Wisconsin’s CAFOs, Karst Topography, and Groundwater Resources

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WDNR Nutrient Management Program Coordinator

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Overview

• CAFO WPDES Program
• Karst Topography
• Groundwater Pollution in Karst
• Current Rules and Regulations
• Proposed NR 151 Rule
CAFO WPDES Program
(Concentrated Animal Feeding Operation)

- State issues WPDES permits to:
  - Farms with 1,000+ Animal Units (AUs)
  - Farms less than 1,000 AUs that discharge to surface or groundwater.

- Permitted farm types include: dairy, beef, turkey, duck, chicken (broilers & layers), swine, sheep, and others.
CAFO WPDES Program

Each CAFO is issued a 5 year Wisconsin Pollutant Discharge Elimination System (WPDES) Permit by the WDNR.
- Production site – zero discharge

CAFO WPDES Program

What is Nutrient Management?
- Managing the amount, source, placement, form, and timing of the application of nutrients and soil amendments.
  - NM is a tool for budgeting nutrients for optimum plant production.
  - NM is also intended to minimize nutrient entry into surface water, groundwater*, and atmospheric resources while maintaining and improving the physical, chemical, and biological condition of the soil.

*Wisconsin has the authority to regulate groundwater.
Karst Topography

- Karst is a type of landscape where water dissolves the underlying bedrock.
  - Rainwater & Groundwater Mixing

![Graph](http://w3.salemstate.edu/~lhanson/gls210/gls210_karst.htm)

- Soluble bedrock
  - Dolomite
    - CaMg(CO₃)₂
  - Limestone
    - CaCO₃

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Karst Topography

• Karst potential in Wisconsin.

Common Features:
- Sinkholes
- Fractures
- Springs
- Swallets

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Karst Topography

Characterization of the shallow groundwater system in an Area with thin soils and sinkholes (Door Co., WI)
Wiersma, J. H., Stieglitz, R. D., Cecil, D. L., & Metzler, G. M.

- Two sinkholes that received surface drainage suspected to be important recharge of nearby spring complex.
- Lithium salt solutions (as tracer) introduced sinkholes
- Little longitudinal mixing – indicates open conduit flow.

Groundwater Pollution in Karst

- Many Pollutant Sources on the Landscape:
  - Manure
  - Septic Waste
  - Industrial Waste
  - Biosolids
  - Septic Systems
  - Illegal Dumping
  - Spills
  - Etc.
- Deal primarily with landspreading of waste
Groundwater Pollution in Karst

- County-wide randomized sampling of private wells stratified by depth-to-bedrock: <5 ft, 5-20 ft, > 20 ft
- Participation rate ~50%
- November 2015
  - Recharge period
  - 327 samples
- Second county-wide sampling in July 2016
  - Non-recharge period
  - 400 samples

Slide from Dr. Maureen Muldoon’s presentation ‘Assessing Groundwater Quality of Kewaunee County, Wisconsin’

Groundwater Pollution in Karst

Total coliform, E. coli, or high nitrate in private wells by depth to bedrock

<table>
<thead>
<tr>
<th>Depth to Bedrock</th>
<th>Coliform %</th>
<th>E. coli %</th>
<th>High Nitrate %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 5 feet</td>
<td>50</td>
<td>33</td>
<td>50</td>
</tr>
<tr>
<td>5 - 20 feet</td>
<td>42</td>
<td>40</td>
<td>23</td>
</tr>
<tr>
<td>20+ feet</td>
<td>23</td>
<td>26</td>
<td>20</td>
</tr>
</tbody>
</table>

High nitrate: exceeds health standard. N-NO₃ > 10 ppm

Slide from Dr. Mark Borchardt’s presentation ‘Assessing Groundwater Quality of Kewaunee County, Wisconsin’

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Groundwater Pollution in Karst

Microbes: Identifying the Fecal Source
(n = 138 samples from 131 wells) (red font indicates pathogenic)

<table>
<thead>
<tr>
<th>Host</th>
<th>Microorganism</th>
<th>Wells</th>
<th>Concentration (gene copies/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human-specific</td>
<td>Adenovirus A</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Bacteroidales-like Hum M2</td>
<td>7</td>
<td>&lt;1 – 1050</td>
</tr>
<tr>
<td></td>
<td>Human Bacteroides</td>
<td>27</td>
<td>&lt;1 – 34</td>
</tr>
<tr>
<td></td>
<td>Cryptosporidum hominis</td>
<td>1</td>
<td>qualitative</td>
</tr>
<tr>
<td>All</td>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bovine-specific</td>
<td>Bacteroidales-like Cow M2</td>
<td>2</td>
<td>29 - 915</td>
</tr>
<tr>
<td></td>
<td>Bacteroidales-like Cow M3</td>
<td>4</td>
<td>3 – 49818</td>
</tr>
<tr>
<td></td>
<td>Bovine Bacteroides</td>
<td>36</td>
<td>&lt;1 – 42398</td>
</tr>
<tr>
<td></td>
<td>Bovine polyomavirus</td>
<td>8</td>
<td>&lt;1 – 451</td>
</tr>
<tr>
<td></td>
<td>Bovine enterovirus</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>All</td>
<td>40</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Groundwater Pollution in Karst

Water-Level Variation: Oct 2016 to April 2017
Precipitation Data from Casco (daily) & Green Bay (cumulative)

Slide from Dr. Mark Borchardt's presentation ‘Assessing Groundwater Quality of Kewaunee County, Wisconsin’

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Current Rules & Regulations

- NR 243: Manure may not cause the fecal contamination of water in a well.
  - NR 151: same
- NR 243: Manure may not be applied to soils less than 24 inches.
  - NR 151: no vertical setback distance
- NR 243: Manure may not be applied within 100 feet of a private well or 1,000 feet of a community well.
  - NR 151: 50 feet

Current Rules & Regulations

- NR 243: Manure may not be applied within 100 feet of a direct conduit to groundwater.
  - NR 151: no setback
- Direct conduit to groundwater includes:
  - Wells
  - Sinkholes
  - Swallets
  - Fractured bedrock at the surface
  - Mine shafts
  - Non-metallic mines
Proposed NR 151 Rule

• Draft rule for Eastern WI (Silurian).
  – Revision of NR 151 targeted performance standard and incorporation into NR 243.
• Focus is on pathogen contamination of groundwater

Proposed NR 151 Rule

• The proposed rule provides best management practices for all farms when spreading on different soil depths.
  – 0-2 ft
  – 2-3 ft
  – 3-5 ft
  – 5-20 ft

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Proposed NR 151 Rule

QUESTIONS?

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