Solar for Nitrate Reduction & Improved Drinking Water

Exploring large-scale solar gardens to mitigate contaminates & improve drinking water quality in areas of elevated health risks.

Introduction

As part of the wellhead protection area, drinking water supply management areas (DWSMAs) can be at-risk of drinking water contamination.

Nitrate has been found in unsafe levels in over 10% of Minnesota's private wells.

EPA safe drinking water = nitrate level < 10 mg/L

- Solar can mitigate contaminants through the replacement of nitrate-producing agriculture

Methods

Mapping data analysis for site identification; use of nitrate leaching calculator for site prioritization.

Identifying high-nitrate watersheds

- Mapping & data overlay of high-risk areas with areas of high ecological/resource value
- See: mitigation level determination process
- See: species of greatest conservation need map

Results

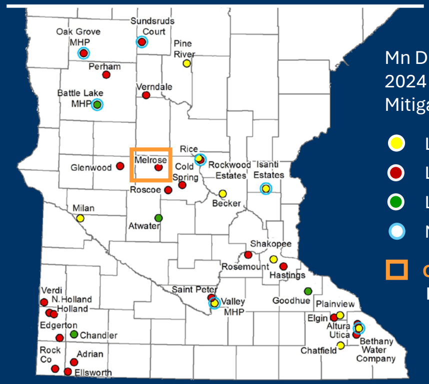
Collaborative effort has led to the identification and prioritization of several communities within high-risk DWSMAs as potential pilot, solar sites.

Prioritization of solar pilot sites

Conclusions

Nitrate calculator is critical in the process, as it demonstrates the benefits of solar within these highly specific groundwater sensitive locations.

Beneficial siting of solar in contamination areas



Mn Department of Agriculture 2024 Drinking Water Supply Mitigation Levels for Nitrates

- Level 1
- Level 2
- Level 3
- Non-Municipal Systems

Case Study / Pilot Site: Melrose, Minnesota

- *see land use scenario comparison tables*

- Nitrate contamination is a risk for groundwater recharge areas and along hydrologic flows of drinking water systems
- 1.3 million acres in MN are identified as vulnerable to nitrate contamination; representing 14,000 MW of solar capacity
- Nitrate leaching meta-analysis and resulting calculator aids in strategically siting solar in areas where groundwater is prone to contamination (e.g., sandy soils or karst topography)
- **Drinking water protection:** solar can aid in reducing nitrate contamination in drinking water supplies
- **Water quality protection:** solar as green infrastructure can improve the water quality of ground and surface water

Nitrogen Calculator Summary: *Comparison of agricultural land use vs. solar land use with prairie vegetation underneath panels*

SCENARIO 1 (Corn) – Melrose Land Use Field Comparisons			
Land Cover: Corn		**Land Cover: Bluestem Grass**	
Leachable N (lb/acre)	114.2	Leachable N (lb/acre)	17.4
Nitrate-N (mg/L)	50.5	Nitrate-N (mg/L)	7.7
Scenario 1 Totals for Potential Leachable Nitrogen			
		Leachable N (lb/acre)	**65.8**
		Field-Weighted Nitrate-N (mg/L)	**29.1**

SCENARIO 2 (Soybeans) – Melrose Field Land Use Field Comparisons			
Land Cover: Soybeans		**Land Cover: Bluestem Grass**	
Leachable N (lb/acre)	190.5	Leachable N (lb/acre)	17.4
Nitrate-N (mg/L)	84.3	Nitrate-N (mg/L)	7.7
Scenario 2 Totals for Potential Leachable Nitrogen			
		Leachable N (lb/acre)	**103.9**
		Field-Weighted Nitrate-N (mg/L)	**46**

SCENARIO 3 (Rye) – Melrose Land Use Field Comparisons			
Land Cover: Rye		**Land Cover: Bluestem Grass**	
Leachable N (lb/acre)	132.7	Leachable N (lb/acre)	17.4
Nitrate-N (mg/L)	58.7	Nitrate-N (mg/L)	7.7
Scenario 3 Totals for Potential Leachable Nitrogen			
		Leachable N (lb/acre)	**75**
		Field-Weighted Nitrate-N (mg/L)	**33.2**

Nitrate Leaching Calculator - *Dr. Kevin Masarick and Grant Moser University of Wisconsin - Stevens Point*

Poster Presenter: Joe Pallardy / Emmons & Olivier Resources, Inc.
www.eorinc.com / renewables@eorinc.com

Project Partners: Great Plains Institute / www.betterenergy.com
Mn Dept. of Health / www.health.state.mn.us
Mn Rural Water Association / www.mrwa.com

PROJECT INFO

CLEANPOWER MAY 6 – 9 | MINNEAPOLIS, MN

AMERICAN CLEAN POWER

DEPARTMENT OF HEALTH

GREAT PLAINS INSTITUTE

EOR water ecology community