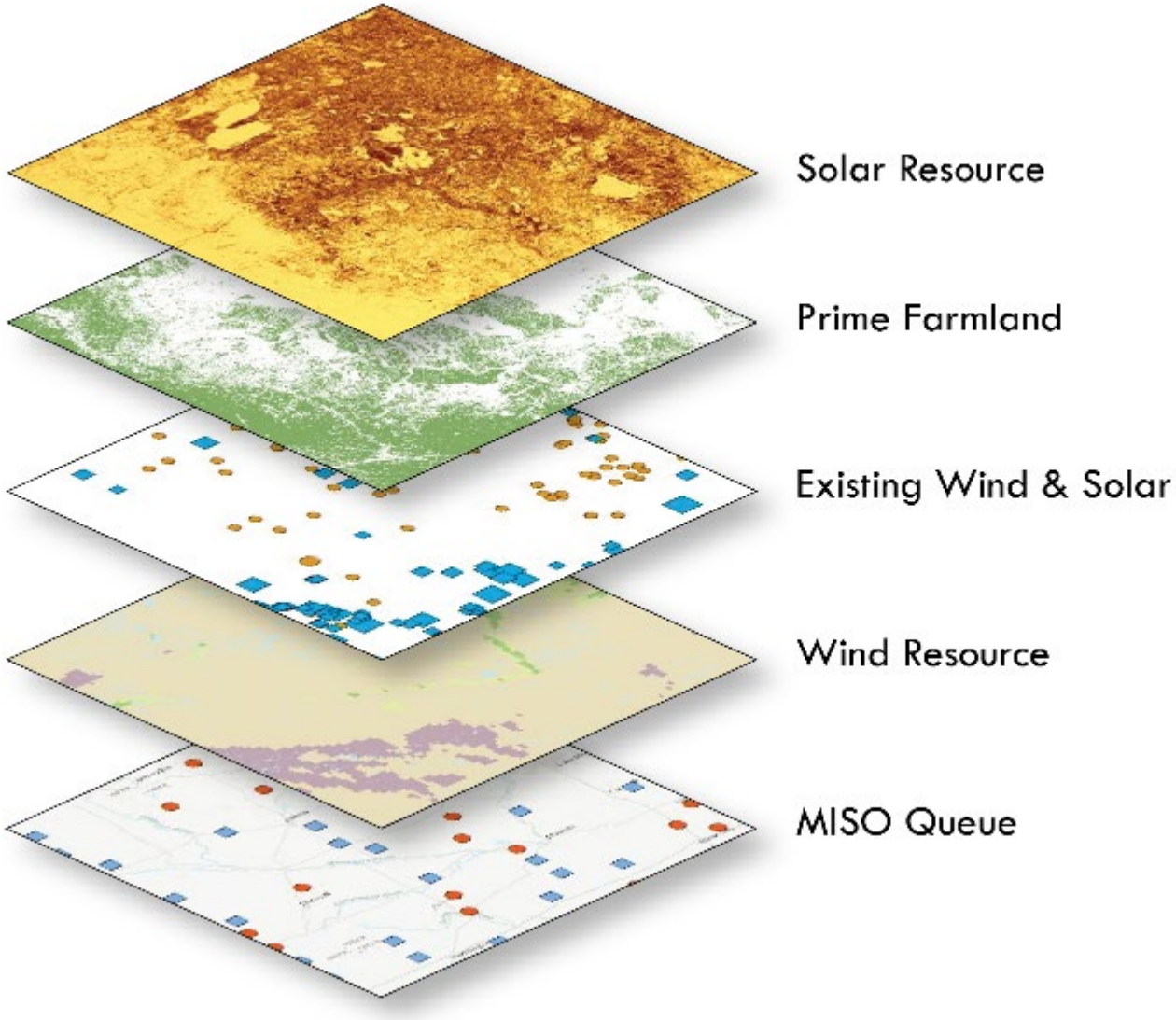
- 0.0 - 15.0
- 15.1 - 50.0
- 50.1 - 100.0
- 100.1 - 200.0
- 200.1 - 735.5

Queue SOLAR Projects (MW)

- 0.0 - 15.0
- 15.1 - 50.0
- 50.1 - 100.0
- 100.1 - 200.0
- 200.1 - 585.9

Data source: MISO Interconnection Queue, January 2019

Decision Making



Optimal Locations and Site Design Criteria

This depends on the goals and priorities that Redwood County sets through this comprehensive planning process

These maps are inputs into your decision-making process, they are not the decisions

We can’t show you a map – you are creating it through your planning process

Wind Site Design Land Use Co-Benefits

Wind has fairly limited conflicts with agricultural land uses

- ✓ Compatible land use with many forms of agriculture
- ✓ Clear benefit of adding to agriculture economic diversity
- ✓ Least costly form of energy generation
- ✓ Significant local tax benefits
- ✓ Primary land use conflicts are with habitat and rural residences
- ✓ Visual impacts cannot be mitigated

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THANK YOU

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