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# Pierce County Groundwater

## Ad hoc Groundwater Committee Interim Report

**Ad hoc Groundwater Committee Members:**

Michael Kahlow- *Chair*

Teresa Davis- *Vice Chair*

Missi Blue- *Member*

Rainbow Barry- *Member*

Chris Wacek-Driver- *Member*

Paul Fetzer-*Member*

Peter Carr- *Member*

Barb Kolpin- *Member*

Eric Soley- *Member*

County staff from Land Conservation, Public Health and Land Management  
Departments assisting

## Summary

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In 2023, the Pierce County Board of Supervisors formed an *ad hoc* committee to review available data, literature, best practices, current regulations, and programs, and to propose solutions to mitigate factors that threaten the quality and health of groundwater. This interim report summarizes risks identified by the committee to date.

All Pierce county residents rely on groundwater for drinking, with an estimated 38% of the population withdrawing drinking water via 5,824 recorded private wells.<sup>1</sup> The remaining 62% access drinking water from municipal sources, which are also withdrawn from groundwater.

The committee has identified nitrate and bacterial contamination as risks to the health of the residents of Pierce County. 14% of tested wells included in the UW-Stevens Point Wisconsin Well Water Viewer dataset have nitrate levels above federal drinking water standards, while 9% of samples tested positive for E.coli. Major areas of contamination appear to be in a cluster in Clifton Township and in a broad swath from Prescott to Plum City.<sup>2</sup>

Likely sources of this contamination include septic systems and agricultural activities. At this time, the data is insufficient to draw conclusions as to sources of contamination.

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<sup>1</sup> Wisconsin Department of Natural Resources Well Construction Information Systems, <https://apps.dnr.wi.gov/wellconstructionpub/#!/PublicSearch/Index> Accessed 09/10/24

<sup>2</sup> UW-Stevens Point Wisconsin Well Water Quality Viewer, [https://gissrv3.uwsp.edu/webapps/gwc/pri\\_wells/](https://gissrv3.uwsp.edu/webapps/gwc/pri_wells/) Accessed 09/19/2024

# Introduction

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A nine member ad Hoc committee was given the following charge:

1. Provides valuable insight and recommendations to the Board by applying local knowledge, review of monitoring and technical data, and discussion of current and potential groundwater management activities.
  2. Researching, gathering, analyzing, and synthesizing scientific literature regarding all potential impacts on groundwater quality, including but not limited to, livestock facilities, row crop production systems, and municipal & industrial nutrient sources, specifically as it applies to Pierce County.
  3. Identifying areas where new regulations may be needed, where current regulations need to be modified, and where enforcement of current regulations is inadequate and are needed to protect groundwater as a resource for Pierce County residents;
  4. Proposing solutions to mitigate problems and/or shortcomings identified in a report to the county board.
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The group then consulted with the following experts to gather information:

Retta Isaacson, Pierce County Land Conservation Water Quality Planner, presented the committee with the 1990 groundwater study from the WGNHS and compared those results to the 2019-2022 county wide sampling. Additionally, she highlighted information derived from well logs of participants in the later study. Discussion included what that information is being used for now, what sampling is continuing, and what might be needed for a better groundwater inventory.

Rod Webb, Pierce County Land Conservation Director, presented an overview of what the Land Conservation Department implements for groundwater protection. Discussion included changes in perennial cover, manure management decisions, and possible direct conduits to groundwater ( i.e. sinkholes and old wells). Questions about septic system regulation and programs were directed to Land Management.

Kevin Masarik from the UW-Steven Point Center for Watershed Science and Education presented an overview of groundwater and emerging contaminants highlighting bacteria, E. Coli, nitrate, chloride, pesticides, and metals. Discussion included the effectiveness of drilling deeper wells, nitrate sources and how they migrate, and isotope testing versus agricultural and human waste water tracers.

Brian Long and AZ Snyder, Pierce County Public Health, presented their department's involvement in groundwater. Highlights included the state funded free well testing for people who are pregnant, breastfeeding, or have a child under 12 months in their home, the transient



noncommunity well testing staff facilitates for the DNR, and what public health data they access related to groundwater quality.

Adam Adank and Andy Pichotta, Pierce County Land Management, presented their role in groundwater including an in-depth look at the Private On-Site Wastewater Treatment Systems (POWTS) permitting and installation process. Discussion included development/dense parcel planning and what the state laws limit.

Maureen Muldoon from the Wisconsin Geological and Natural History Survey (WGNHS) presented on geology and karst topography and how it relates to groundwater recharge and quality. Discussion included geographic variability, well casing depth regulation, and what resources Pierce County has. Amy Wiersma, also in attendance from WGNHS, works with counties to develop tools, like maps, and will highlight those options available to Pierce County when the committee is ready to discuss them.

Rod Webb presented the committee with the overview of nutrient management, how on and off farm nutrients are accounted for, and how plans are created and implemented in Pierce County. Jeff Jackson, WDNR Agricultural Runoff Specialist, presented a summary of the WI Pollutant Discharge Elimination System (WPDES) permit process for confined animal feeding operations (CAFOs) and how that involves nutrient management planning and implementation. Discussion included how adequate acres for spreading is determined and ensured, noncompliance response, and consultants that are a part of the planning process.

Adam Freihoefer, WDNR Water Use program manager, presented about water quantity and high capacity well regulations in Wisconsin. Discussion involved conversations about the monitoring network and how high capacity wells are approved and monitored.

Sarah Yang, a toxicologist with the Wisconsin Department of Health Services' Bureau of Public Health, presented about drinking water quality standard development in Wisconsin and their relation to human health. Questions included studies on cancer clusters, PFAS occurrences in the area, and promoting well testing.

## Findings

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### **Nitrate**

Nitrate is a natural chemical nutrient. In groundwater, nitrate, from natural sources, should occur at levels of less than 2 mg/L. Excess nitrate in groundwater is caused by leaching from the surface. This can come from septic systems or excessive nutrient application (such as synthetic fertilizer, manure, digestate, biosolids etc.). Whenever nitrate is introduced to a system and there is not adequate capture by vegetation or soil it can end up in the groundwater at levels higher than expected.

### **Impacts of nitrate contamination**

Nitrate contamination presents a public health risk. In babies, excess nitrates can cause blue baby syndrome (methemoglobinemia), which is a condition that affects how the blood carries oxygen. In excess nitrate may increase risk of certain birth defects, may increase risk of thyroid disease, and may increase risk of certain types of cancers.

Few options exist for wells that exceed nitrate standards. The most common is installation of a point-of-use reverse osmosis system which requires regular filter changes and maintenance. Other options include drilling a new well in hopes of accessing older, less contaminated groundwater, or purchasing bottled water for drinking and cooking.

There are many factors contributing to well water nitrate concentration. Neighboring wells can be accessing water at varying quality because of how their wells are constructed (differing drill depth, casing length, surrounding geology, etc.). Old or poorly maintained wells may have cracks that make surface influence easier. Area land use determines nutrient load and possibility of loss. For example, a forested area or prairie where no additional nutrients are being added would not leach nitrate like a row crop system where nitrate is regularly applied or residential areas with concentrated septic systems designed to leach nitrate gradually into the subsurface.

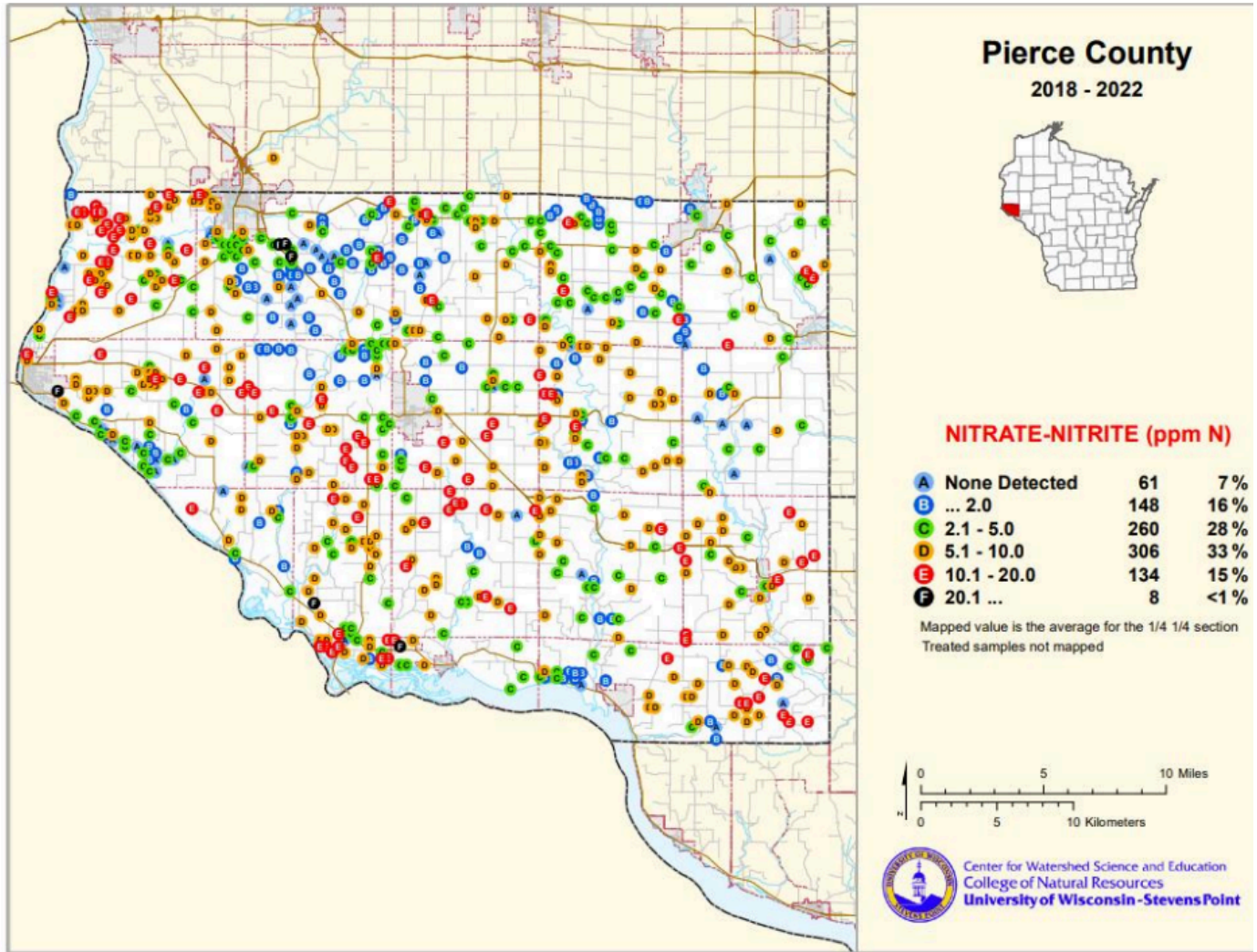
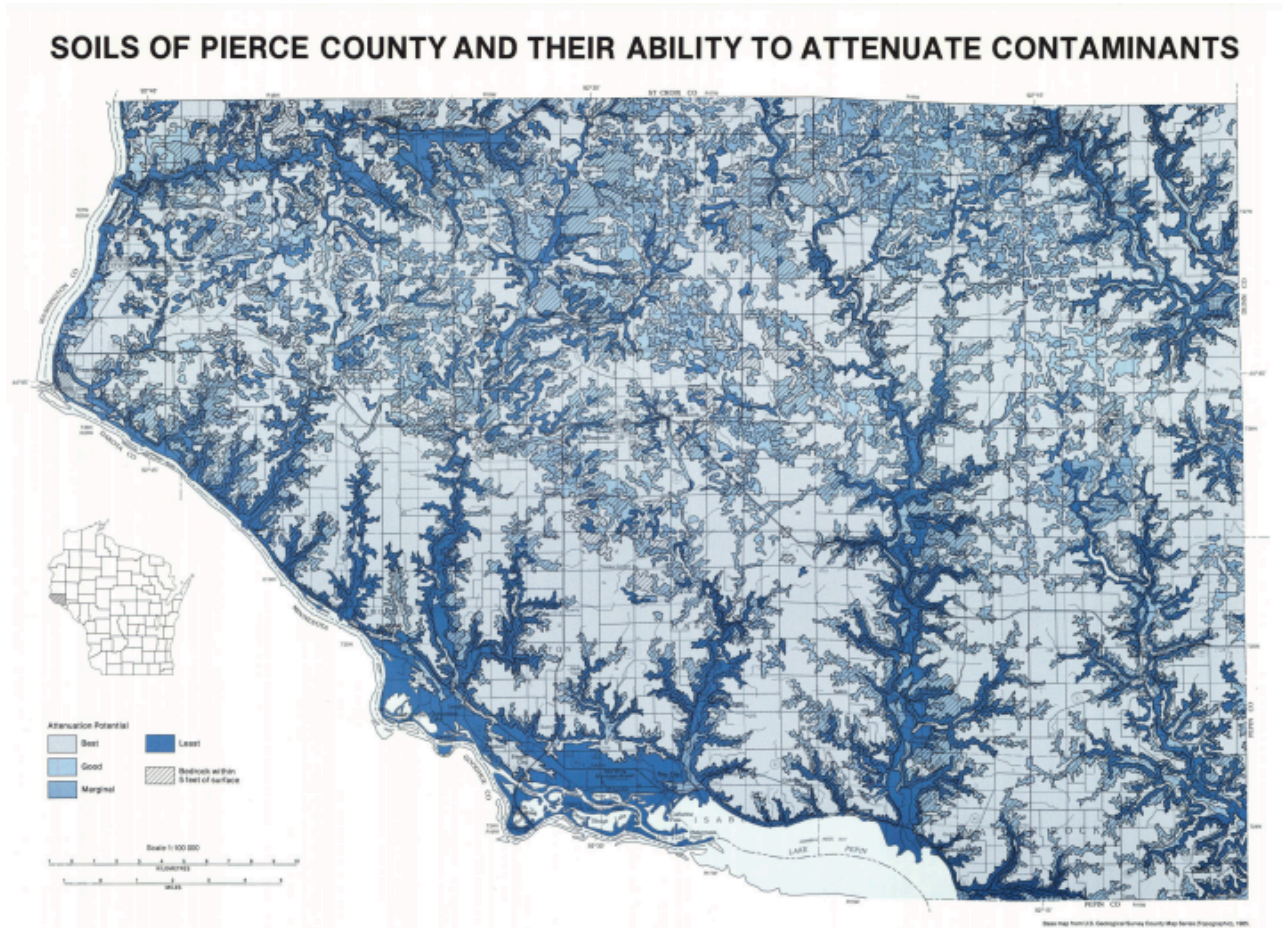


Figure #1: Map of Pierce County's 2019-2022 sampling program generated by UW-Stevens Point Water and Environmental Analysis Lab. Each circle represents the average for the 1/4 1/4 section. Samples denoted in red and black exceed the drinking water standard of nitrate at 10 ppm.

[https://cms5.revize.com/revize/piercewi/Document\\_center/Community/Department/Land%20Conservation/Pierce\\_CountyBoard\\_2023.pdf](https://cms5.revize.com/revize/piercewi/Document_center/Community/Department/Land%20Conservation/Pierce_CountyBoard_2023.pdf)

Soils act as a filter for groundwater. Thin or sandy soils are less likely to hold on to nutrients where plants can take them up compared to thick or clay rich soils. Clifton Township in the upper left hand corner of Figure #1 has many points of nitrate exceedance. This was also observed at a 2023 nitrate screening clinic hosted at Clifton town hall where it was common to have well water brought in screening almost double the nitrate drinking water standard. Clifton Township is known for sandy coarse textured soils which have a low attenuation potential of nitrate and other surface influences. The township is also home to some of the oldest subdivisions in Pierce County, so septic concentrations may be an additional contributing factor.

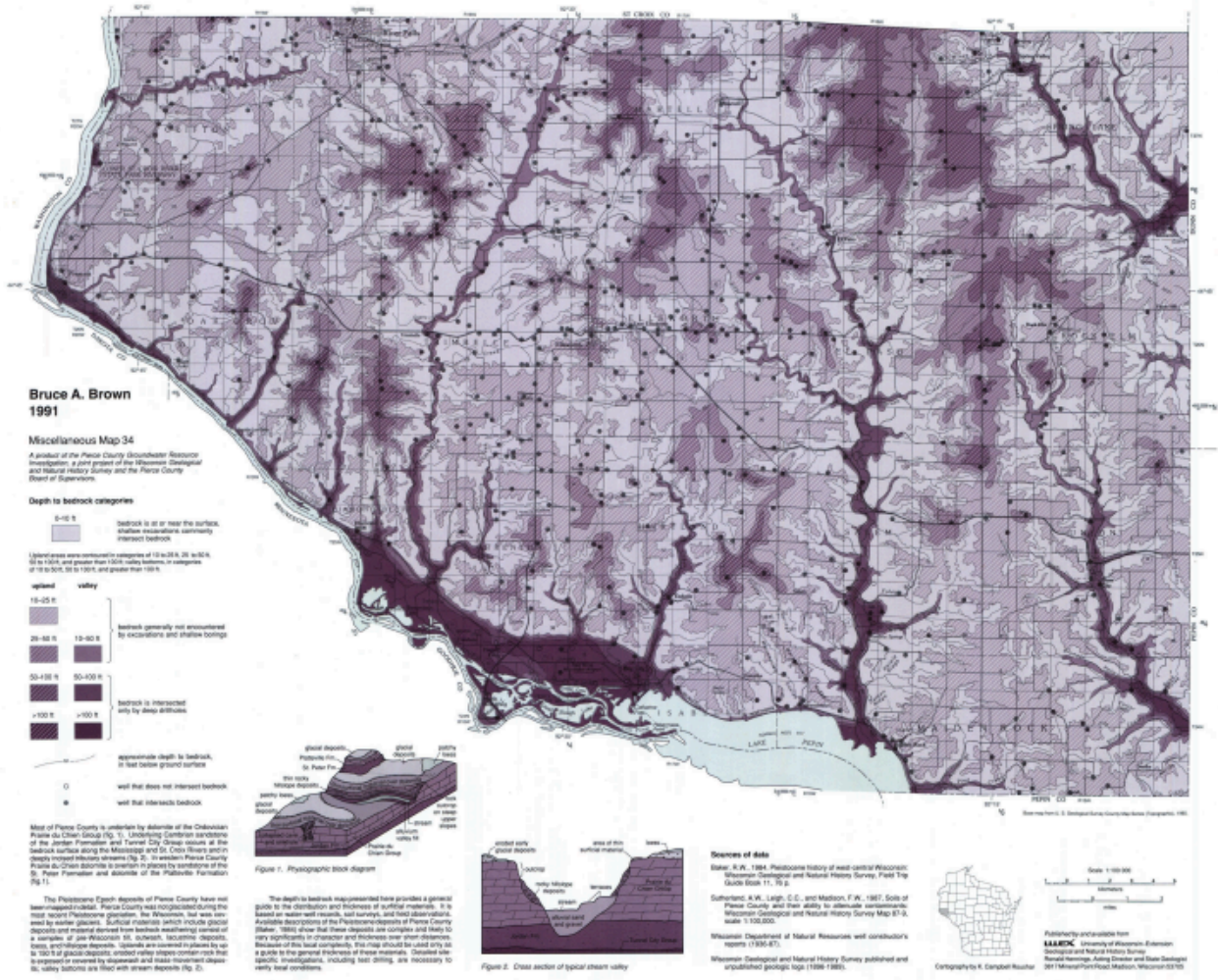
Conversely, the cluster of no nitrate detected south of highway 72 in Rock Elm Township is attributed to a thick clay layer which has good attenuation potential. This clay is part of the Rock Elm Disturbance, a geologic feature created by a meteorite impact in the late Ordovician. 76.1% of Pierce County has soils listed with good to best attenuation potential (Figure #2).



*Figure #2: Soils of Pierce County and their ability to attenuate contaminants. Attenuation is the ability to reduce the effect of something. Soils with good to best attenuation shown are lighter blue when managed well to prevent the migration of surface contaminants to groundwater.*  
<https://wgnhs.wisc.edu/catalog/dataset/000404/resource/m092/view/d59b1c43-6f63-4f4b-b677-17506fb464d9>



### Depth to Bedrock Map of Pierce County, Wisconsin



**Figure #3: Depth to bedrock map of Pierce County. Shallow bedrock shown in light purple is mostly on hillslopes where soil is easily eroded. Shallow bedrock areas have a more direct surface to groundwater connection and are more susceptible to groundwater contamination.**  
<https://wgnhs.wisc.edu/catalog/dataset/000428/resource/m116/view/1823aa0d-1029-4c14-9aa1-1367899547d5>

Geology and aquifer characteristics determine recharge and flow, therefore also contamination vulnerability. Many wells in Pierce County access water in the dolomite of the Prairie du Chien formation. Dolomite cracks and fractures can create preferential flow paths, funneling water much faster than it moves through the small pore spaces in the rock. Wells that pump water from a fracture may have higher contamination levels because there is less time between surface activity to groundwater contribution. Sinkholes and fractures are a known occurrence in

Pierce county's landscape. There have been documented cases of wells receiving water from a fracture with contamination but the extent of fracture contribution to private wells is not proficiently documented as boring telemetry is relatively expensive.

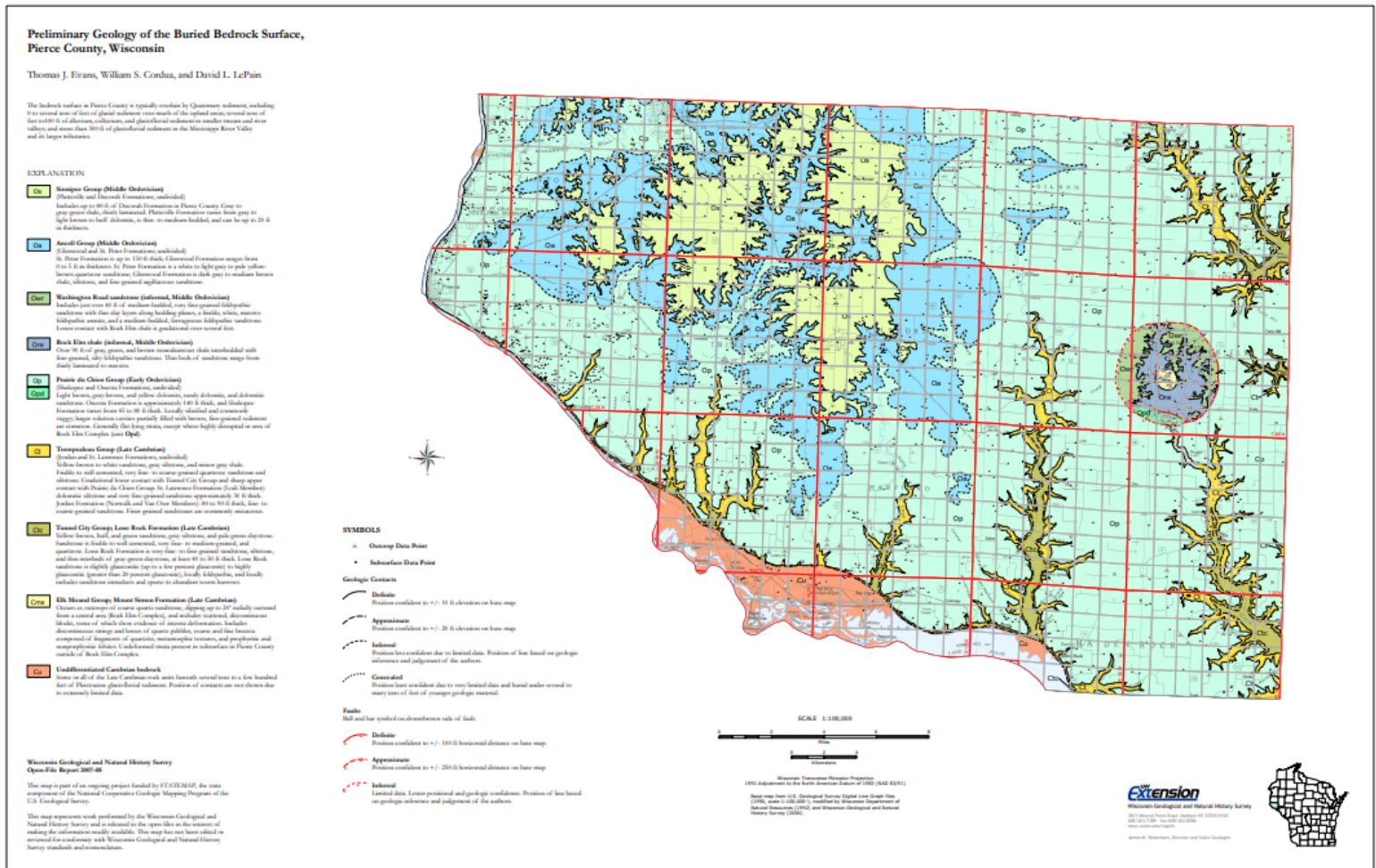


Figure #4: Preliminary bedrock geology of Pierce County. The circular feature to the right is the Rock Elm Disturbance (a meteorite crater complex). The Prairie du Chien dolomite in teal covers most of the county.

<https://wgns.wisc.edu/pubshare/WOFR2007-08.pdf>

### Limitations of the data

Pierce County groundwater data is limited. There are no rules or regulations requiring regular testing of private wells. Wells that are tested are not a random sample. The dataset does not include all wells. Those tested are by people who suspect issues with their water and can afford to pay for a lab to analyze the results. Low participation (14% return rate) in county assisted well testing can be attributed to lack of well owner awareness of testing regimes and their importance, and distrust in what a government agency might do with the data collected.

Another limiting factor with voluntary participation is the uncontrolled spatial variable. There are clusters of neighbors that submitted samples and other areas with few or no samples at all which may also skew results.

Change of groundwater quality overtime is not clearly documented in the data collection that has occurred so far. Strategic samples taken at the same location over time are necessary to attest to true temporal trends.

### **Bacterial contamination**

Groundwater with coliform bacteria, which can be found in the soil, in surface water, and in human or animal waste show a vulnerability to germs that can make people sick. While coliform does not usually cause illness in healthy individuals, their presence in well water indicates the water system is at risk to more serious forms of contamination. If coliform bacteria are present in the well, more dangerous bacteria may also reach the well so it is important to explore the likely source, even if the sample is negative for E. coli bacteria. E. Coli is a fecal bacteria of warm blooded animals and humans, so its presence in groundwater shows it is affected by animal or human feces.

A major limitation in bacterial measurement is that water samples must be at the lab within 30 hours after collecting. Wells that test positive for total coliform bacteria and/or E. Coli are recommended to retest to confirm due to the many variables that can cause a false positive result. For example, an unclean hand touching the inside of the sterilized sample bottle or a dirty kitchen sink aerator could trip a positive result which is not representative of the well water quality but rather sampling error.

Remediation, unlike nitrate, can be relatively straightforward by chlorinating the well and retesting for bacteria for effectiveness. Water contaminated by bacteria can be consumed after boiling.

### **Other contaminants**

In addition to testing for nitrates and bacteria annually, the WDNR encourages every well to be tested for arsenic at least once. This naturally occurring substance typically does not fluctuate dramatically overtime and is present in high concentration where oxygenated water is interacting with arsenic rich minerals, like pyrite or other sulfides. The WEAL Lab in Stevens Point has received 659 water samples to test for arsenic in Pierce county. Only 8% of those submitted even detected arsenic and none had detects greater than the drinking water standard (10 ppb).

Perfluoroalkyl and polyfluoroalkyl substances (PFAS) are a family of human-made chemicals first used widely in commercial products since the 1950s that are resistant to oil, water, and heat. There is emerging evidence that high levels of PFAS may increase cholesterol levels, decrease vaccine response, increase risk of thyroid disease, some cancers, conditions during pregnancy, and lower infant birth weight. Although there is not enough research to know what levels of PFAS exposure is needed before health problems are expected. Additionally how most

PFAs enter groundwater is unknown, although research on the relationship between PFAS and land application of municipal and paper mill sludge is developing.

When considering drinking water contaminants and potential health impacts, it is important to understand that drinking water standards are set using toxicology data, which includes biological, dose-response, and exposure data. Many substances considered drinking water contaminants occur naturally in the environment and can never be fully eliminated from drinking water. It is critical to understand the intensity, frequency, and duration of human exposures that lead to increased health risks.

For more information about drinking water standards by substance in Wisconsin, visit the Wisconsin DNR website:

<https://dnr.wisconsin.gov/sites/default/files/topic/DrinkingWater/HALtable.pdf>

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## **Future Threats:**

After covering many topics related to concerns in Pierce County several threats to groundwater have been identified. Given the interim nature of this report the ad hoc committee acknowledges the following threats and reserves the right to expand on this nonexhaustive list:

- High capacity well withdrawals
  - Concentrated agricultural operations (confined animal feeding operations (CAFOs) and intensive row crop agriculture)
  - Land use changes that impact groundwater quality factors such as infiltration and nutrient loading
  - Soil health deterioration and soil erosion
  - Surface water impacts on groundwater
  - Point sources of contamination (industry)
  - Public awareness of issues related to groundwater quality
  - Aging groundwater infrastructure
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## **Recommended courses of action:**

The committee recognizes the lack of statistically significant data on how groundwater nitrate concentrations in Pierce County are changing over time. After exploring several ways to accomplish collection of meaningful long term groundwater data, they recommend Pierce County establish a community well-water trend monitoring network in partnership with the University of Wisconsin Stevens Point's Center for Watershed Science and Education. Other Wisconsin counties improved their local understanding of water quality changes over time successfully with this method.

According to the center's website "These are 5-year programs designed to test the same wells over a set time period in order to collect data that can be useful in understanding well water quality fluctuations over time and space. The well networks are designed to be representative of the diverse land-use, soils, and geologic regions within the county. Well owners receive a sample kit and mail their well water sample back to the Center where it is analyzed at the state-certified Water and Environmental Analysis Lab for nitrate-nitrogen, chloride, pH, total hardness, alkalinity, and conductivity." The 5-year program is estimated to cost \$35,000 per year including lab fees and data processing into a public facing dashboard.

More recommendations on how to address future threats to Pierce County groundwater are forthcoming.

## Appendix A: Inventory of Pierce County's current groundwater activities

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Land Conservation, Land Management, and Public Health departments each have guidance documents that outline priorities and actions related to all their departmental functions. The following inventory reflects the goals and implementation strategies in these documents ([Land and Water Resource Management Plan](#), [Comprehensive Plan](#), and [Community Health Needs Assessment and Improvement Plan](#) respectively).

**Ongoing nitrate screening clinics:** Adapted from a similar process used by St. Croix County, Pierce County offers free well water nitrate screening clinics to help homeowners monitor and protect their drinking water supply. It is free to participate and water from any well is accepted for screening. Results are available in less than a minute with a margin of error of plus or minus 2 ppm or 10%, whichever is greater. All information is submitted to the County on a voluntary basis and submitting information is not required to participate. This screening is not intended to replace a certified drinking water test from an approved laboratory. Staff from Public Health, Land Conservation and UW-Extension are available to answer questions from the public and assist in distributing UW-Stevens Point test kits. As of December 2024, 173 well samples have been screened for nitrates at a Pierce County hosted clinic.

**Transient Non-Community (TNC) Well Oversight:** Any public water system that serves at least 25 different people at least 60 days a year is considered a transient non-community well (e.g. churches, bars, etc) and is subject to oversight by the DNR. Pierce County Public Health acts as an agent for the DNR to monitor 74 systems. Approximately 10% of those wells had a nitrate level above the EPA standard of 10 ppm and will have to reduce to under that level by 2026 to stay compliant with the expectations of the DNR.

**Potentially Waterborne Illness Reports:** As required by state statute, Public Health investigates and manages reportable communicable disease. This includes the following potentially waterborne illnesses: E-Coli (all types), Salmonellosis, Cyclosporiasis, Giardiasis, Cryptosporidiosis, Legionellosis, Shigellosis, and Vibriosis. Some of these illnesses could be caused by compromised wells.

**Private On-Site Wastewater Treatment Systems (POWTS) installation and maintenance oversight:** Land Management Department staff have local authority through the Department of Safety & Professional Services to issue sanitary permits, inspect septic systems, and fail septic systems. Pierce County has approximately 8,100 POWTS including 1,100 installed before 1970 and have not been updated. Maintenance notices to landowners are mailed every 3 years on a rotating basis. When the department receives a replacement soil evaluation report or fails a septic system they share information on funding options. One funding option that Land Management can help administer is the Wisconsin Fund with eligibility based on income and septic system age, however this program sunsets on June, 30th 2025 without funding reauthorization from the state budget.

**Fee Exempt Well Testing:** Any Pierce County homeowner who is pregnant, breastfeeding, or has a child in the house 12 months or younger is eligible for a free well water test from the Public Health Department. The kit participants mail to the state lab of hygiene tests for coliform bacteria, E. coli, nitrate, fluoride, and metals. Eligibility requirements were expanded in 2024, updates on what those changes mean for Pierce County are forthcoming.

**Conservation Cost Share Program:**

Funded through the county tax levy and the Department of Agriculture Trade and Consumer Protection (DATCP) conservation practices are applied for and granted by the Land Conservation Committee for up to 70% cost share. Well closures, sinkhole repair, and nutrient management planning are all eligible practices that tie directly to groundwater protection.

**Waste Storage Ordinance:**

Land Conservation oversees the implementation of the waste storage ordinance, any structure built to hold waste after 1985 is subject to permitting and inspection. In 2023, ordinance revisions adopted by the county board included addition of NR151 Agricultural Performance Standards and Manure Prohibitions and a certificate of use requirement going forward.

**Farmland Preservation Program:**

Farmland in qualifying areas that meet applicable state soil and water conservation standards are eligible for a per acre tax credit. Qualifying areas are determined by township zoning adoptions, certification of standards is completed by the Land Conservation Department.

**Update and maintain a sinkhole and karst feature database:**

With emerging remote sensing technologies, such as LiDAR, becoming available the Land Conservation department is documenting sinkholes so that their locations can be included in nutrient management plans to meet appropriate application setbacks. A shapefile of known locations in fields is provided to DATCP to include in their free publicly available nutrient management software (Snap+). <https://snapplus.wisc.edu/>

**Nutrient Management Planning:**

A free nutrient management planning workshop is hosted in collaboration with DATCP and UW-Extension on the first Thursday of December. This is an in-person program for those who may need more technical assistance, although the virtual nutrient management program is available year round on the [DATCP Nutrient Management planning website](https://datcp.wi.gov/Pages/Programs_Services/NutrientManagement.aspx). [https://datcp.wi.gov/Pages/Programs\\_Services/NutrientManagement.aspx](https://datcp.wi.gov/Pages/Programs_Services/NutrientManagement.aspx)