Monitoring of nitrate and other contaminants in groundwater in Pahrump Valley

Background

USGS conducted pilot study in 2012

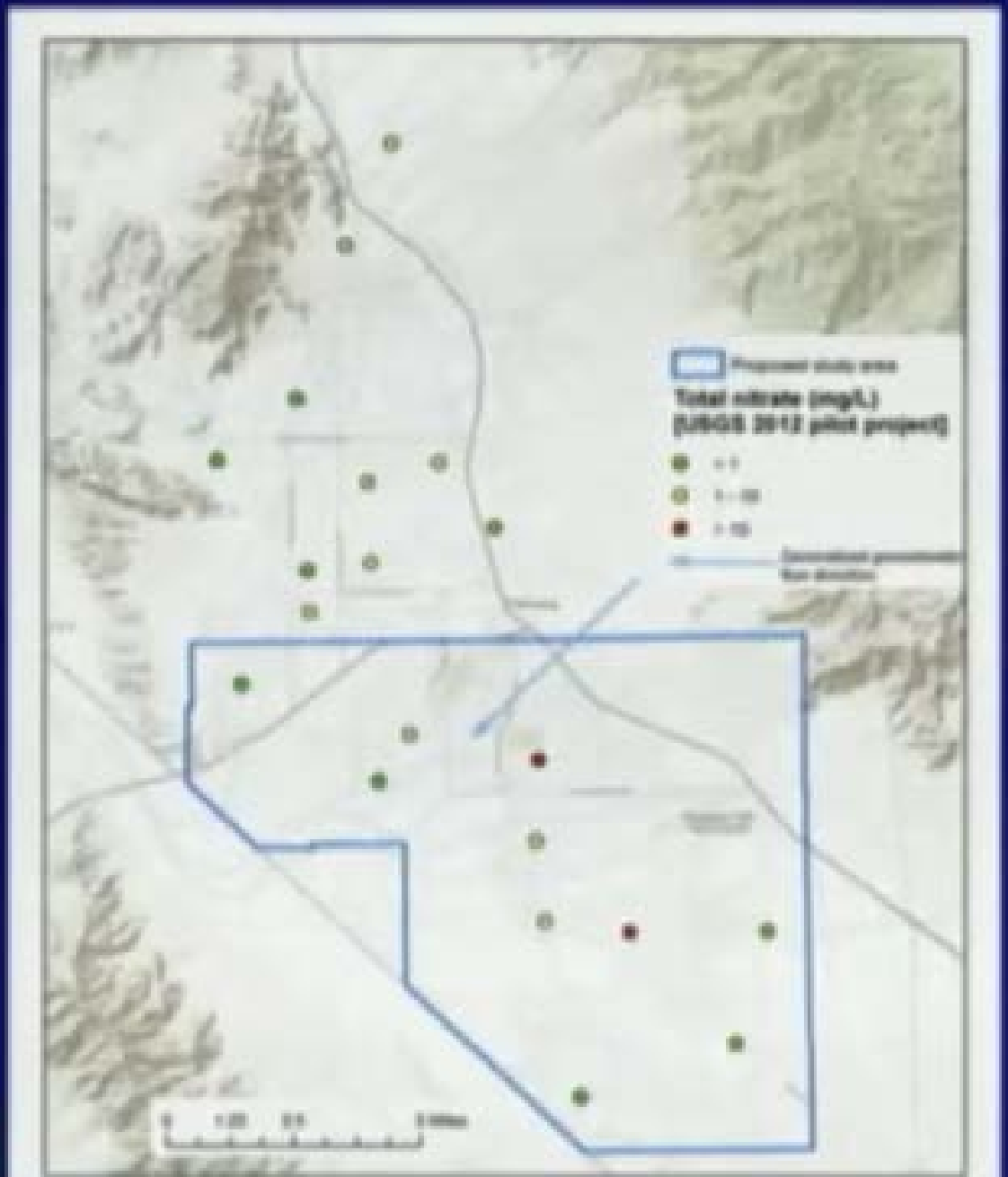
- 20 wells sampled
- Mostly domestic wells
- Objective was to identify the distribution and concentrations of nitrate in groundwater from domestic wells in Pahrump Valley

Background

Pilot Study Results

- All wells had detectable nitrate
- 2 of 20 wells (10%) had nitrate concentrations above the USEPA drinking-water standard (10 mg/L)
- Most domestic wells with elevated nitrate concentrations were located in the southern part of the Pahrump Valley

USGS



Nitrate concentrations from pilot study

Background

USGS Conducted Phase 2 Study 2014-2015

- Sampled an additional 27 new wells and re-sampled 4 wells from pilot study (31 total)
- Analyzed samples for major ions, nitrate, nitrogen isotopes, coliform bacteria, and waste water compounds
- Focused on southern part of Pahrump Valley

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Background

Phase 2 Results

- All wells had detectable nitrate
- 2 of 31 wells (6.5%) had nitrate concentrations above the USEPA drinking-water standard (10 mg/L)
- 2 additional wells (6.5%) had nitrate concentrations close to the USEPA drinking-water standard (> 9 mg/L)

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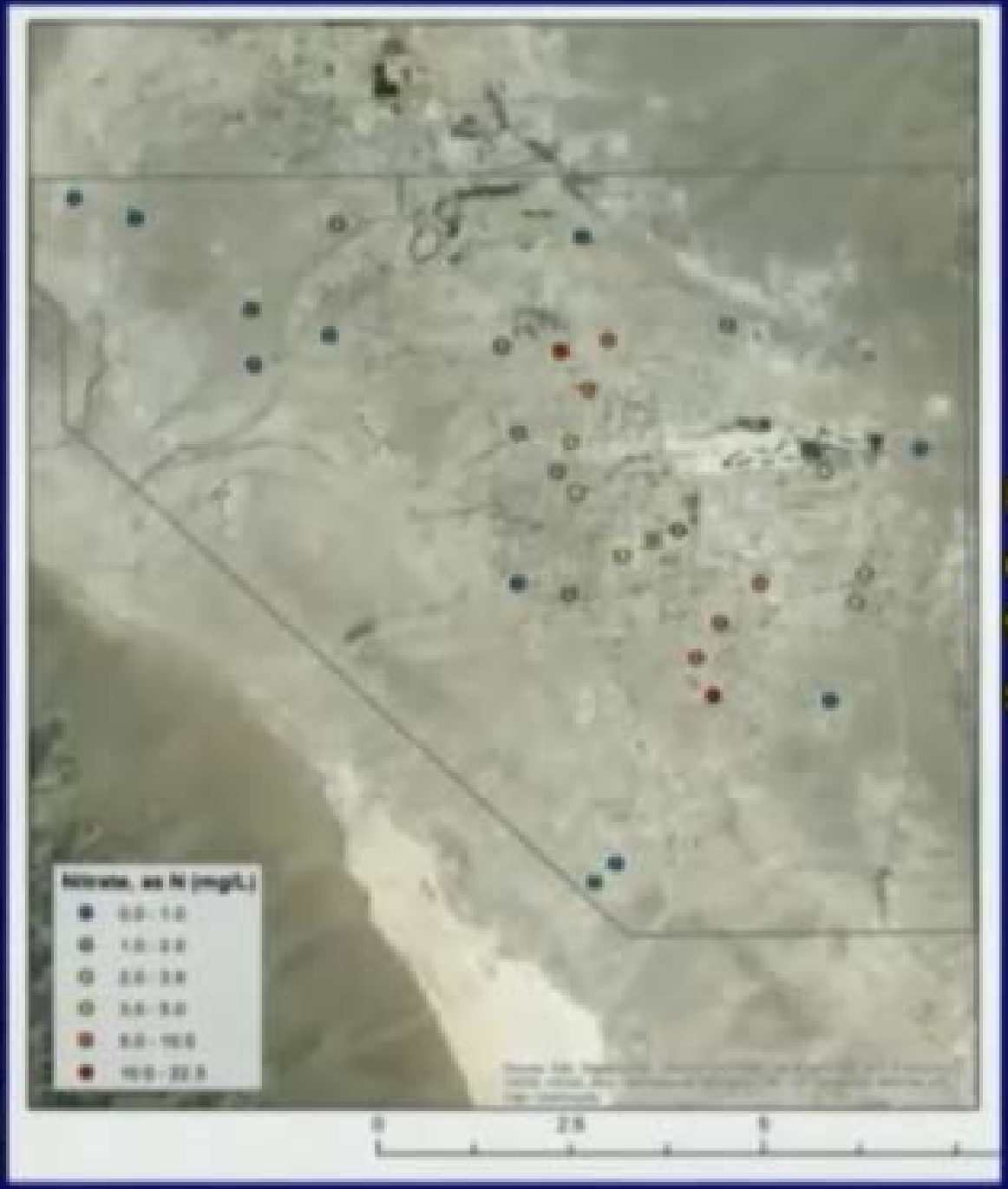

Nitrate concentrations from phase 2 study

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Background

All Nitrate Results

- 47 unique wells sampled for nitrate
- 3 of 47 wells (6.4%) had nitrate concentrations above the USEPA drinking-water standard (10 mg/L)
- 2 additional wells (4.2%) had nitrate concentrations close to the USEPA drinking-water standard (> 9 < 10 mg/L)
- *10.6% of all wells had high nitrate* ←

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Quality Control Check

Duplicate Nitrate Results

Well	Sample Date	Nitrate (mg/L)
1	12/10/2012	1.1
1	9/3/2014	1.6
2	7/2/2012	1.1
2	9/23/2014	1.01
3	10/15/2012	21.9
3	12/9/2014	22.7
4	6/25/2012	0.16
4	12/17/2014	0.15

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What is the source of the nitrate?

- Nitrogen isotopes indicate:
  - septic system waste and manure are sources
  - natural soil N is also a source
  - nitrate and ammonia fertilizers are not sources
- Waster water compounds indicate a septic system source

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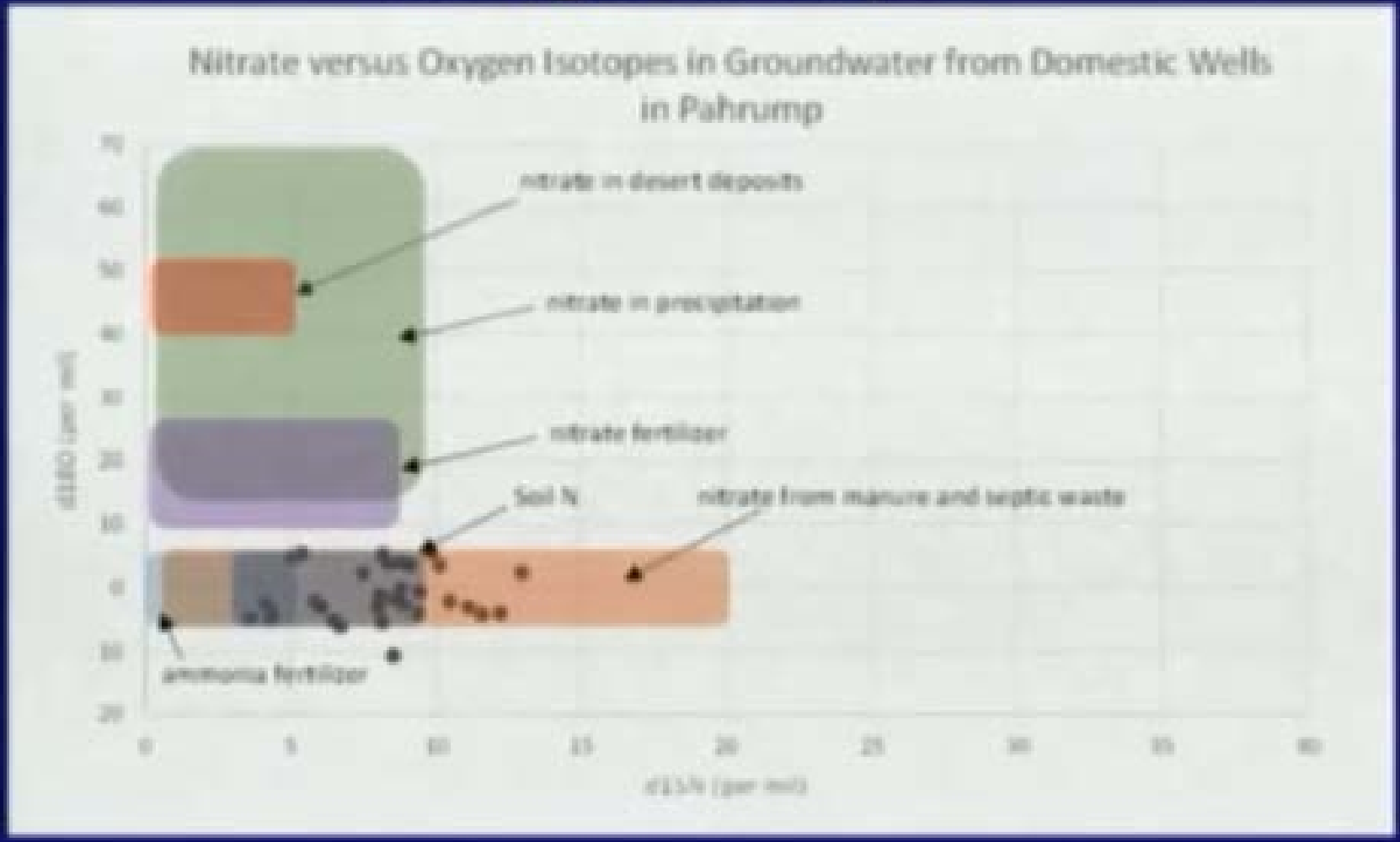
Nitrogen Isotopes



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Waste Water Compounds

- 42% of wells had detection of 1 or more waste water compounds
- Average concentration of nitrate only slightly higher in wells with waste water compounds
- Some compounds only have man-made sources; i.e., can not be from a natural source

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Total Dissolved Solids

- Sometimes an indicator of waste water
- No correlation with nitrate concentrations
- However, 8 wells had concentrations of TDS > secondary drinking water standard of 500 mg/L
  - Secondary standard is mainly related to aesthetic and technical concerns

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Chloride, Boron, and Fecal Coliform

- Sometimes an indicator of waste water
- No detections of fecal coliform
- No correlation of chloride or boron with nitrate concentrations

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Bottom Line on Nitrate Sources

- Nitrogen isotopes strongly suggest sources from septic/manure and soil
  - mixing model needed to separate septic N from soil N
- Detections of waste water compounds support this interpretation
- Isotope signal indicates nitrate source is *not* from;
  - fertilizers
  - precipitation
  - natural desert deposits

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What Are The Next Steps?

1. Sample around RIBs to determine potential for these to be a nitrate source

2. Further examine the relation between nitrate and septic systems

3. Use mixing models to determine relative contributions of nitrate concentrations

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Proposed Work Objectives

1. Sample around RIBs to determine potential for these to be a nitrate source

    - very difficult to separate septic waste from RIB waste
    - concentration of nitrate in water from RIBs may be an indicator
    - can determine other contaminants from RIBs (such as pharmaceuticals)

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Proposed Work Objectives

1 (cont.). Sample around RIBs to determine potential for these to be a nitrate source

a. sampling of groundwater upgradient and downgradent of RIBS
b. sampling of RIB effluent

- samples analyzed for:
  - pharmaceuticals
  - hormones
  - priority pollutants
  - organohalogens

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Proposed Work Objectives

2. Further examine the relation between nitrate and septic systems

   - analyze relations between septic density, point sources (RIBs), groundwater levels, and groundwater flow directions with nitrate concentrations

   - these results could further separate septic source from RIB source

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Proposed Work Objectives

3. Mixing models to determine nitrate concentrations coming from different waste water sources

   - quantify the relative contributions of different waste water and soil nitrogen end-member sources to nitrate concentrations

   - these results could further separate septic source from RIB source

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