Kentucky Interagency Groundwater Monitoring Network: Expanded Monitoring Programs

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Interagency Groundwater Quality Monitoring Program Design

- Interagency Technical Advisory Committee (ITAC) on Groundwater
- Goals: 1) Baseline data on ambient groundwater conditions
  2) Characterize groundwater resources
  3) Disseminate info collected
- Represent all aquifer types (karst, fracture flow and granular) and Physiographic Regions of KY, consider Ohio River alluvium as unique region/aquifer
- Ideal Design: 640 active sites
  120 rotating “one-time” sites
- Kentucky Revised Statute 151 (1998) – Mandated groundwater monitoring, established ITAC and set KGS as KY groundwater repository

Actual Groundwater Quality Monitoring in Kentucky

Actual (Reasonable) Design:

- Ambient Groundwater Quality Monitoring Network:
  - 59 active sites (~10% of "Ideal")
    - 29 wells and 30 springs
  - Sampled 4 times per year (some less frequent)
  - Priority given to Public Water Suppliers using groundwater (18 wells, 5 springs)

- Approximate total of 200 samples per year
  - Roughly 120 from GW Quality Network
  - Remainder from NPS studies, technical assistance, complaint investigations and one-time sites

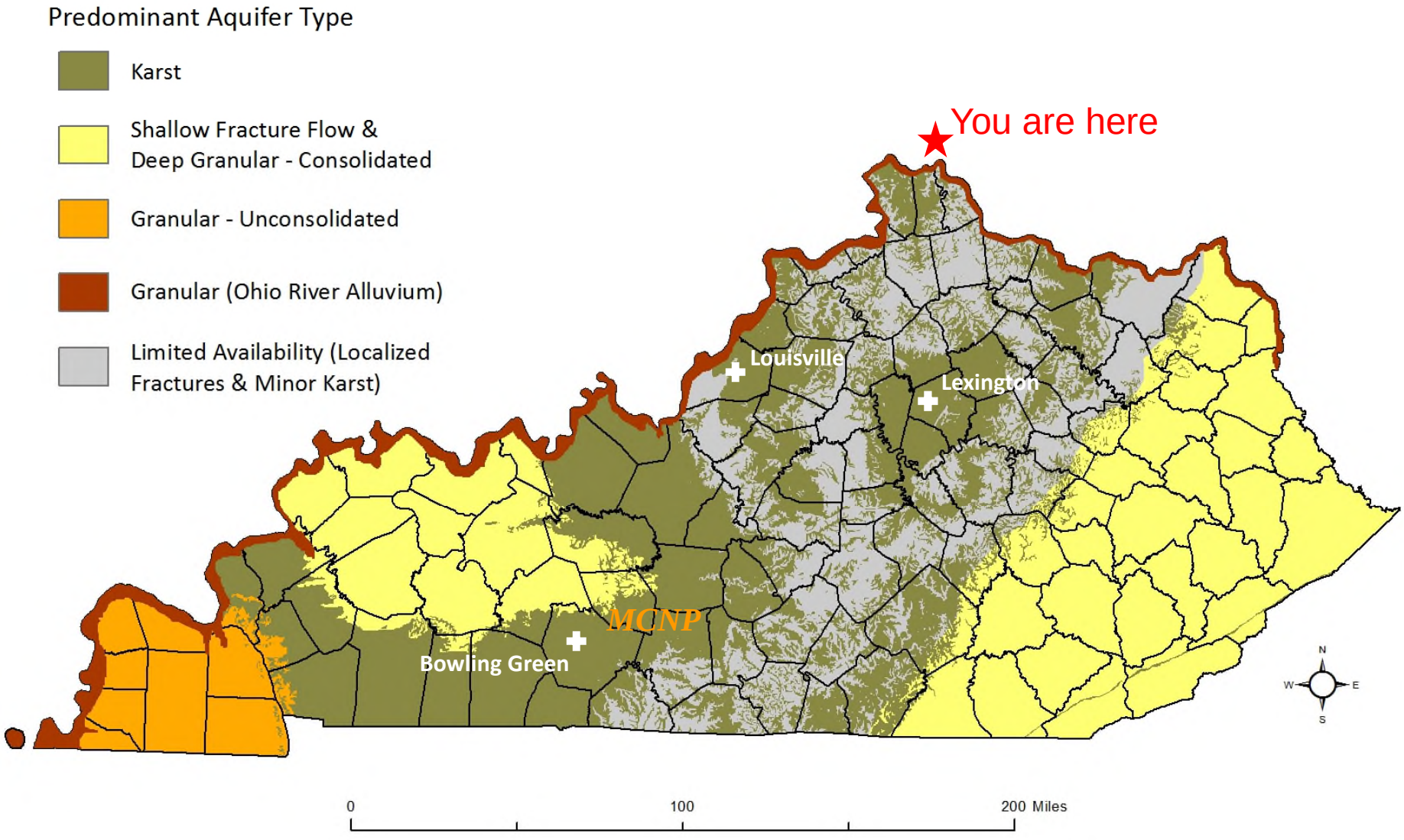
Parameters Summarized

- **Bulk Parameters** – pH, Temp, Specific Conductance, TSS & TDS
- **Nutrients** – NO_3-N, NO_2-N, NH_3-N, TKN, TOC, Total-P & Ortho-P
- **Major Inorganic Ions** – Cl^-, F^- & SO_4^-
- **Metals** (Dissolved and Total) – Ca, Fe, Mg, K, Na, Al, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag & Zn
- **Organics** – N/P and Chlorinated Pesticides, Herbicides & PCBs
- **Volatile Organics** – BTEX & MTBE (numerous others)
- **Caffeine** – recent addition, surrogate for potential anthropogenic impacts

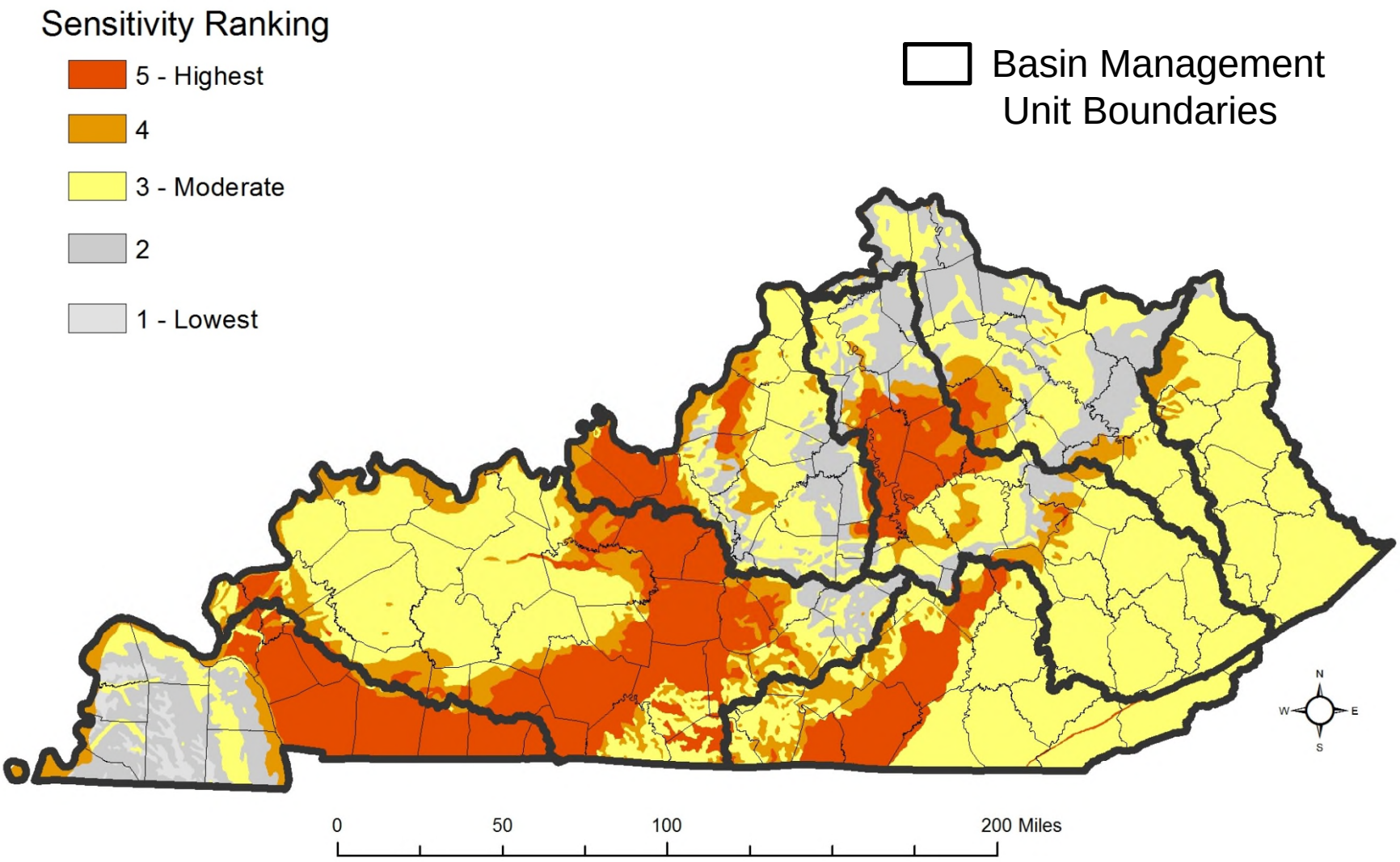
Funding Groundwater Quality Monitoring in Kentucky

- General operating funds
- Water Well Drillers Certification Fees (agency receipts)
- Federal Insecticide Fungicide, and Rodenticide Act (FIFRA) – KY Dept. of Agriculture
- Clean Water Act §319(h) assessment projects

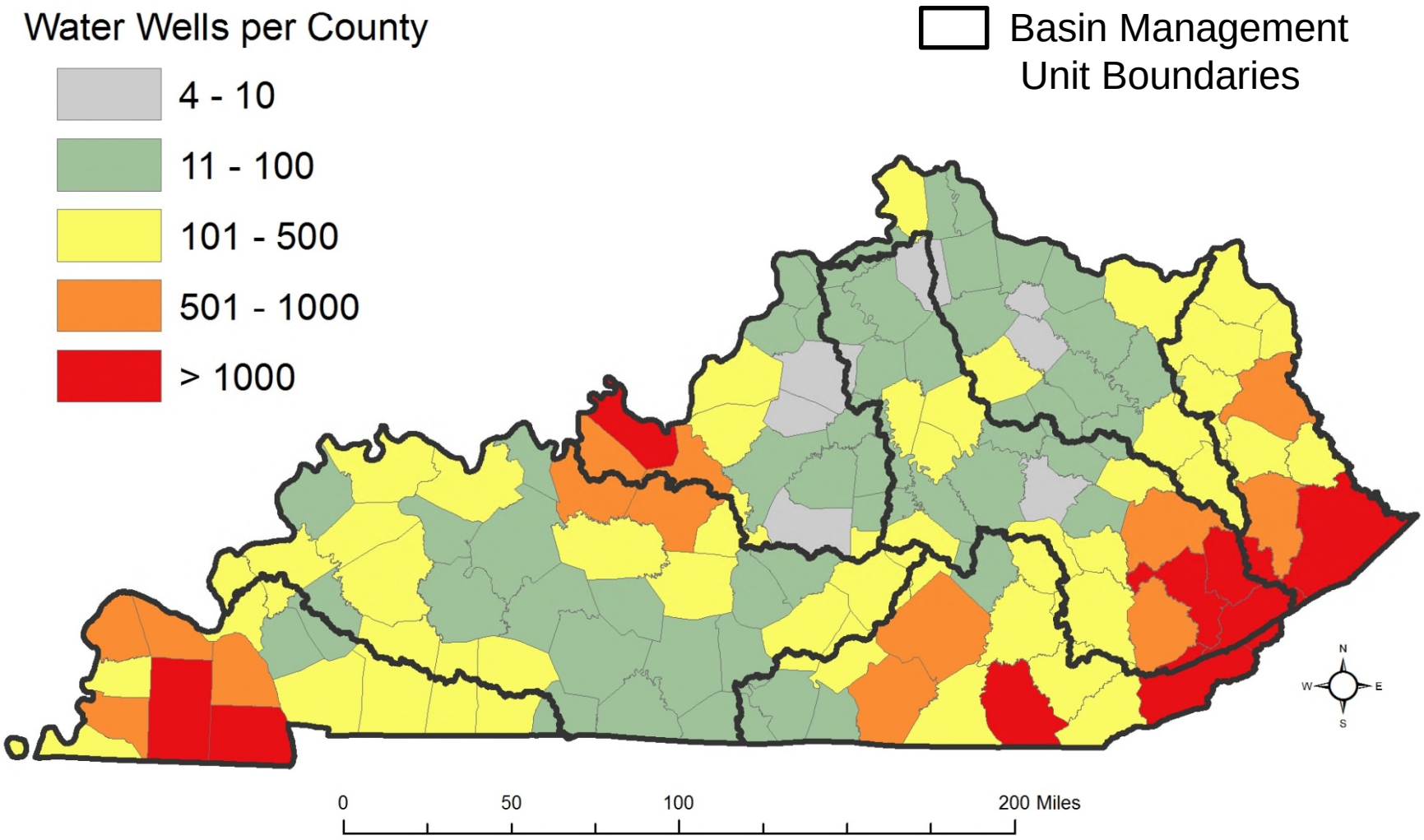
Generalized Aquifers of Kentucky



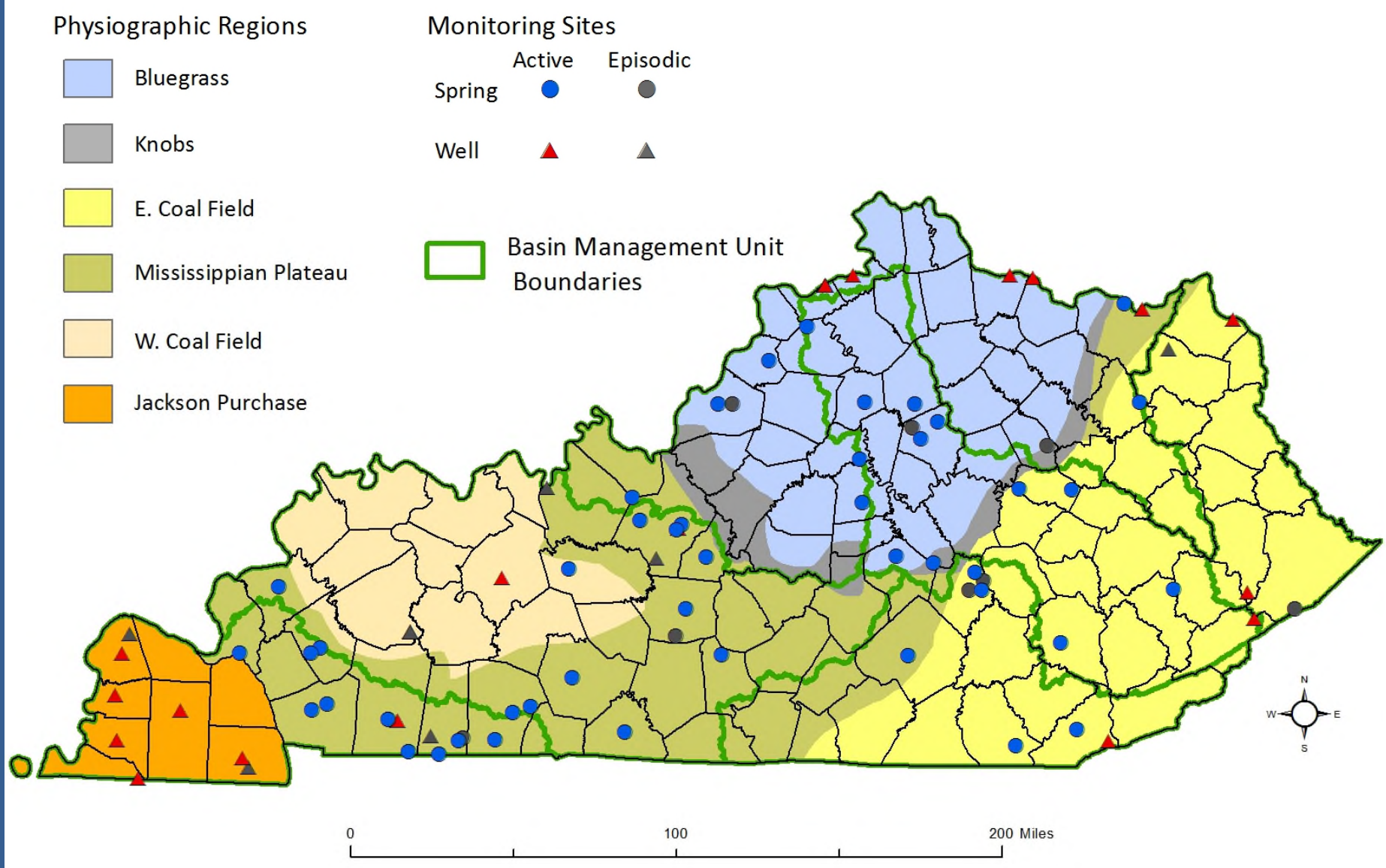
Groundwater Sensitivity Regions of Kentucky
Division of Water, 1994



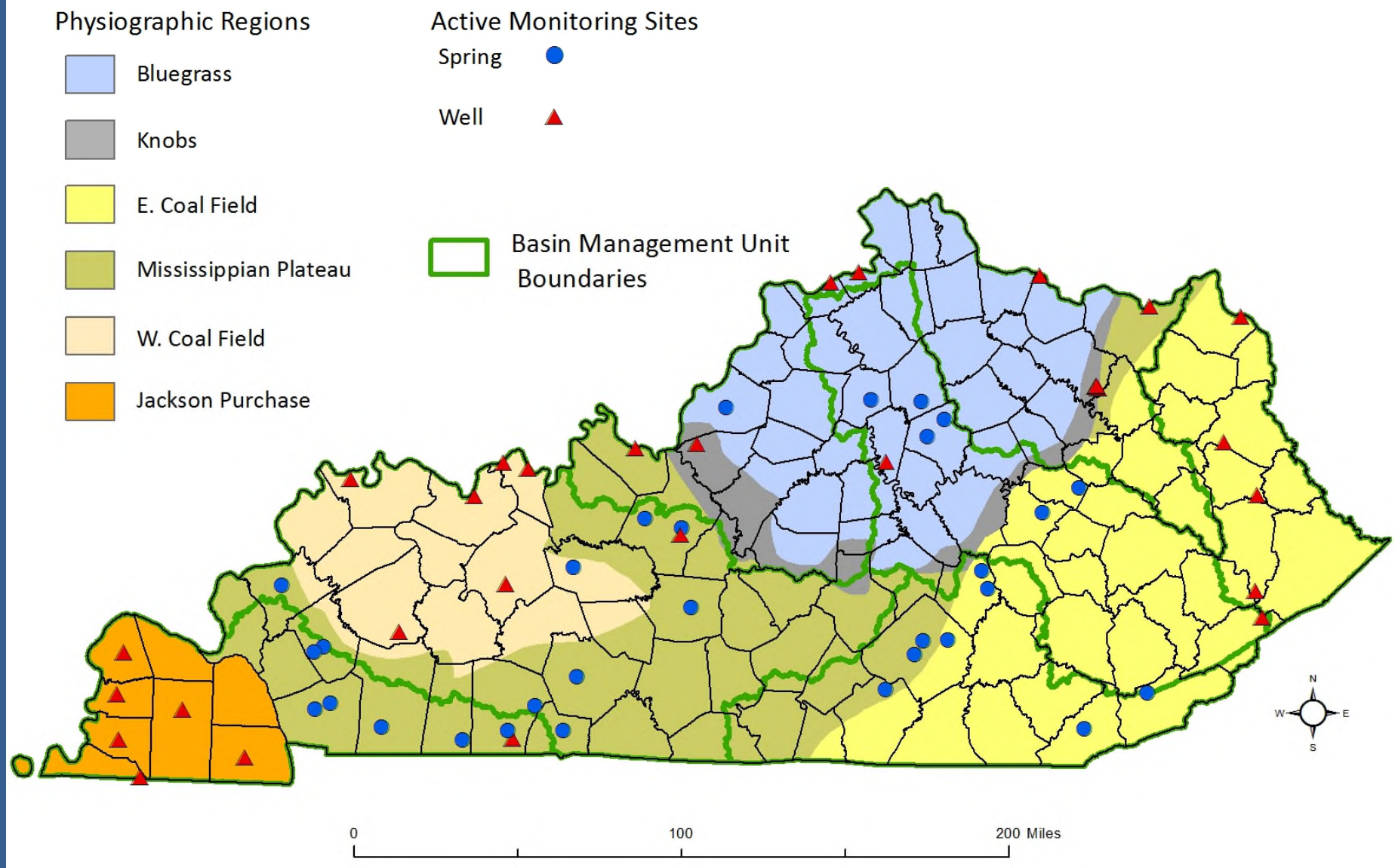
Water Well Distribution
Kentucky Division of Water
2013



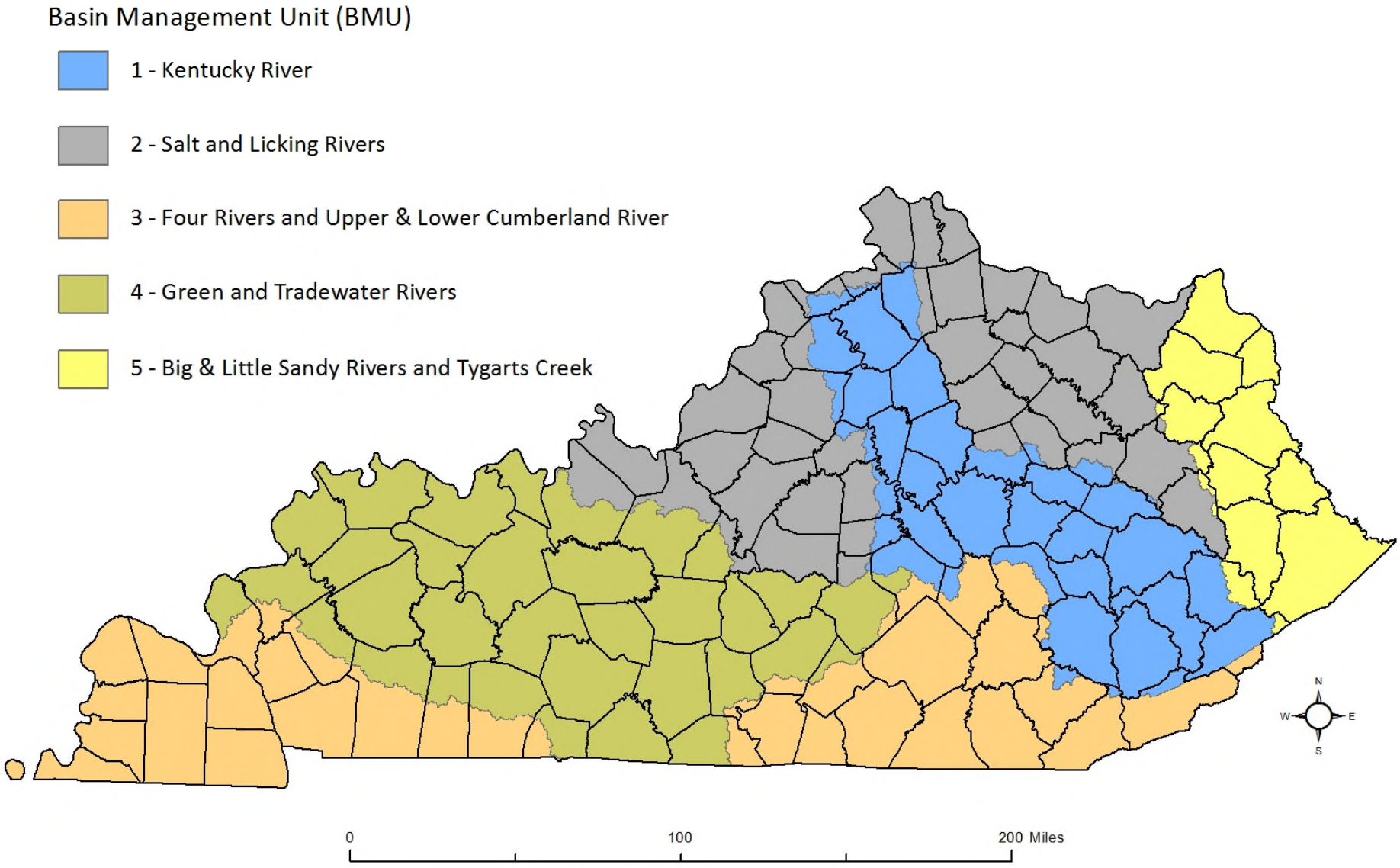
KY Ambient Groundwater Quality Monitoring Network: Initial Monitoring Sites 1995 - 2000



KY Ambient Groundwater Quality Monitoring Network: Active Monitoring Sites 2014



Expanded Monitoring Sites: Basin Management Unit Cycles



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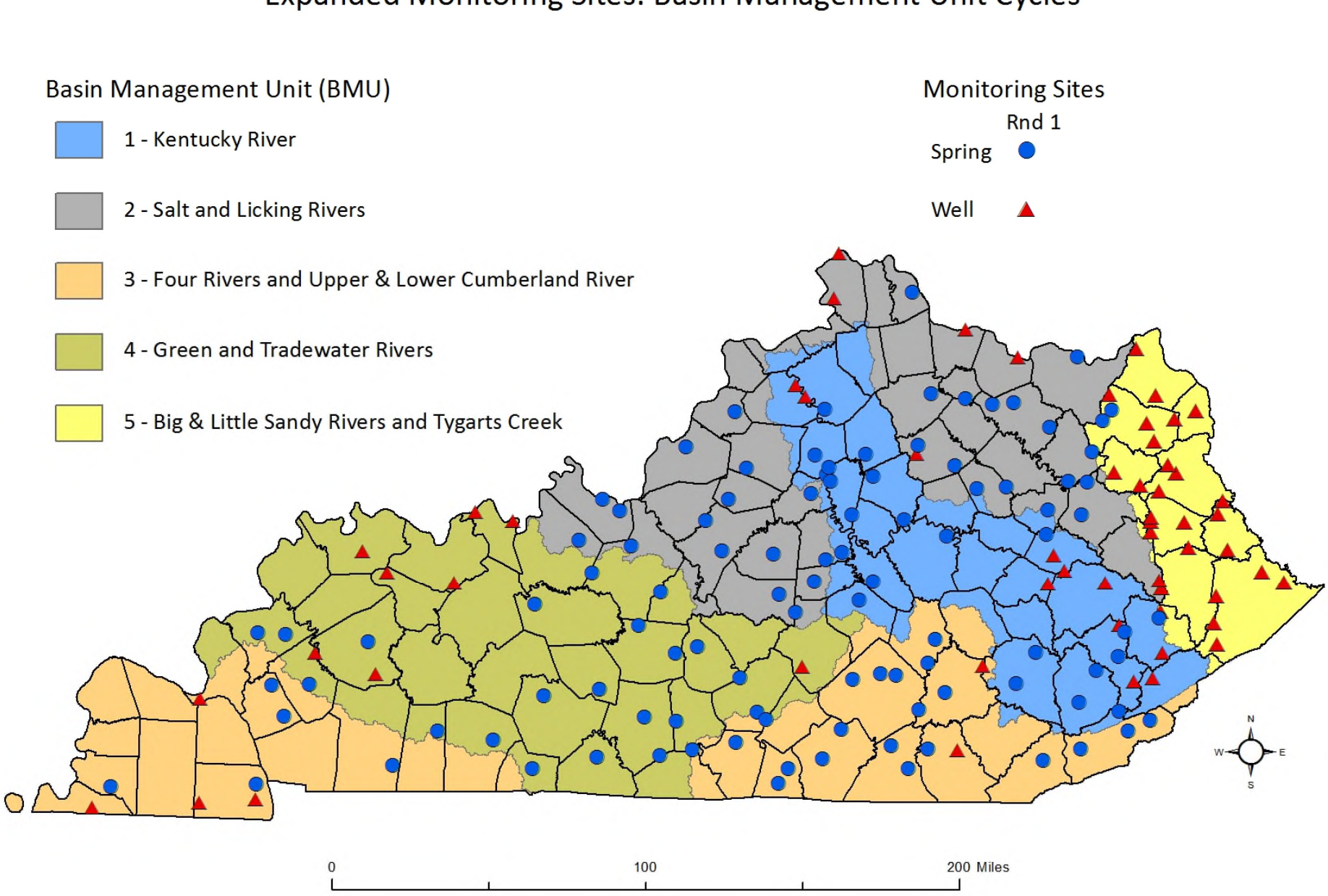

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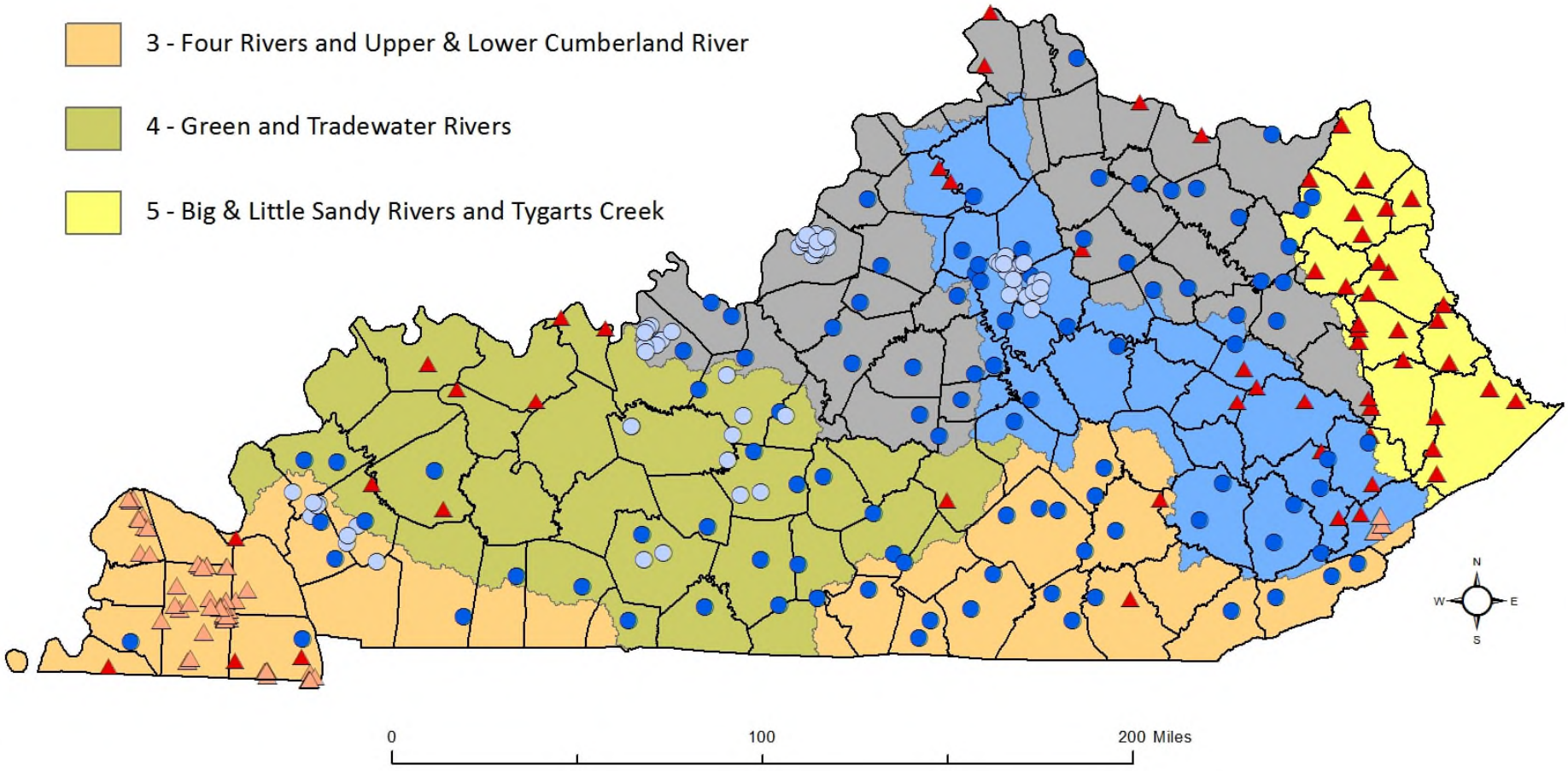
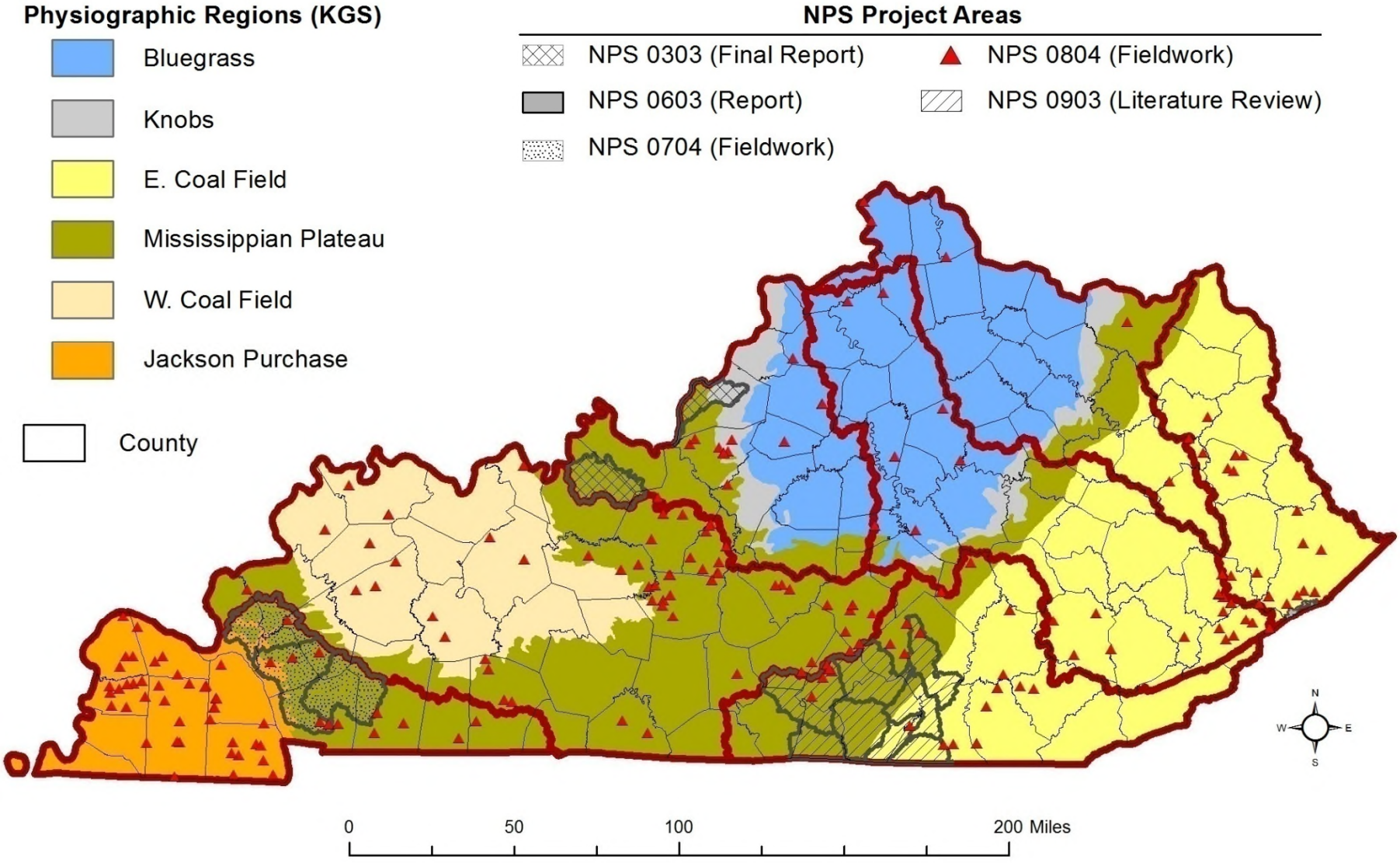
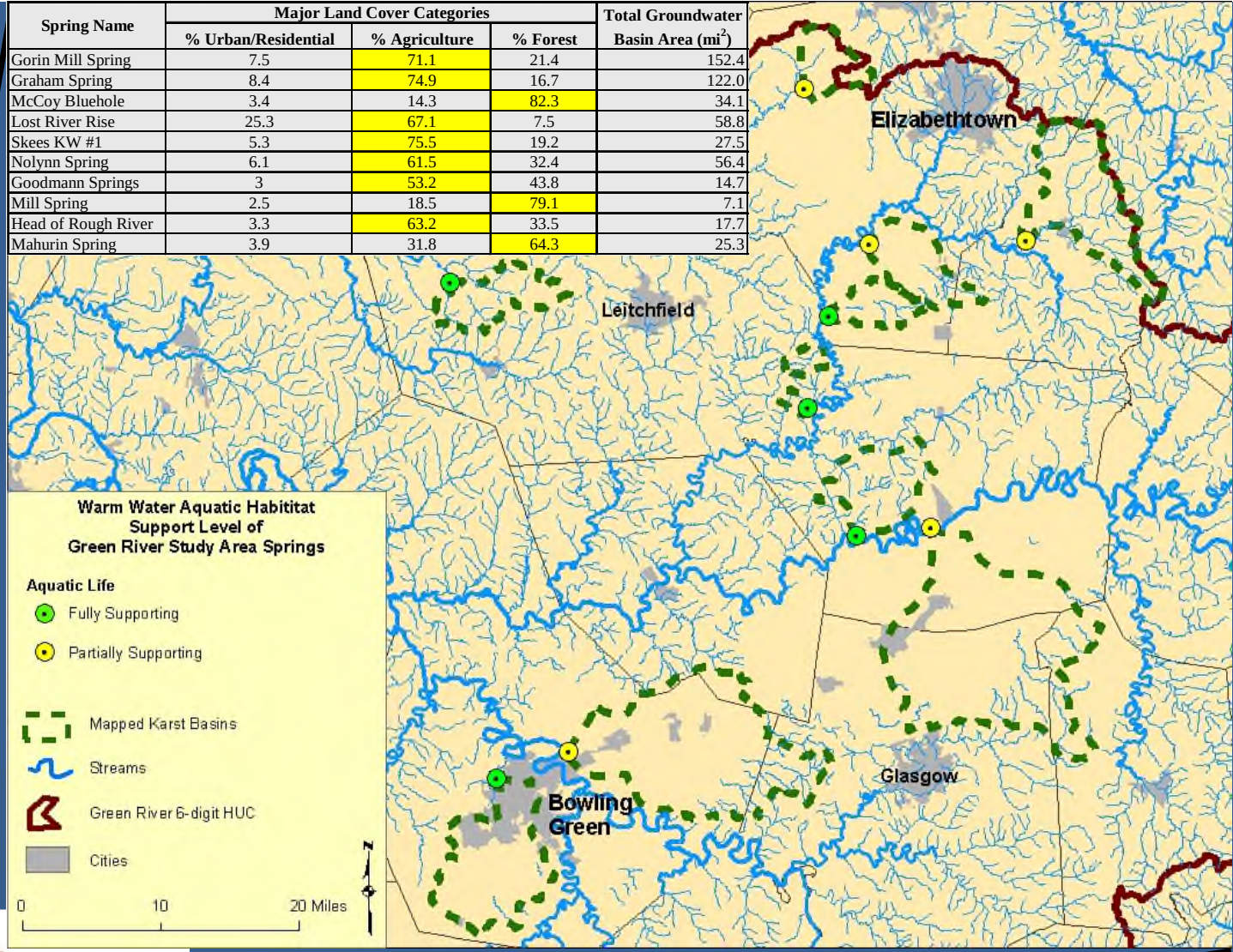
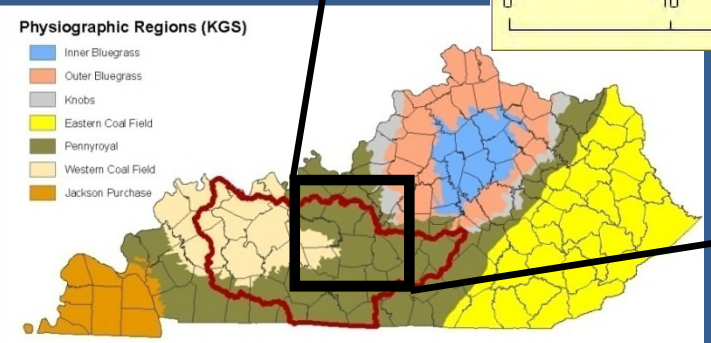


Current Nonpoint Source Groundwater Assessment Project Areas
Kentucky Division of Water
2012



Spring Name	Major Land Cover Categories			Total Groundwater Basin Area (mi^2)
	% Urban/Residential	% Agriculture	% Forest	
Gorin Mill Spring	7.5	71.1	21.4	152.4
Graham Spring	8.4	74.9	16.7	122.0
McCoy Bluehole	3.4	14.3	82.3	34.1
Lost River Rise	25.3	67.1	7.5	58.8
Skees KW #1	5.3	75.5	19.2	27.5
Nolynn Spring	6.1	61.5	32.4	56.4
Goodmann Springs	3	53.2	43.8	14.7
Mill Spring	2.5	18.5	79.1	7.1
Head of Rough River	3.3	63.2	33.5	17.7
Mahurin Spring	3.9	31.8	64.3	25.3





Large Springs in Green River: Major issues were Nutrients and Bacteria (9 of 10 springs failed to meet PCR)

Fill Data Gaps with:
Technical Assistance and Complaint Samples

- Technical Assistance requests from PWSs and private citizens using groundwater as drinking water source

  1) Some fairly simple – groundwater quality info lacking, but necessary for new well or bringing old well back online

  2) Some Complaint driven – groundwater quality or quantity has been degraded
     - Water well maintenance issues
     - Resource extraction (mining, oil & gas)
     - Construction and development
     - Leaking sewer and/or failing septic systems
     - Naturally occurring
     - Spill or leak of hazardous material
     - Source of problem(s) completely unknown

- Collect other parameters as needed (pathogens, dissolved gas…)

Fill Data Gaps with:
Technical Assistance and Complaint Samples

- Technical Assistance also includes water well and spring inspections

  - Wellhead and down hole camera inspections

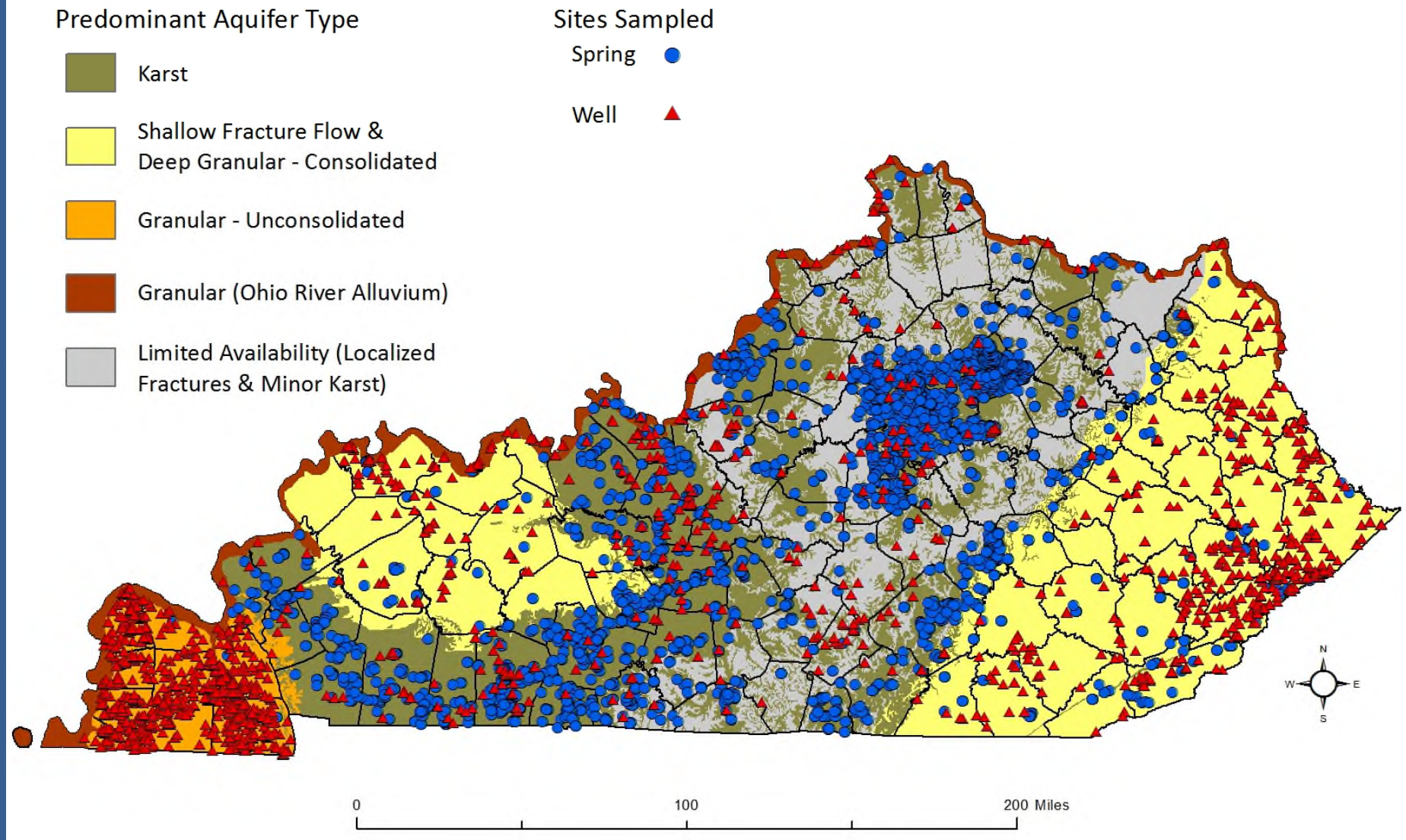
  - Review construction records and groundwater data from surrounding area

- One-Time Samples generally for public relations

  - Already on site for other matter and someone requests that we collect samples from their water well or spring

  - Must be drinking water source

All Groundwater Sites Sampled Through December 2013



Success

- Collected considerable amount of groundwater quality data
  - Roughly 19,000 sample results from ~6300 groundwater sources
- Baseline geochemistry in all physiographic regions and aquifers
- Determined problematic issues: Nutrients, Pesticides, Pathogens and education/outreach about water well maintenance
- Provide groundwater data to support other agencies/programs
- KGS developed web-interfaces to Groundwater Repository

Challenges

- Data gaps spatially and temporally
    1) Need to expand geographically/number of sites
    2) Need increased frequency in karst areas

- Only minor changes in nearly 20 years
    1) Added, dropped and changed sampling frequency
    2) Time to review and evaluate goals and design
    3) Review, evaluate and report on all available data

- Personnel and resource constraints
    1) Sample smarter not harder?

Acknowledgements

- Interagency Technical Advisory Committee on Groundwater
  - Past and present representatives
- Commonwealth of Kentucky Legislature and Department of Agriculture
- US Environmental Protection Agency
- DOW and KGS field staff – field activities, data management & analysis and reporting

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