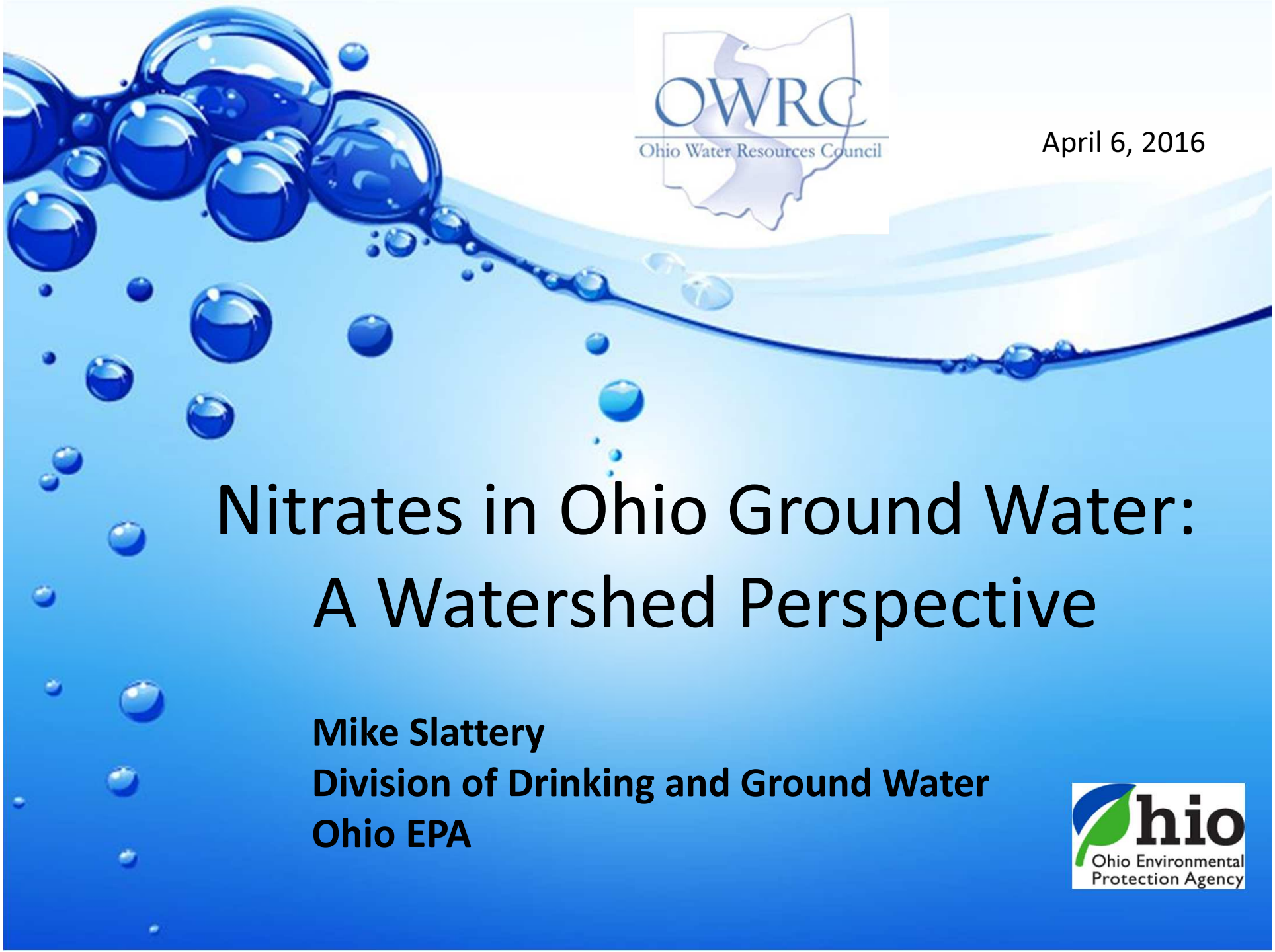

April 6, 2016

Nitrates in Ohio Ground Water: A Watershed Perspective

Mike Slattery
Division of Drinking and Ground Water
Ohio EPA

Ohio Environmental Protection Agency

Outline

- Acknowledgments
- Context of Problem
- Data Wrangling
- Spatial Distribution of Nitrate
  - geolocated
  - w'shed sums
  - w'shed means

  } priority watersheds
- Preliminary Conclusions

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Acknowledgments

- Ohio EPA Ambient Program Field Staff
- ODH – Rachel Townsend; County Field Staff
- USGS Water Center Field Staff - NWIS
- MCD – Michael Ekberg and Staff
- ODNR – Wayne Jones
- Ohio EPA GIS Services

Dave “I don’t know, let me go look at the door” White

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Context

- Ohio Nutrient Reduction Strategy (NRS)
  - Objective: reduce nutrient impact on Ohio's (GW) resources – Point, NP sources of P, $N0_3$
  - Focus: Integrate GW nutrient impacts into NRS
  - Address: Drinking Water Sources (GW + SW)
  - Collab. Effort: ODA, ODNR, OEPA

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Data Wrangling

	Wells	Samples
• OEPA AGWQMP…….	224	6994
• OEPA SDWIS……..	3762	87,000
• USGS NWIS……..	1005	1160
• ODH……..	277	922
• MCD……..	24	39
Total:	5,292	96,115

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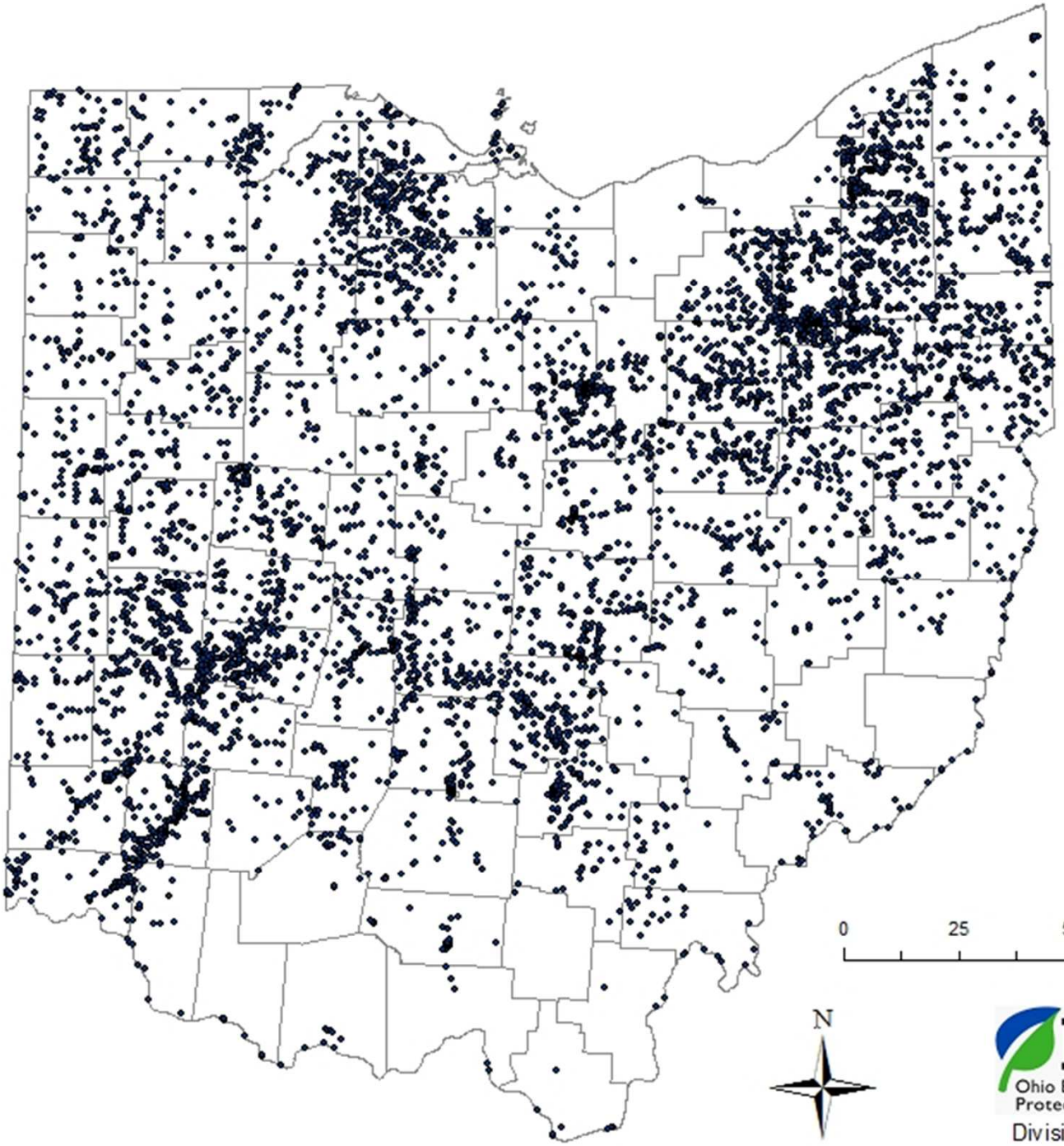

Ground Water NRS Data Compilation

5,292 wells
96,115 samples

HUC 8 Name	Count
Tuscarawas	1088
Upper Great Miami	1027
Upper Scioto	554
Cuyahoga	436
Little Miami	427
Sandusky	382
Mohican	353
Walhonding	345
Mahoning	341
Lower Scioto	295
Lower Great Miami	276
Cedar-Portage	275

0 25 50 100 Miles

N

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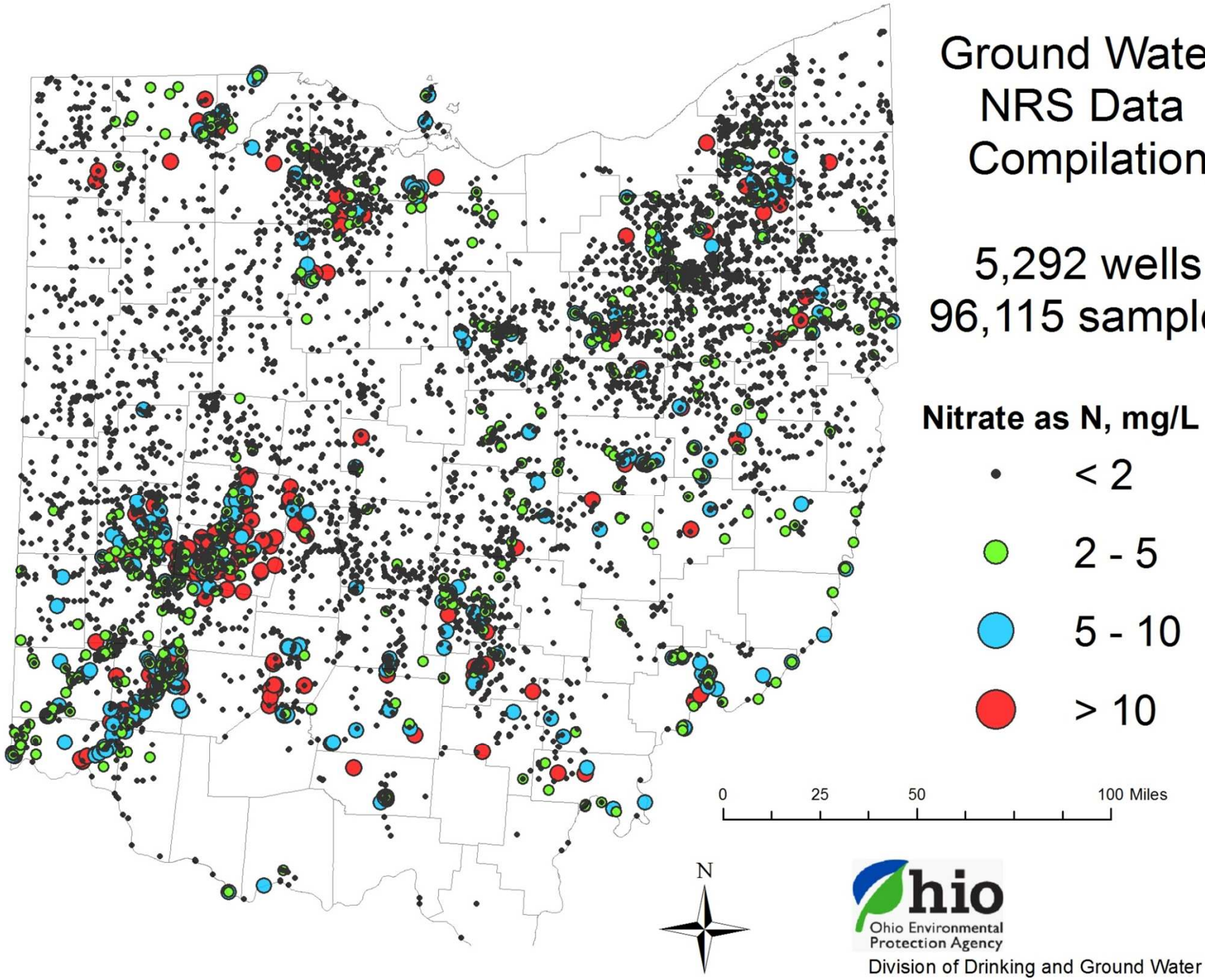
Ground Water
NRS Data
Compilation
5,292 wells
96,115 samples
Nitrate as N, mg/L
< 2
2 - 5
5 - 10
> 10
0
25
50
100 Miles
N
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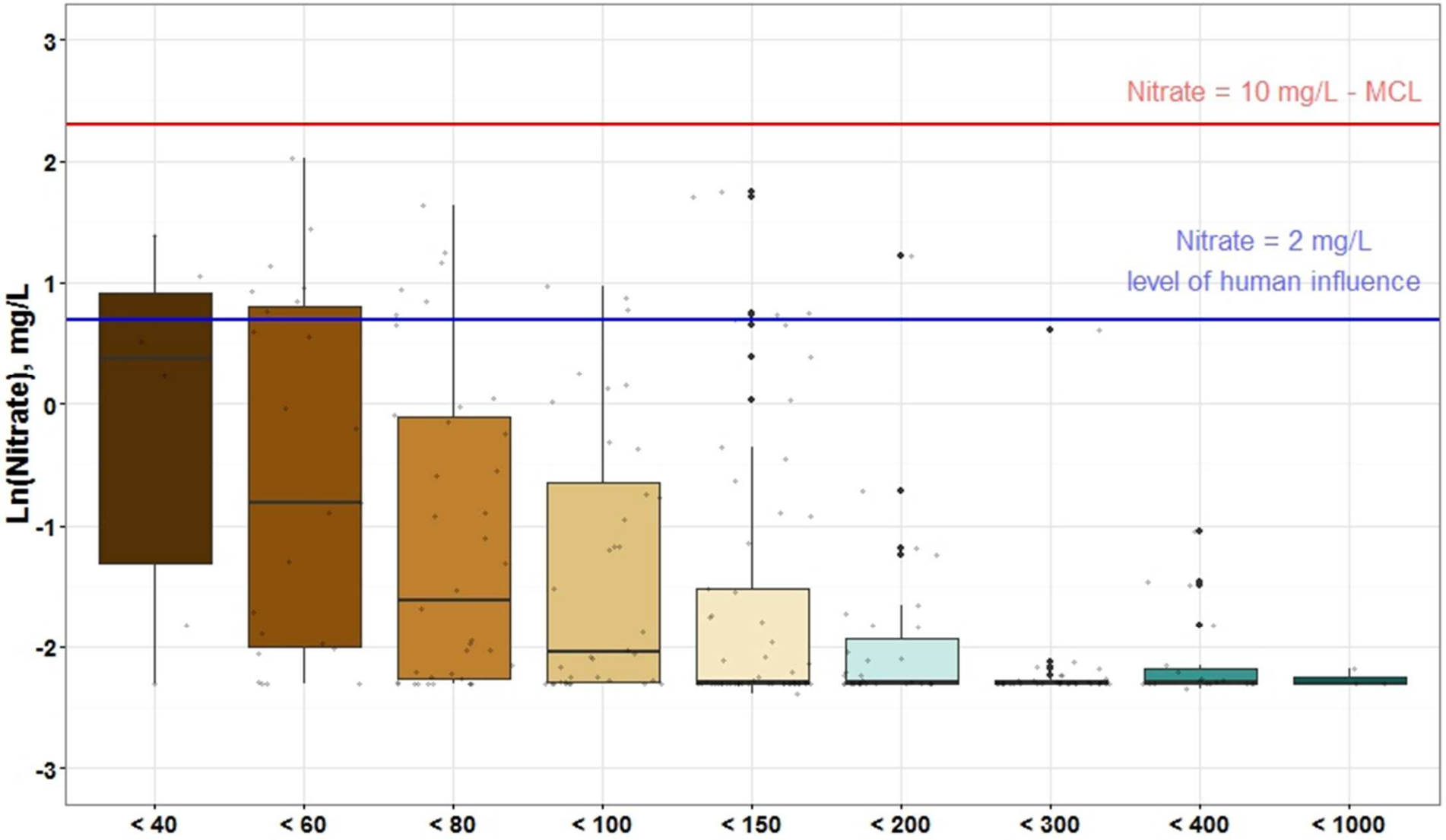
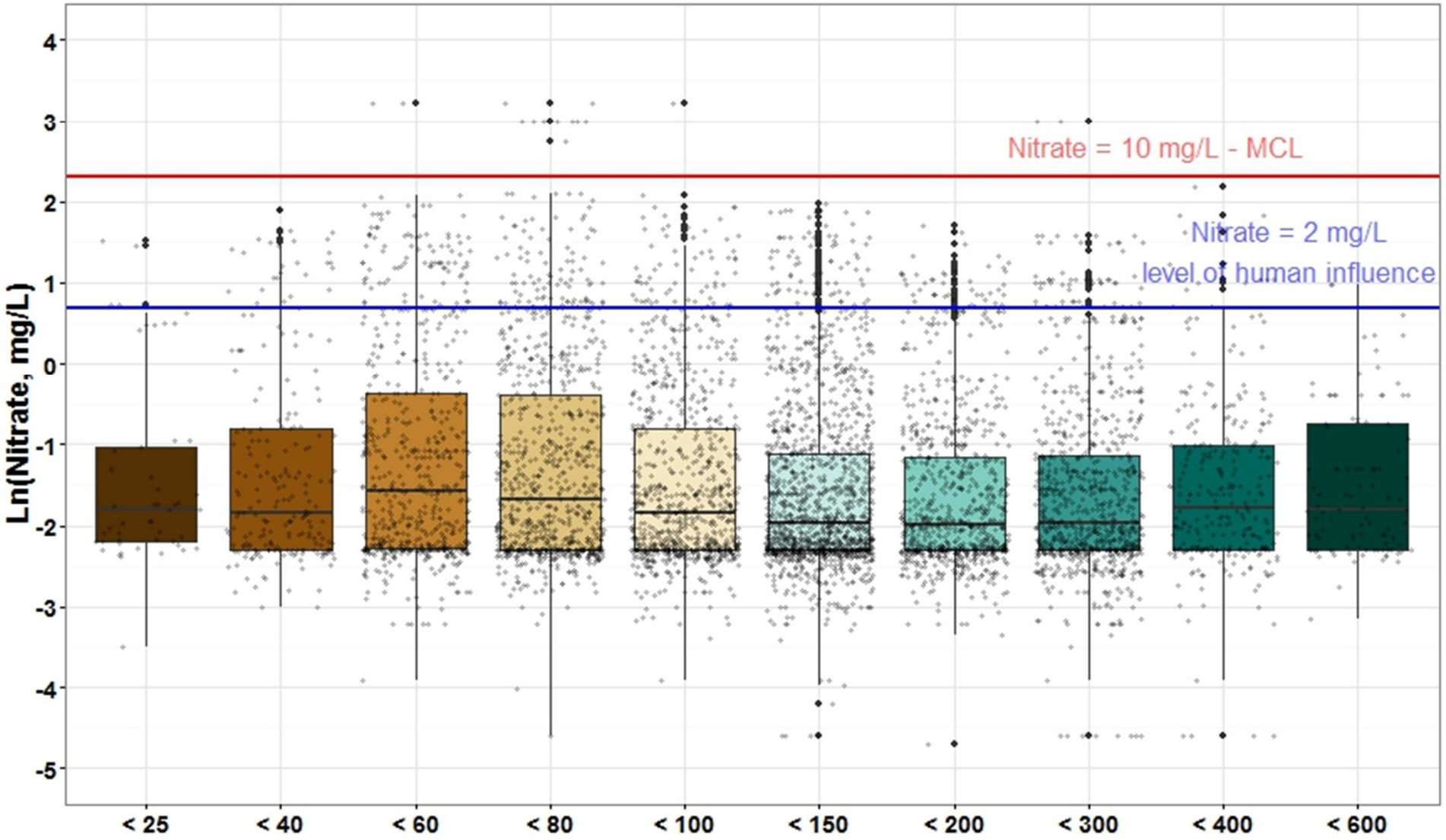
Nitrate by Well Depth, Ambient GWMP, 1970-2015

N = 224/6994, Mean ln(Nitrate) Decreases with Increasing Well Depth



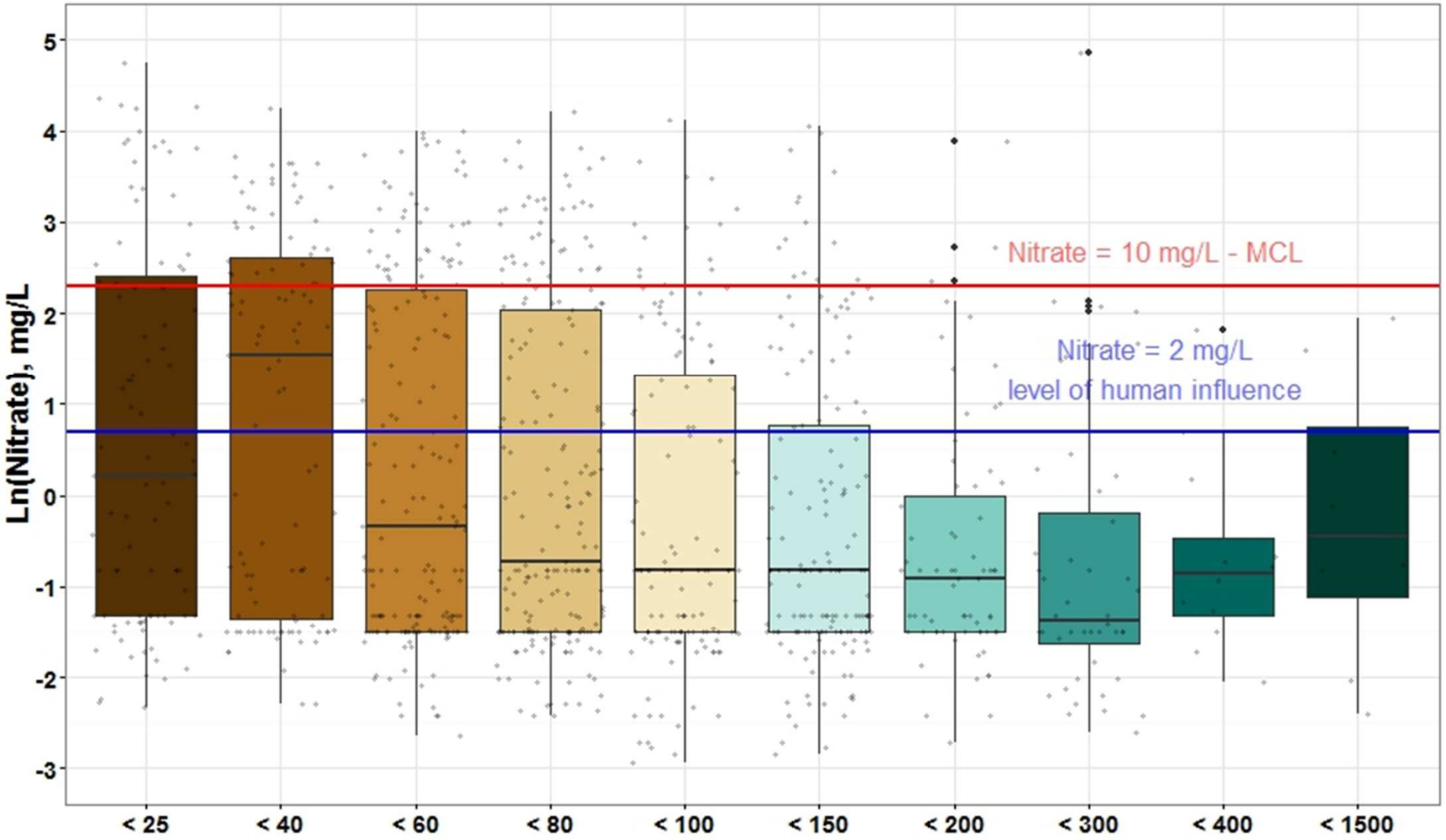
Nitrate by Well Depth, Ohio EPA SDWIS, 2001-2015

N=2812/51k, Mean ln(Nitrate) Mixed with Increasing Well Depth



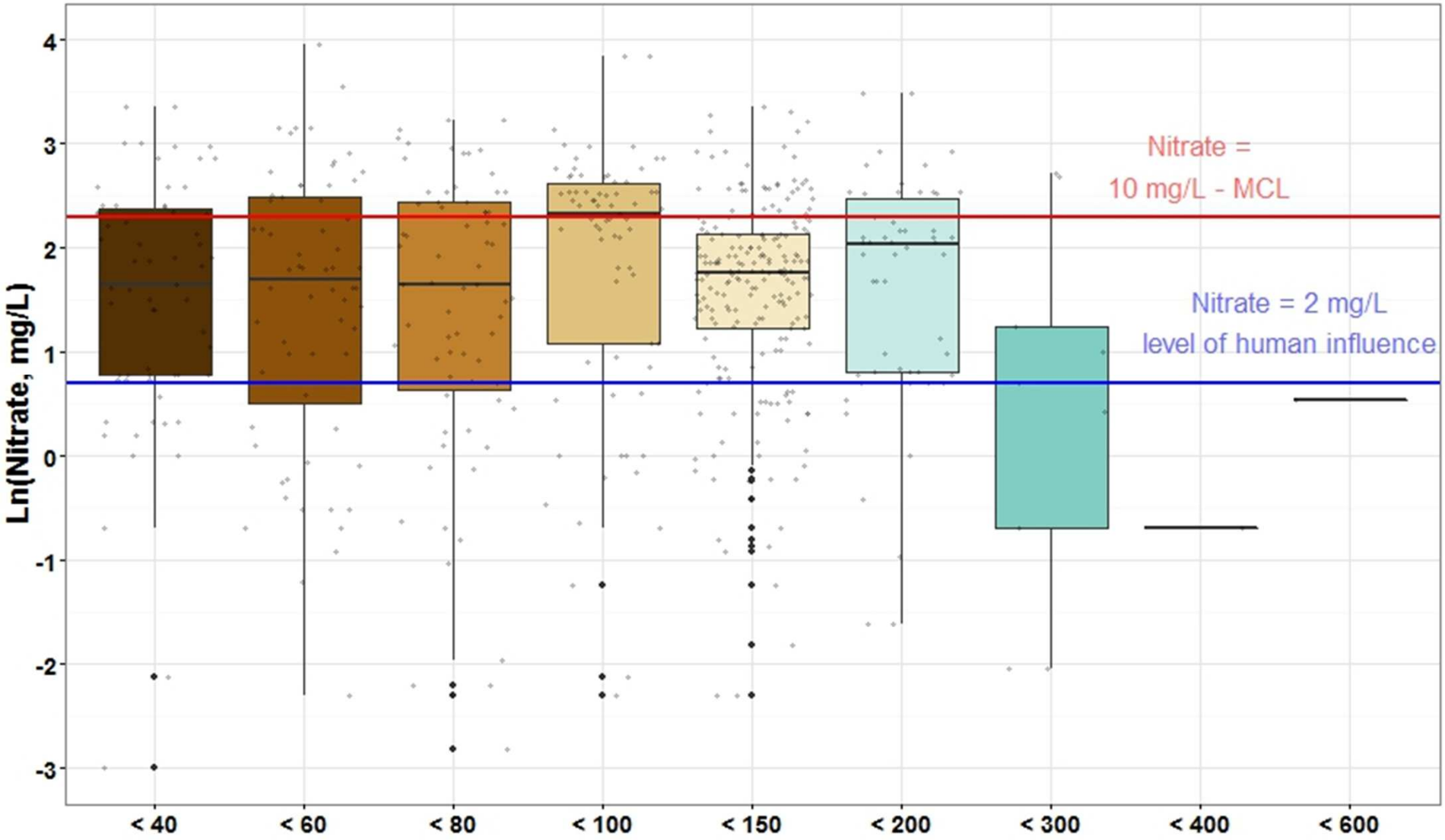
Nitrate by Well Depth, USGS NWIS, 2003-2013

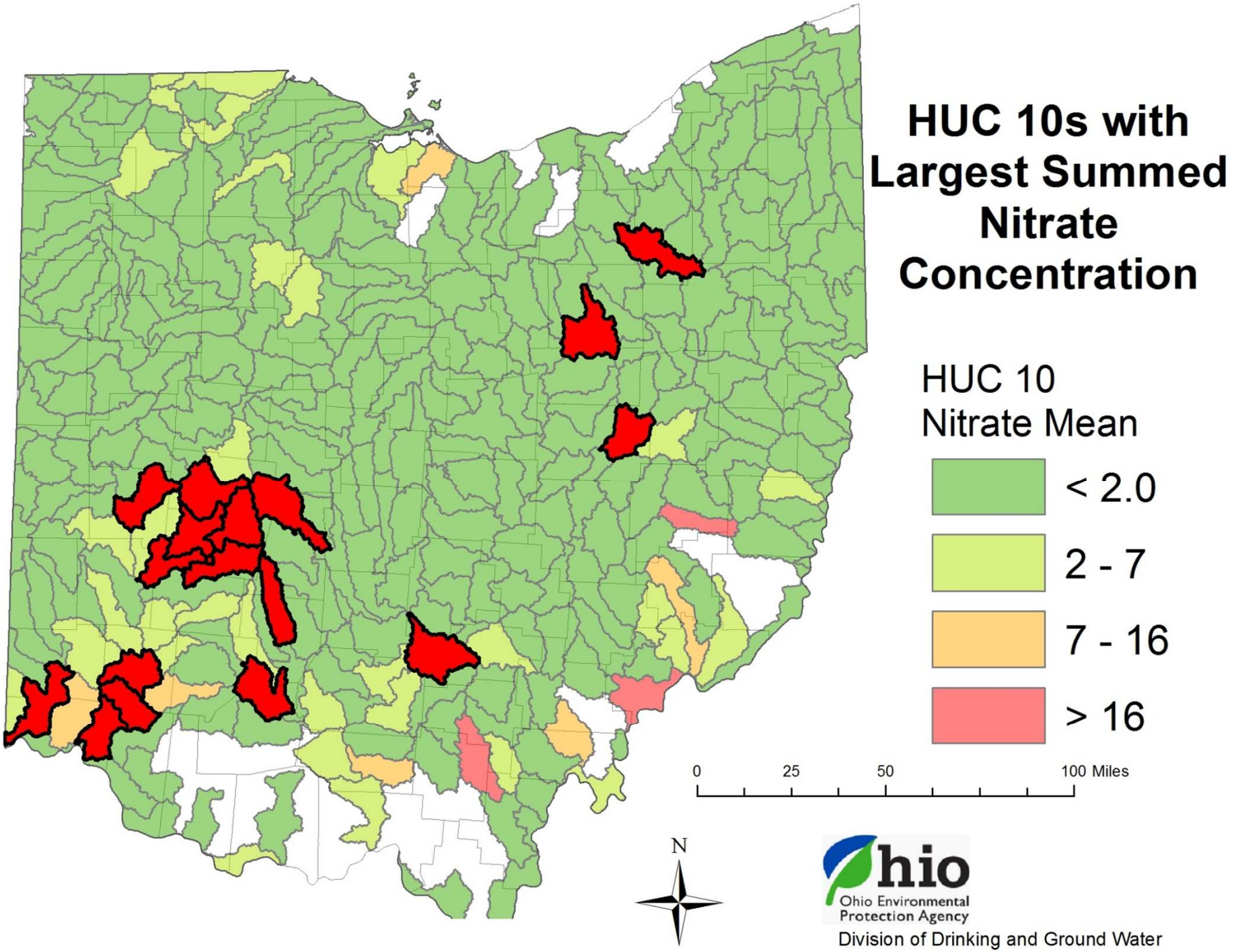
N=1005/1160, Mean ln(Nitrate) Decreases with Increasing Well Depth



Nitrate by Well Depth, ODH, 1995-2015

N=277/922, Sampling Bias of Elevated ln(Nitrate) Values




HUC 10s with Largest Summed Nitrate Concentration
HUC 10
Nitrate Mean
< 2.0
2 - 7
7 - 16
> 16
0
25
50
100 Miles
N
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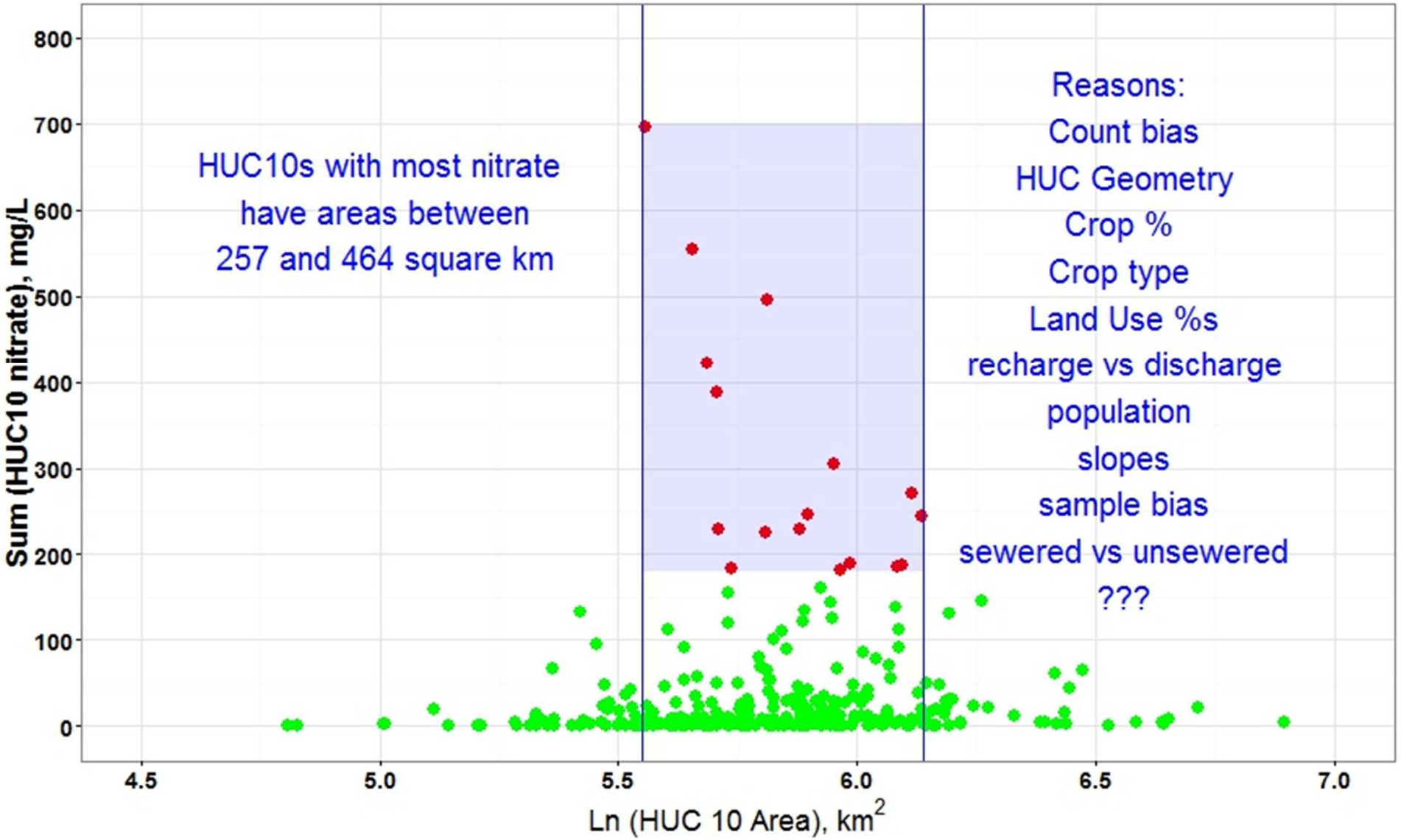
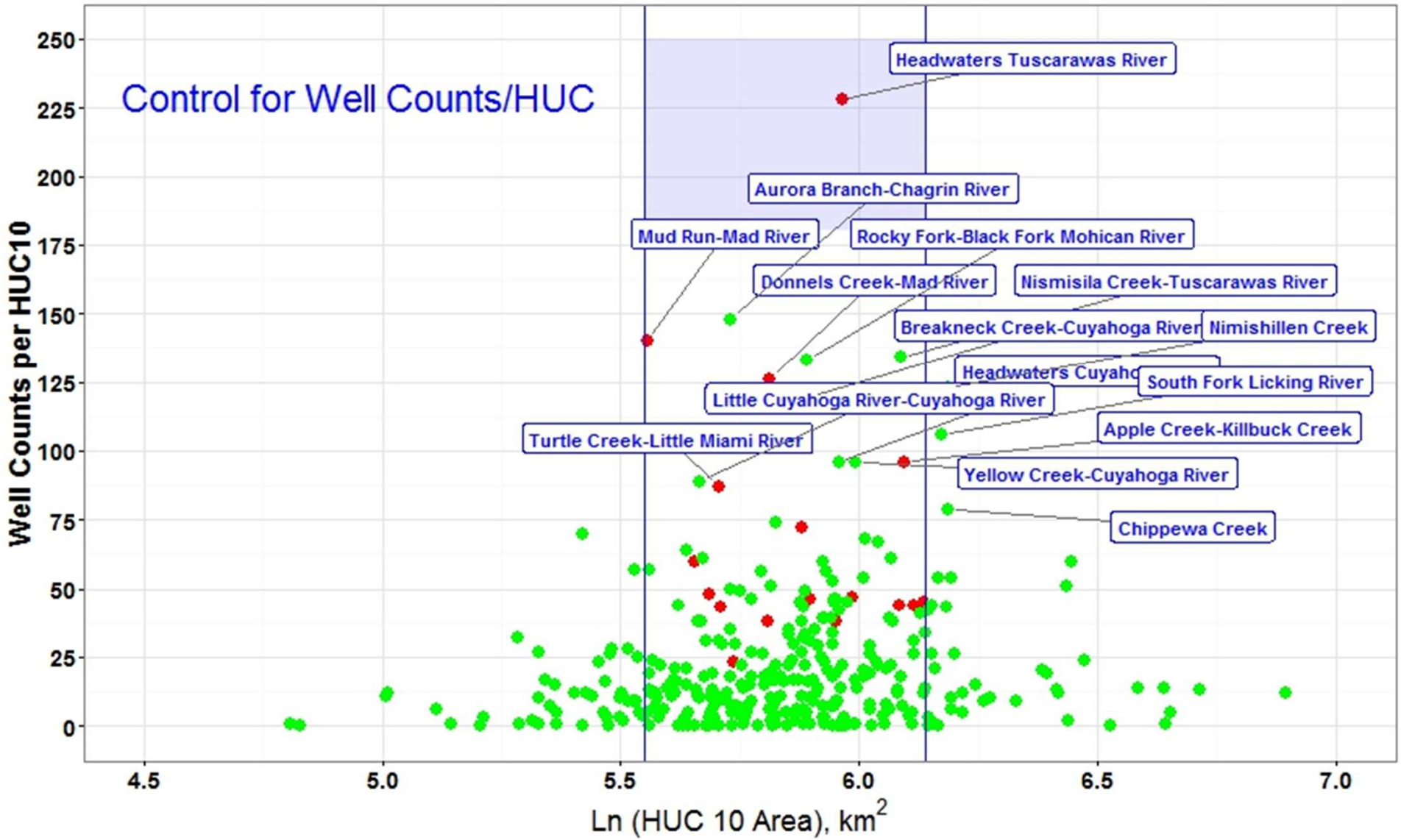
Sum (HUC10 Nitrate) as function of Ln(HUC10 Area)

Watersheds with Sum > 180 mg/L in Red



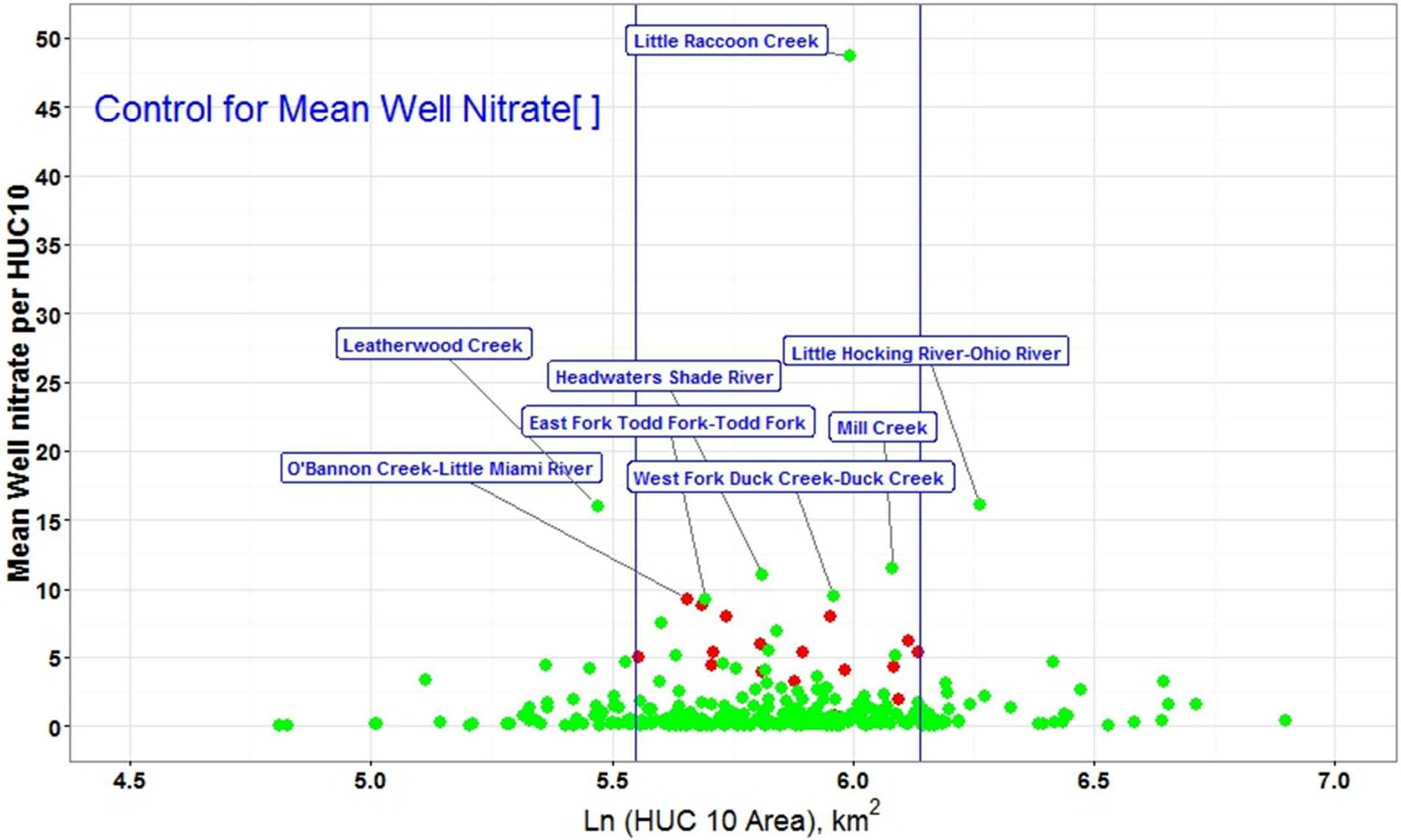
Well counts as function of Ln(HUC10 Area)

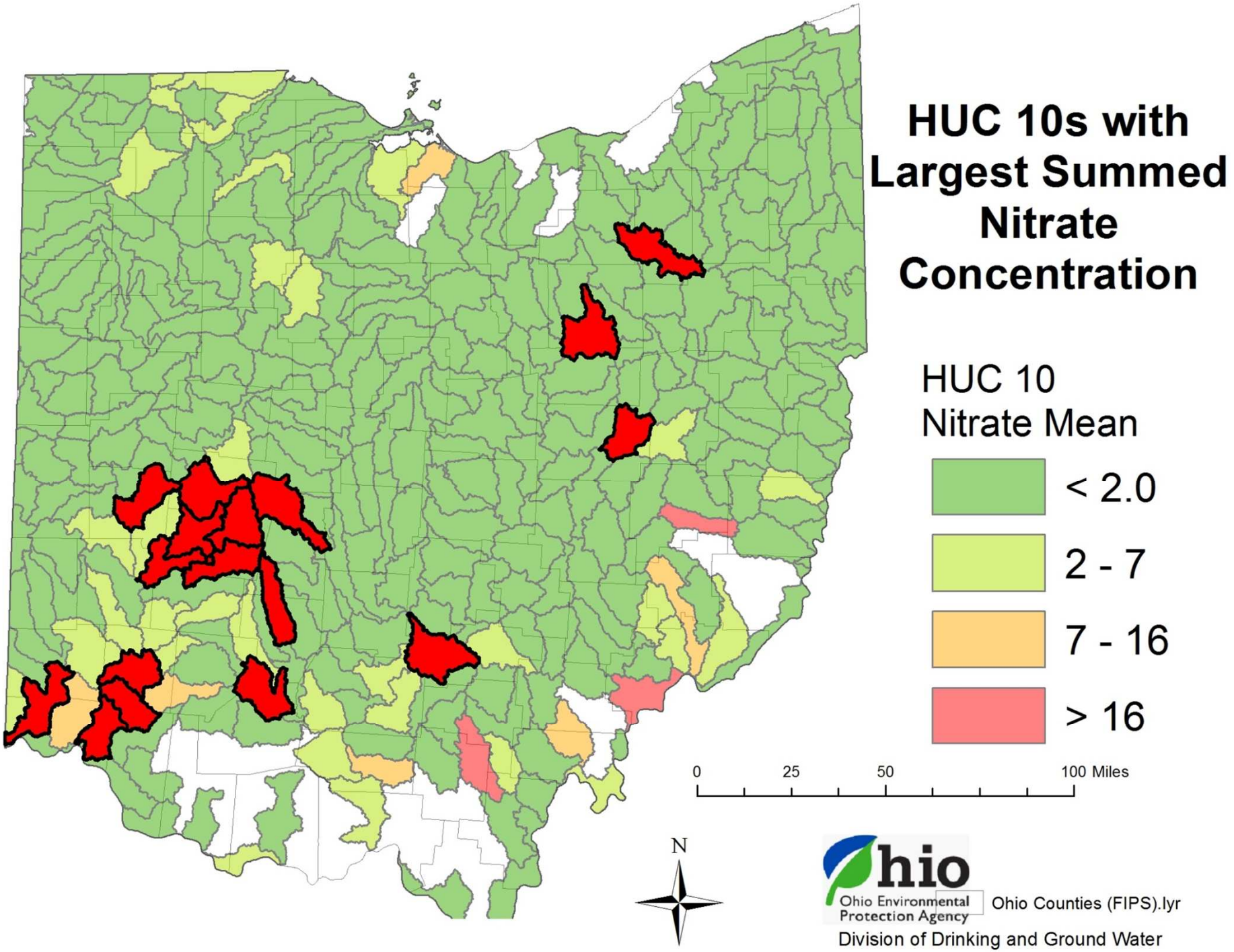
Watersheds with Sum > 180 mg/L in Red



Mean well nitrate per HUC10 as function of Ln(HUC10 Area)

Watersheds with Sum > 180 mg/L in Red




HUC 10s with Largest Summed Nitrate Concentration
HUC 10
Nitrate Mean
< 2.0
2 - 7
7 - 16
> 16
0
25
50
100 Miles
N
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Ohio Counties (FIPS).lyr
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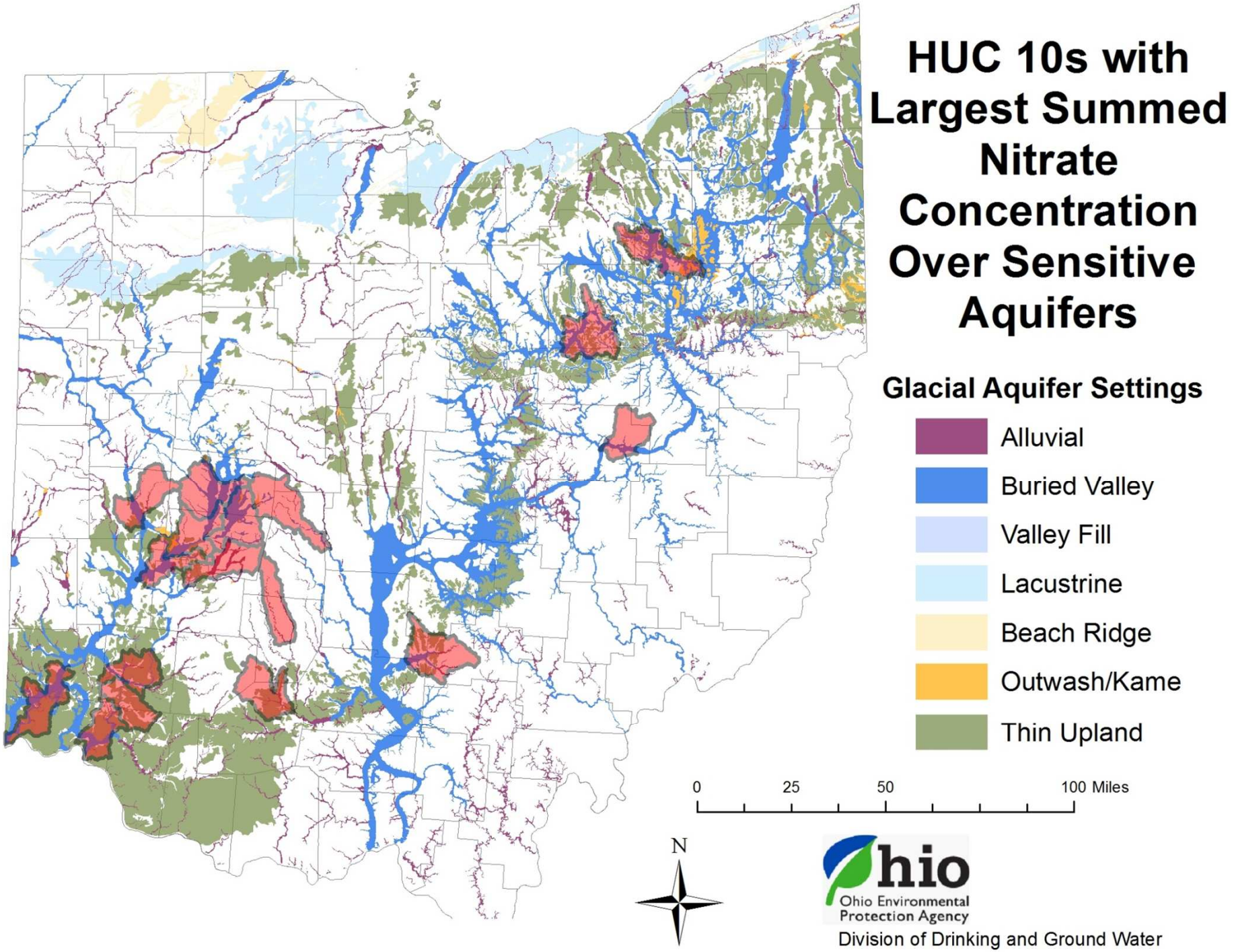
HUC 10s with Largest Summed Nitrate Concentration Over Sensitive Aquifers
Glacial Aquifer Settings
Alluvial
Buried Valley
Valley Fill
Lacustrine
Beach Ridge
Outwash/Kame
Thin Upland
0
25
50
100 Miles
N
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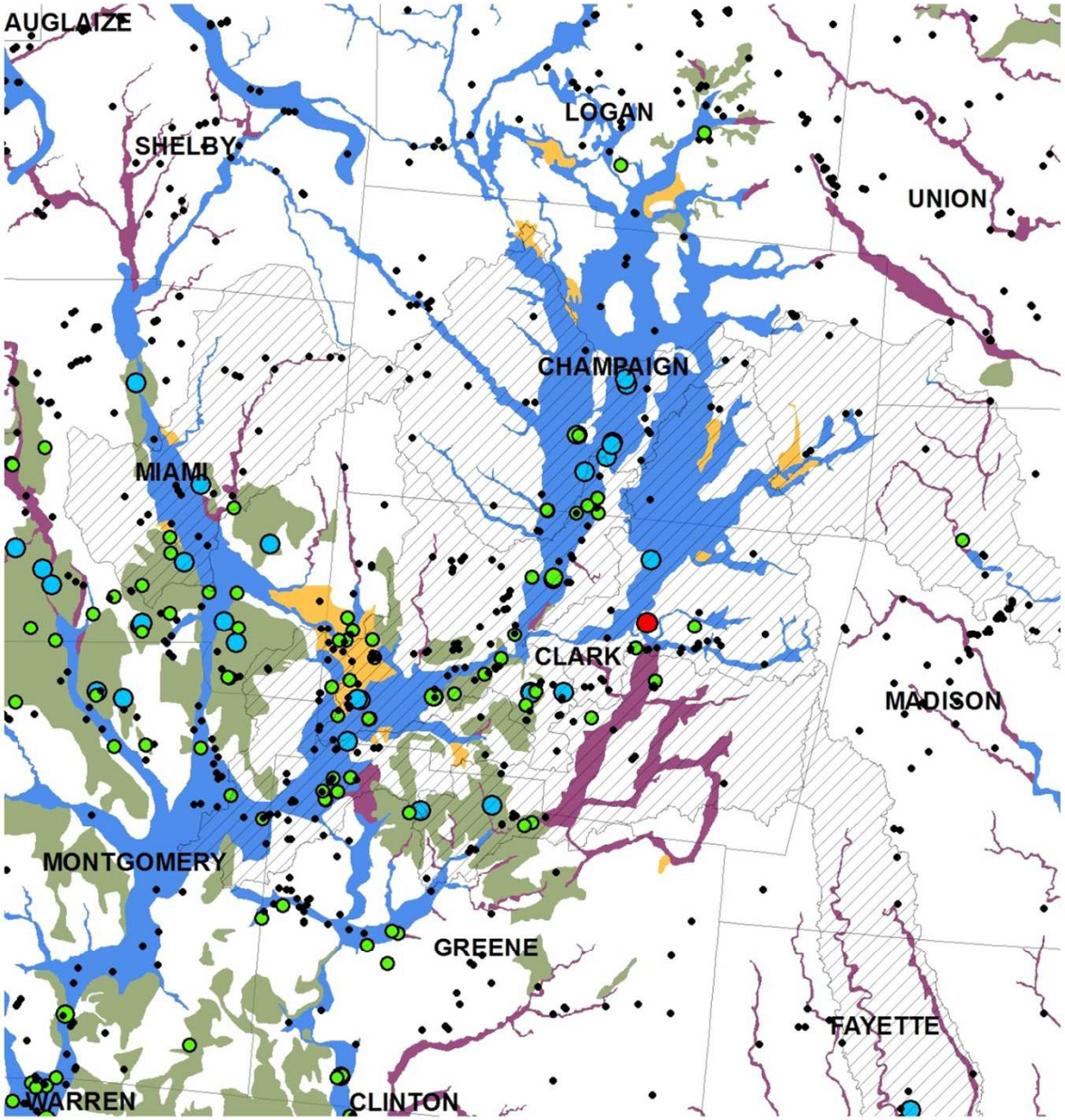

SDWIS and Ambient Nitrate

Glacial Aquifer Settings

- Alluvial
- Buried Valley
- Valley Fill
- Outwash/Kame
- Thin Upland

HUC10s w/ highest mean NO3

- > 180

Nitrate as N, mg/L

- < 2
- 2 - 5
- 5 - 10
- > 10

N

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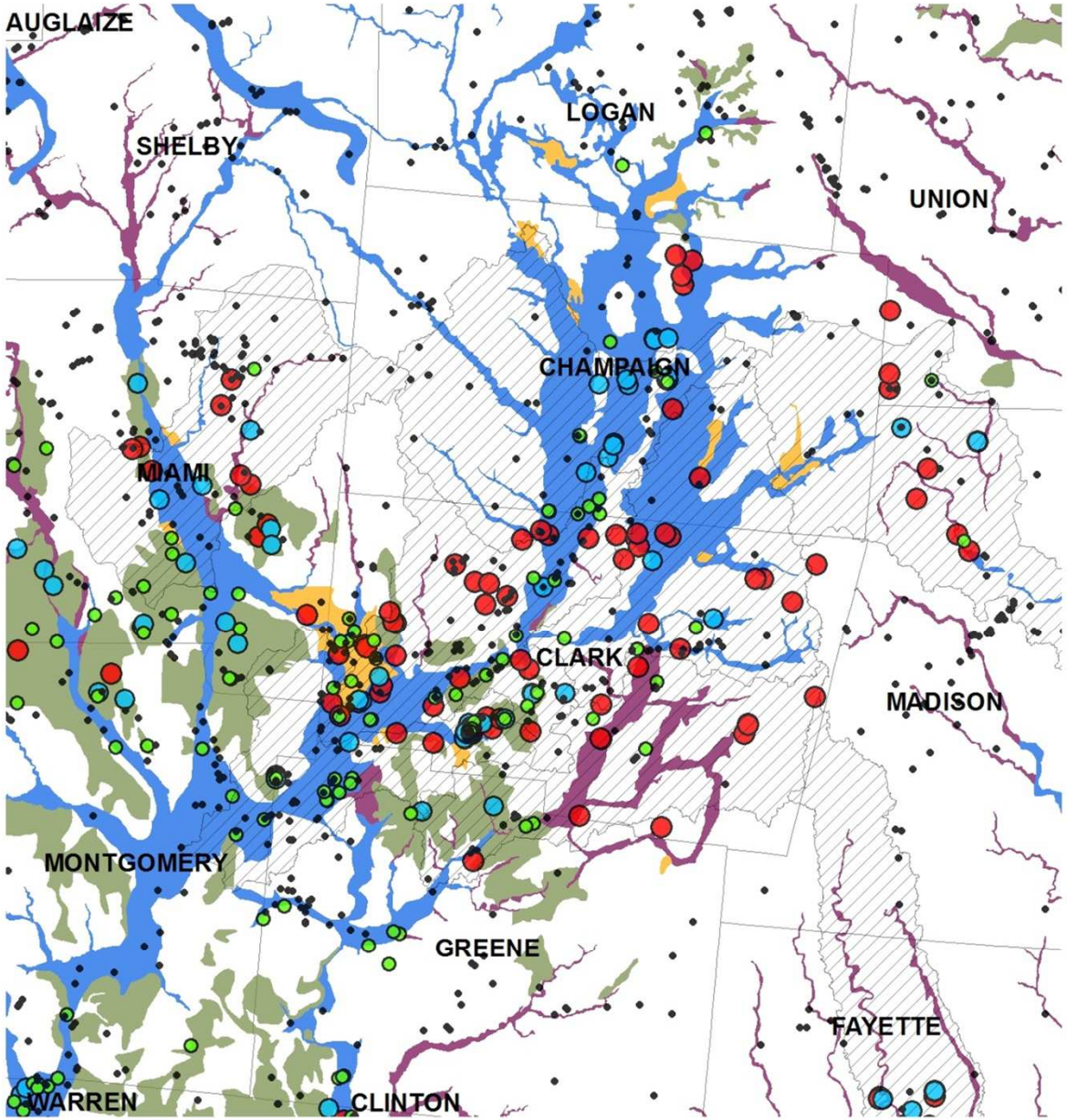

SDWIS, Ambient, ODH, MCD, USGS Nitrate

Glacial Aquifer Settings

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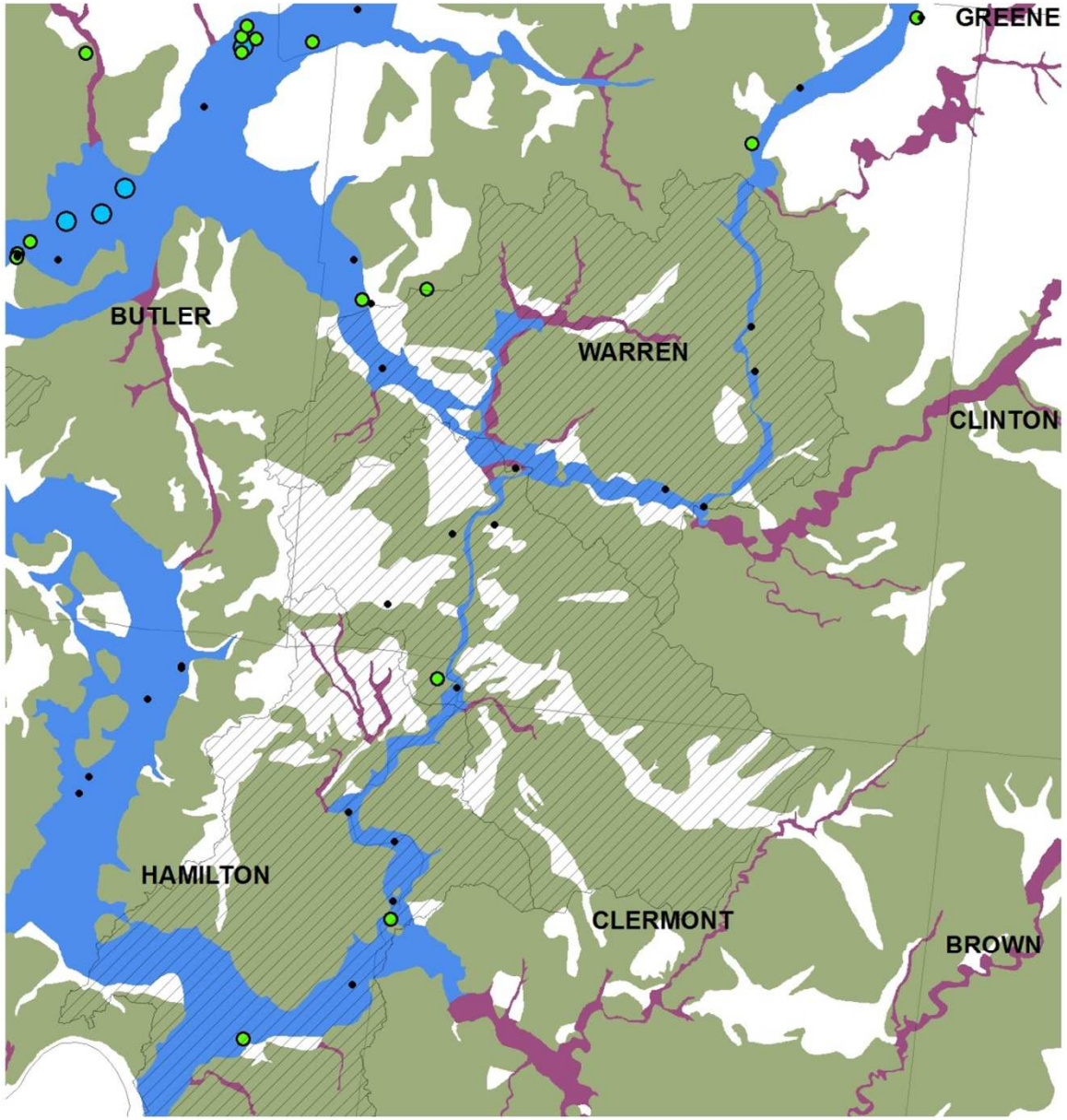

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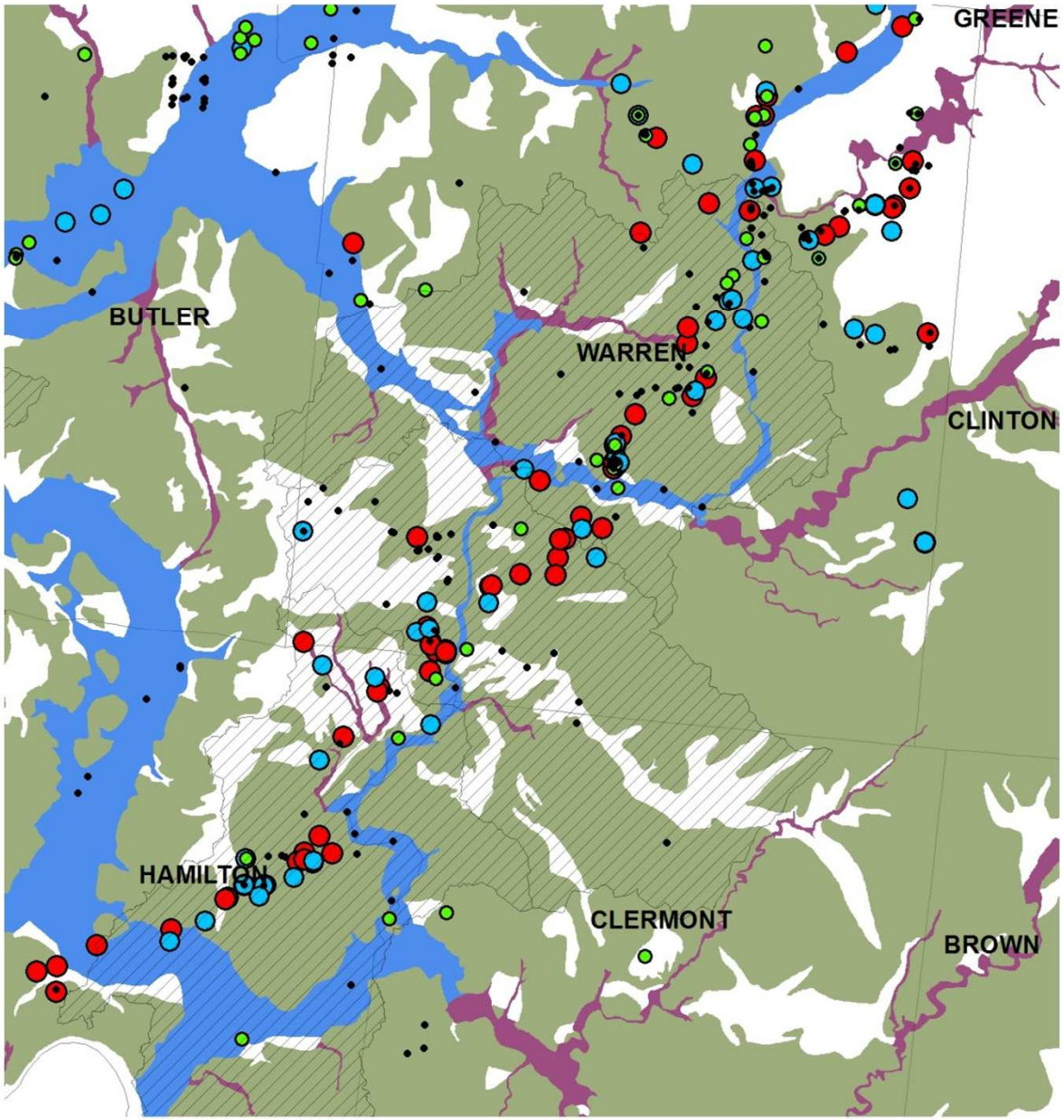

SDWIS, Ambient, ODH, MCD, USGS Nitrate

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- 5 - 10
- > 10

N

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Conclusions

- New combined dataset for Ohio GW
- Identified GW priority HUC10 w'sheds
- Small, but impactful datasets add value
  - First water is significant
  - Thick fractured tills are vulnerable
- Upper, lower GMR most sig. for GW
- HUC10s Outside GMR:
  - Headwaters Tuscarawas (Summit/Medina)
  - Apple-Killbuck Creek (Wayne/Holmes)
  - White Eyes Creek (Coshocton)
  - Headwaters Salt Creek (Hocking/Picaway)

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Next Steps

- Integrate with SW data at watershed scale
- Collaborate with ODA, ODNR, others
- mv pred. model: NO_3 =

  {LU} + {Dr} + {soils} + loading + pop. + lith. + geom + precip

  LU = land use (rowcrop/forest/urban,etc)
  Dr = Drastic measures (depth to water/recharge, etc)
  soils = well draining, slopes
  loading = nitrate loading to surface (e.g, kg NO_3/hec)
  geom = watershed geometry

- Geochemical fence diagram

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Questions?

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