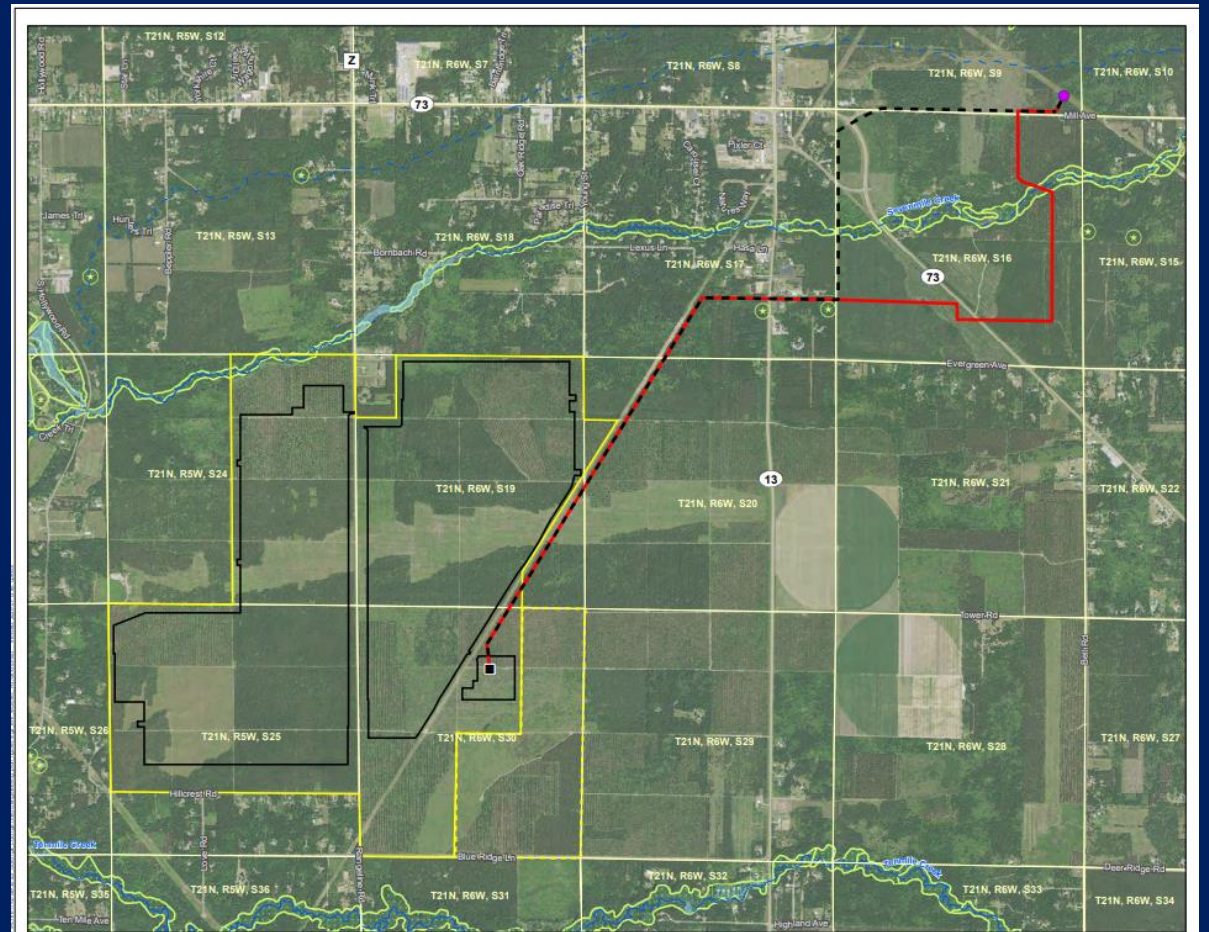
Wood County Solar Project Review

Kent M. Syverson, Ph.D., P.G.
Syverson GeoConsulting LLC



My Background

- Education
  - UMD (major Geology, minor Chemistry)
  - UW-Madison (M.S., Ph.D in Geology, minor distributed between Civil and Environmental Engineering and Geography)
- Glacial geologist with consulting experience in
  - Sedimentology
  - Hydrogeology
  - Geotechnical properties of soils
  - Industrial sand

Disclosure of Potential Conflicts of Interest

- Never been employed by Savion or Alliant Energy.
- No financial stake in Savion or Alliant Energy.
- Here solely as a scientist representing the interests of the Town of Saratoga and its residents.
  - Go where the evidence leads
  - Available to answer questions

Overview

- Hired by the Town of Saratoga to evaluate the Wood County Solar Project.
- Asked to evaluate “potential impacts on public health safety, and welfare,” as outlined in Developer Agreement item #10.
- Will outline my observations about the Wood County Solar Project and my evaluation of potential impacts.
- Will answer questions as directed by the Town Chairman.

Sources of information

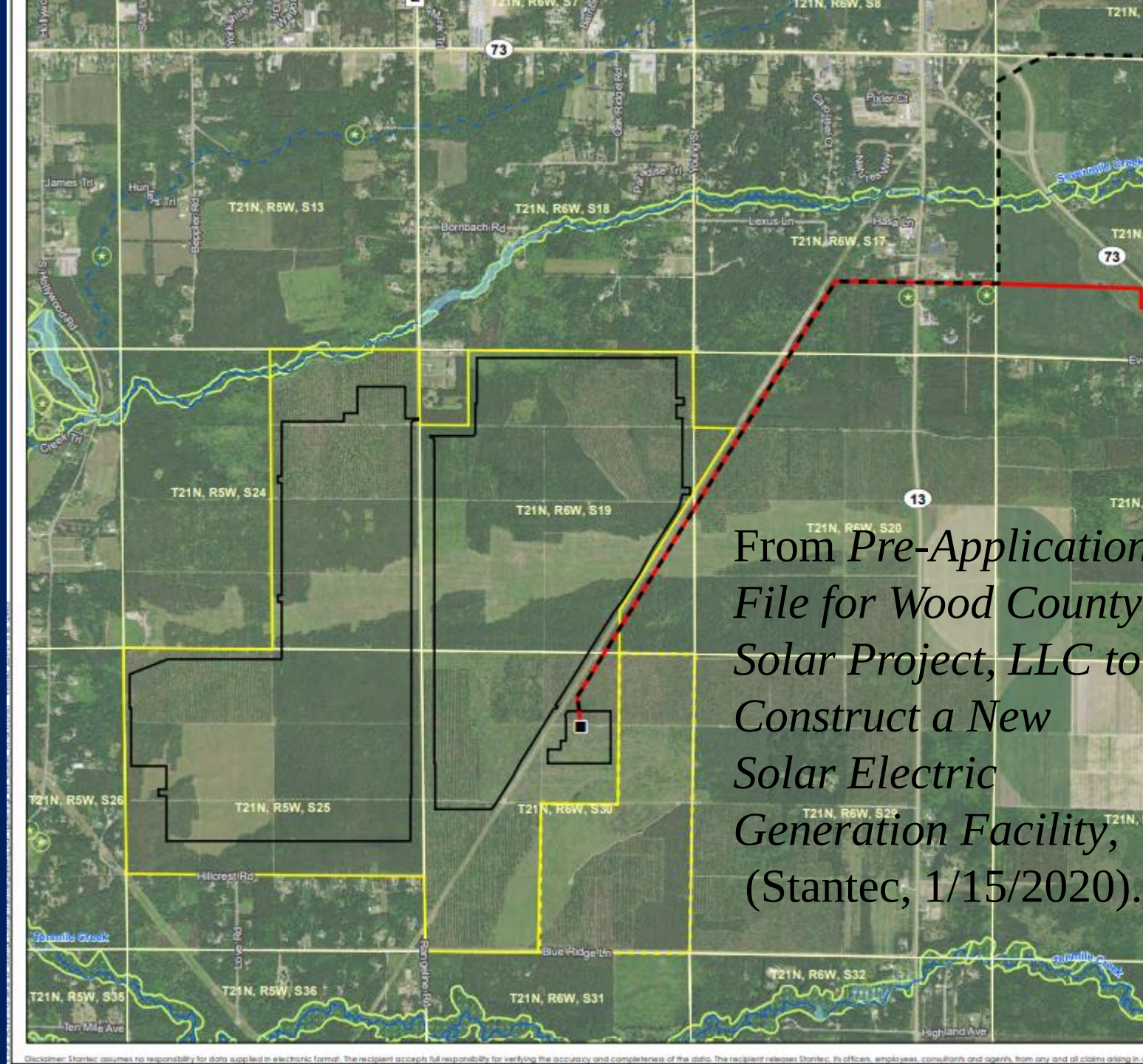
- Savion documents filed with PSC-Wisconsin.
- PSC-WI, university, and agency documents on EMFs and herbicides.
- EPA Fact Sheets (herbicides).
- Town of Saratoga groundwater monitoring reports (from wells install during Golden Dairy controversy).
- Discussions with Savion/Alliant Energy experts.
- Site visit immediately prior to this meeting.

Potential impacts on public health and safety

- Solar panel materials
- Dust
- Electromagnetic field (EMF) issues
- Groundwater contamination
  - Herbicide use
  - Other potential water contamination issues
- Will briefly discuss stormwater and decommissioning issues

Wood County Solar Project

- 150 MW facility
- Extremely low frequency (ELF, 60Hz)
- Pilings driven into the ground
- Panels designed to track the sun
- Currently no plans for “industrial-strength” battery system



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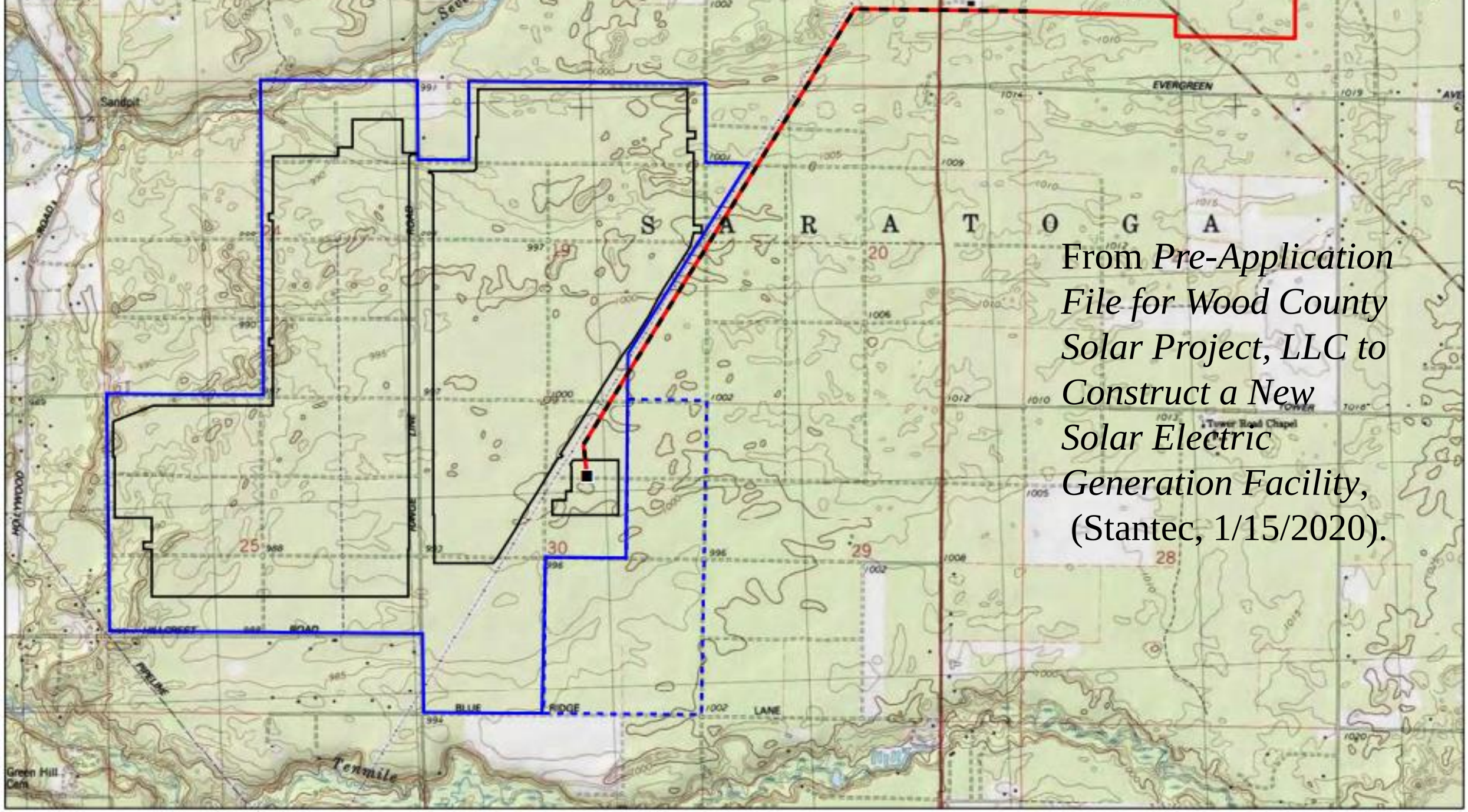

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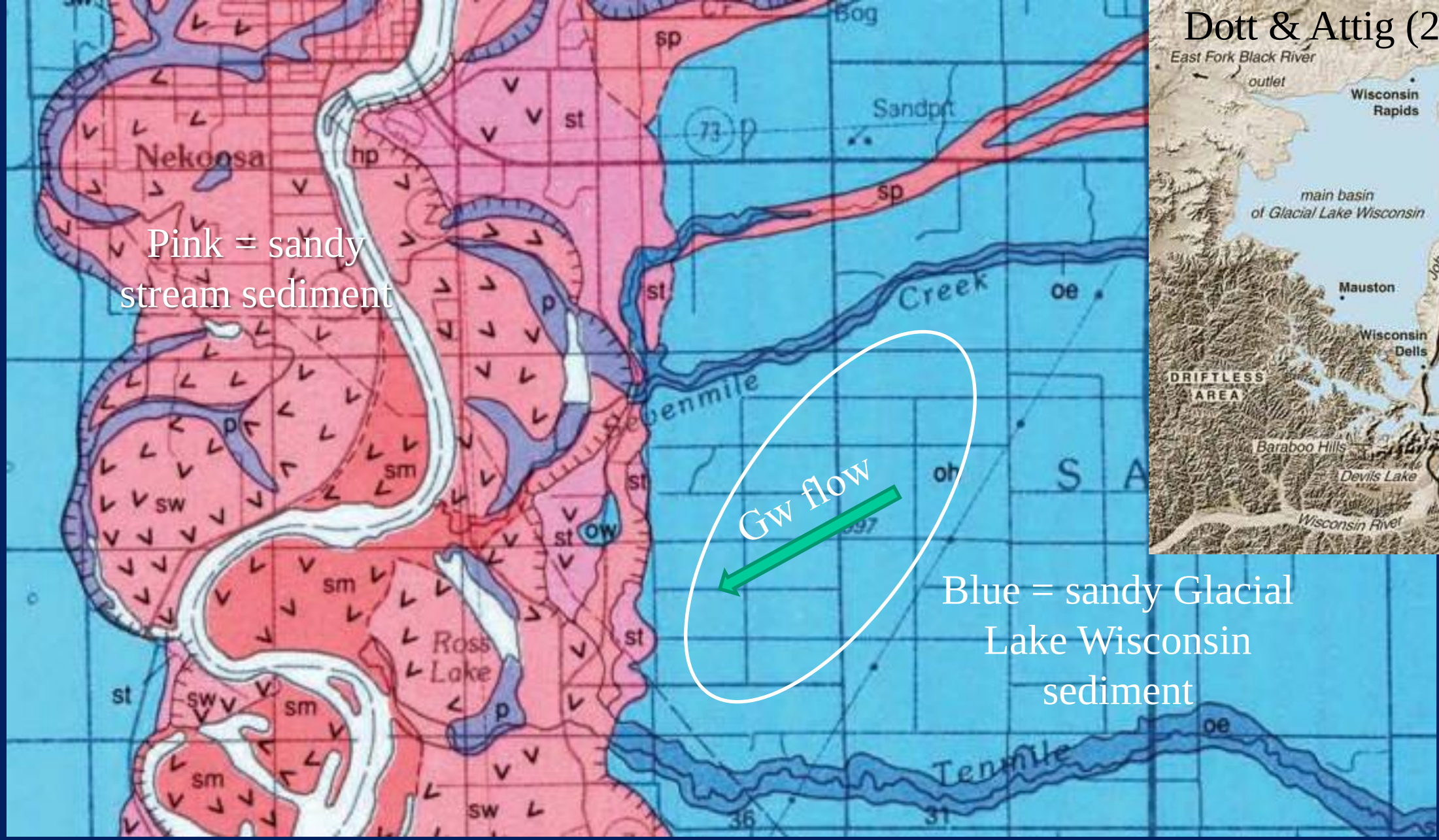


Clayton (1991) – Pleistocene Geology of Wood County, WI (WGNHS Info Circ 68)

Solar Panels—made of common, low-reactivity materials

- Glass (70%)
- Aluminum frame (18%)
- Silicon (3.5%)
- Copper, silver, aluminum wire
- Polymers (plastic)

Site Design

Photo Credit: Savion. Myrtle Solar Project. Suffolk County, VA. Owned and operated by Dominion Energy

- Pilings pounded into the ground (no cement foundations—easier for decommissioning).
- Vegetation between/under panels will decrease runoff.

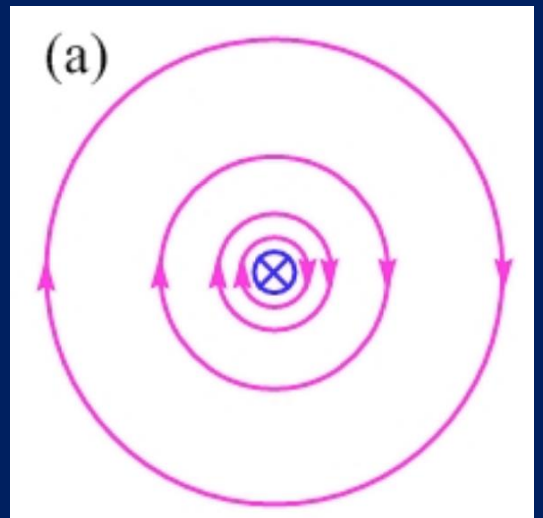
Potential dust issues

- Construction—sediment exposed. Need to water site.
- Vegetation between/beneath panels, tree buffers around site.
- No combustion at site (source of “ultrafine” PM).
- Dust-free panels maximize sunlight absorption.
- KMS conclusion – Dust is not a public health concern

Photo Credit: Savion. Myrtle Solar Project. Suffolk County, VA. Owned and operated by Dominion Energy.

Potential Electromagnetic Field (EMF) Issues

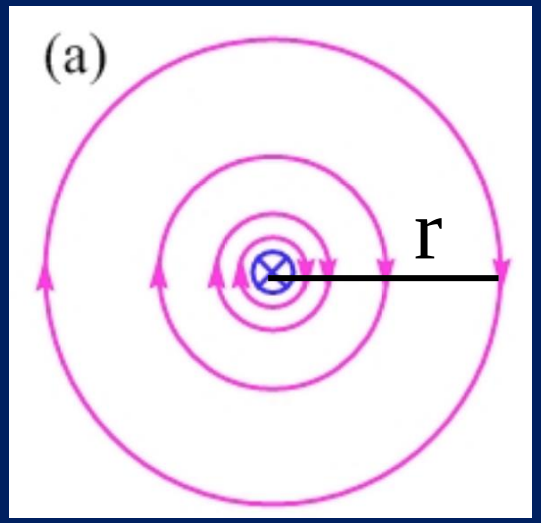
- Moving electrons in a wire cause electromagnetic field (EMF)
- Wood County Solar Project EMF's were modeled by Stantec and submitted to the PSC-WI during approval process.



Magnetic field B at distance r from straight wire

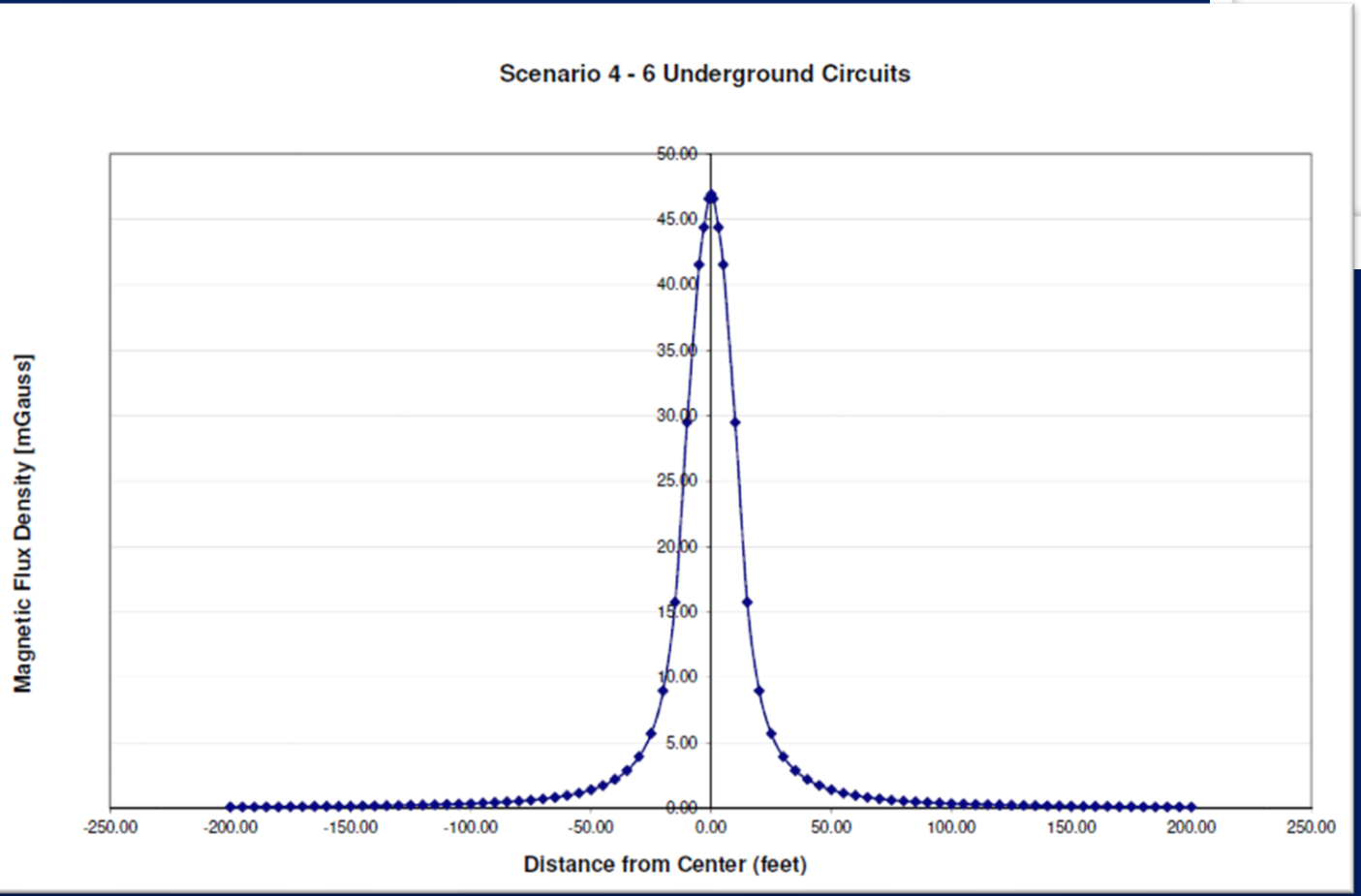
$$B = \frac{\mu_0 I}{2\pi r}$$

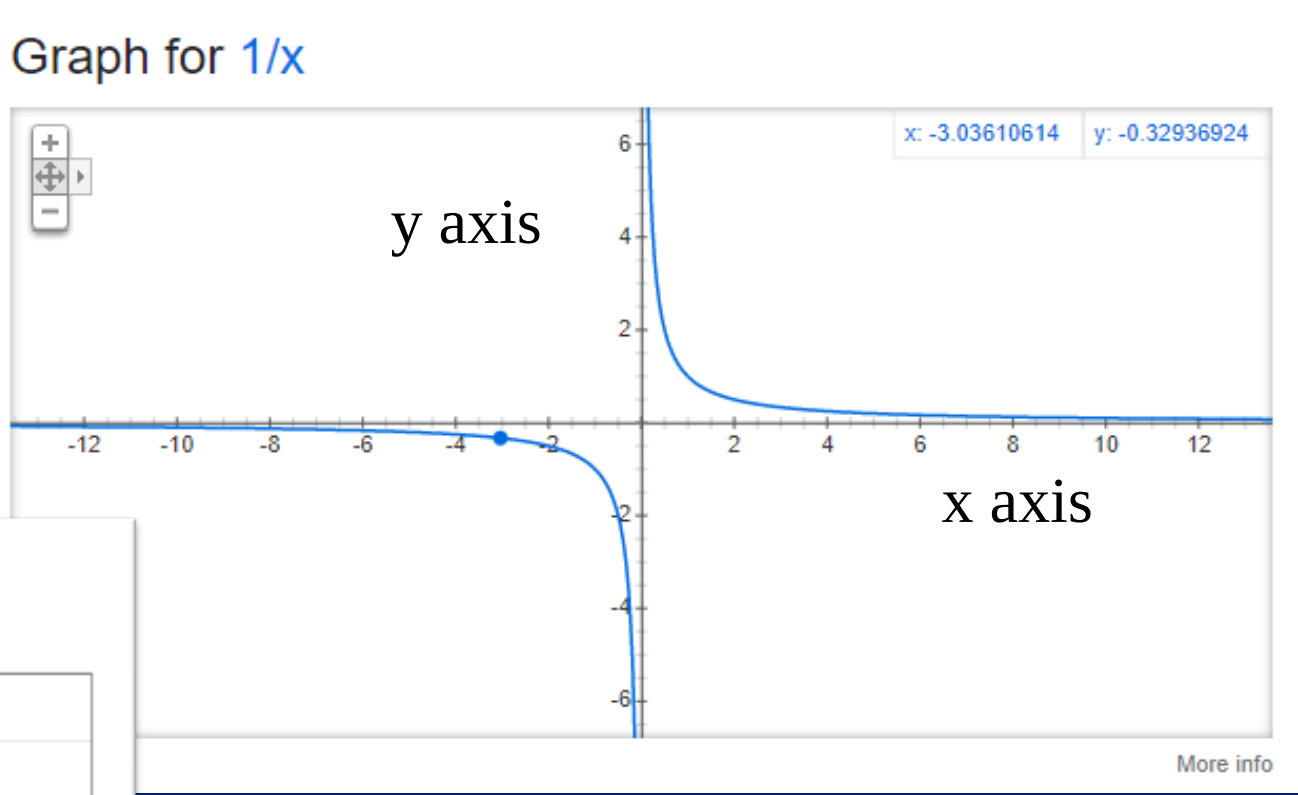
μ_0 = constant (perm. of free space)
I = electrical current
r = distance from straight wire



EMF decreases in intensity as distance from wire increases (1/r)

Underground collector lines, 4-6 parallel cables





From *Savion Wood County EMF report* for PSC, App. O (Stantec, 2/26/20)

Magnetic field intensity reference points

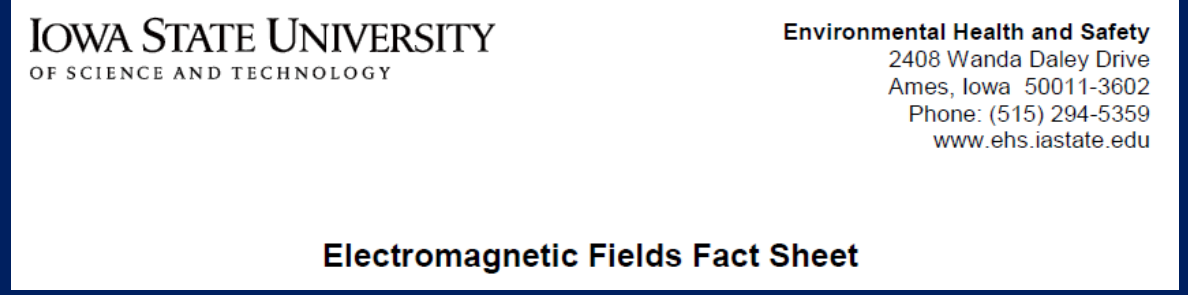
- Earth's magnetic field – 250 - 650 mGauss (NOAA)

Table 1 Common Sources of Magnetic Fields (mG)[1]

PSC-Wisconsin

Sources*	Distance From Source	
	6 inches (mG)	24 inches (mG)
Microwave Ovens	100 - 300	1 - 30
Dishwashers	10 - 100	2 - 7
Refrigerators	Ambient - 40	Ambient - 10
Fluorescent Lights	20 - 100	Ambient - 8
Copy Machines	4 - 200	1 - 13
Drills	100 - 200	3 - 6
Power Saws	50 – 1,000	1 - 40

* Different makes and models of appliances, tools, or fixtures will produce different levels of magnetic fields. These are generally-accepted ranges.


IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

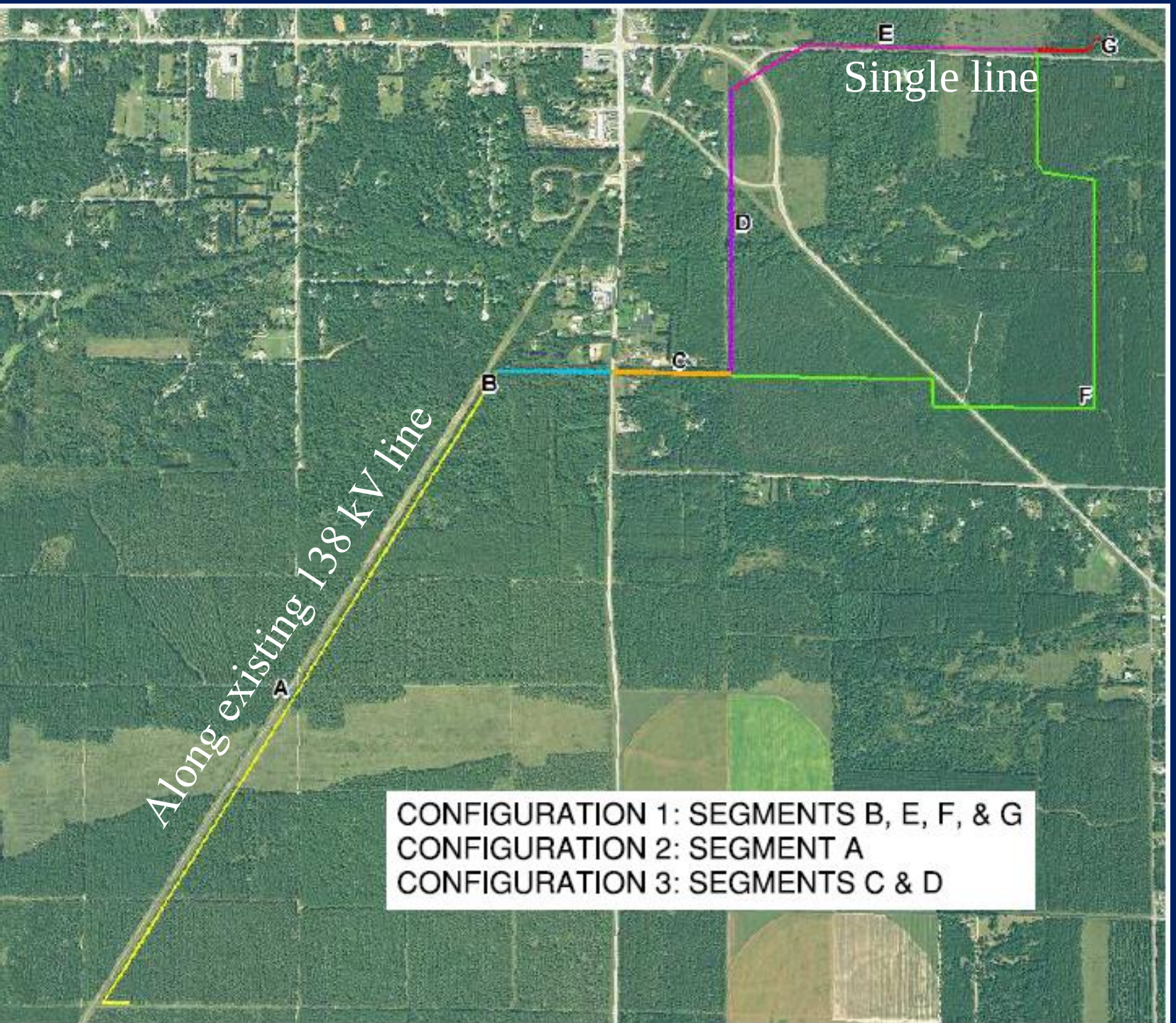
Environmental Health and Safety
2408 Wanda Daley Drive
Ames, Iowa 50011-3602
Phone: (515) 294-5359
www.ehs.iastate.edu

Electromagnetic Fields Fact Sheet

- https://www.ehs.iastate.edu/pub/factsheets/electromagnetic-fields-fact-sheet (reviewed 2018)

From *International Radiation Protection Association (IRPA)*

- "Members of the general public should not be exposed on a continuous basis to . . . electric field strengths exceeding 5 kV/m," or to magnetic fields exceeding 1,000 mG.
- Magnetic fields for occupational exposures should be limited to less than 5,000 mG.



C & D –
Along 69 kV line

From Savion *Wood County EMF report* for PSC-WI, App. O (Stantec, 2/26/20)

Modeling for new 138 KV line parallel to existing 138 kV line

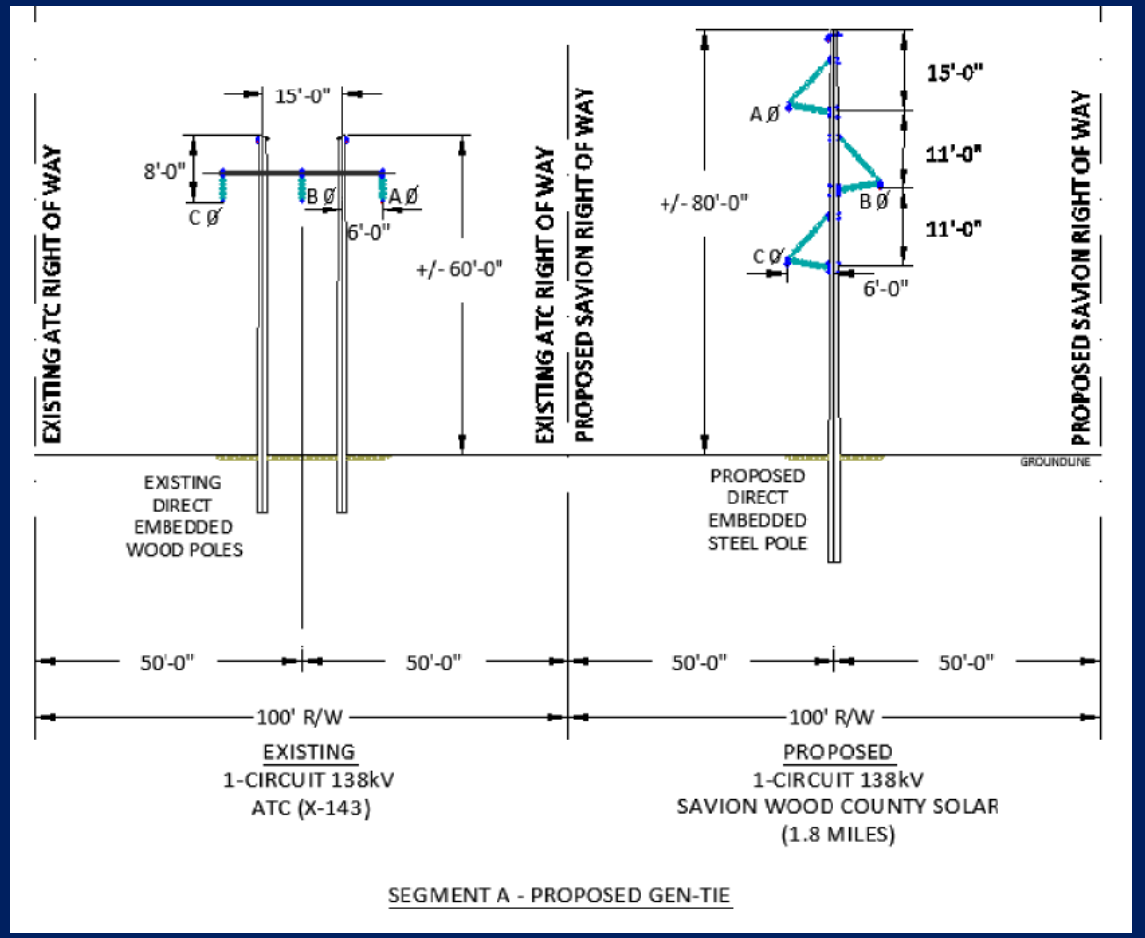
Point Of Interest Name	Distance (ft)	Electric (kV/m)	Magnetic (mG)
-300ft	-150	**0.0**	**2.2**
-200ft	-50	**0.1**	**6.9**
-150ft	0	**0.5**	**21.3**
-100ft	50	**0.9**	**102.9**
-50ft	100	**0.6**	**64.9**
-25ft	125	**1.0**	**109.2**
0ft	150	**1.8**	**154.2**
+25ft	175	**0.7**	**72.8**
+50ft	200	**0.3**	**31.8**
+100ft	250	**0.1**	**10.5**
+150ft	300	**0.0**	**5.2**
+200ft	350	**0.0**	**3.1**
+300ft	450	**0.0**	**1.4**

100% capacity

Current line, center

New parallel line, center

Right ROW

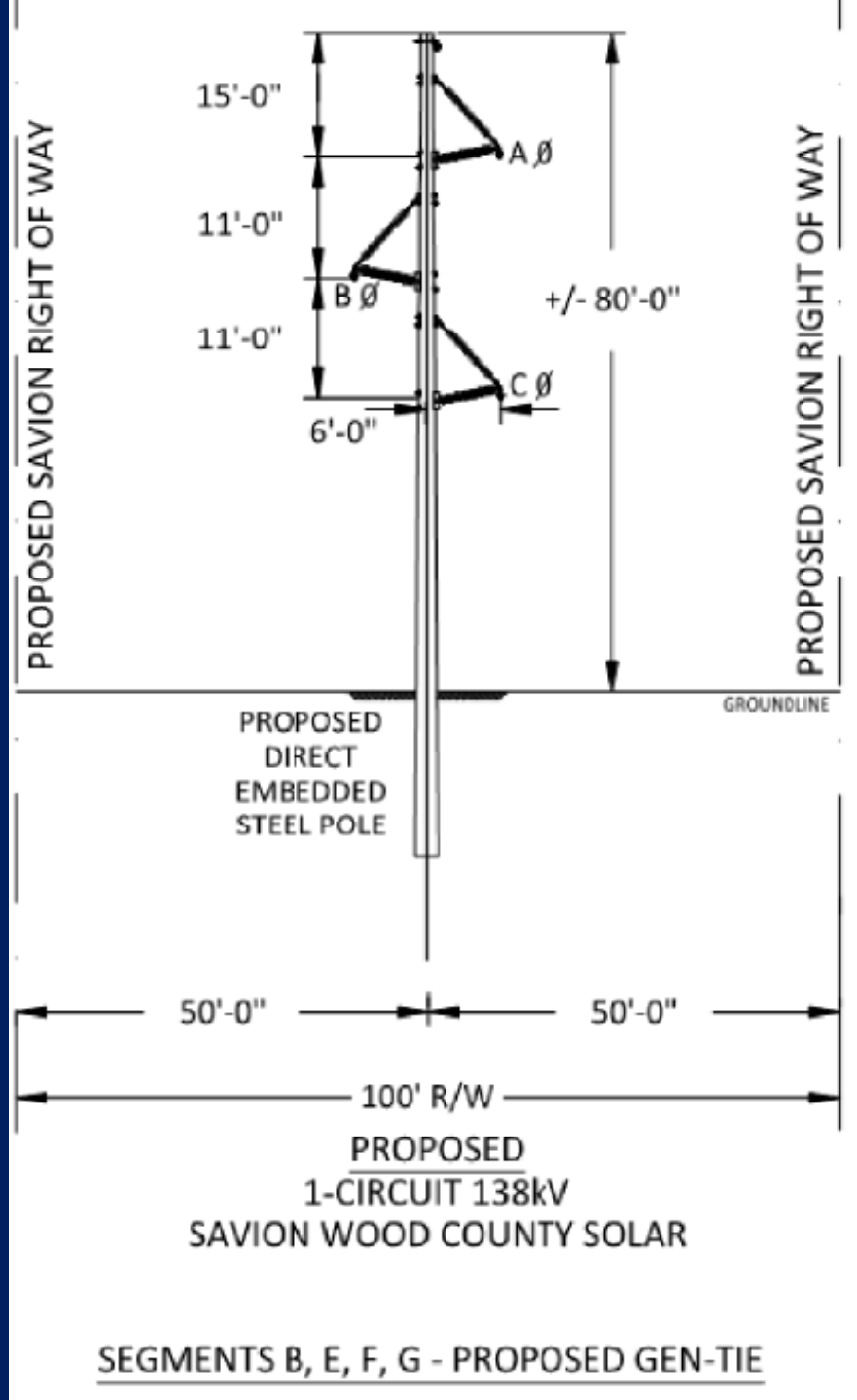


From Savion *Wood County EMF report* for PSC-WI, App. O (Stantec, 2/26/20)

Modeling for single new 138 KV line, 100% capacity

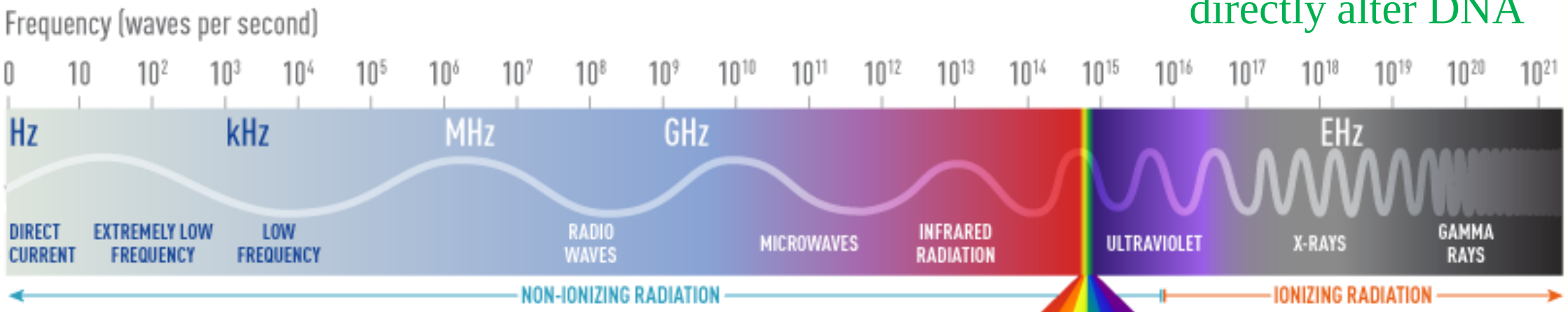
Point Of Interest Name		Maximum Calculated Fields and Distance from Left ROW		
		Distance (ft)	**Electric** (kV/m)	**Magnetic** (mG)
C/L -300ft		-250	**0.0**	**1.4**
C/L -200ft		-150	**0.0**	**3.0**
C/L -150ft		-100	**0.0**	**5.2**
C/L -100ft		-50	**0.1**	**10.8**
C/L -50ft	Left ROW boundary	0	**0.3**	**32.5**
C/L -25ft		25	**0.7**	**74.7**
C/L 0ft	Center of power line	50	**1.8**	**158.4**
C/L +25ft		75	**1.1**	**103.8**
C/L +50ft	Right ROW boundary	100	**0.3**	**44.7**
C/L +100ft		150	**0.1**	**13.3**
C/L +150ft		200	**0.0**	**6.1**
C/L +200ft		250	**0.0**	**3.4**
C/L +300ft		350	**0.0**	**1.5**

From Savion *Wood County EMF report* for PSC-WI, App. O (Stantec, 2/26/20)



ELECTROMAGNETIC SPECTRUM

High energy—can directly alter DNA



Computer
60-100 Hz

Power Lines
50-60 Hz

TV Broadcast
54-700 MHz

Microwave
3-30 GHz

Mobile Phone
1.9-2.2 GHz

Radio
AM 520-1610 kHz
FM 87.5-108 MHz

Diagnostic Radiation
5-50 EHz

Therapeutic Radiation
500-5,000 EHz

Smart Meters
0.9-2.45 GHz

Wi-Fi
2.4-2.5 GHz
5-5.8 GHz

Remote Control
5.8 GHz

NIH-National Cancer Institute (accessed 8/3/21)

Evaluation of reports -- EMF-cancer linkage

- **Committee on Interagency Radiation Research and Policy Coordination** (CIRRPC) – 1989
- The panel reviewed about 1,000 scientific articles. They concluded that there was "No convincing evidence . . . that exposures to extremely low-frequency electric and magnetic fields (ELF-EMF) generated by sources such as household appliances, video display terminals, and local powerlines are demonstrable health hazards."

Reports of EMF causing cancer

- **International Agency for Research on Cancer** (IARC, part of WHO) – 2002.
  - Classified ELF-EMFs as "possibly carcinogenic to humans," based on limited evidence from human studies in relation to childhood leukemia.
- **European Commission Scientific Committee on Emerging and Newly Identified Health Risks – 2015.**
  - [Field] studies of ELF fields show an increased risk of childhood leukemia with estimated daily average exposures above 3 to 4 mG
  - No mechanisms have been identified
  - No support from experimental studies explains these findings.

Reports of EMF causing cancer

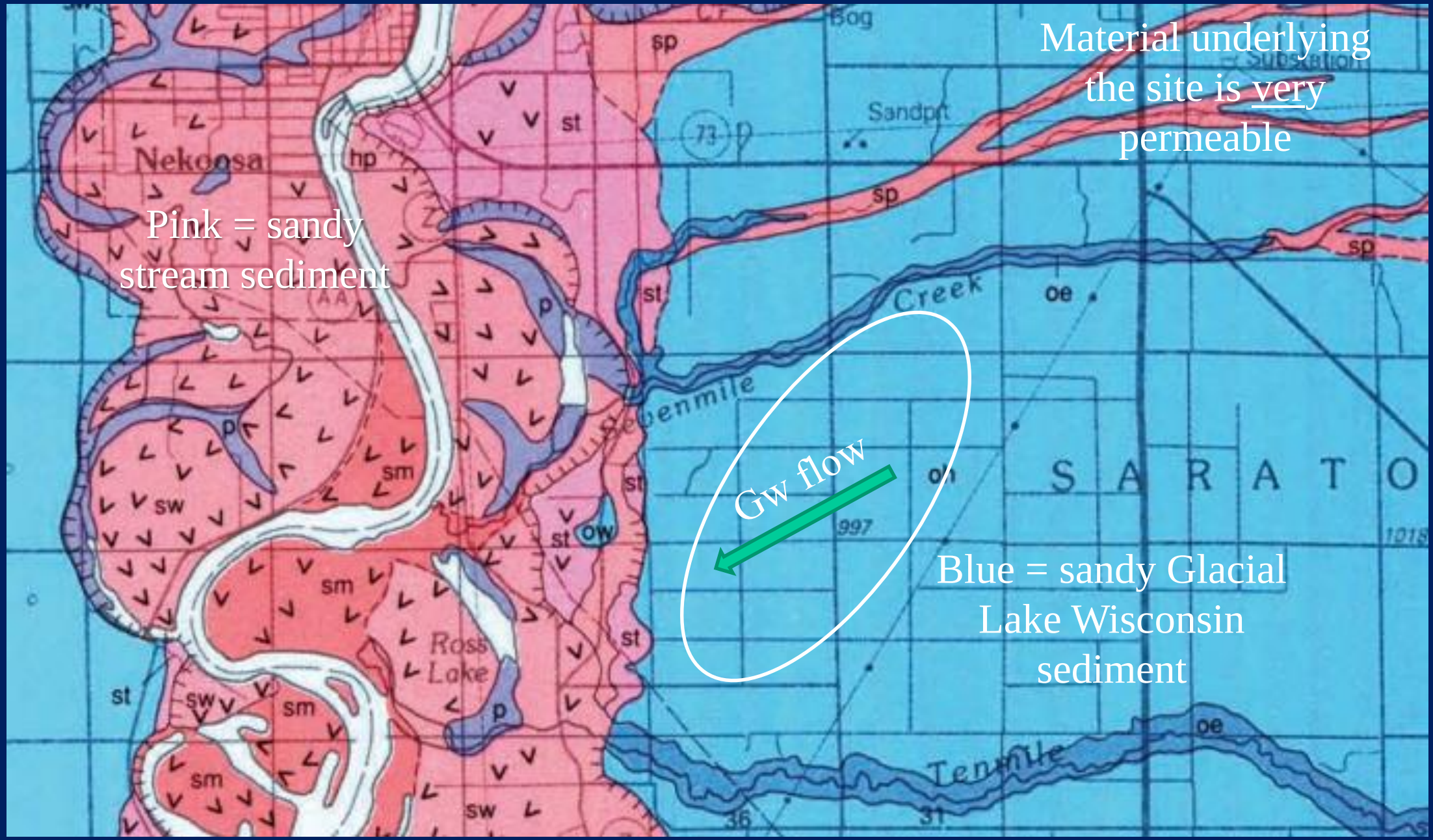
- **NIH-National Cancer Institute** (accessed 8/3/21)
  - "No consistent evidence for an association between any source of non-ionizing EMF and cancer has been found."
  - The interpretation of the finding of increased childhood leukemia risk among children with the highest exposures (at least 3 mG) is unclear.
- USA has no federal standards limiting occupational or residential EMF
- KMS conclusion – Not see convincing evidence of link between extremely low frequency EMF and cancer based on scientific literature.

Stray Voltage Issues

- Electrical potential between two objects that should not have such potential (voltage). Energy can flow through an animal (cow, human). Dairy cows are very sensitive to stray voltage.
- Caused by improper grounding of electrical systems.
- Has been documented as an issue in urban and farm areas.
- Did not find examples of stray voltage issues associated with cross-country power lines.

Potential Groundwater Contamination Evaluation

- Photovoltaic panels not potential source of contamination.
- Currently battery system not planned at site (but this could change).
- Shallow water table at site (<40 ft below land surface based on Town of Saratoga 2020 Monitoring Report (1/22/21)
- Herbicides (and mowing) will be used to control vegetation at the WCSP site. Examine the following:
  - Environmental persistence of the herbicides (half life)
  - Potential for entering the groundwater



Clayton (1991) – Pleistocene Geology of Wood County, WI (WGNHS Info Circ 68)

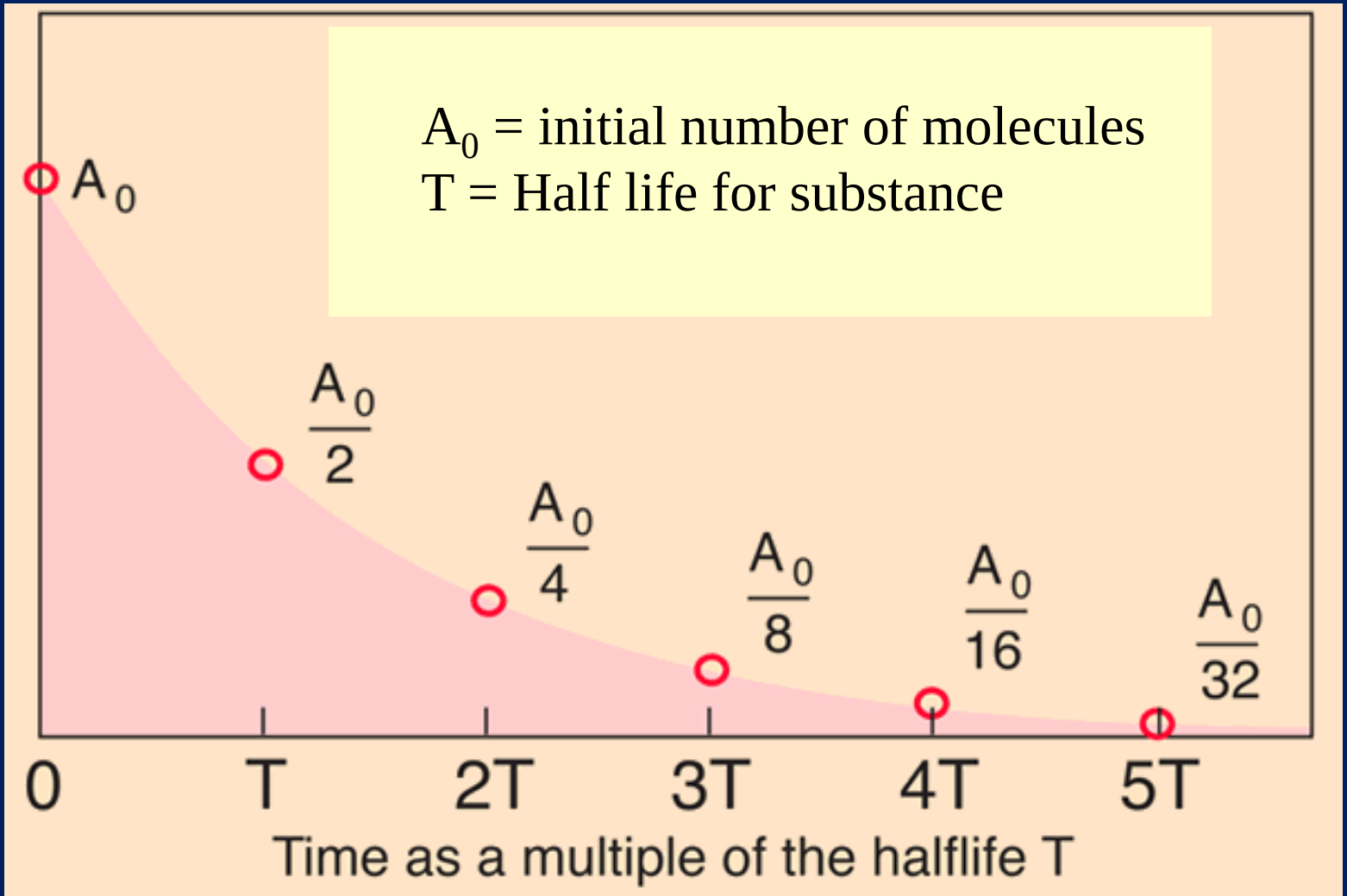
Active Ingredient	Herbicide Type	Potential Uses	Environmental Fate[1,2]			
			Water Solubility	Soil Half-life	Mineral Soil Sorption Coefficient K_{OC} / FAO Mobility Classification[3]	Groundwater Ubiquity Score (GUS)[4] / Potential to Reach Shallow Groundwater
Glyphosate Roundup	Non-selective systemic foliar	Non-selective treatment of grasses and broadleaf plants	Very soluble	3.6 days	33,025 / Immobile	-0.29 / Very unlikely
2,4-D	Broadleaf systemic foliar	Selective treatment of weedy and invasive broadleaf plants	Moderately soluble	2.9 days	73 / Mobile	0.99 / Unlikely
Triclopyr Brush B Gon	Broadleaf selective foliar	Selective treatment of woody plants	Moderately soluble	13 days in unknown soil	93.6 in unknown soil / Mobile	2.26 in unknown soil / Moderate potential
Clethodim Arrest Max	Grass-selective systemic foliar	Selective treatment of weedy and invasive grasses	Very soluble	3 days in unknown soil	137.5 in unknown soil / Moderately mobile	0.89 in unknown soil / Unlikely

Must define these terms!

From *Vegetation Management Plan, Wood County Solar Project* (Stantec, 4/18/20)

Terms

- Half life – amount of time it take for half of a substance to change into something else. Short half life = good thing.



Variables impacting groundwater contamination

- Binding affinity (K_{oc}) – how well the substance binds or "sticks" to soil material.
- Groundwater Ubiquity Score (GUS) – Calculated score using half life and K_{oc} to rate potential to move toward groundwater.

National Pesticide Info Center (Oregon State Univ.)

GUS Value	Potential for movement toward groundwater
Below 0	Extremely Low
0 – 1.8	Low
1.8 – 2.8	Moderate
Above 2.8	High

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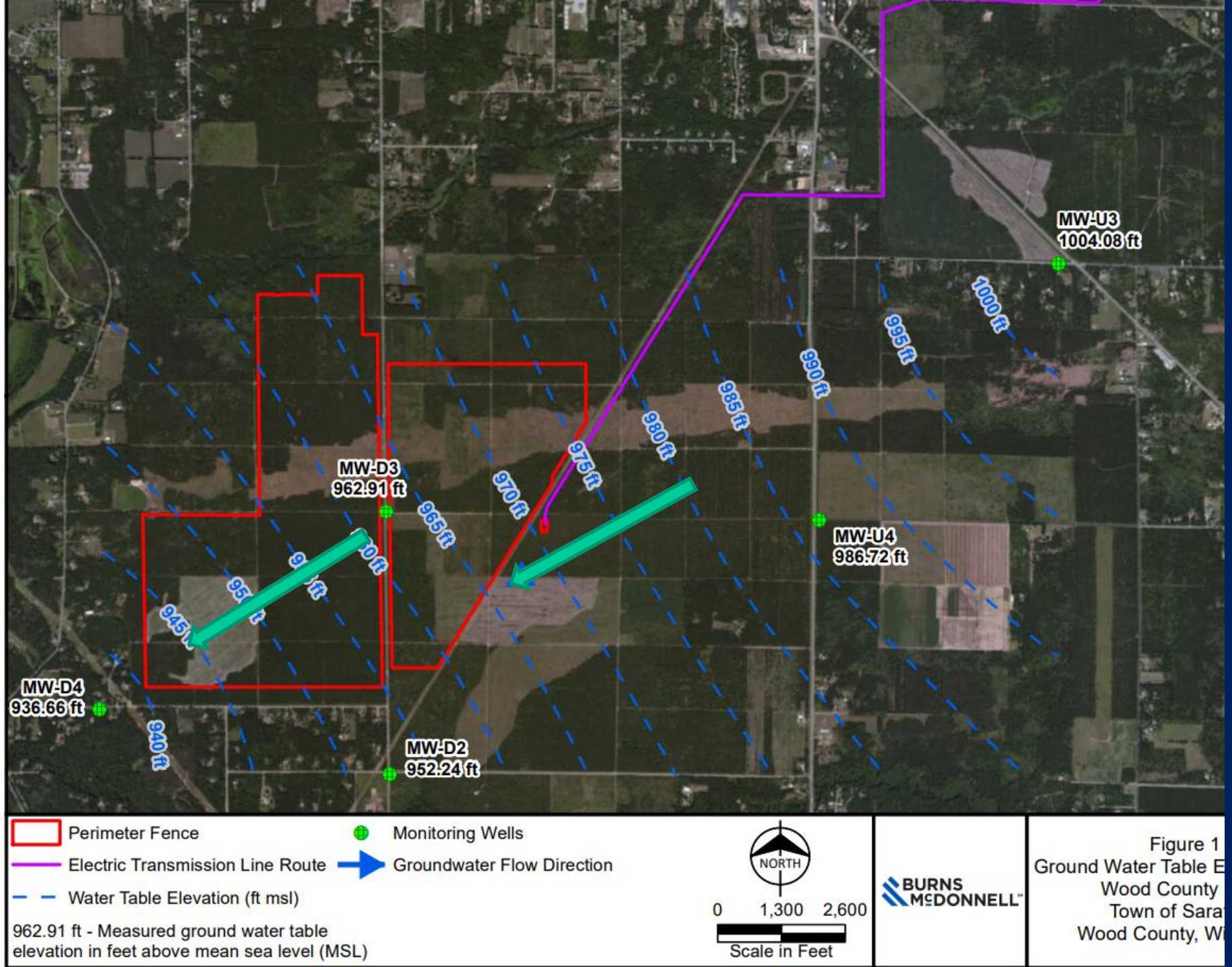

What if a contaminant DID reach the groundwater?

From *Pre-Application File for Wood County Solar Project, LLC to Construct a New Solar Electric Generation Facility*, (Stantec, 1/15/2020).

Calculate groundwater travel time from center of project to the SW boundary houses

- Well logs from Town of Saratoga monitoring wells => medium sand
- K = 10^{-3} to 10^{-1} cm/s (from hydrogeology table)
- Porosity = 25-50% (well sorted sand, from table)
- Hydraulic gradient = 0.00316 (calc. from water table map)
- V_{max} = 3.6 ft/day, V_{min} = 0.036 ft/day
- Center to houses SW of project = 1.2 miles = 6336 ft. Minimum travel time using V_{max} = ~4.8 years

Potential for groundwater contamination

- Most of the proposed herbicides have short half lives and low GUS ratings. Triclopyr has higher probability of reaching groundwater.
- Long travel time (4.8 yrs) from center of project to houses to the SW (time for degradation and dilution).
- KMS conclusion – groundwater contamination from herbicide application unlikely to impact public health.

Watch for these things—Battery systems

- Currently battery system not permitted by PSC for the site.
- Batteries contain extremely reactive metals (unlike solar panels). Potential for “bad things” increases markedly with batteries on site (fires, leaks, etc.).
- Developer’s Agreement item #7 addresses batteries
  - Secondary containment meeting applicable codes including National Fire Protection Association 855 required to prevent potential release into the environment.
  - Current codes and standards will be reviewed and details provided to the town.

Battery system permitting process

- Alliant Energy required to file a Certificate of Authority Application with the PSC of Wisconsin if project exceeds a statutory dollar threshold (currently ~$12M).
  - Recent battery projects were constructed at roughly $2M / megawatt.
  - Battery prices decreasing and dollar threshold can increase.
- Obtain WDNR stormwater construction permit.
- Abide by provisions of the legally binding Wood County Solar Joint Development Agreement.

Watch for these things—Storage on the site

- Beware of fuel and herbicide storage on the WCSP site.
  - Leakage of storage vessels could lead to a constant supply of highly concentrated contaminant.
  - Point sources such as these could reach the shallow groundwater and cause a public health issue.
- When asked, Alliant Energy officials told me they do not plan to store fuel or herbicides at the WCSP site once it is operational. (Contractor may store fuel at site during construction process.)

Conclusions of Kent Syverson's review

- Not see public health and safety issues associated with panel materials, dust, or groundwater contamination from herbicide applications.
- EMF -- No consistent evidence for an association between any source of non-ionizing EMF and cancer has been found.
- Future things for the Town of Saratoga to monitor
  - Battery system permitting
  - Storage of fuel and herbicides at the site

Thanks for your time! Send it back to the Town Chair.