ZONING AS A TOOL IN GROUNDWATER PROTECTION

JANUARY 4, 2022

CENTRAL SANDS GROUNDWATER COLLABORATIVE

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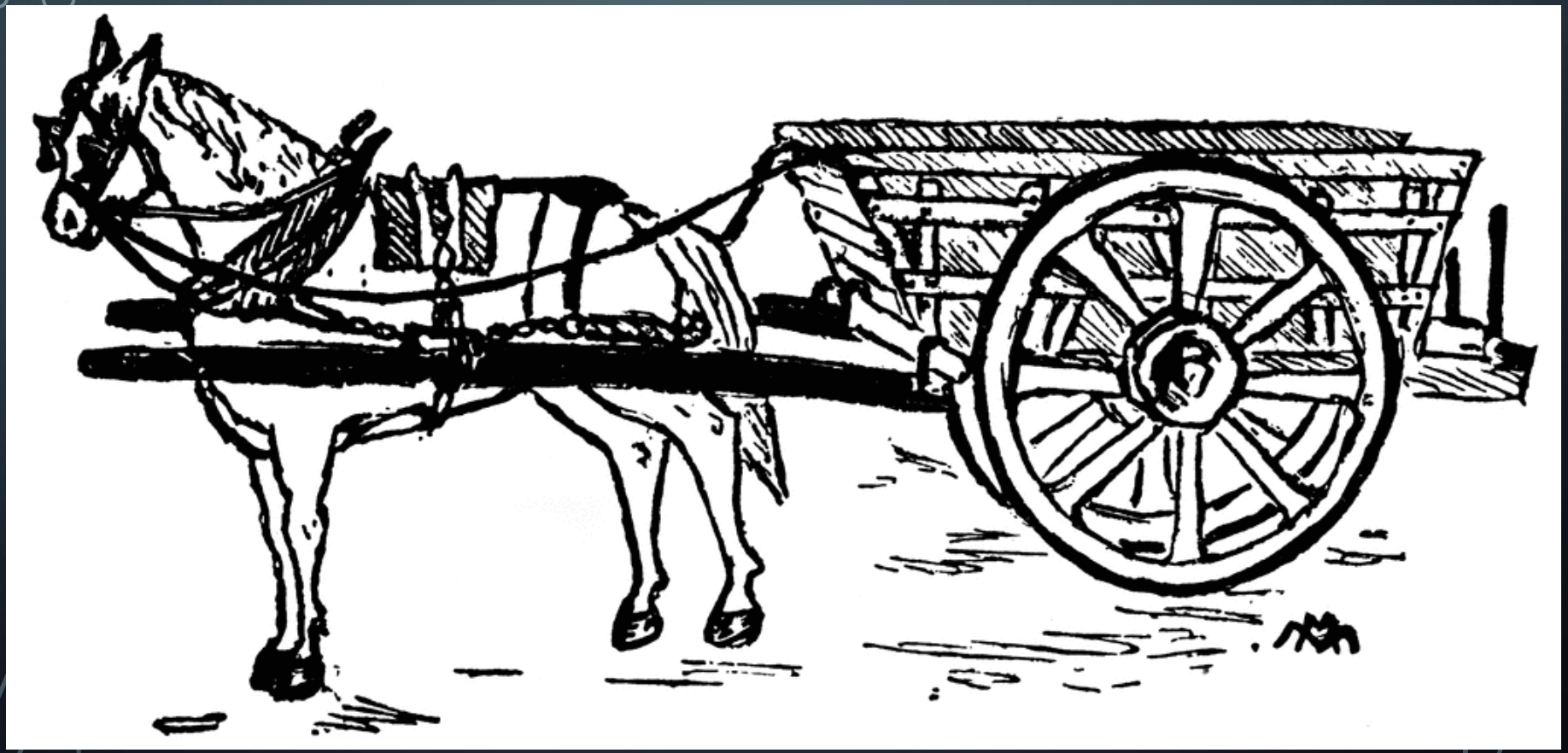
SUMMARY

- Zoning has strengths and weaknesses related to protecting groundwater
- Weaknesses
  - Limited ability to address existing problematic land uses
  - Zoning doesn't determine which crops are grown in ag districts, even though they have different amounts of nitrogen leaching to groundwater
- Strengths
  - Can use wellhead protection ordinances to protect municipal/community wells
  - Can set minimum lot sizes to space out residential septic systems and protect private well water quality from septic systems
  - Can list high nitrogen uses as conditional or prohibited uses (e.g. fertilizer plants, landfills, feedlots, cemeteries, golf courses, possibly CAFOs)
  - Can geographically separate high nitrogen uses from wells - theoretically
- Can be changed at any time by elected officials (town-county zoning). Land purchases are more certain long-term protection, and more expensive.

Comprehensive plan = Goals

Zoning = Way to achieve goals



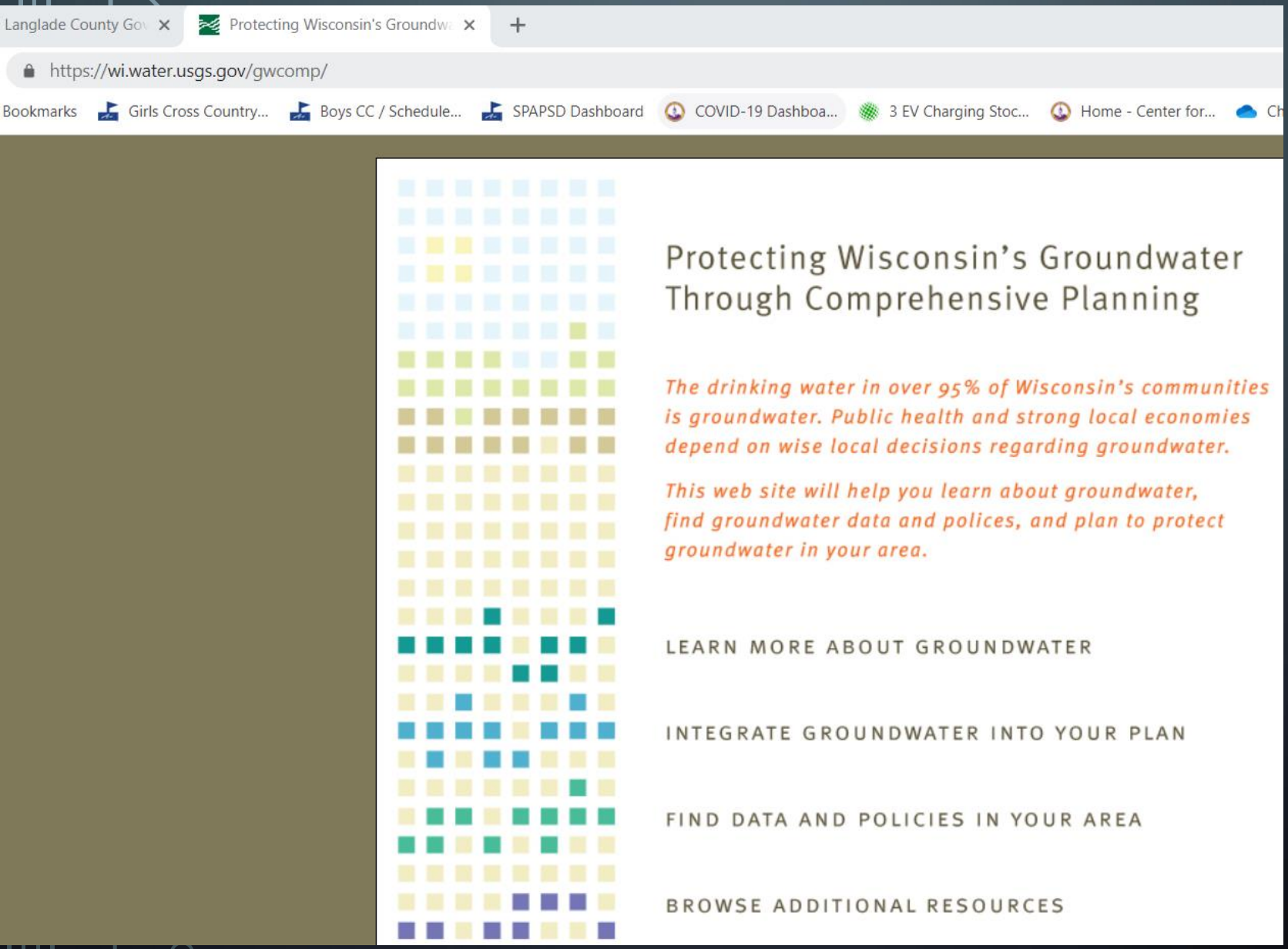
Guiding Document

Comprehensive Plan

Regulatory Tools to Implement the Plan

Zoning Ordinance

Subdivision Ordinance

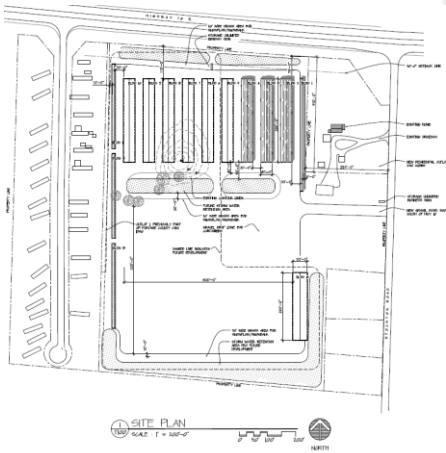


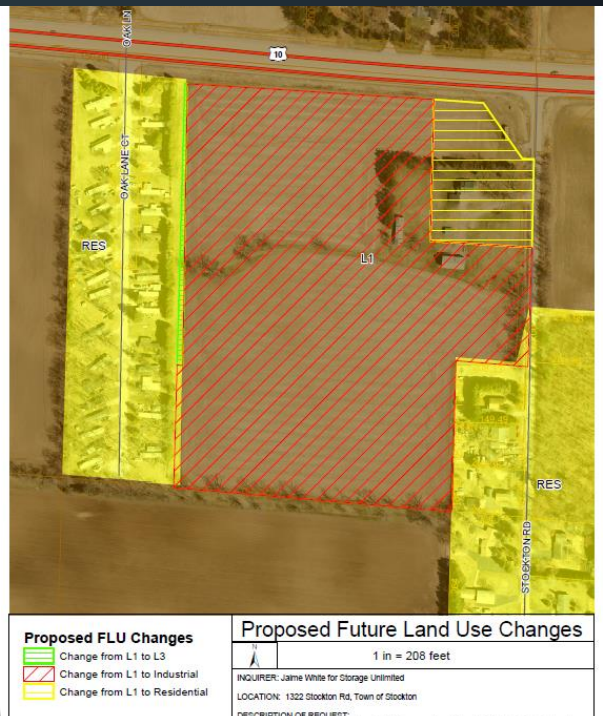
Policy suggestions for updating comp plans.

Note: Data on this website is old. Use Well Water Quality Viewer for data.

EXAMPLE OF USING YOUR PLAN TO PROTECT GROUNDWATER

- Plans are only valuable if they are used in making decisions
- Changes to zoning are required to be <u>consistent</u> with the comprehensive plan
- Portage County used their comp plan to guide groundwater protection conditions for a new proposed development that required a change in zoning





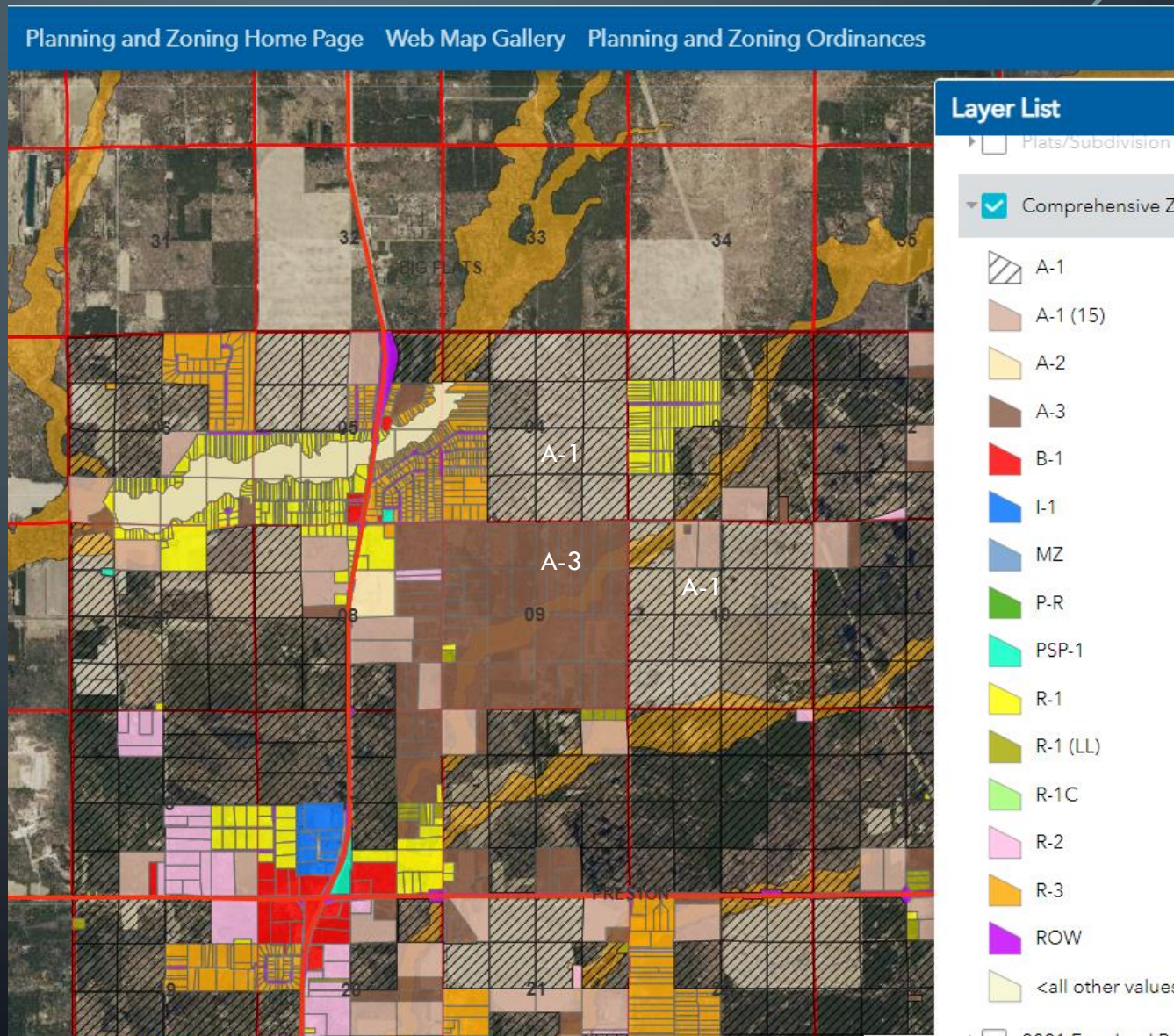
WHAT DO ZONING AND SUBDIVISION REGS DO?

- Sets the development pattern
  - Density
  - Land Uses
  - Building envelope dimensions (setbacks, height, etc.)
  - Roads
- Impacts how our communities look and how they function

HOW DOES ZONING WORK?

A zoning ordinance contains two parts:

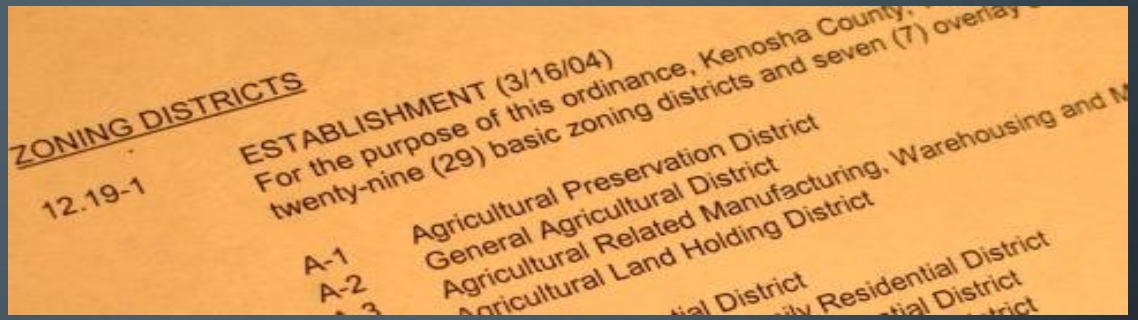
Zoning Map divides the community into districts

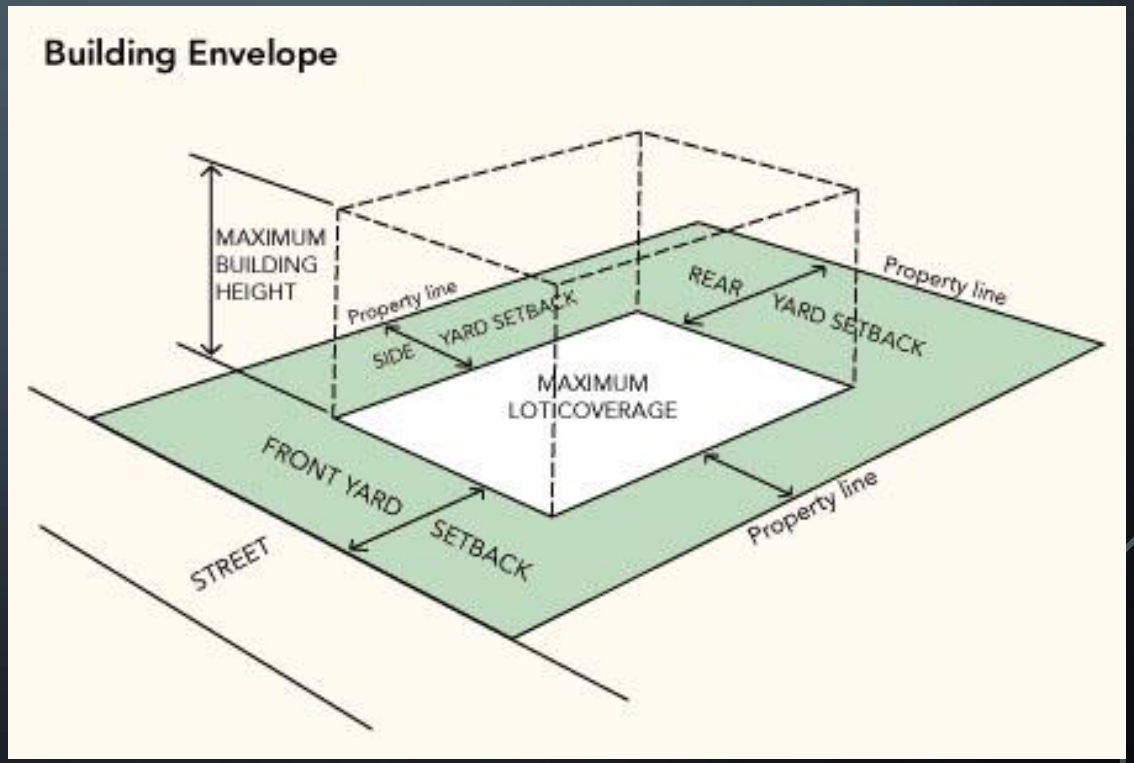


A zoning ordinance contains two parts:

Zoning Text

- purposes
- uses allowed in each district
- dimensional standards i.e. lot size, setbacks, etc.
- requirements related to parking, signage, landscaping, etc.





USES FOR EACH DISTRICT:

Permitted Use

Use is listed and allowed by right in all parts of the zoning district

Granted by zoning administrator

Conditional Use

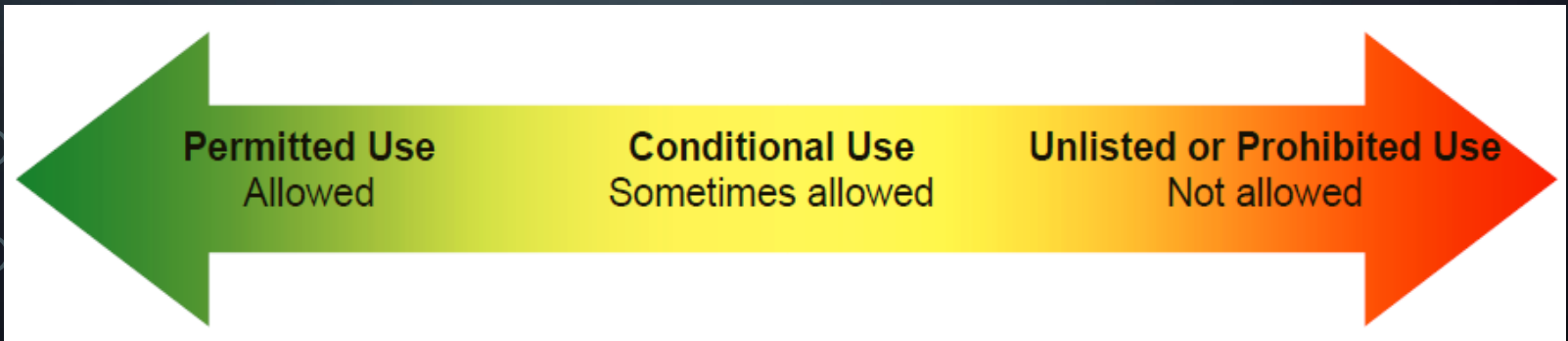
Use is listed for the district and may be allowed if suited to the location

Decided by zoning board, plan commission, or governing body

Prohibited Use

Use is not listed for the district or is expressly prohibited

May apply for rezone or use variance, if allowed



COUNTY SURVEY RESULTS

	Adams	Juneau	Marquette	Portage	Waushara	Wood
Which towns have county zoning?	Most	None	Most	Most	Most	All. 11/21 towns also have town zoning.
Large residential lot sizes that limit septic system density and nutrient loading?	At least one residential zoning district with a lot size ≥2 acres (R1 & R2)	N/A	No. Ag districts have lot sizes ≥2 acres	At least one residential zoning district with a lot size ≥2 acres (Rural & Urban Fringe)	At least one residential zoning district with a lot size ≥2 acres (Residential Single-Family Planned Devt)	No minimum lot sizes in county zoning
Comments	• How widely do residential zoning districts with a minimum lot size 2 acres or greater apply in your county? What percentage of residentially zoned areas have minimum lot sizes 2 acres or greater? • Where residential zoning districts have lot sizes 2 acres or greater, drinking water quality should be fairly well protected from nearby septic systems. Ag or other land uses applying nitrogen may still affect drinking water quality in residential zoning districts with minimum lot sizes 2 acre or greater. • Large residential lot sizes also take more farmland and woodlands out of production. An alternative is to guide new residential development to villages/hamlets with public water and sewer to provide safe drinking water. Jefferson County uses this approach to an extent. • Most ag districts have lot sizes greater than 2 acres, though some ag districts and general purpose districts have minimum lot sizes less than 2 acres and allow residential development (e.g. Waushara, Marquette, Town of Rudolph).					

DIFFERENT CROPS LEACH DIFFERENT AMOUNTS OF NITROGEN TO GROUNDWATER

- Ag zoning districts do <u>not</u> differentiate based on how much nitrogen is leached to groundwater

N Inputs - N Outputs - N Storage = Leachable N

		Inputs			Outputs		Storage	
Crop	Yield (per acre)	Fertilizer	Irrigation[1]	Precip+ Deposition	Harvest Yield N	Misc. losses	Change in N	Leachable Nitrogen
		----------lbs nitrogen per acre----------						
Potato	424 cwt	220-300	41	8	170	30-37	0	72-144
Sweet Corn	8.5 ton	130-170	41	8	73	22-25	0	86-123
Field Corn	204 bu	180-240	41	8	149	26-32	0	56-110
Carrots	27 ton	100-140	41	8	97	19-23	0	35-71
Snap Beans[2]	8 ton	40-80	41	8	62	14-17	0	15-51

[1]Assumes 10 inches of irrigation water containing 18 mg/L nitrate-nitrogen. At this concentration each inch of irrigation water contains 4 lbs N/acre.
[2]Non-nodulating

Sandy soils

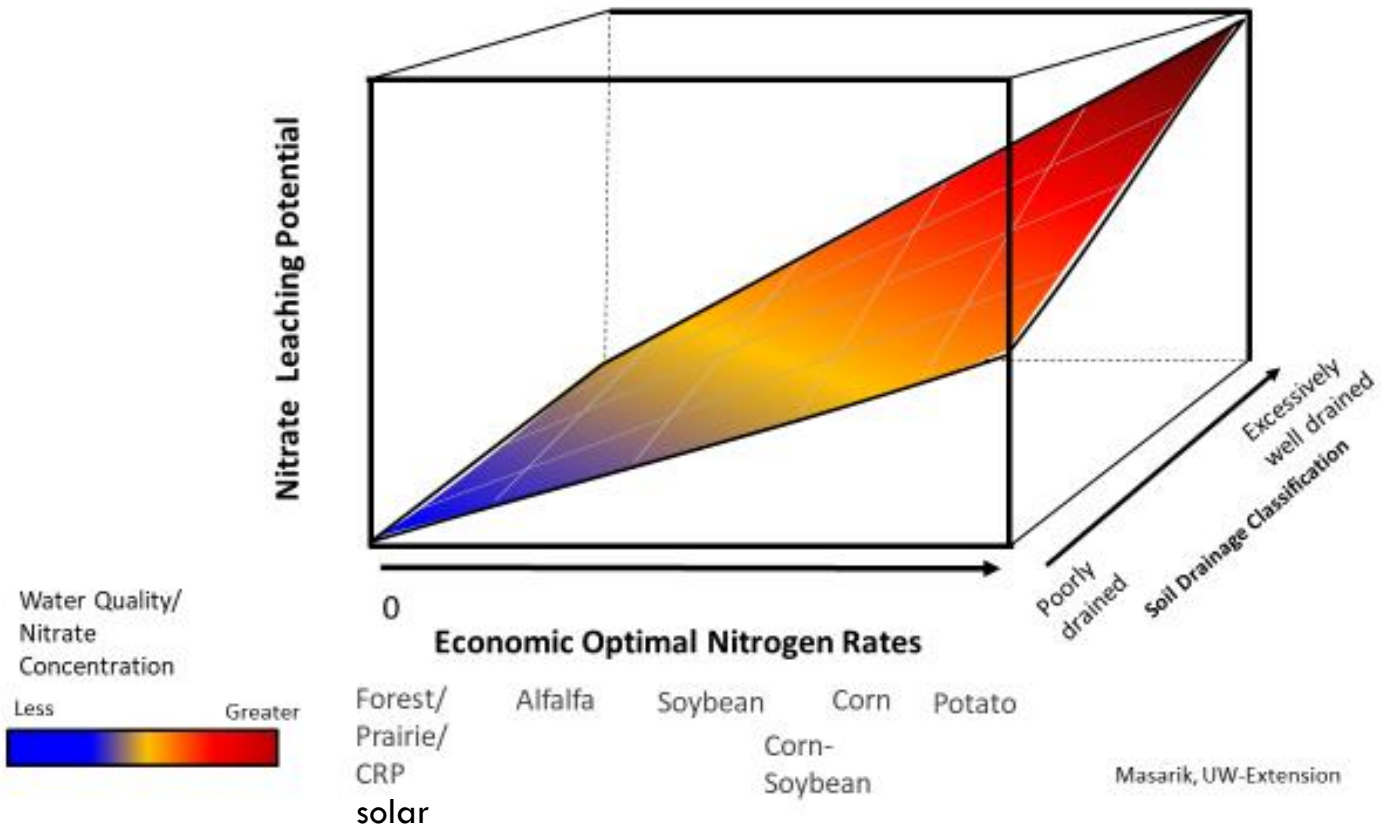
Kevin Masarik, Groundwater Specialist

Comparing Land-use Impacts

	Corn[1] (per acre)	Prairie[1] (per acre)	Septic[2] System
Total Nitrogen Inputs (lb)	169	9	20-25
Nitrogen Leaching Loss (lb)	36	0.04	16-20
Amount N lost to leaching (%)	20	0.4	80-90

1 Data from Masarik, Economic Optimum Rate on a silt-loam soil, 2003
2 Data from Tri-State Water Quality Council, 2005 and EPA 625/R-00/008

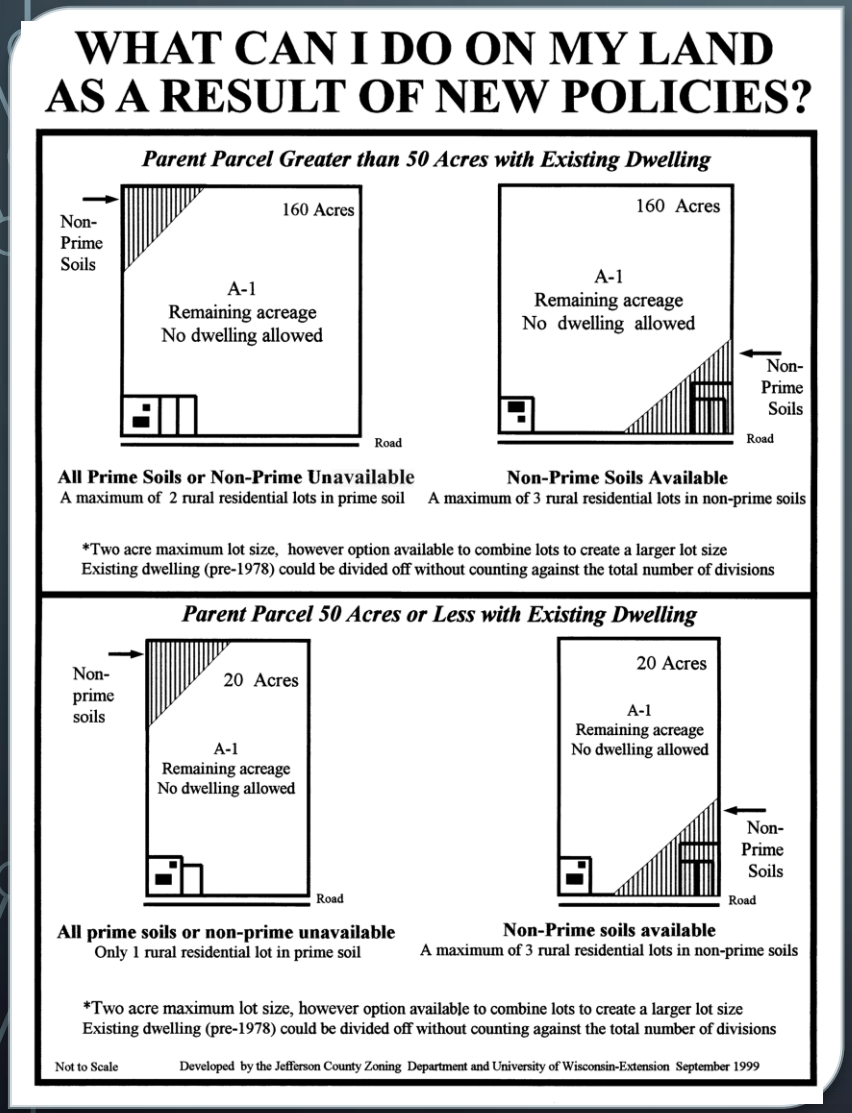
Nitrate Leaching Potential



solar

- Different crops on the same soil have different rates of nitrate leaching that vary from year to year based on fertilizer inputs, yield, and weather
- Nitrate leaching below the same crop can vary depending on soil type and location in the state
- Zoning doesn't determine which crops are grown. LWCD and FSA offices can affect this topic.

Kevin Masarik, Groundwater Specialist, send PowerPoint and video



LIMITED RESIDENTIAL ALLOWED IN A-1 ZONING DISTRICTS

- Farmland preservation
- Fewer <u>new</u> residential lots in A-1 zoning districts which may have high nitrate levels

SURVEY RESULTS

Limiting new residential lots where drinking water is not safe

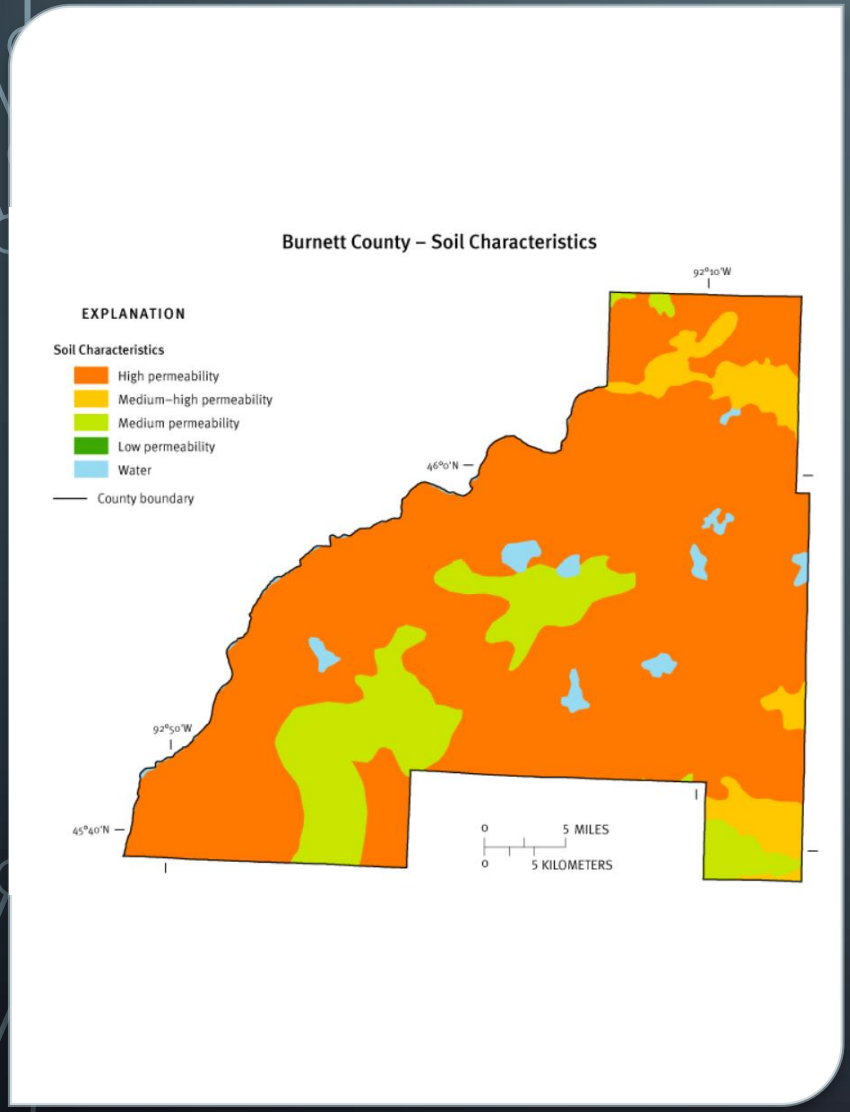
Do drinking water health standards such as 10 mg/l nitrate-nitrogen, pesticide standards, or other drinking water standards need to be met before subdividing land?	No for all counties except Portage. Portage Co has a subdivision ordinance that requires a water test prior to the division of land. However, it does not necessarily have to meet drinking water standards in order to be divided. Extremely elevated levels may prevent a property from being divided or may require notification be placed on the Certified Survey Map or treatment may need to be provided.

CAN USE ZONING TO MAKE LAND USES WITH HIGH NITROGEN LEACHING CONDITIONAL OR PROHIBITED USES

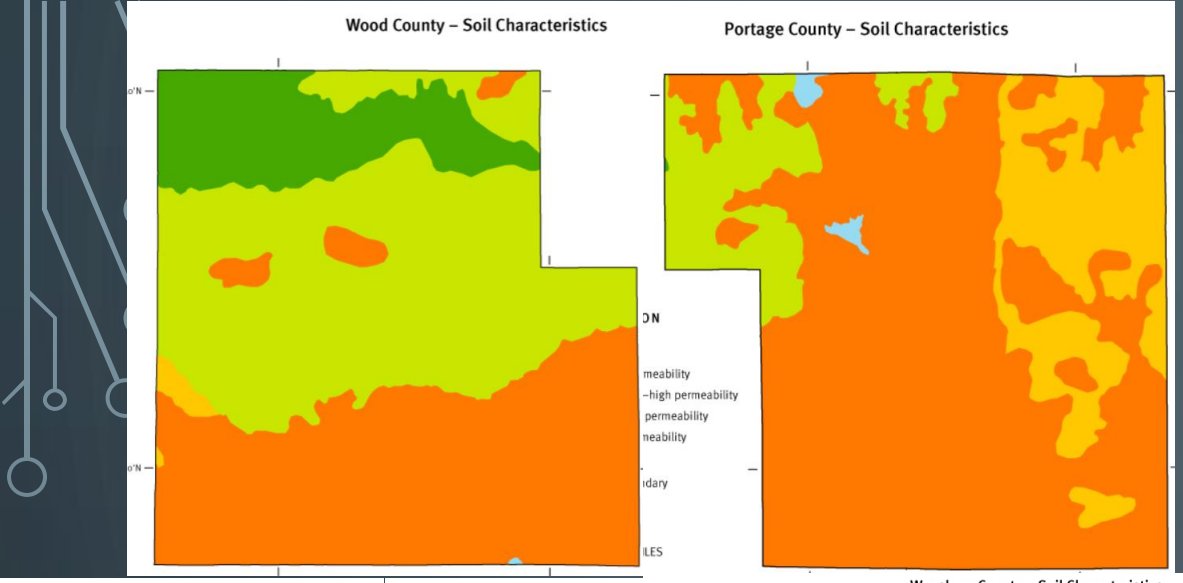
	Adams	Juneau	Marquette	Portage	Waushara	Wood
Are land uses with high potential to contaminate drinking water prohibited or restricted in areas with drinking water wells?	**Conditional uses:** Fertilizer plants, feedlots, gas stations. Require a public hearing to decide whether to grant or deny depending on if standards are met, including impacts on adjacent properties. **Permitted uses:** Ag uses, golf courses and cemeteries. Allowed. **Comment**: Portage Co has GW flow maps, depth to GW, irrigated fields, water quality viewer, locations of wells and septics.					

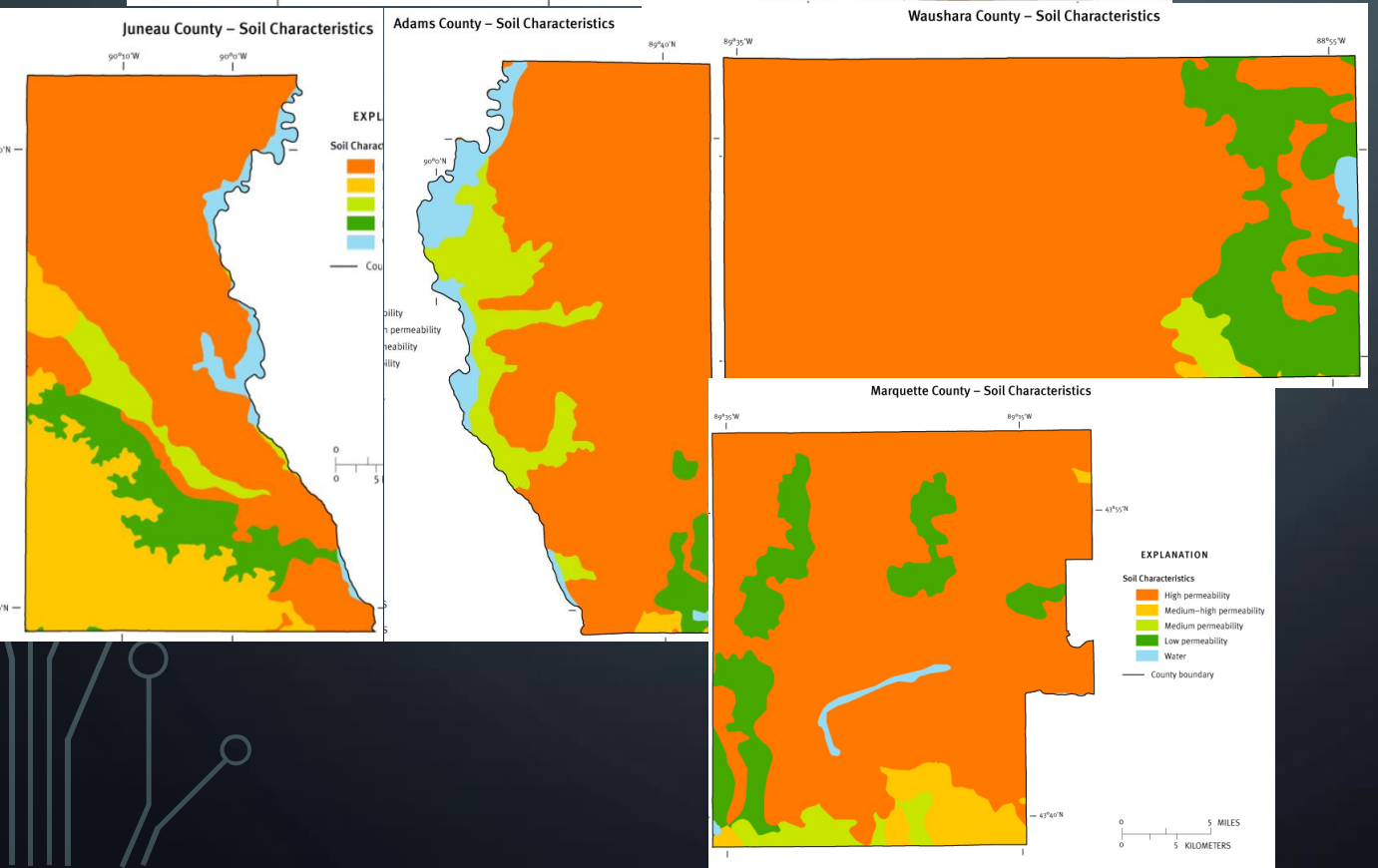
- Review the permitted, conditional, and unlisted/prohibited uses listed for each zoning district in your ordinance. Compare your zoning maps with your groundwater susceptibility/soil maps. Do they need to be updated to protect groundwater qualiy?
- 2017 Act 67 says if a CUP meets standards in ordinance it must be granted

BURNETT COUNTY PLANS TO USE GW SUSCEPTIBILITY MAPS AND ZONING TO LIMIT WHERE NEW CAFOS CAN BE LOCATED



- About 80% of Burnett County is less than 20 feet to the water table and has highly permeable soils
- Burnett County has three ag districts
- Not much exclusive ag zoning (A1) is located in the sandy soil areas of the county
- Land use committee is working on a proposal to allow CAFOs (1000 animal units or more) only in A1, and limit animal units in other ag districts to 250 or 500





- All counties in CSGCC have areas of highly permeable soils, and some areas with lower permeable soils
- Areas with lower permeable soils are likely safer places for land uses that are potential sources of GW contamination
- Zoning can be used to determine where NEW land uses will be located (e.g. fertilizer plant, manufacturing)

SURVEY RESULTS

- Zoning districts that maintain or allow low nitrogen land uses
- GW downgradient of these areas may be protected & low nitrate. Map?

	Adams	Juneau	Marquette	Portage	Waushara	Wood
Which zoning districts allow ground-mounted solar energy (where there is typically minimal nitrogen application)?	Not addressed	Not addressed	Any district	Not addressed	General ag	Not addressed in county zoning. Town by town.
Zoning districts that maintain woodlands, grassland or wetland areas, which are land uses that typically have minimal nitrogen application	Shoreland/conservancy	None in county ordinance	Resource Protection	Conservancy	Natural Resource Preservation, Forest, Parks and Rec	None in county ordinance
Comments on row above	How widely do these districts apply? They may provide low nitrate drinking water downgradient. Note: I cut shoreland-wetland zone from minimal nitrogen districts because it allows septics on ½ acre lots.					

Comparing Land-use Impacts

20 acres

36 lbs	36 lbs	36 lbs	36 lbs
36 lbs	36 lbs	36 lbs	36 lbs
36 lbs	36 lbs	36 lbs	36 lbs
36 lbs	36 lbs	36 lbs	36 lbs
36 lbs	36 lbs	36 lbs	36 lbs

36 lbs/ac x 20 acres = 720 lbs

16 mg/L

20 acres

20 lbs

20 lbs/septic system x 1 septic systems = 20 lbs

1/36th the impact on water quality

0.44 mg/L

Assuming 10 inches of recharge -

Masarik, UW-Extension

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20 acres

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20 lbs	20 lbs	20 lbs	20 lbs
20 lbs	20 lbs	20 lbs	20 lbs
20 lbs	20 lbs	20 lbs	20 lbs
20 lbs	20 lbs	20 lbs	20 lbs

20 lbs/septic system x 36 septic systems = 720 lbs

Using these numbers: 36 septic systems on 20 acres (0.55 acre lots) needed to achieve same impact to water quality as 20 acres of corn

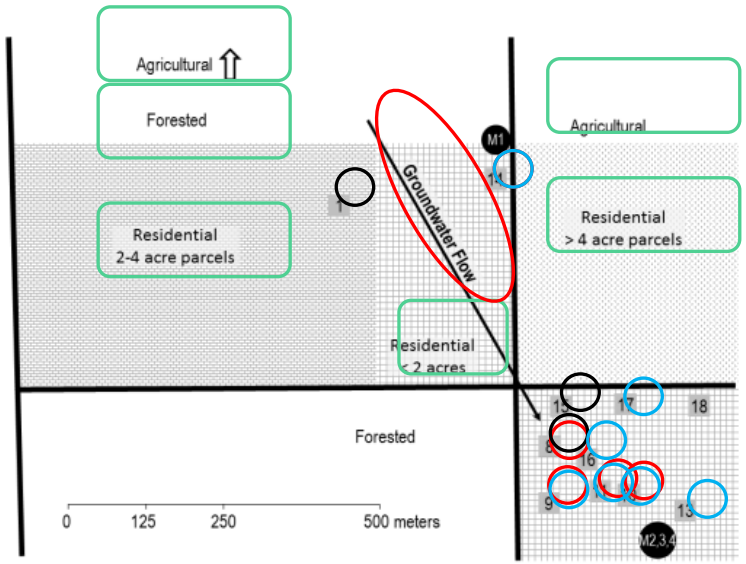
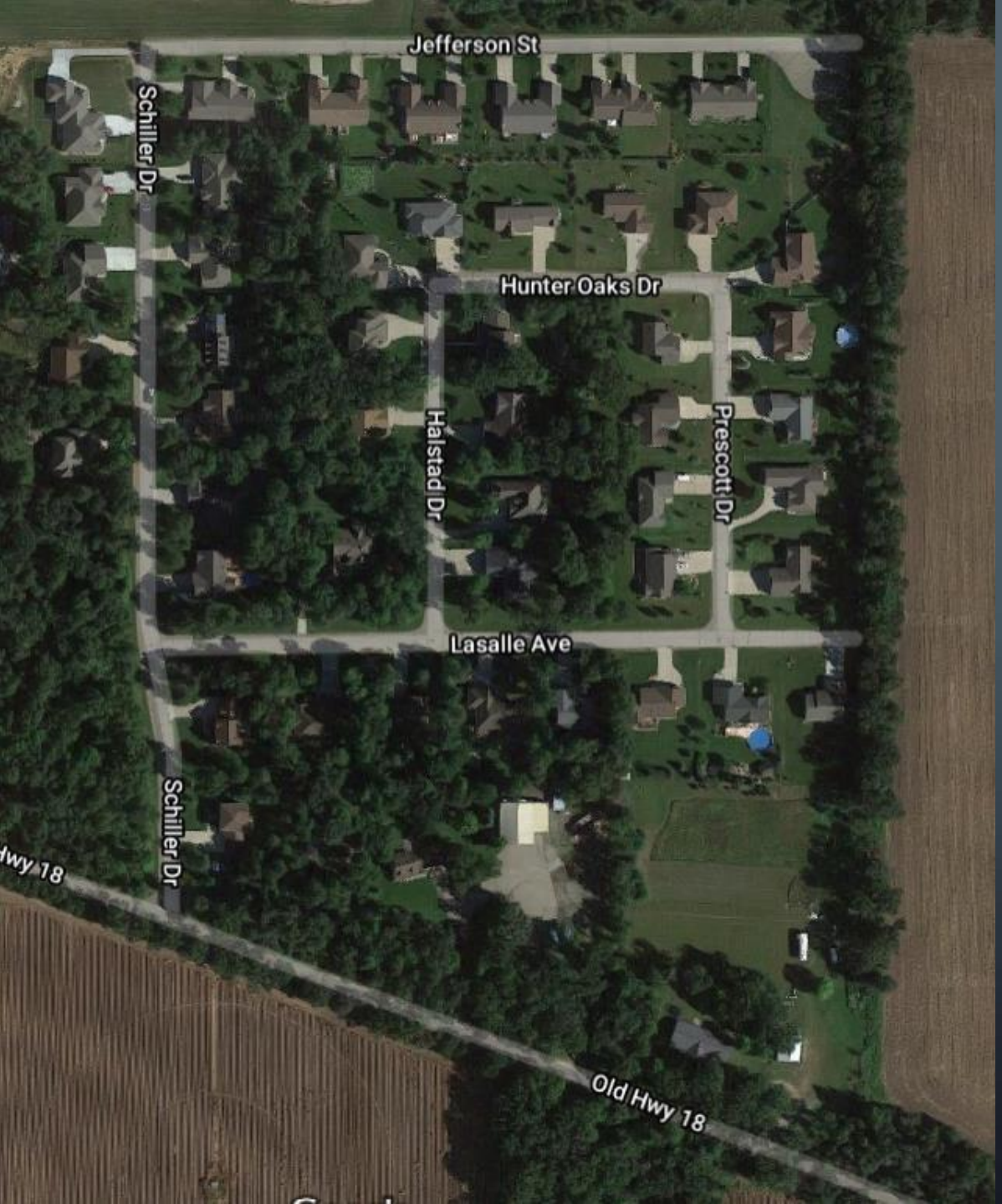


Figure 2. North study area showing land uses and density of homes in the residential areas. Numbered squares show location of private wells sampled and dark circles show the location of the monitoring wells.

UNSEWERED RESIDENTIAL AREAS

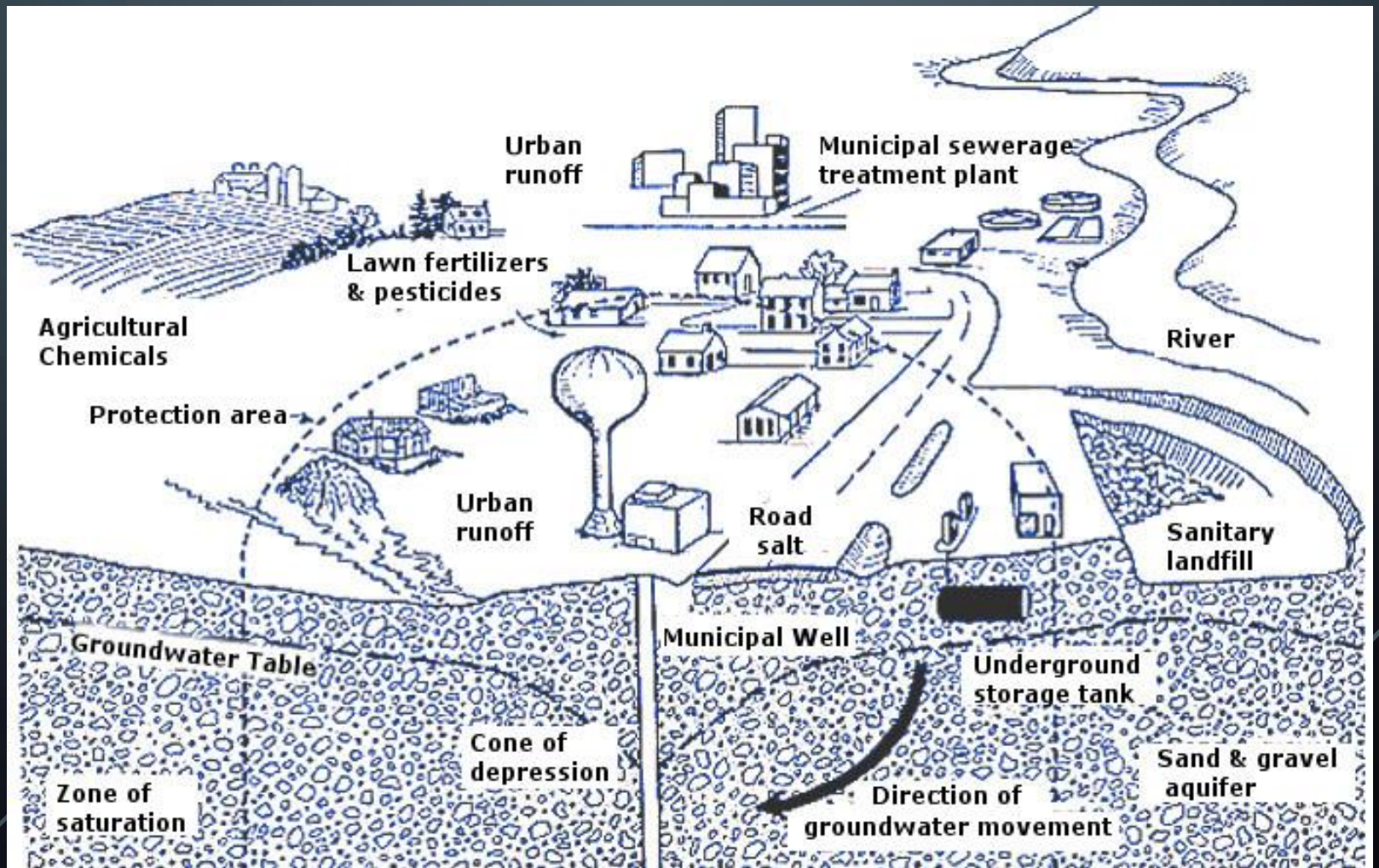
- In a sandy area with unsewered lot sizes less than 2 acres, nitrate levels were:
  - 7 wells 2-10 ppm = blue circles
  - 3 wells over 10 ppm= black circles
  - 1 well less than 2 ppm
- Sulfamethoxazole, a human antibiotic = red circles
- Let me know if you'd like a copy of this study



RESIDENTIAL ZONING FOR UNSEWERED DEVELOPMENT

- Zoning can be used to set unsewered minimum residential lot sizes at 2 or more acres to limit well contamination by nitrate and pharmaceuticals from nearby septics

Wellhead protection ordinance



SURVEY RESULTS

	Adams	Juneau	Marquette	Portage	Waushara	Wood
Do you have overlay districts to reduce groundwater contamination? This might include districts to protect municipal wells, wells for trailer courts, or other wells.	No	N/A for county regs	No	Wellhead protection overlay for muni wells	No	Wellhead protection overlays for muni wells in WI Rapids, Marshfield and Pittsville? Not for other 5 munis.

ENVIRONMENT INVESTIGATES

Ford megasite atop 'recharge zone' for underregulated Memphis Sands aquifer

An area that provides drinking water for more than a million people depends on company and state for protection

BY: **ASHLI BLOW** - JANUARY 3, 2022 5:01 AM

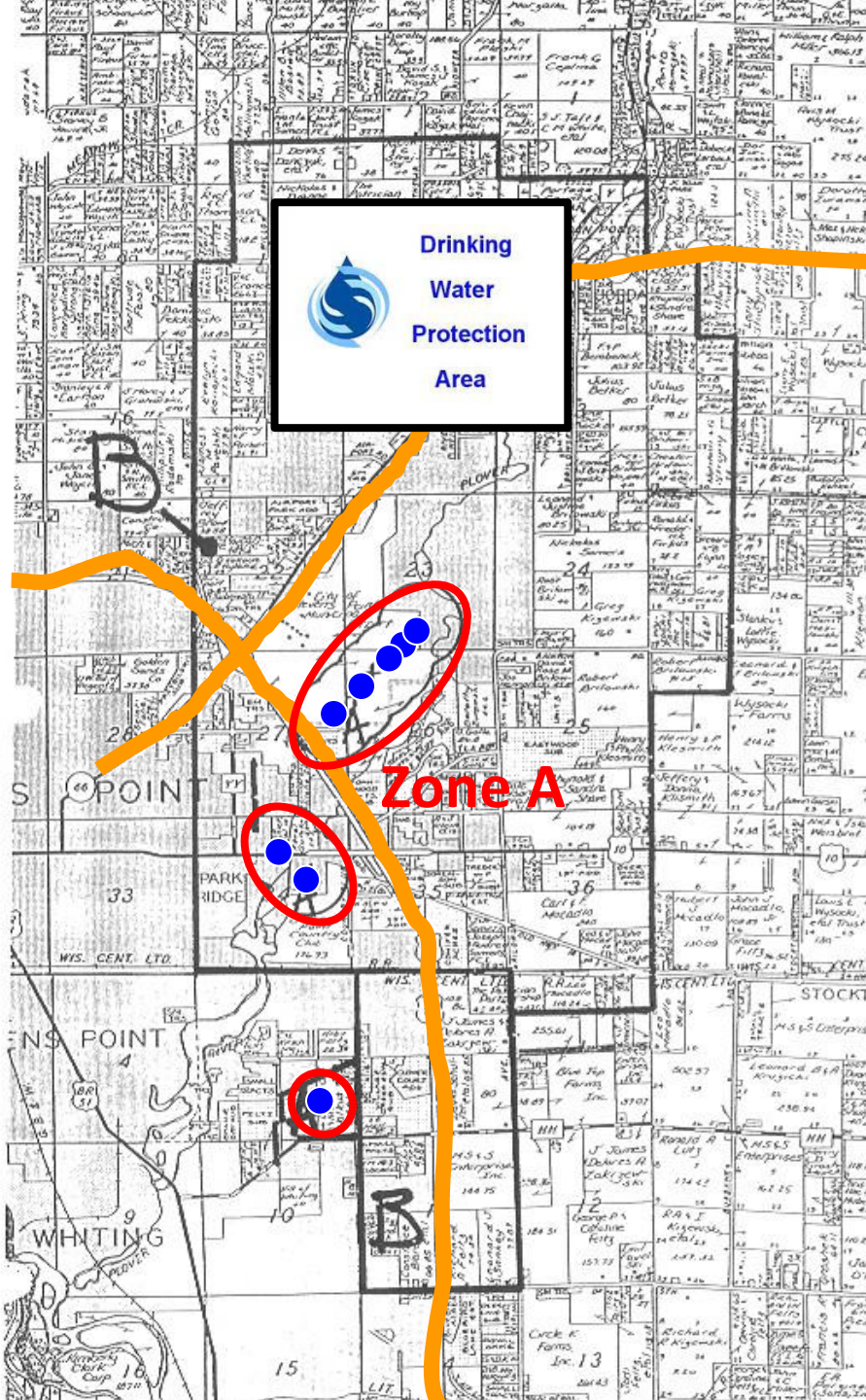
Satellite image of a portion of the Megasite of West Tennesseee. (Tennessee Department of General Services.)

Wellhead Protection Ordinance

Zone A – allows only land uses with low potential to pollute drinking water such as unfertilized parks

Zone B – allows more land uses but not gas stations, fertilizer plants, cemeteries, etc.

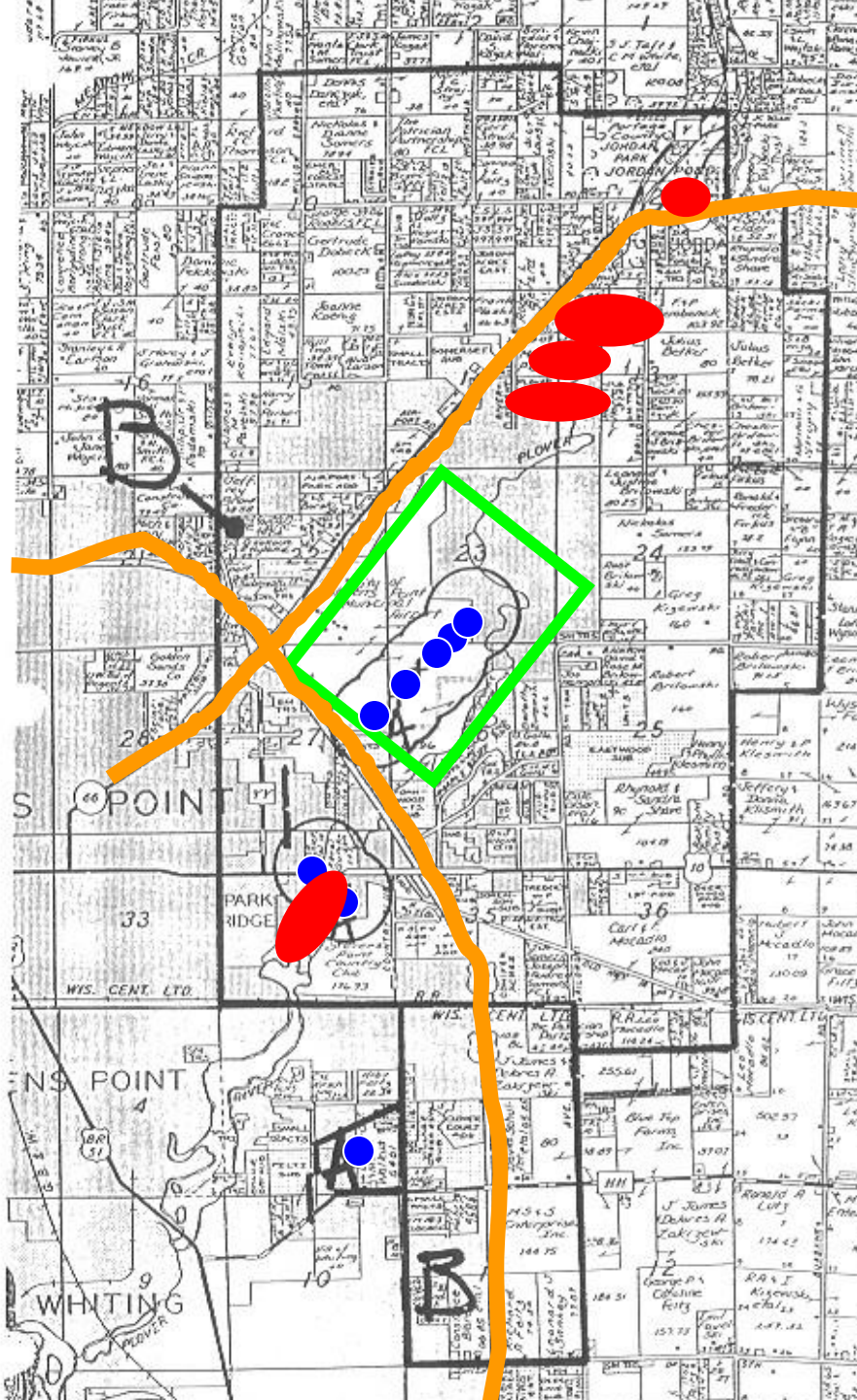
Municipalities can save $ by keeping their drinking water safe



Other approaches to wellhead protection

- Purchase and lease of lands around the wells:
  - City forested recreation area
  - Izaak Walton League lodge and shooting range
  - Boy Scout camp
  - Conservation easement

ARPA funding?



SUMMARY

- Zoning has strengths and weaknesses related to protecting groundwater
- Weaknesses
  - Limited ability to address existing problematic land uses (e.g. fertilizer plant with regular spills); can limit building expansions
  - Zoning doesn't determine which crops are grown in ag districts, even though they have different amounts of nitrogen leaching to groundwater
- Strengths
  - Can use wellhead protection ordinances to protect municipal/community wells
  - Can set minimum lot sizes to space out residential septic systems and protect private well water quality from septic systems
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