

**SBX2 1 (2008, Perata)**

**UC Davis Report to State Water Board  
for its Report to the Legislature**

**ADDRESSING NITRATE IN  
CALIFORNIA'S DRINKING WATER,  
TULARE LAKE BASIN AND SALINAS VALLEY**

**SWRCB Public Hearing**

**May 23, 2012**

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*Co-Investigators*



Aaron King, Allan Hollander, Alison McNally, Anna Fryjoff-Hung, Cathryn Lawrence, Daniel Liptzin, Danielle Dolan, Dylan Boyle, Elena Lopez, Giorgos Kourakos, Holly Canada, Josue Medellin-Azuara, Kristin Dzurella, Kristin Honeycutt, Megan Mayzelle, Mimi Jenkins, Nicole de la Mora, Todd Rosenstock, Vivian Jensen,  
*Researchers*

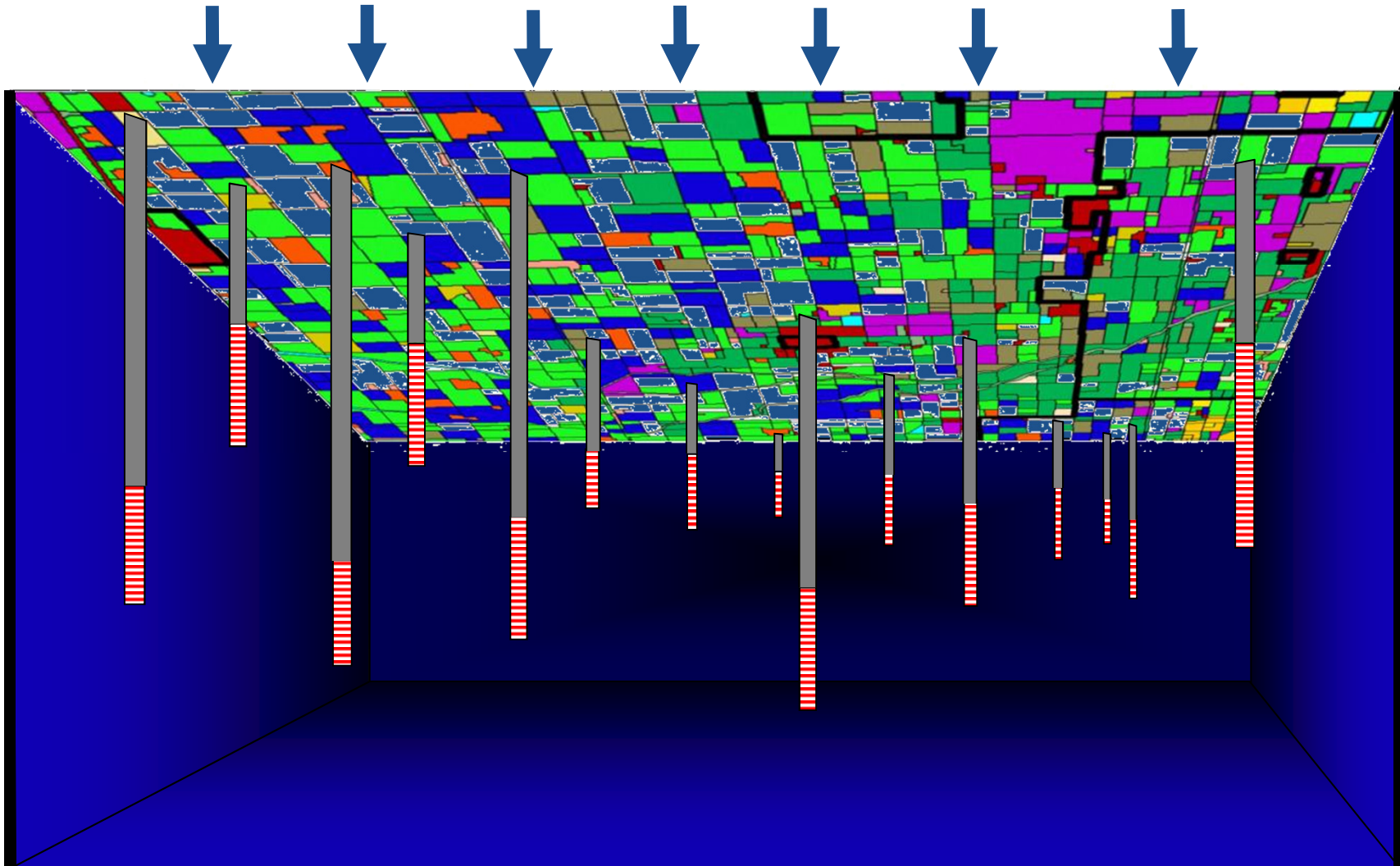
**<http://groundwaternitrate.ucdavis.edu>**

Watershed Science Center  
University of California, Davis  
Contact: [ThHarter@ucdavis.edu](mailto:ThHarter@ucdavis.edu)



# #1: Sources of Nitrate

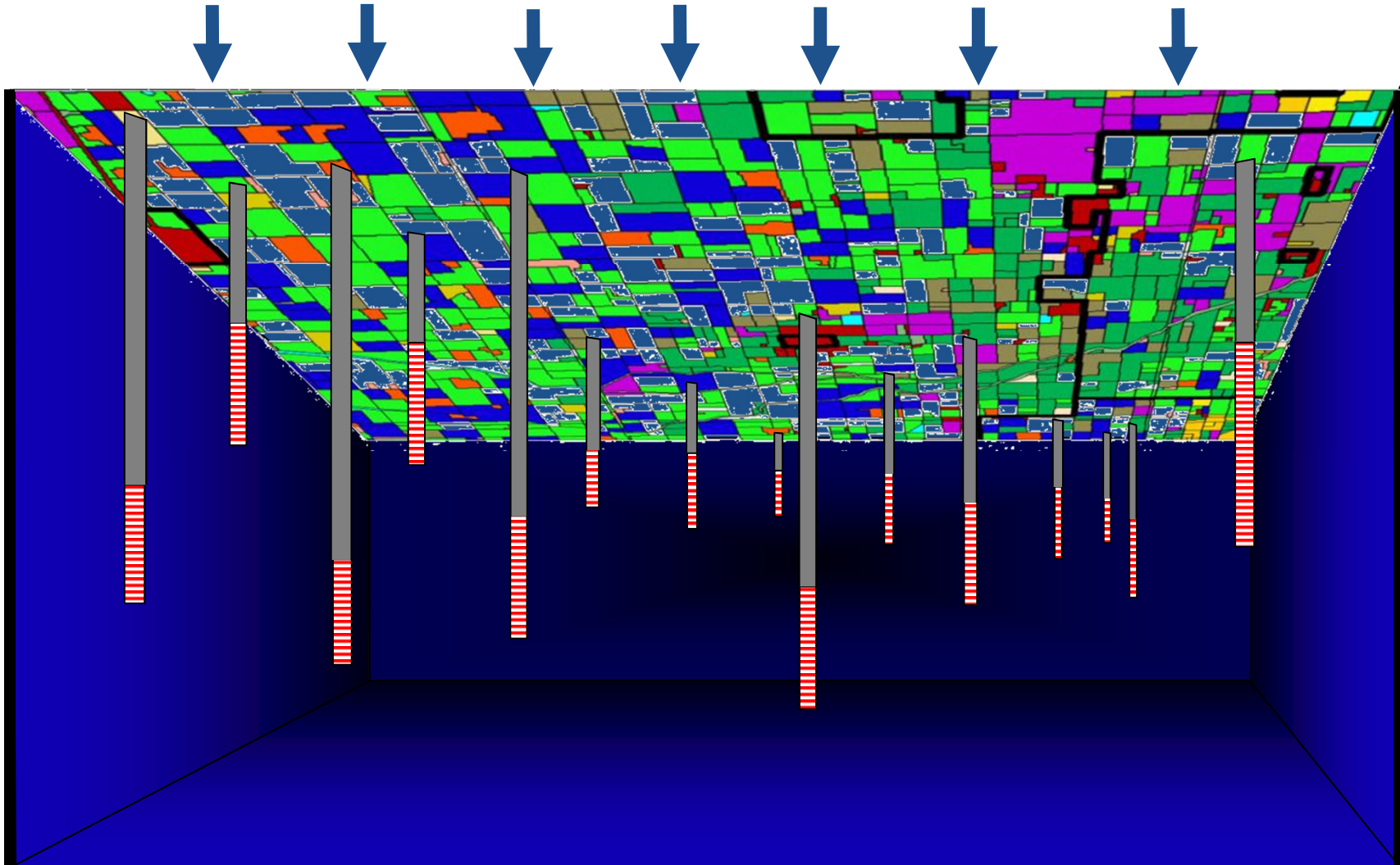
N Loading / Sources





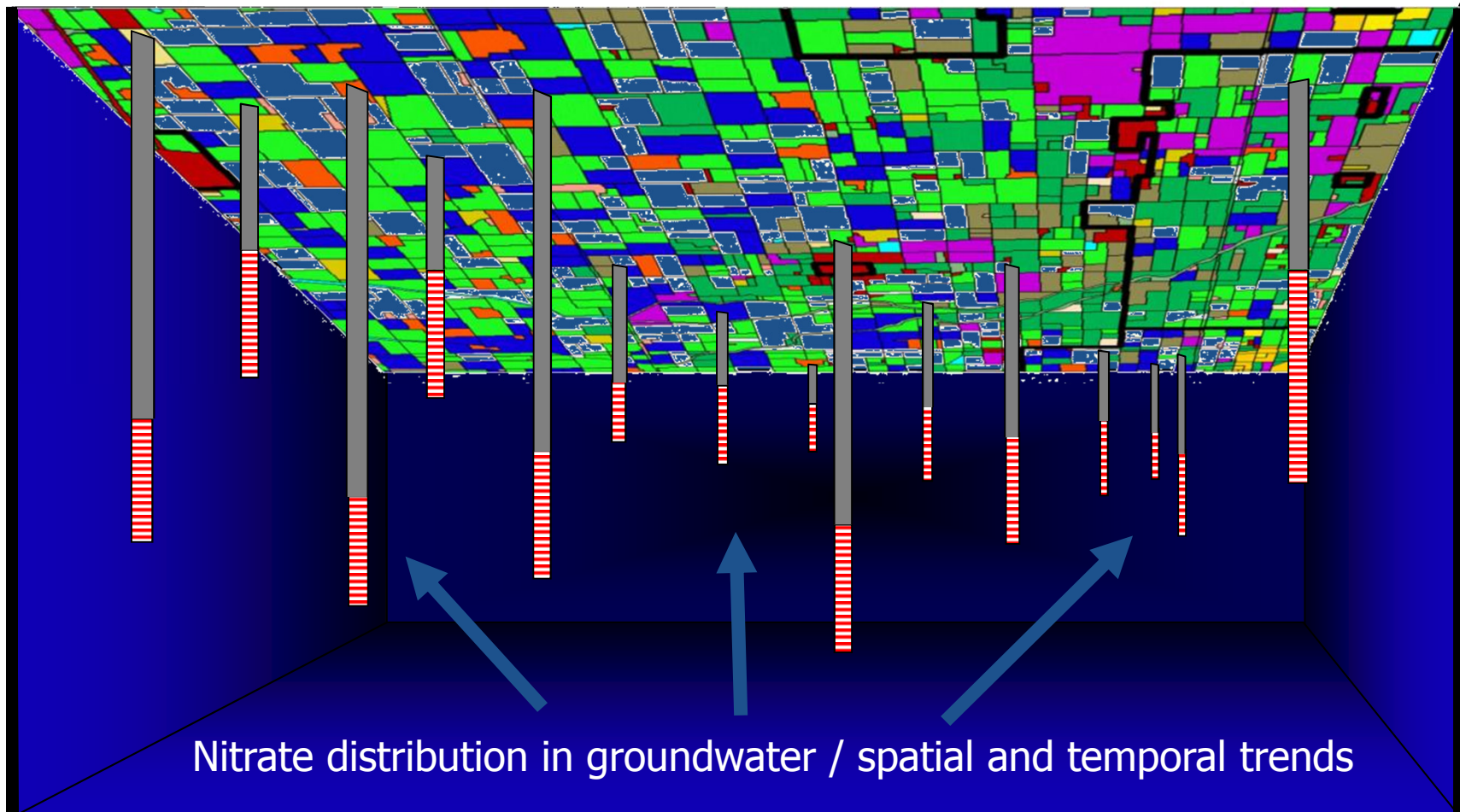
## #2: Nitrate Source Reduction

N Loading Reduction Options / Source Control





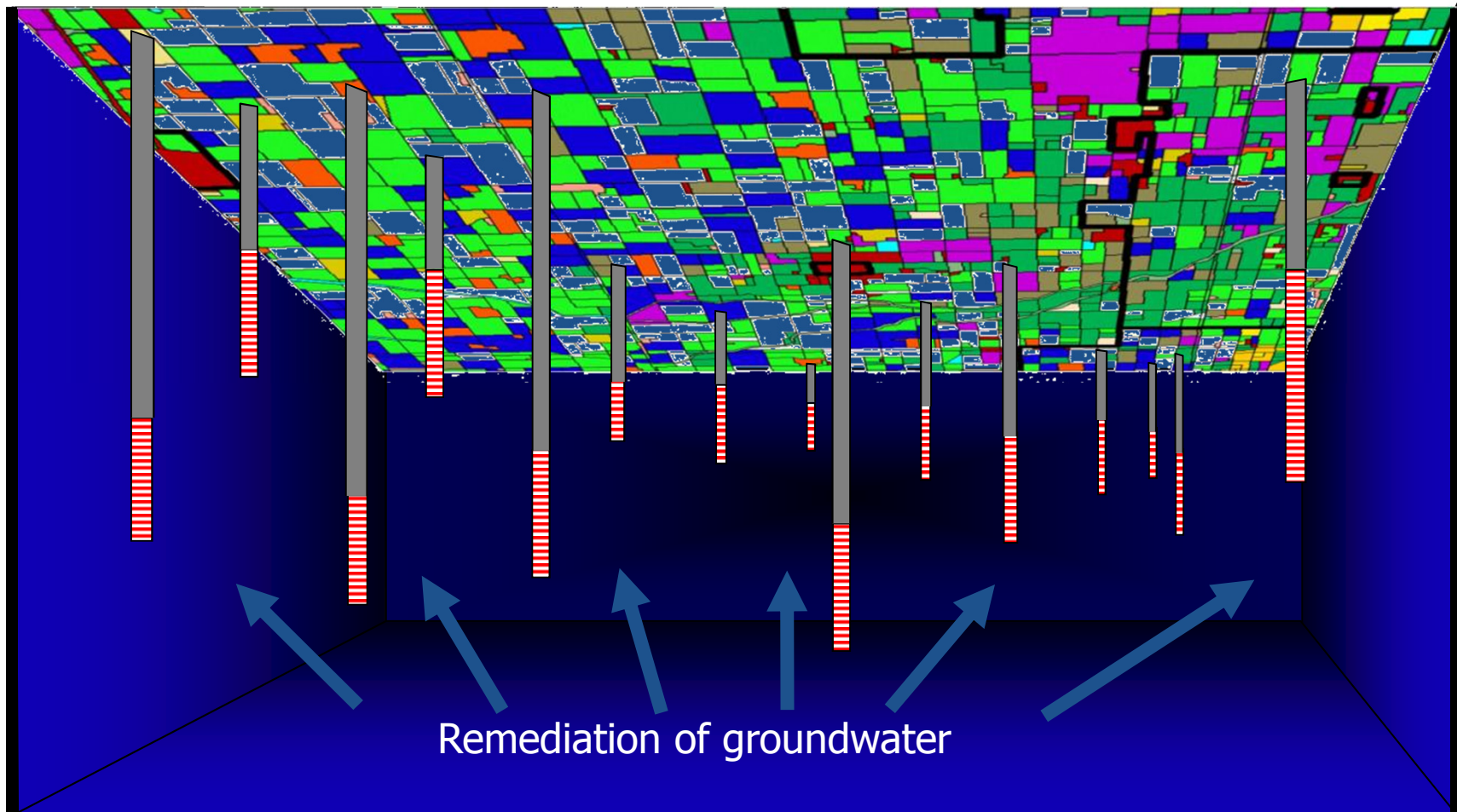
## #3: Groundwater Nitrate







## #4: Groundwater Remediation

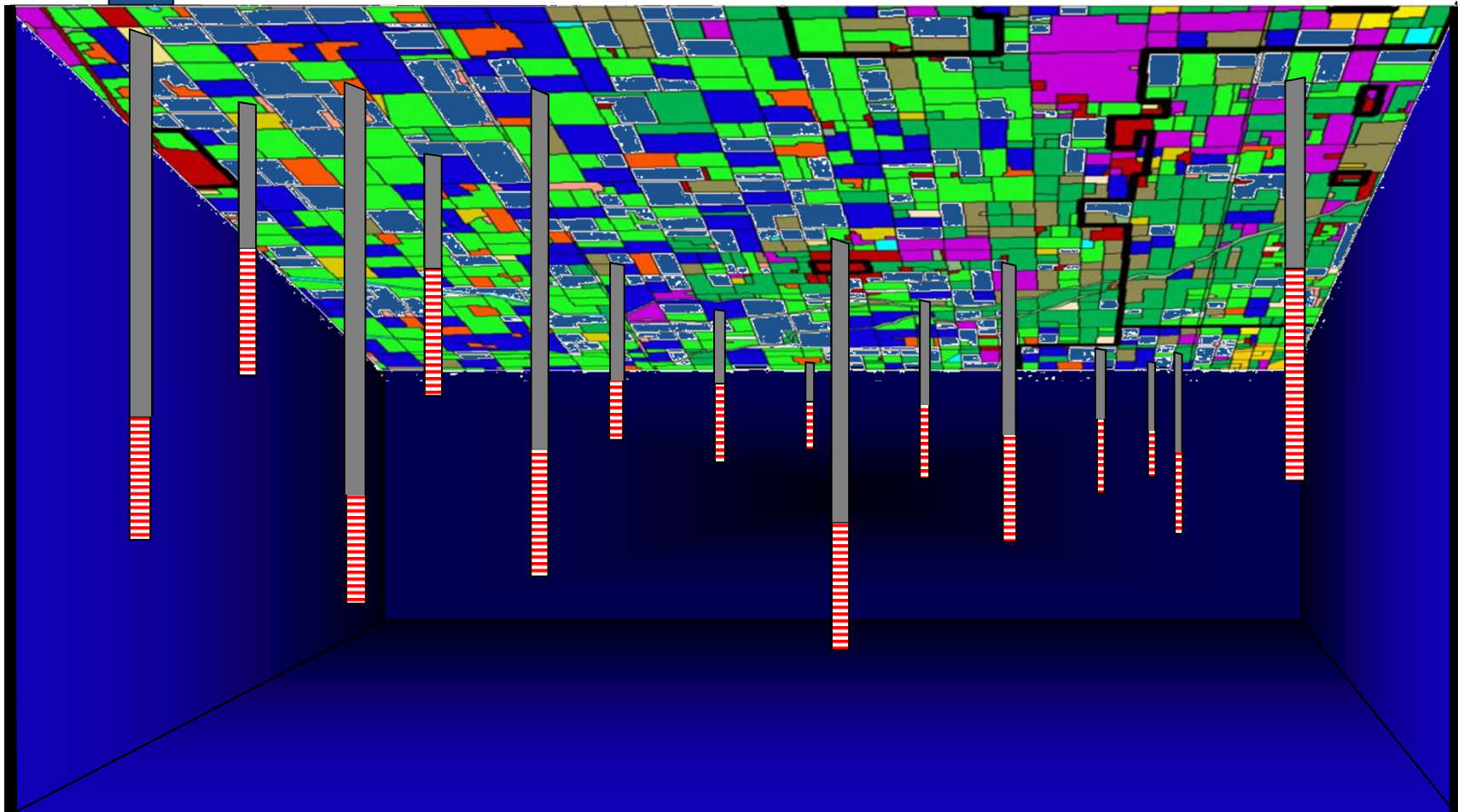




# #5: Drinking Water Treatment

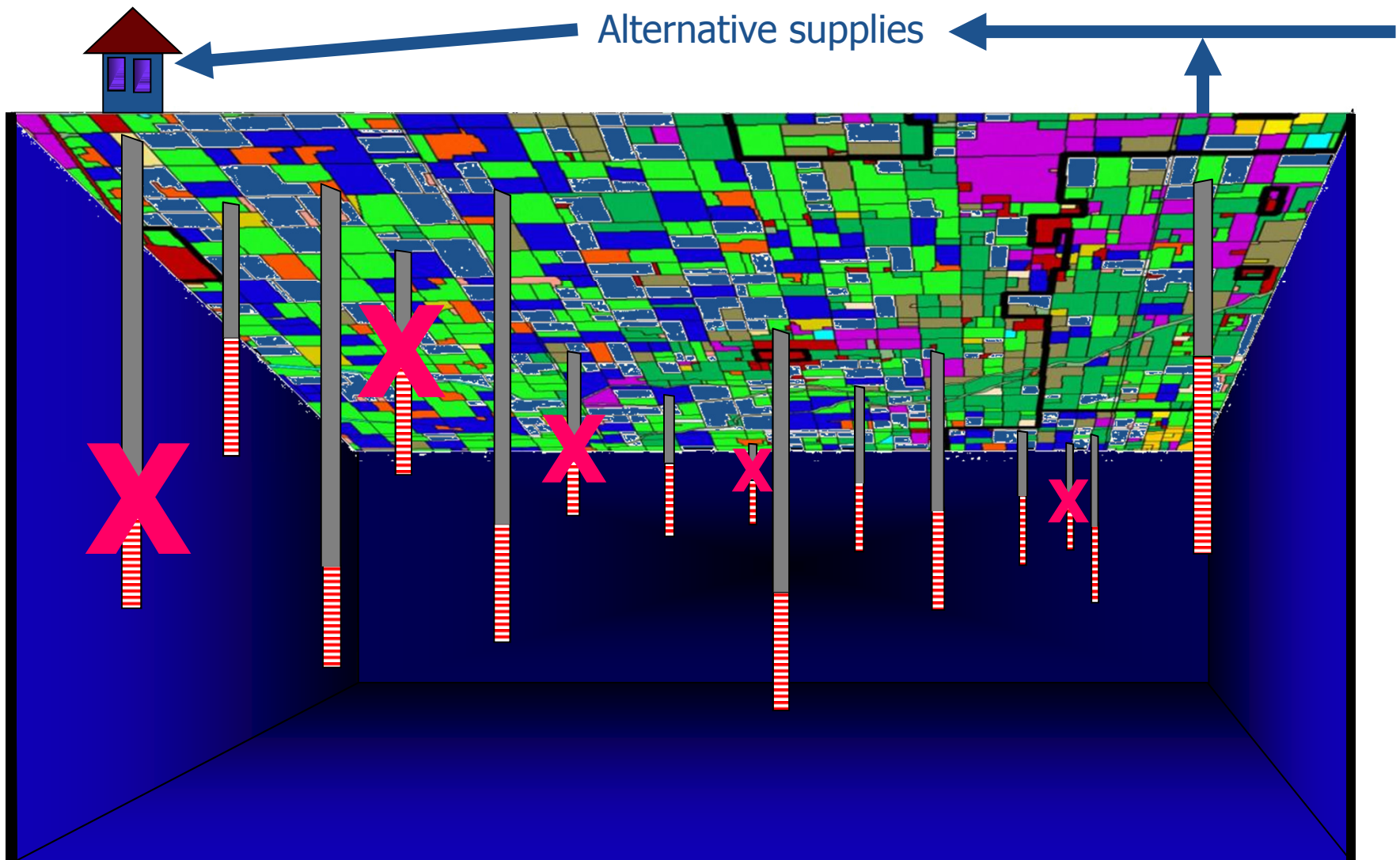


N treatment options





## #6: Alternative Supplies

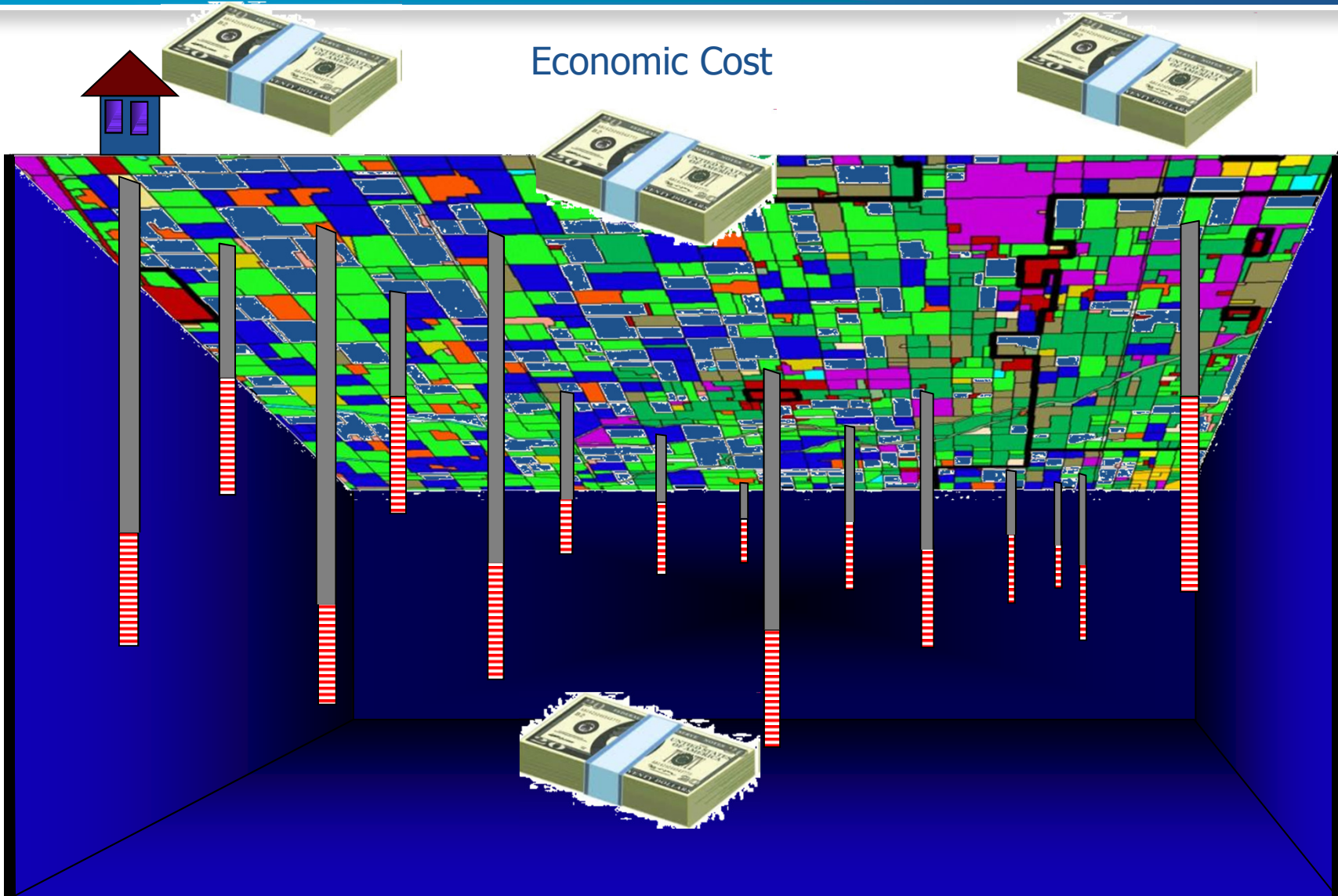






# #7: Costs of Actions

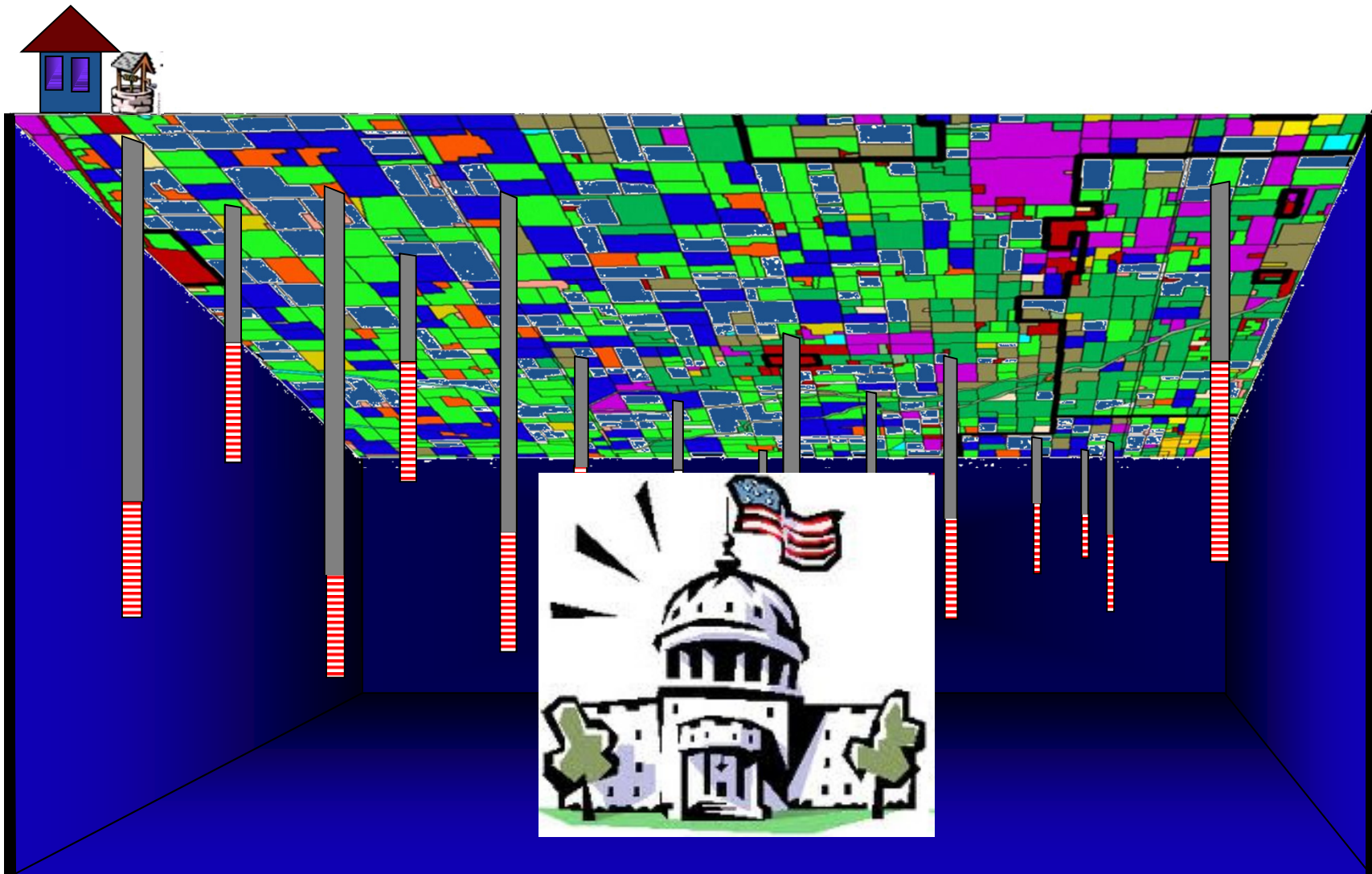
Economic Cost





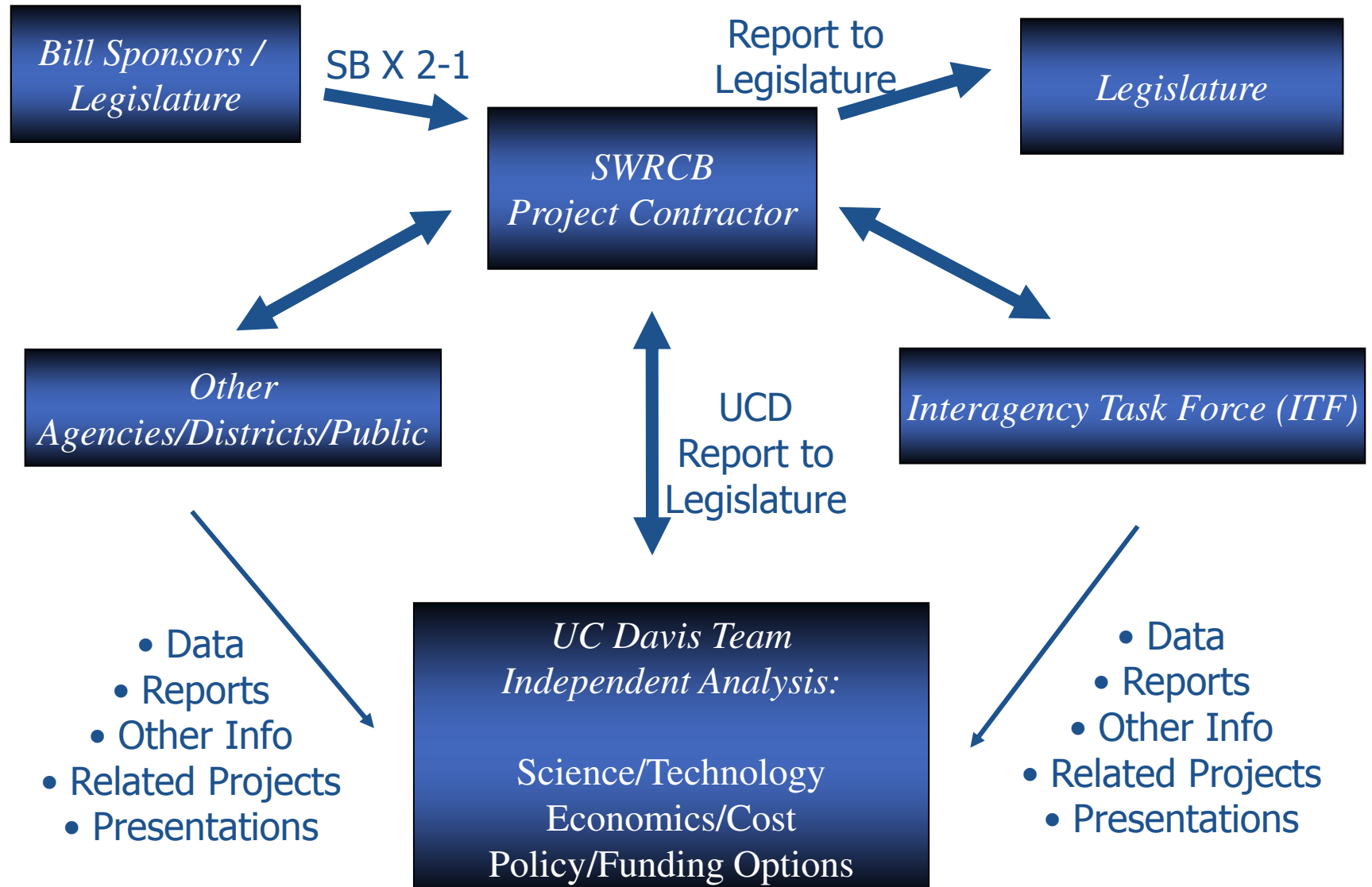


## #8: Funding and Policy





# UC Davis Role



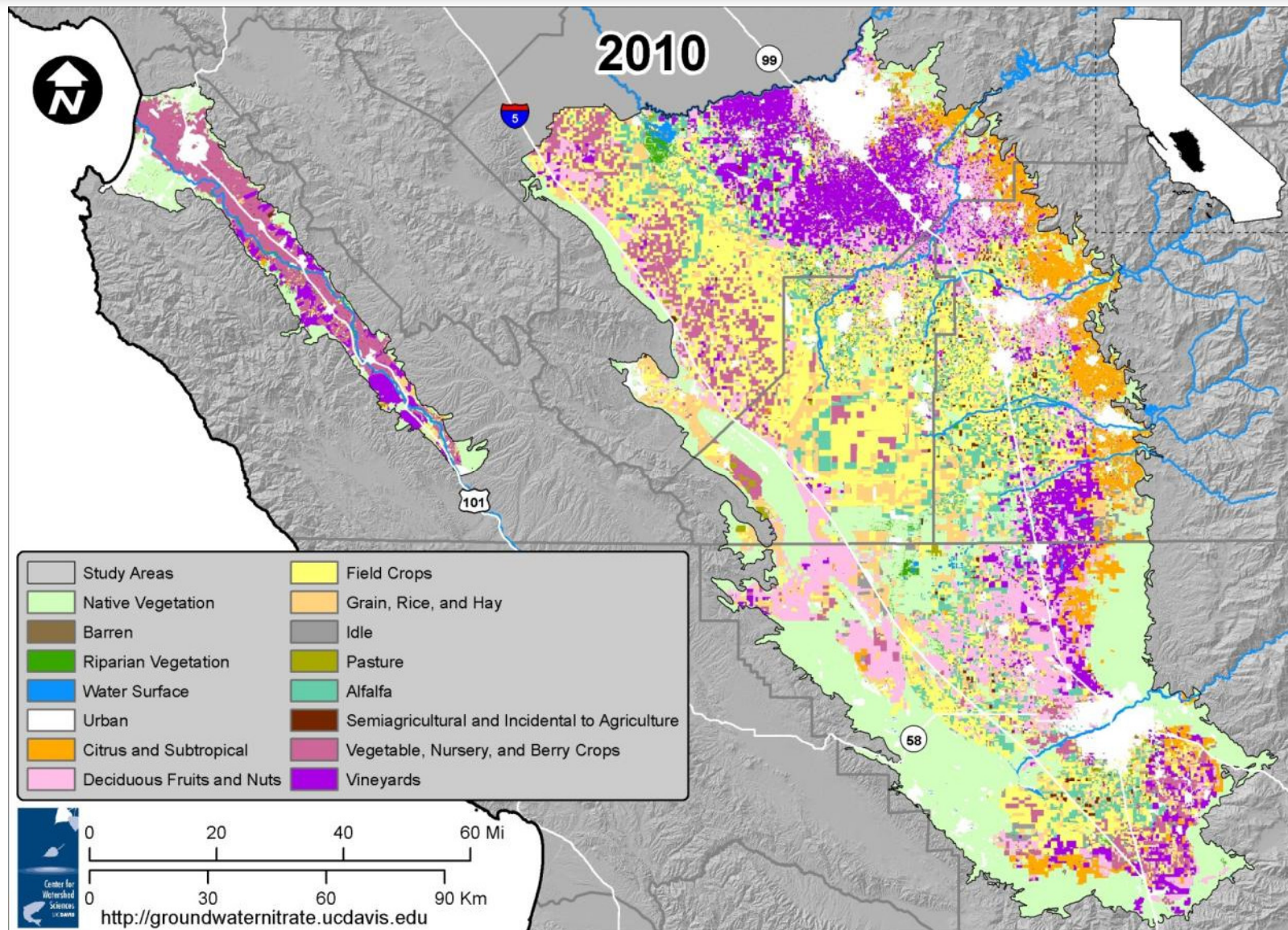
# Funding and Regulatory Framework







# Nitrate Contamination Study Area





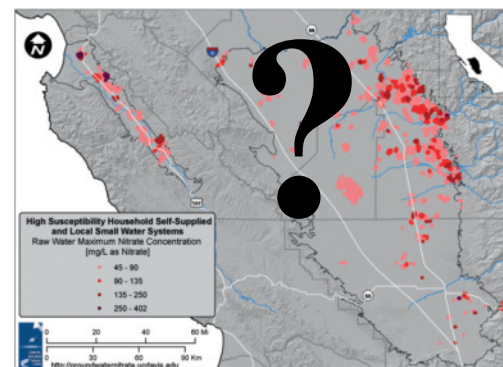
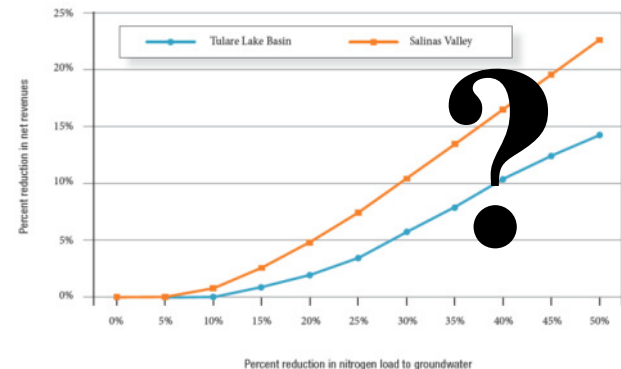
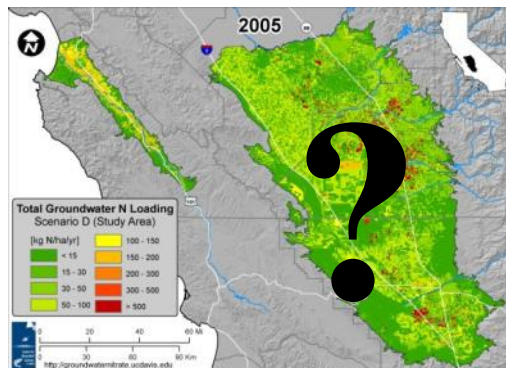


# KEY FINDINGS



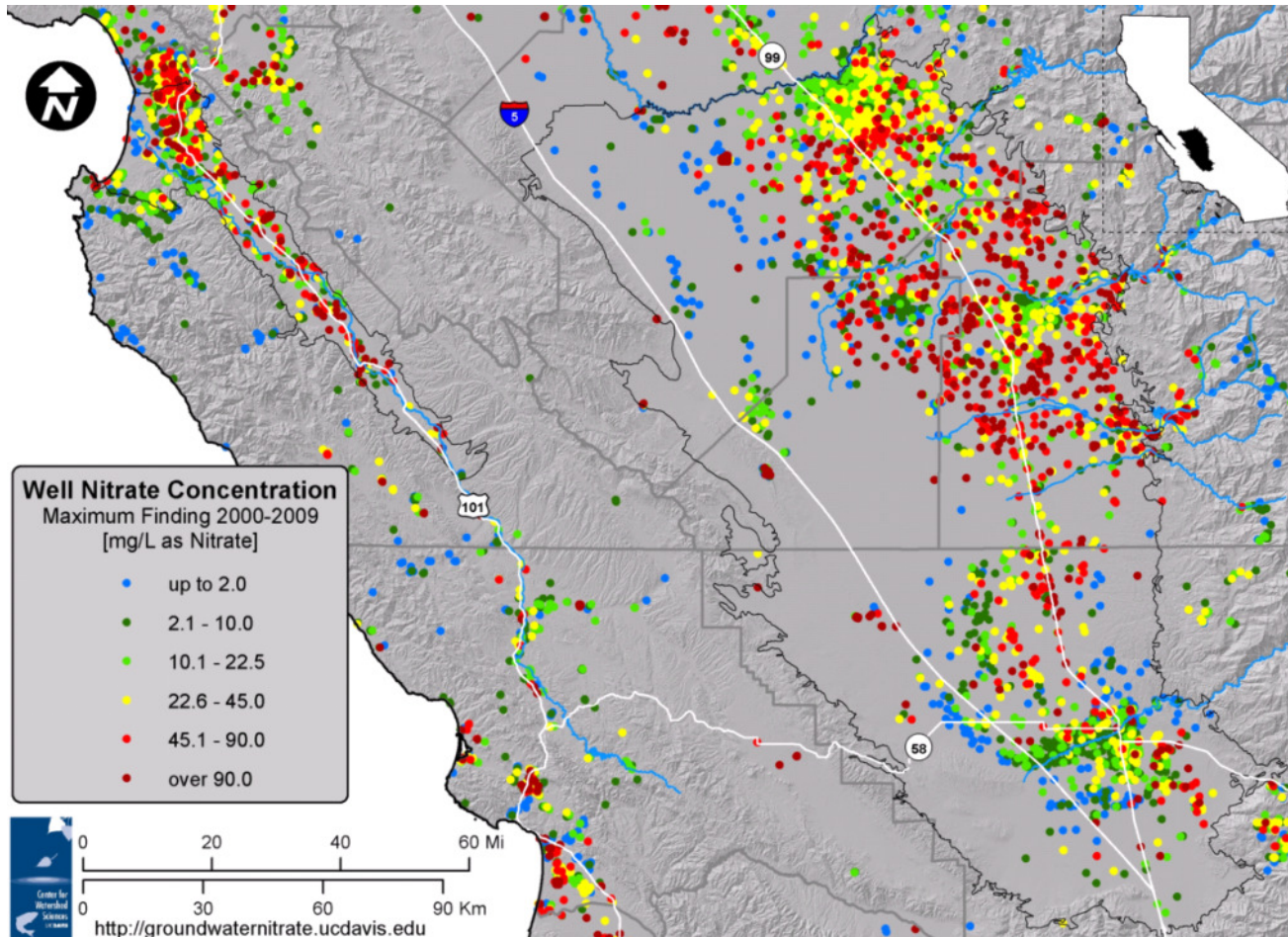
# Data for Assessing Public Exposure and Nitrate Sources

- More consistent, accessible data needed for efficient implementation
- Agencies not organized to gather data or make effective use of data





# Nitrate Contamination Will Persist



- Nitrate contamination will worsen for years/decades
- Direct remediation of groundwater is extremely costly

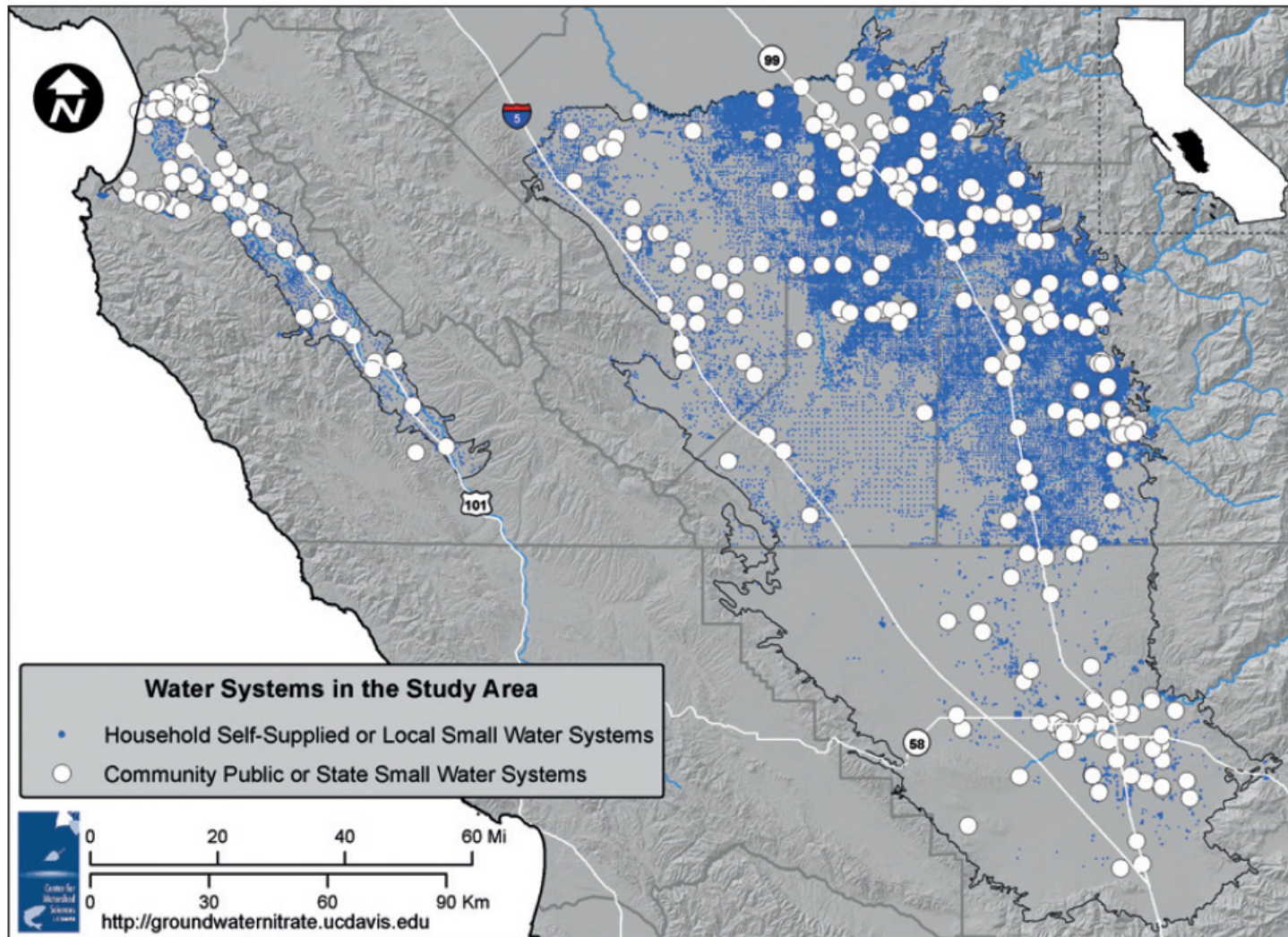
**RED: ABOVE THE NITRATE MCL (45 mg/L)**

**DARK RED: ABOVE TWICE THE NITRATE MCL (90 mg/L)**





# All Water Systems

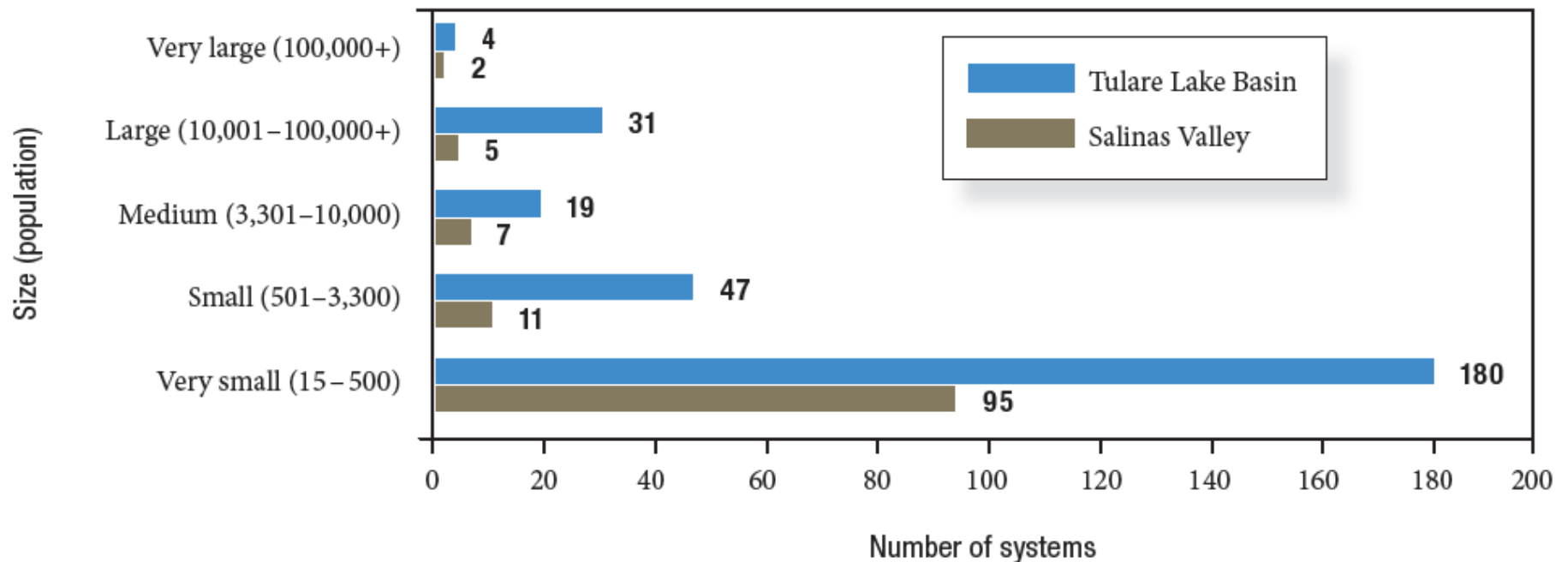


*Estimated locations of the area's roughly 400 regulated community public and state-documented state small water systems and of 74,000 unregulated self-supplied water systems. Source: Honeycutt et al. 2012; CDPH PICME 2010.*





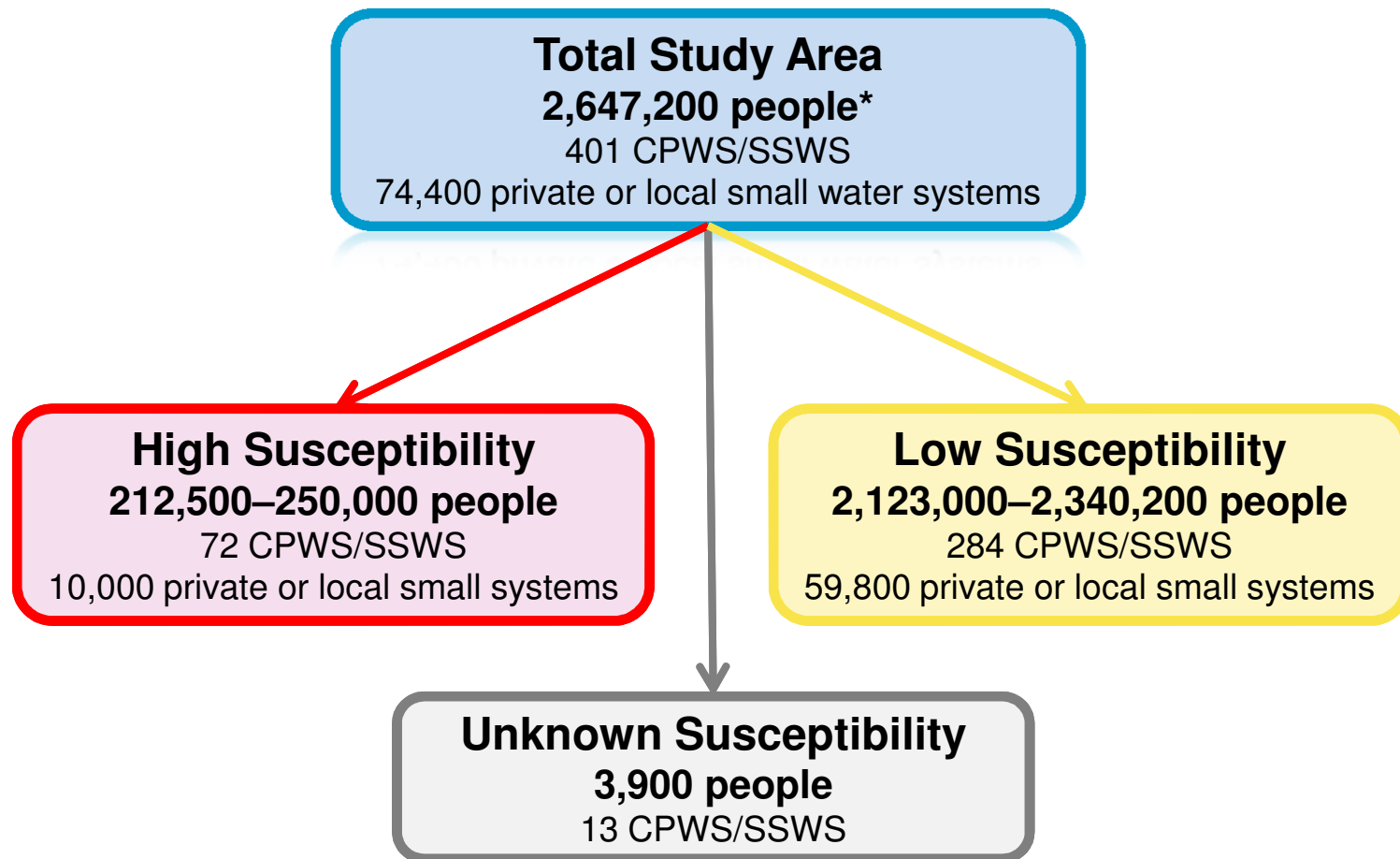
# Community Public & State Small Water Systems



*Community public and state-documented state small water systems of the Tulare Lake Basin and Salinas Valley.  
Source: CDPH 2010.*



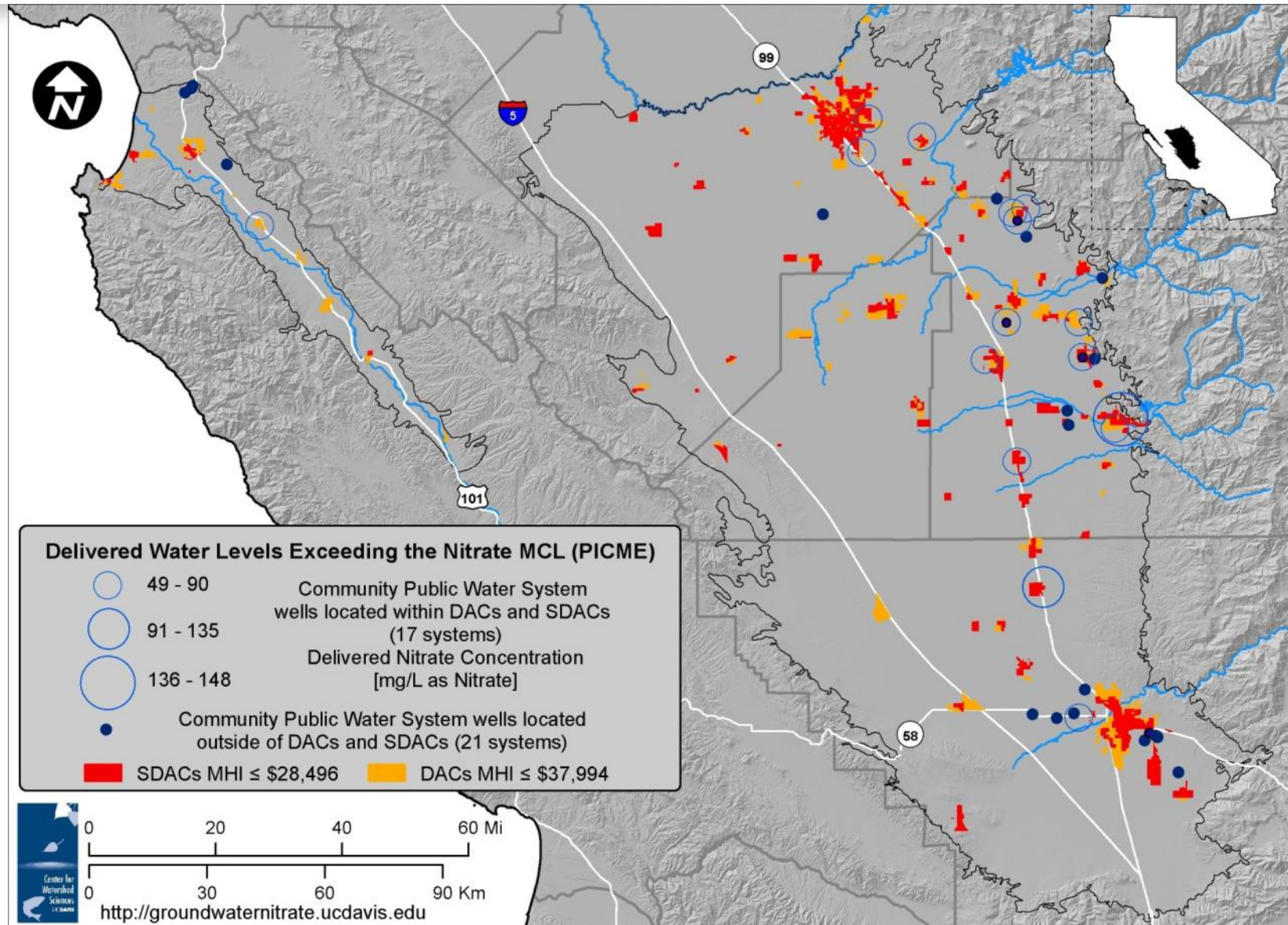
# Susceptible Population



*\*Total study area population includes population served by surface water systems which is not susceptible to groundwater nitrate contamination and is not included in the subsequent susceptibility classifications.*



# DACs and Delivered Water Quality

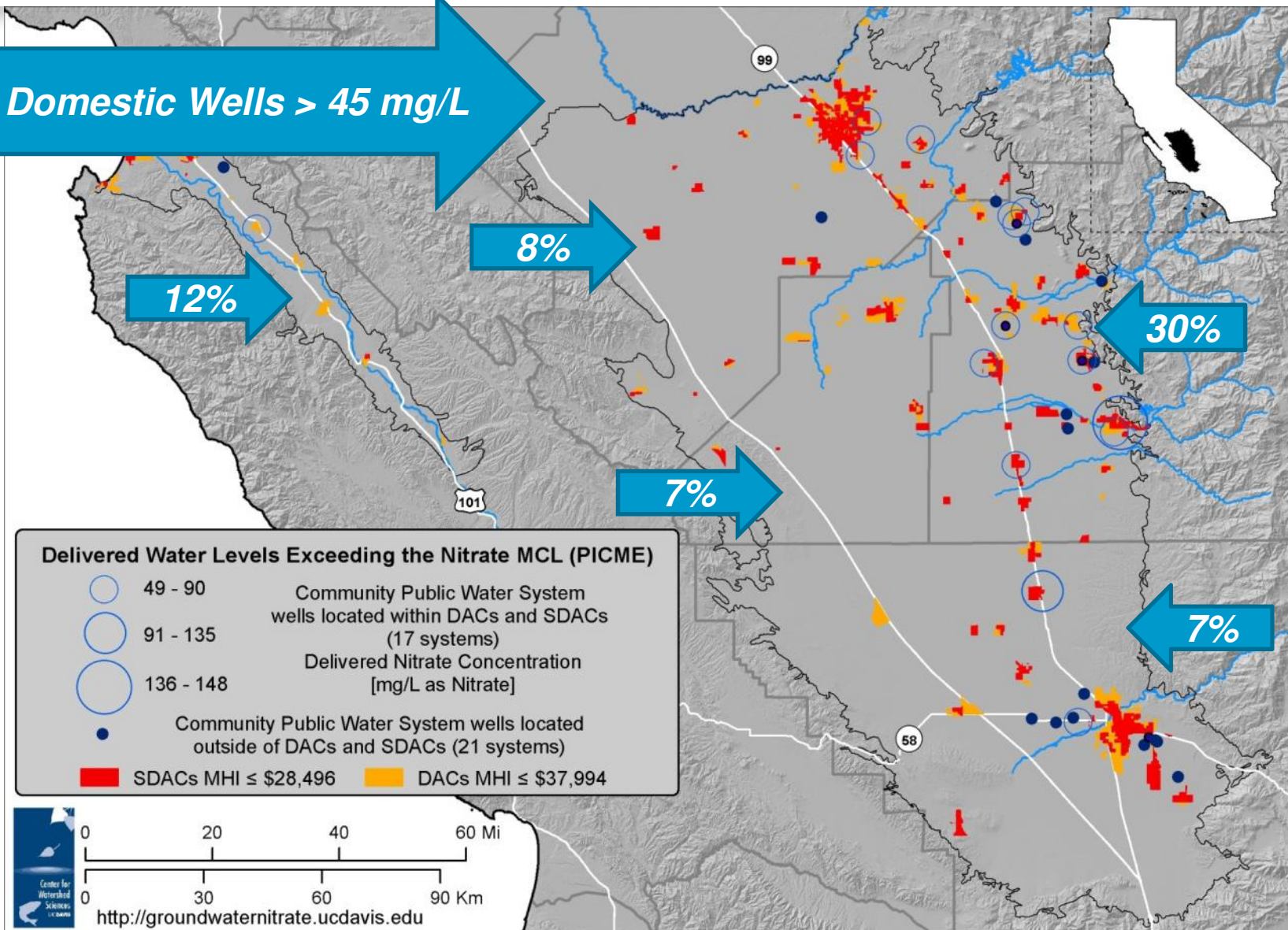






# DACs and Delivered Water Quality

% of Domestic Wells > 45 mg/L







# Costs for Alternative Supply Options

Option	Estimated Annual Cost Range (\$/year)	
	Self-Supplied Household	Small Water System (1,000 households)
<b>Improve Existing Water Source</b>		
Blending	N/A	\$85,000–\$150,000
Drill deeper well	\$860–\$3,300	\$80,000–\$100,000
Drill a new well	\$2,100–\$3,100	\$40,000–\$290,000
Community supply treatment	N/A	\$135,000–\$1,090,000
Household supply treatment (POU)	\$250–\$360	\$223,000
<b>Alternative Supplies</b>		
Piped connection to an existing system	\$52,400–\$185,500	\$59,700–\$192,800
Trucked water	\$950	\$350,000
Bottled water	\$1,339	\$1.34 M
Relocate households	\$15,090	\$15.1 M
<b>Ancillary Activities</b>		
Well water quality testing	\$15–\$50	N/A
Dual distribution system	\$575–\$1,580	\$260,000–\$900,000



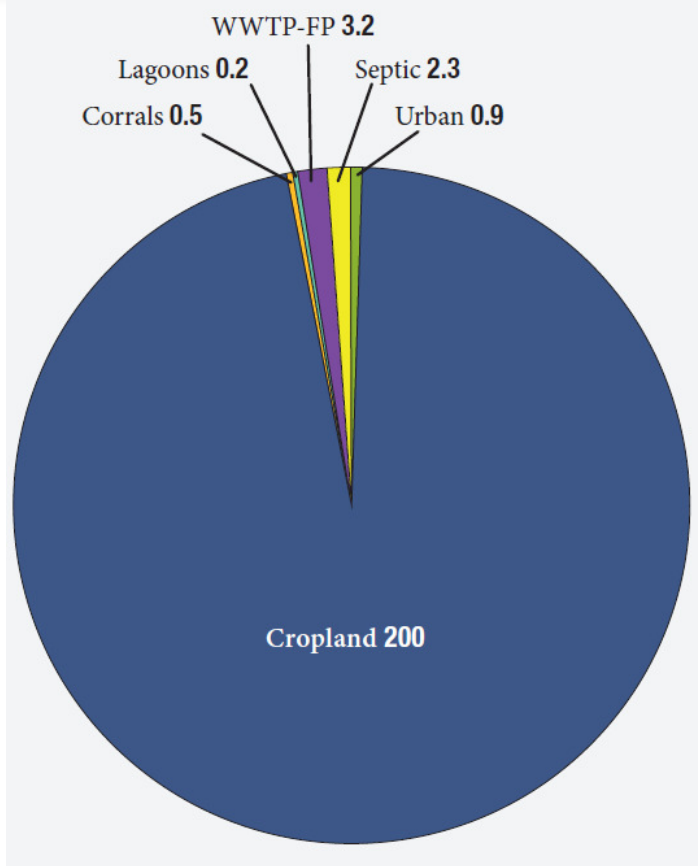
## Cost of Safe Drinking Water: \$20 - \$36 Million / Year (Study Area)

- **Most cost-effective drinking water supply actions:**
  - Blending
  - Treatment (community, point-of-use)
  - Consolidation/regionalization
  - Other alternative supplies
- **Affordability difficult for small communities**
- **Most promising revenue source:**
  - Fee on nitrogen fertilizer use
  - Fee on water use
  - Local compensation under Section 13304 of CA Water Code





# Largest Nitrate Source: Cropland



- Nitrate loading reductions are possible

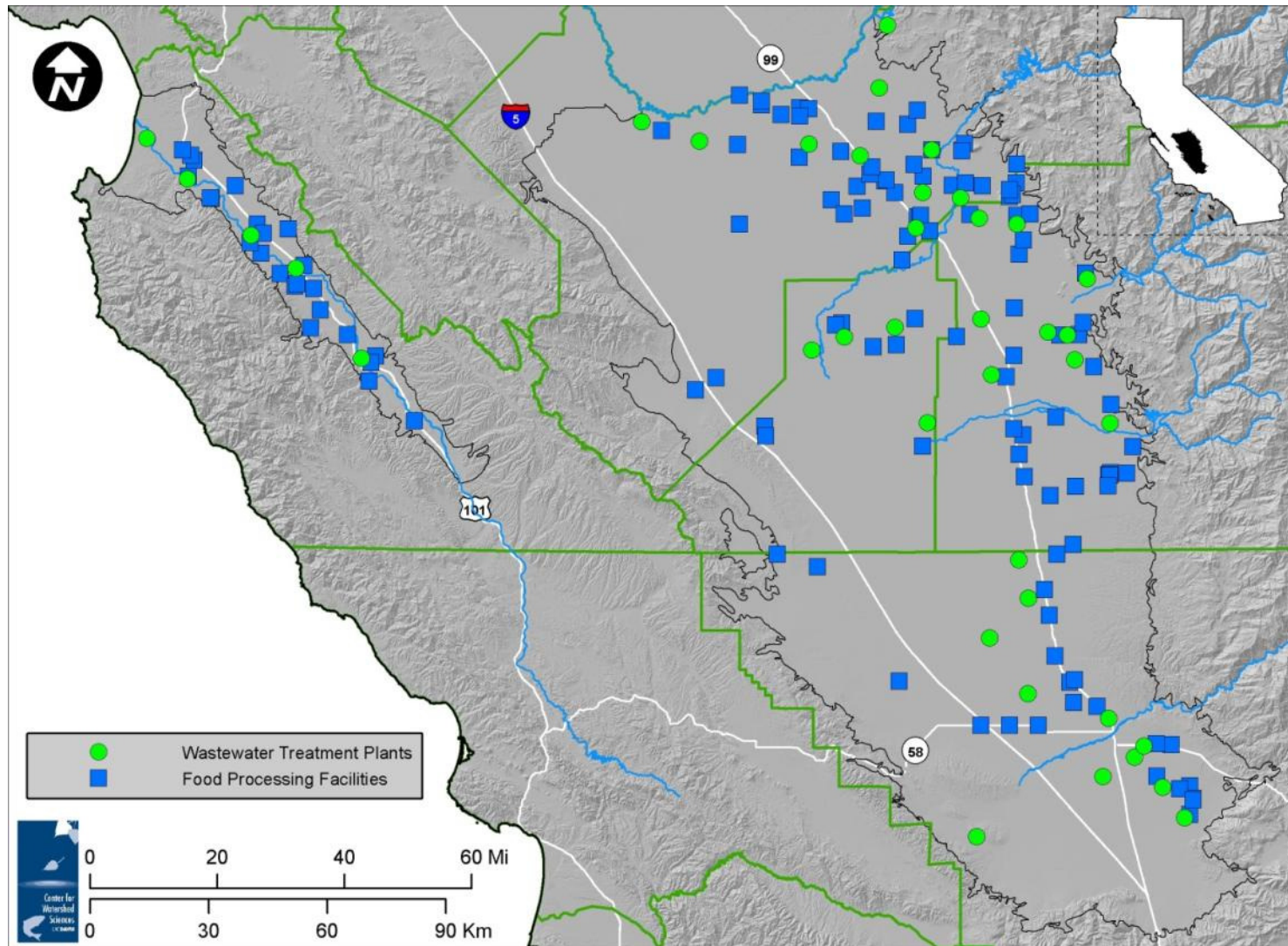
- Largest cropland nitrogen sources:
  - Synthetic fertilizer
  - Animal manure





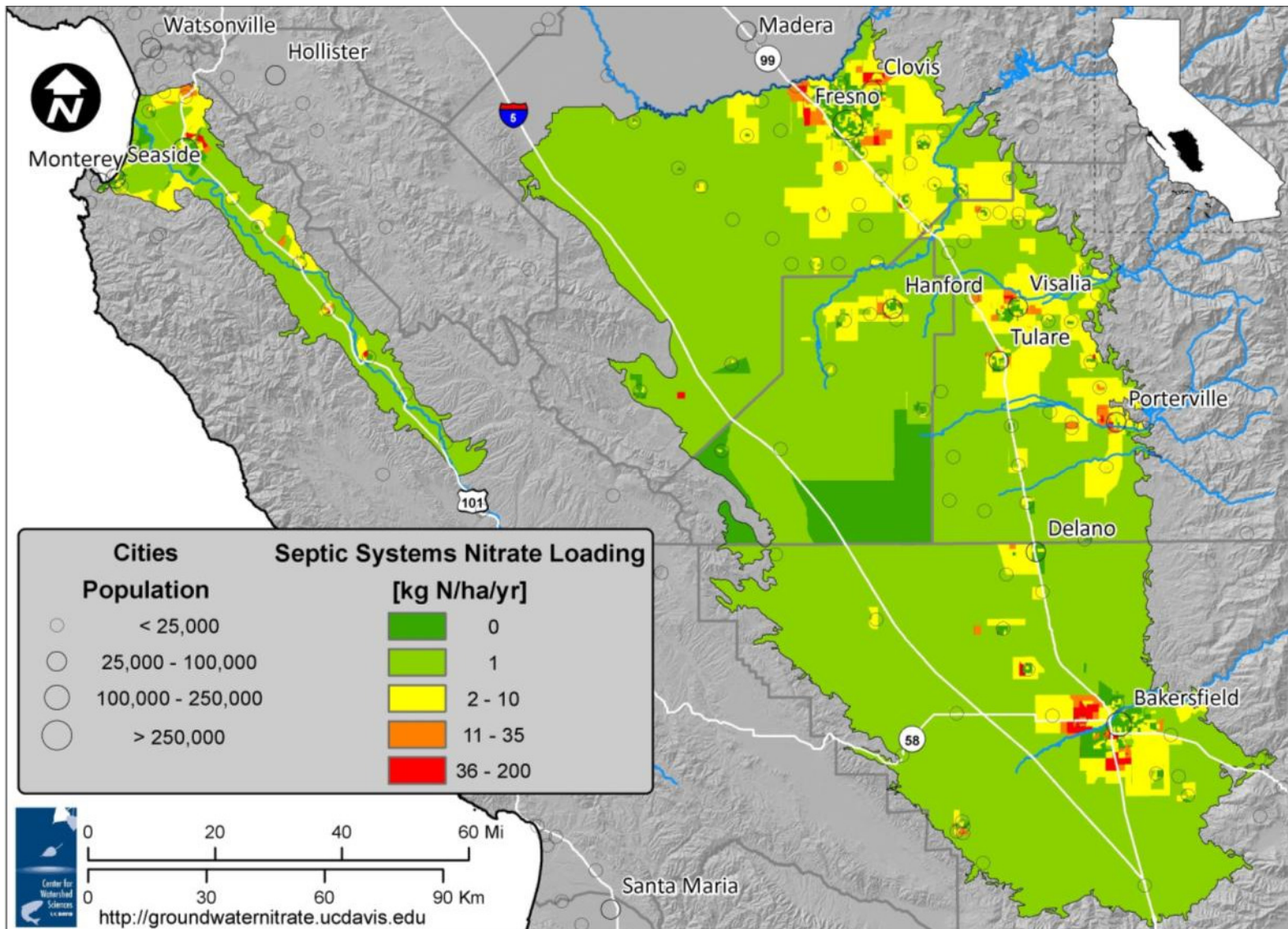


# Wastewater Treatment Plants and Food Processors

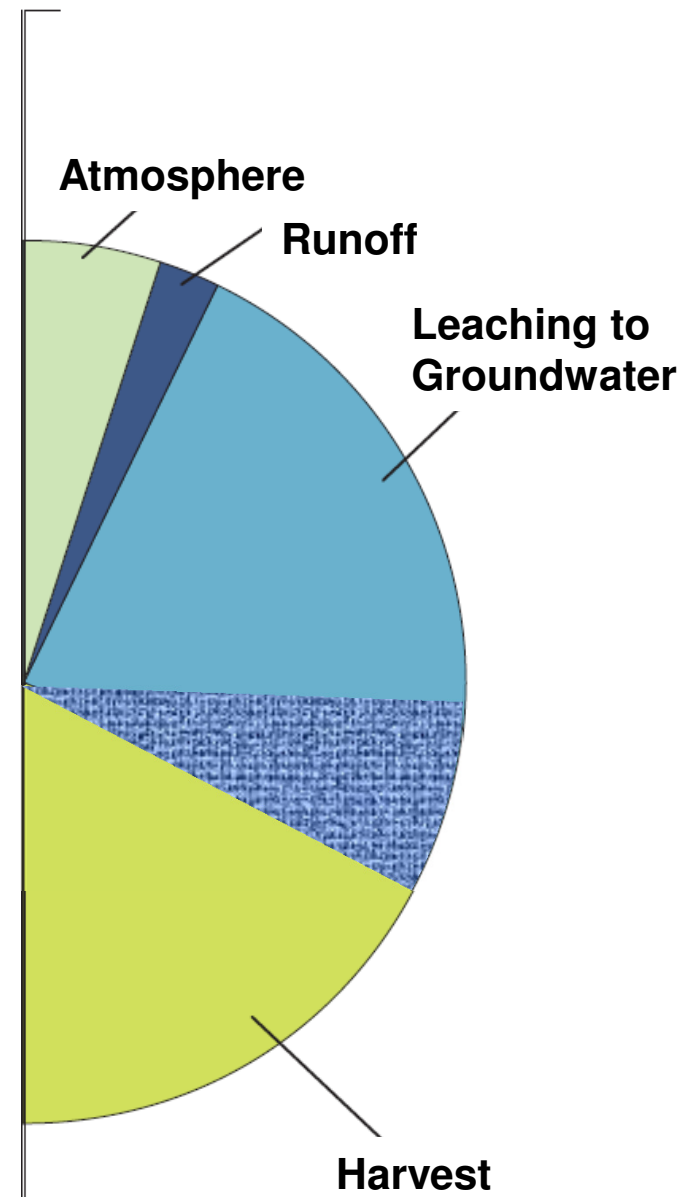
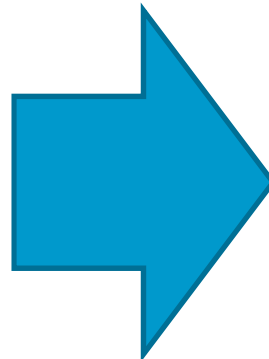
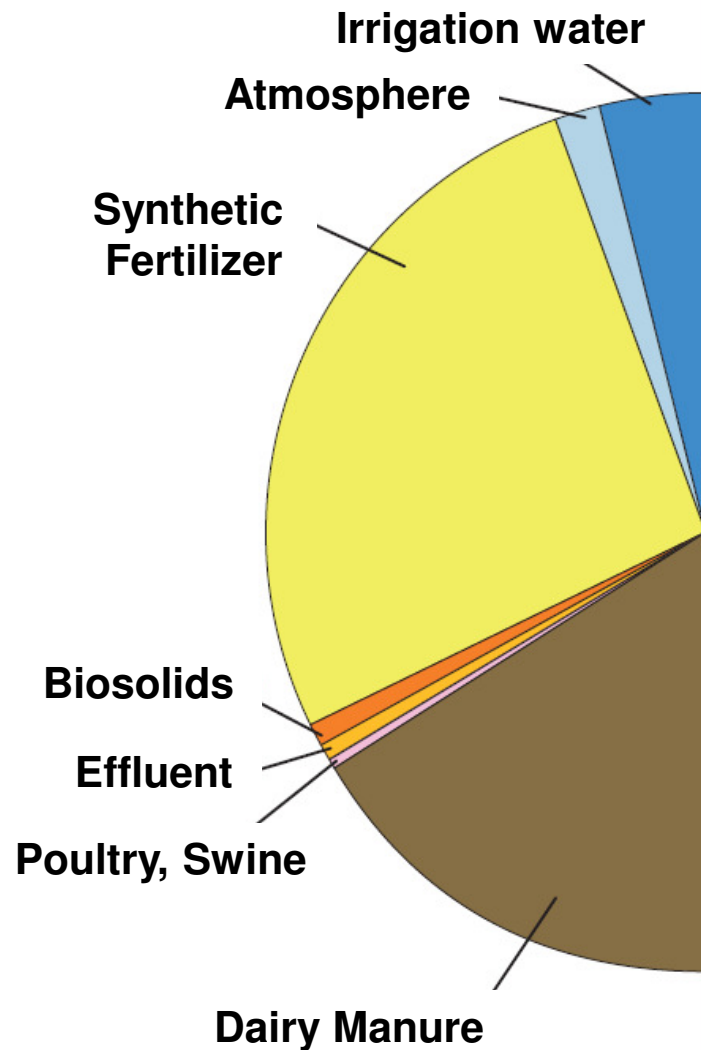




# Septic Systems



**Total Nitrogen Inputs:  
420,000 tons N/yr**



**Total Nitrogen Outputs:  
420,000 tons N/yr**

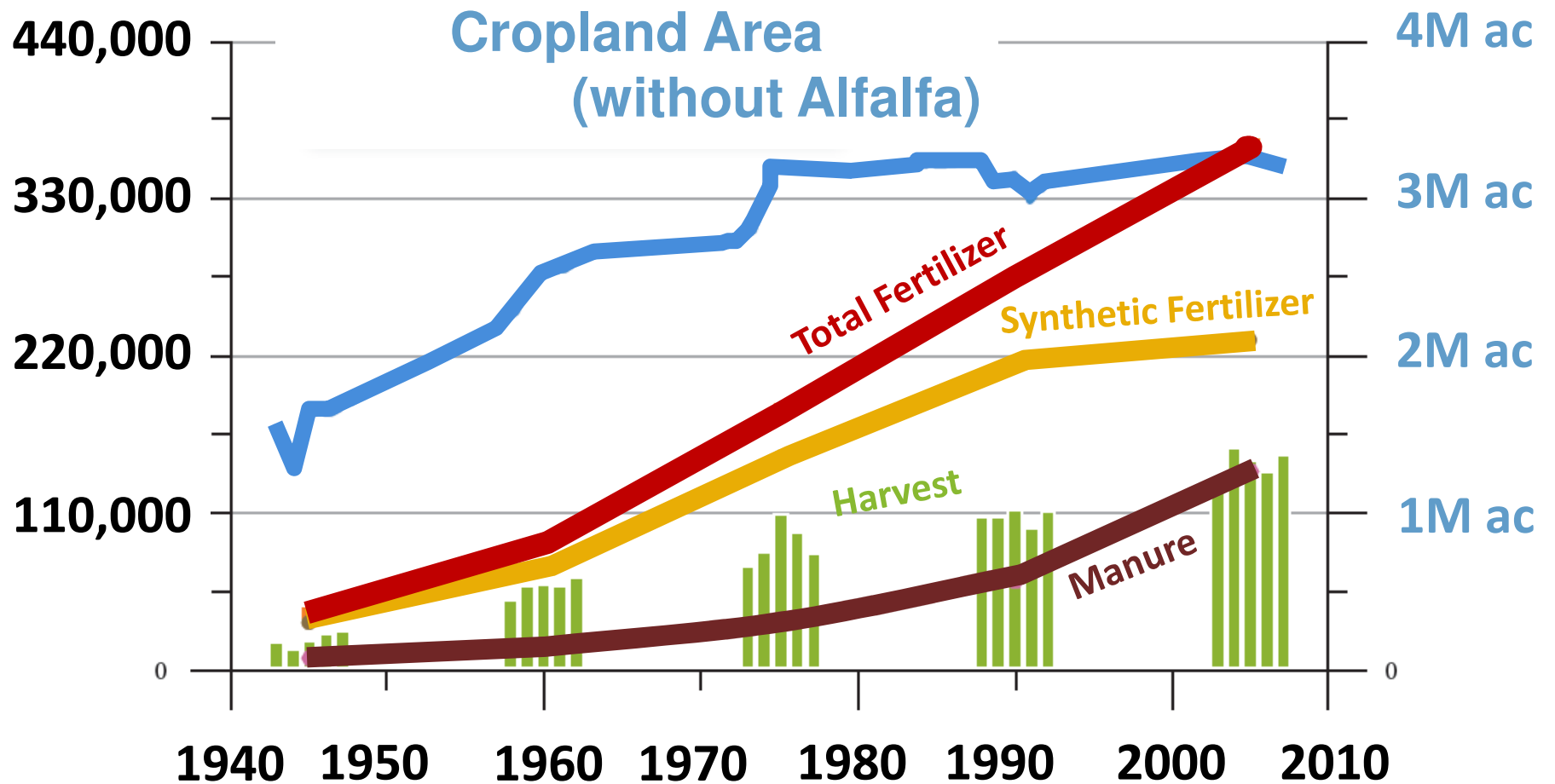




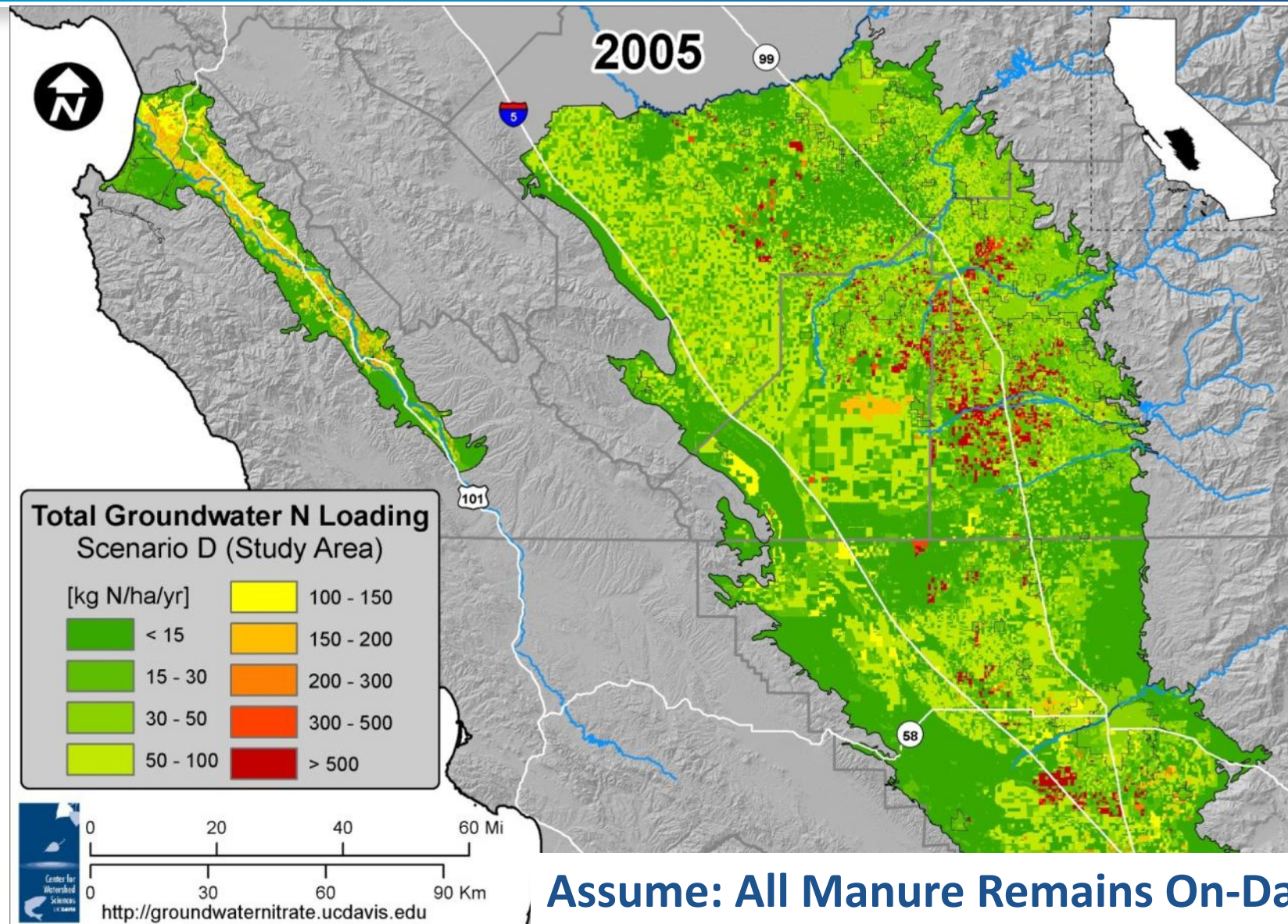
# Historic Nitrogen Fluxes

tons N/yr

Cropland Area



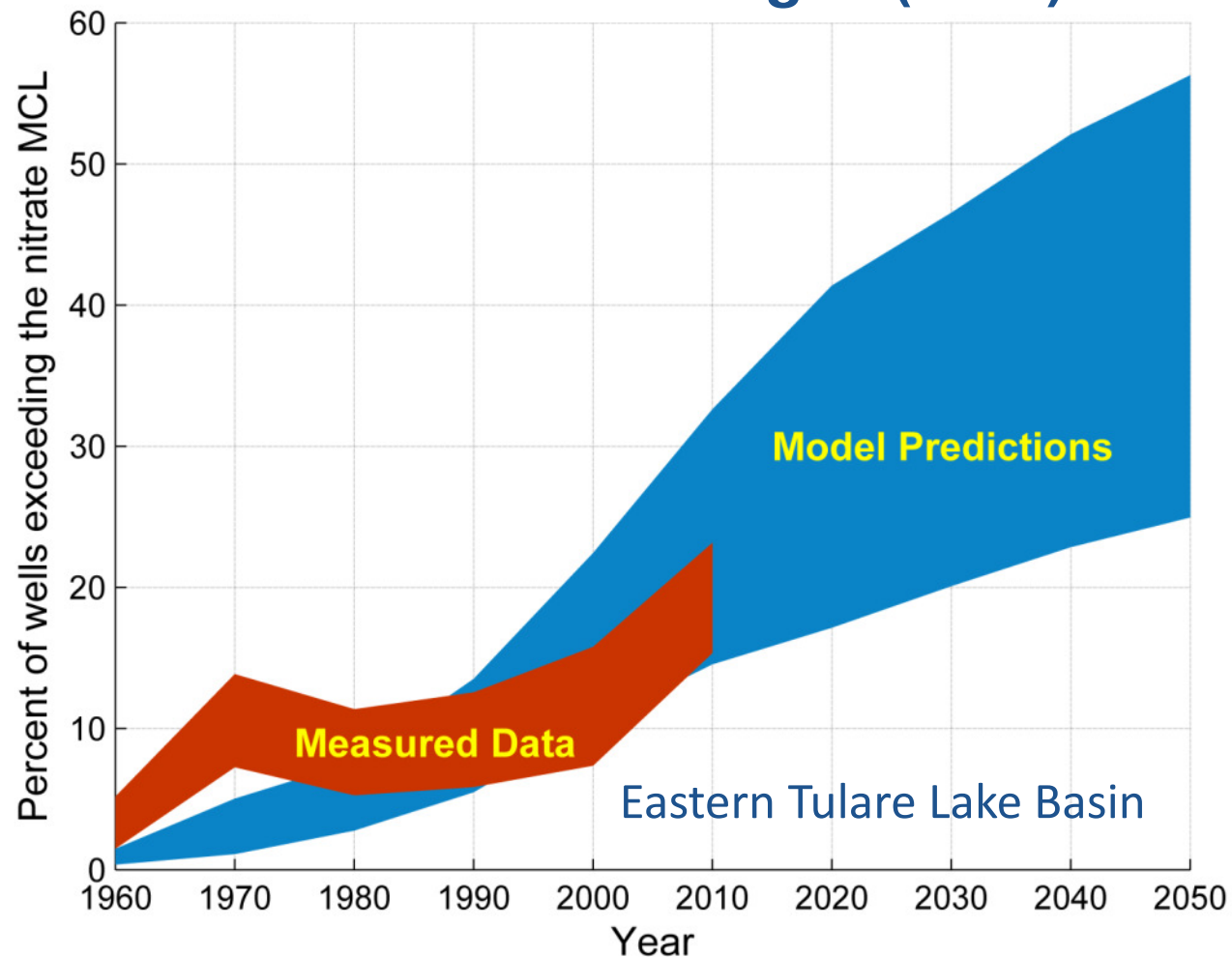
# Estimated Groundwater Nitrate Loading





# Predictions Using Groundwater Nitrate Loading

**Exceedance Probability,  
Nitrate above 45 mg/L (MCL)**







# Agricultural Source Reduction

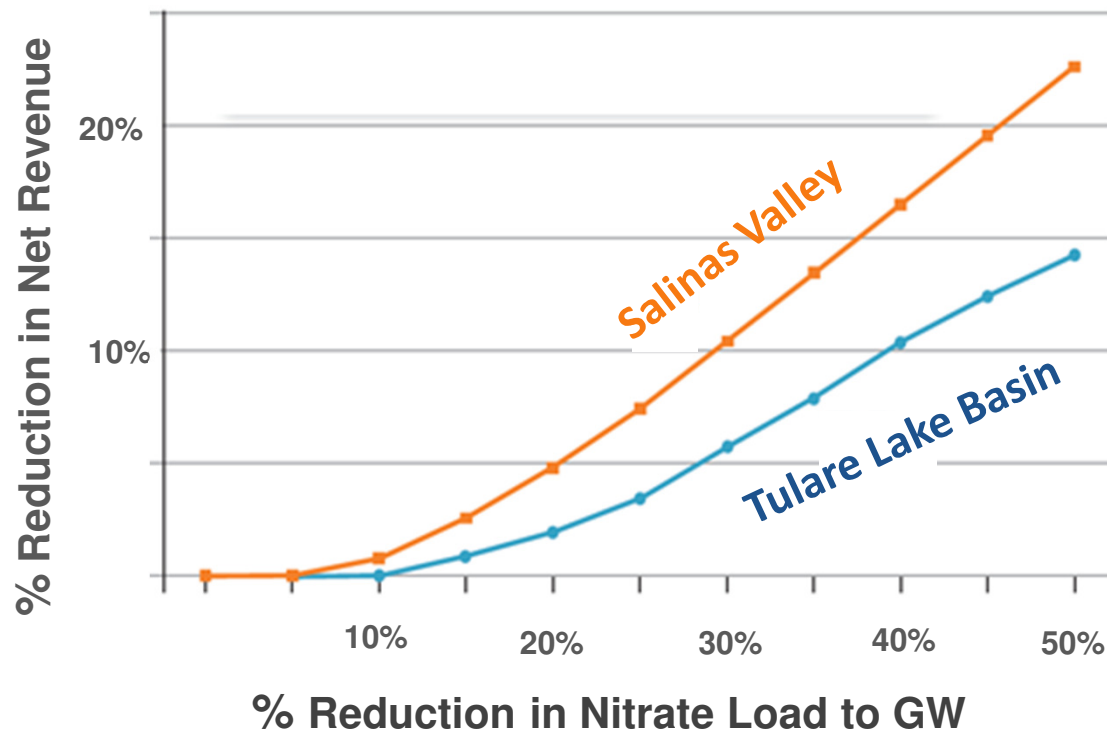
**Increase crop N-use efficiency -- Decrease deep percolation**

Basic Components	Management Measures	50 Practices
<b>Improve irrigation and drainage systems</b>	✓ Perform system evaluation and monitoring	3
	✓ Improve Irrigation scheduling	4
	✓ Improve irrigation system design and operation	13
	✓ Other irrigation infrastructure improvements	2
<b>Improve fertilizer and manure use</b>	✓ Improve rate, timing, and placement	15
<b>Change crop rotation</b>	✓ Modify crop rotation or grow cover crops	4
<b>Improve storage and handling</b>	✓ Avoid fertilizer material and manure spills during transport, storage and application	9



# Economics of Source Reduction

- Cost of improving crop N use efficiency is uncertain but likely low for small improvements.
- Load reductions of half or more may come at a significant cost, potential reduction in irrigated crop area.





# Regulatory Options Considered

- Technology Mandate
- Performance Standard
- Fee
- Cap and Trade
- Information Disclosure
- Liability Rules
- Negotiation or Payment for Service
- De-designation of Beneficial Use





# Funding Options



**Cap and Trade  
with Auctioned  
Permits**

**Fee on  
Bottled Water**

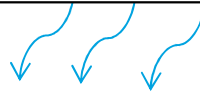


**Food Tax**

**Fixed or  
Volumetric  
Fee on  
Agricultural  
Water**



**Nitrogen Fee**

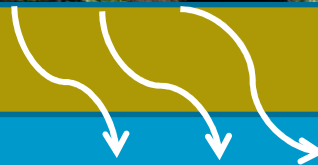


**Agricultural  
Property Tax**

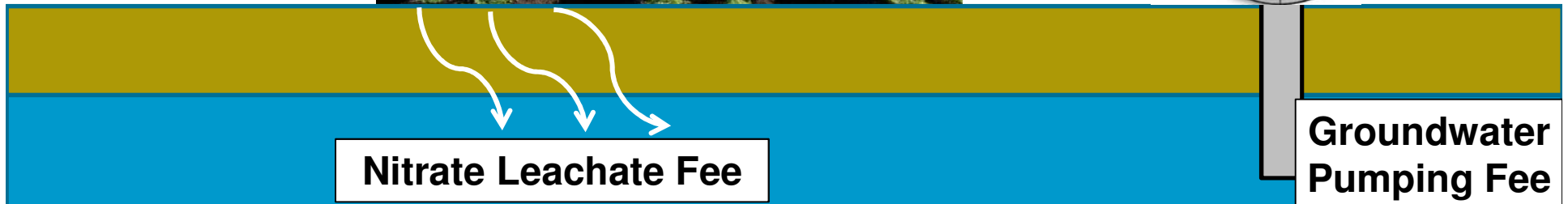
**Fixed or  
Volumetric  
Fee on  
Drinking  
Water**



**Nitrate Leachate Fee**



**Groundwater  
Pumping Fee**





# Promising Actions

- See back page of the “Executive Summary”

**Addressing Nitrate in California's Drinking Water**  
With a Focus on Tulare Lake Basin and Salinas Valley

Report for the State Water Resources Control Board Report to the Legislature

**EXECUTIVE SUMMARY**

This Report and its associated eight Technical Reports were prepared by:  
Thomas Hunter and Jay R. Lund (Principal Investigators)  
Katharine Darby, Graham E. Fogg, Richard Hewitt, James E. Quisenberry, G. Stuart Pettygrove, and Joshua H. Viers (Co-Investigators)

Maximum Nitrate in Wells (mg/L as Nitrate)  
2000-2009  
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Action	Safe Drinking Water	Groundwater Degradation	Economic Cost
<b>No Legislation Required</b>			
<b>Safe Drinking Water Actions</b>			
D1: Point-of-Use Treatment Option for Small Systems +	♦♦		low
D2: Small Water Systems Task Force +	♦		low
D3: Regionalization and Consolidation of Small Systems +	♦♦		low
<b>Source Reduction Actions</b>			
S1: Nitrogen/Nitrate Education and Research +		♦♦♦	low-moderate
S2: Nitrogen Accounting Task Force +		♦♦	low
<b>Monitoring and Assessment</b>			
M1: Regional Boards Define Areas at Risk +	♦♦♦	♦♦♦	low
M2: CDPH Monitors At-Risk Population +	♦	♦	low
M3: Implement Nitrogen Use Reporting +		♦♦	low
M4: Groundwater Data Task Force +	♦	♦	low
M5: Groundwater Task Force +	♦	♦	low
<b>Funding</b>			
F1: Nitrogen Fertilizer Mill Fee		♦♦♦	low
F2: Local Compensation Agreements for Water +	♦♦	♦	moderate
<b>New Legislation Required</b>			
D4: Domestic Well Testing *	♦♦		low
D5: Stable Small System Funds	♦		moderate
Non-tax legislation could also strengthen and augment existing authority.			
<b>Fiscal Legislation Required</b>			
<b>Source Reduction</b>			
S3: Fertilizer Excise Fee	♦♦	♦	moderate
S4: Higher Fertilizer Fee In Areas at Risk	♦	♦	moderate
<b>Funding Options</b>			
F3: Fertilizer Excise Fee	♦♦	♦♦	moderate
F4: Water Use Fee	♦♦	♦♦	moderate





# Key Take Home Messages

- Safe drinking water is the most pressing issue
  - Challenges: organization and funding
- Nitrate loading can be reduced, long-term
  - Challenges: training, research, investment, compliance, and funding
- State needs to collect and organize data to allow for better assessment
  - Challenges: institutional silos, organization, privacy issues/data security, and funding

**SBX2 1 (2008, Perata)**

**UC Davis Report to State Water Board  
for its Report to the Legislature**

**ADDRESSING NITRATE IN  
CALIFORNIA'S DRINKING WATER,  
TULARE LAKE BASIN AND SALINAS VALLEY**

**SWRCB Public Hearing**

**May 23, 2012**

Thomas Harter & Jay Lund, *Principal Investigators*

Jeannie Darby, Graham Fogg, Richard Howitt, Katrina Jessoe, Jim Quinn, Stu Pettygrove, Joshua Viers,  
*Co-Investigators*



Aaron King, Allan Hollander, Alison McNally, Anna Fryjoff-Hung, Cathryn Lawrence, Daniel Liptzin, Danielle Dolan, Dylan Boyle, Elena Lopez, Giorgos Kourakos, Holly Canada, Josue Medellin-Azuara, Kristin Dzurella, Kristin Honeycutt, Megan Mayzelle, Mimi Jenkins, Nicole de la Mora, Todd Rosenstock, Vivian Jensen,  
*Researchers*

**<http://groundwaternitrate.ucdavis.edu>**

Watershed Science Center  
University of California, Davis  
Contact: ThHarter@ucdavis.edu

# SBX2 1

## Addressing Nitrate in California's Drinking Water

### TECHNICAL REPORT 2: LANDUSE & POTENTIAL GROUNDWATER LOADING

SWRCB Hearing  
May 23, 2012



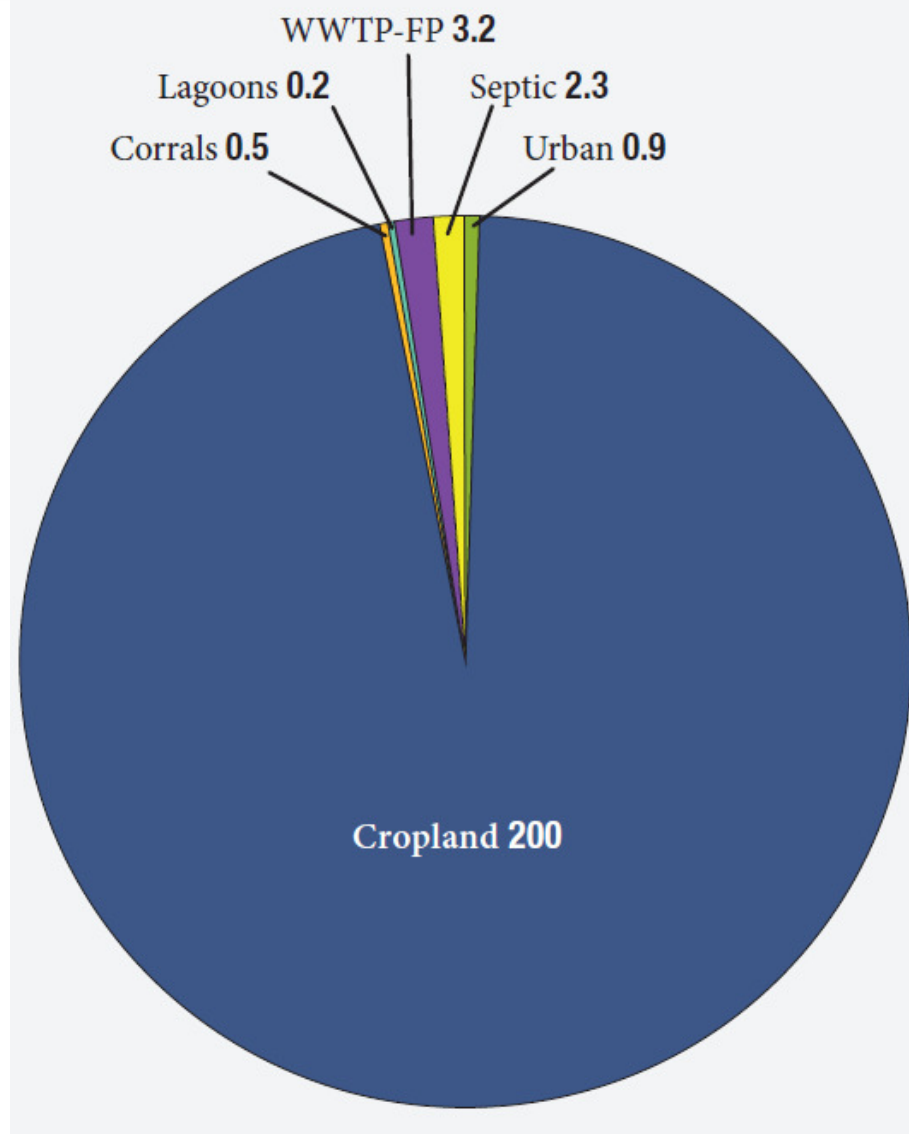
Thomas Harter, Anna Fryjoff-Hung, Allan Hollander,  
Vivian Jensen, Aaron King, Dan Liptzin, Elena M. Lopez,  
Alison McNally, Josue Medellin-Azuara, Stu Pettygrove,  
Jim Quinn, Todd Rosenstock, Josh Viers

Center for Watershed Sciences  
University of California, Davis  
Contact: [tharter@ucdavis.edu](mailto:tharter@ucdavis.edu)





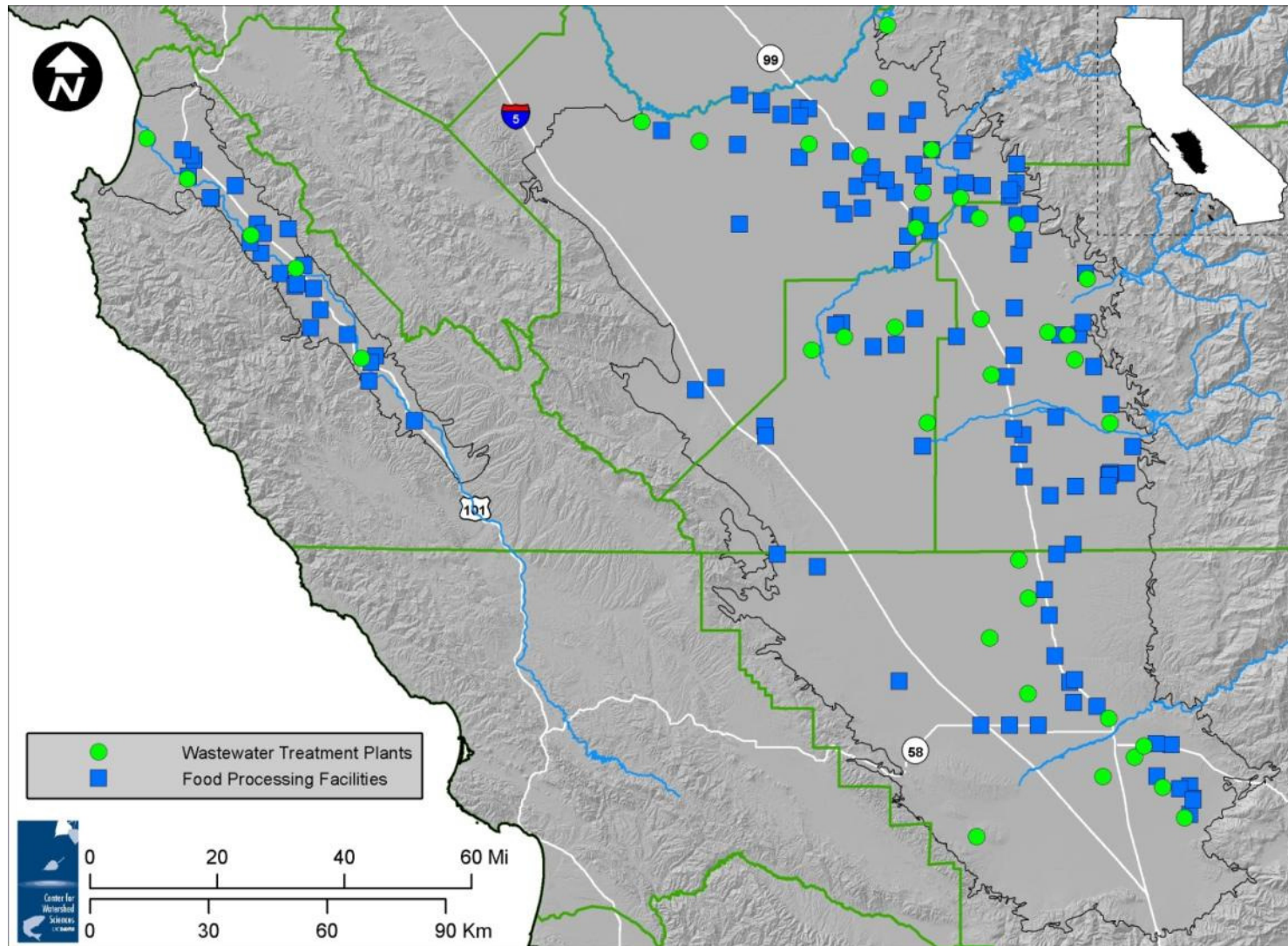
# Sources of Groundwater Nitrate



Gg N/yr

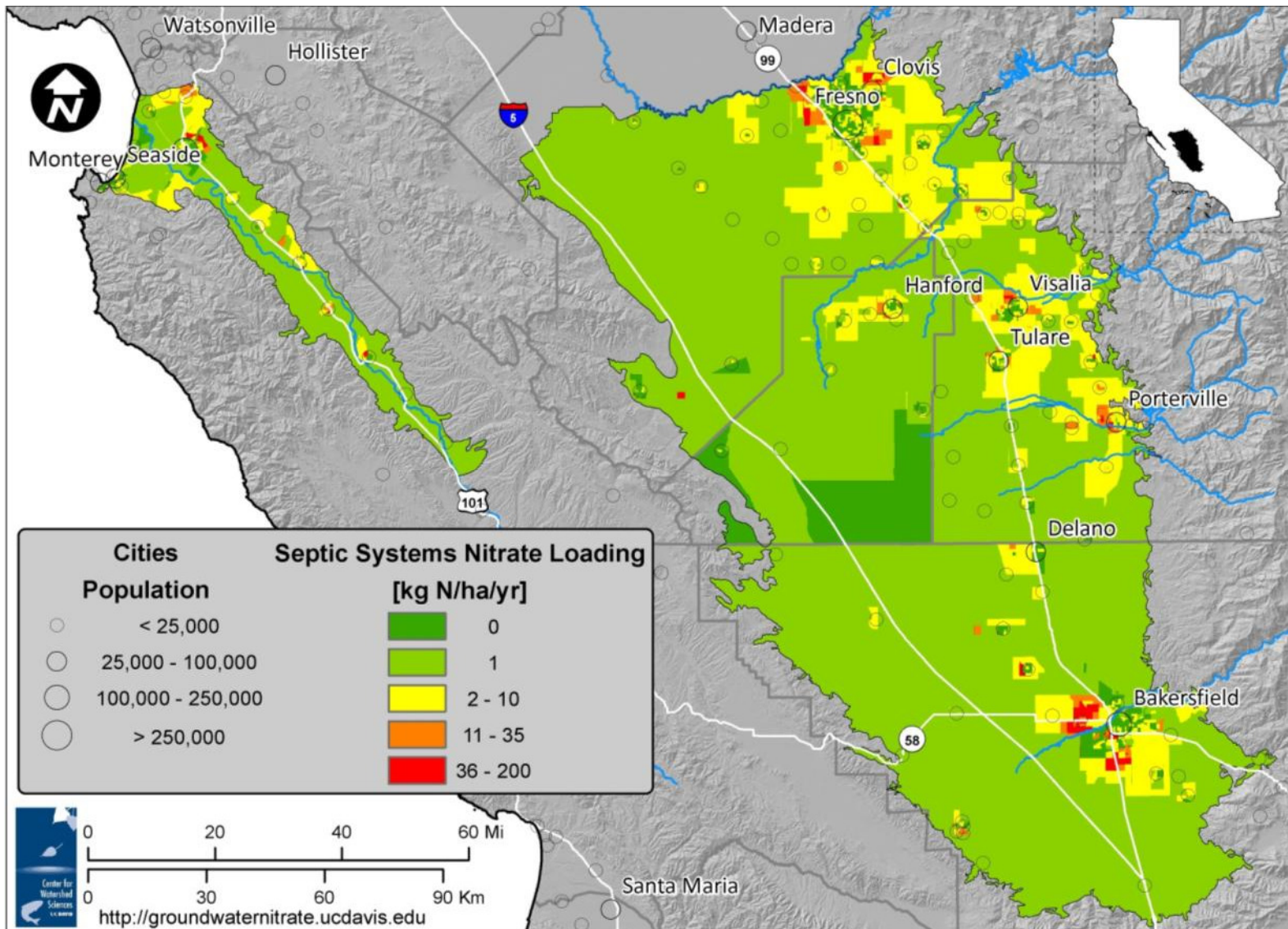


# Wastewater Treatment Plants and Food Processors





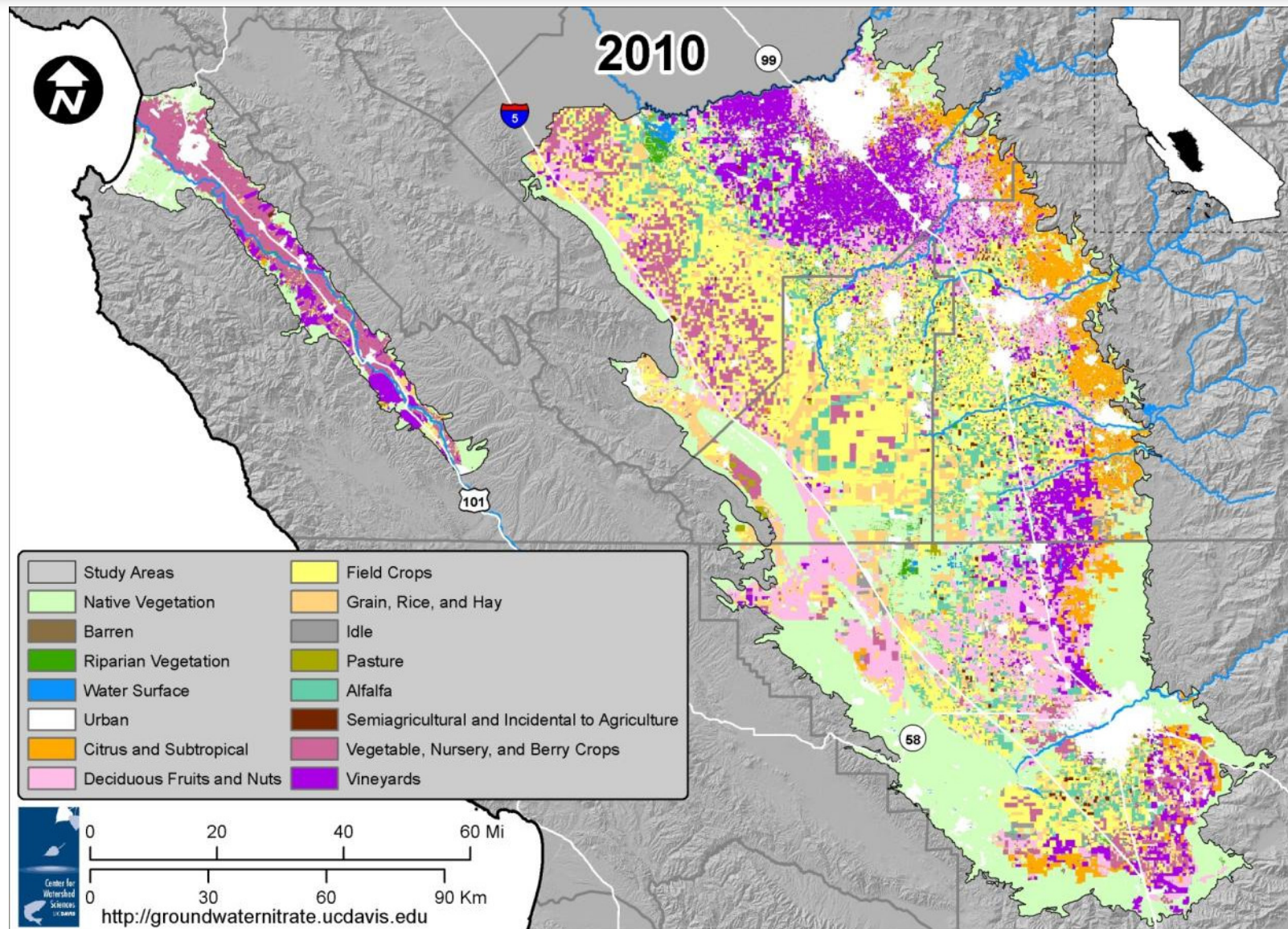
# Septic Systems





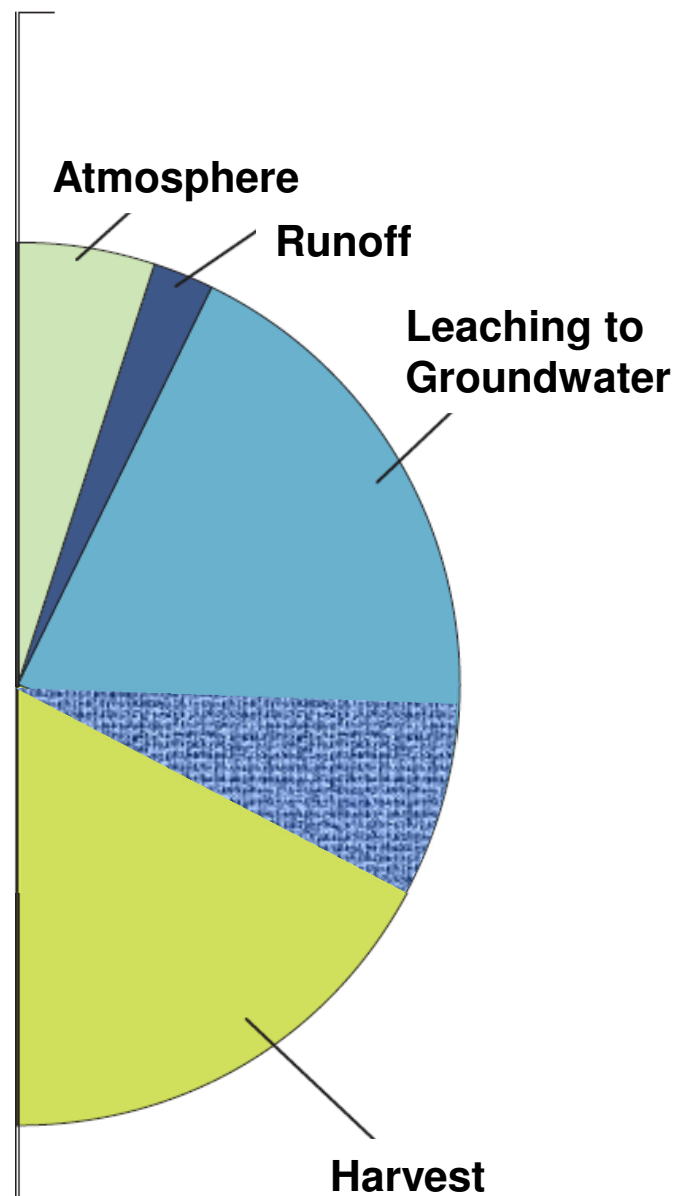
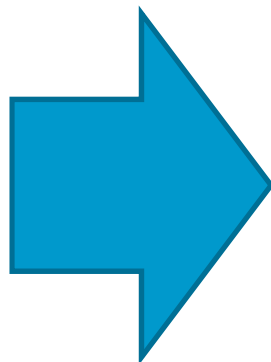
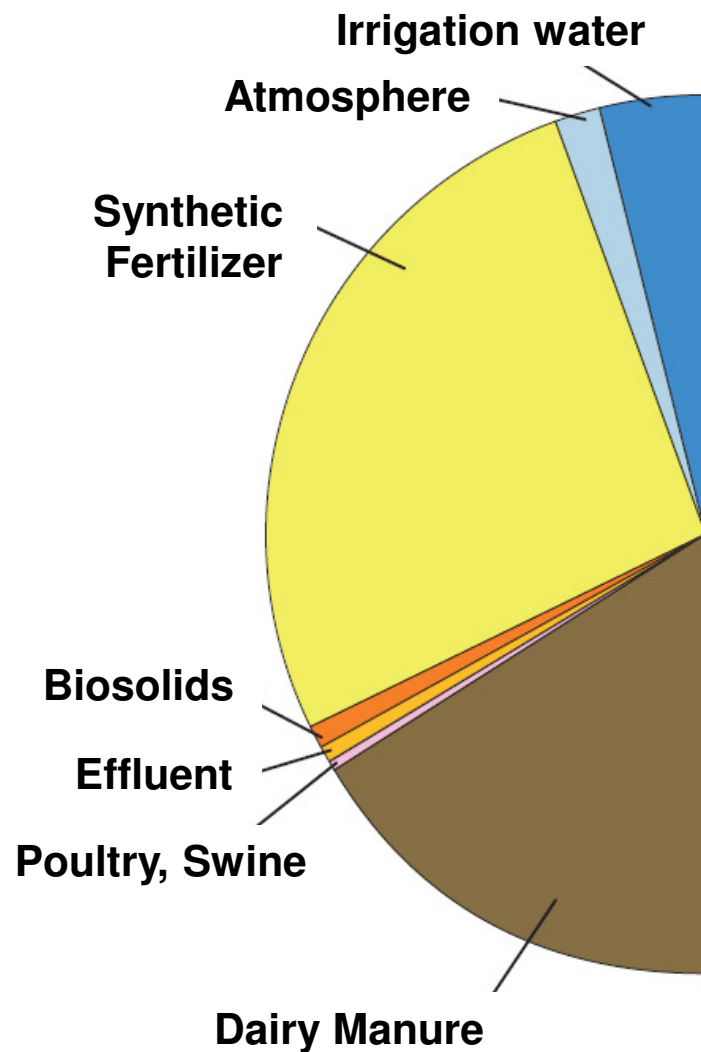


# Agricultural Sources





**Total Nitrogen Inputs:  
420,000 tons N/yr**



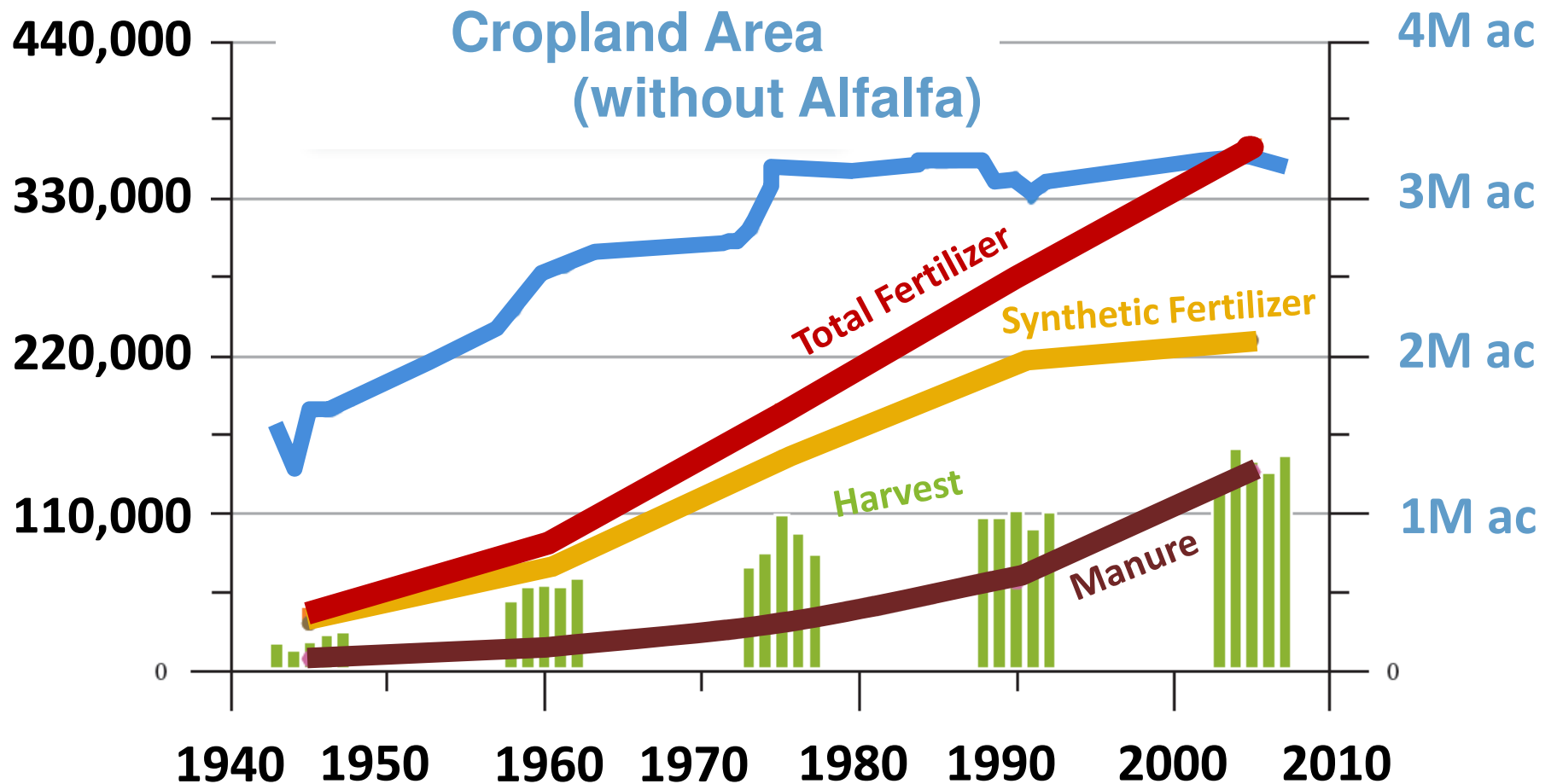
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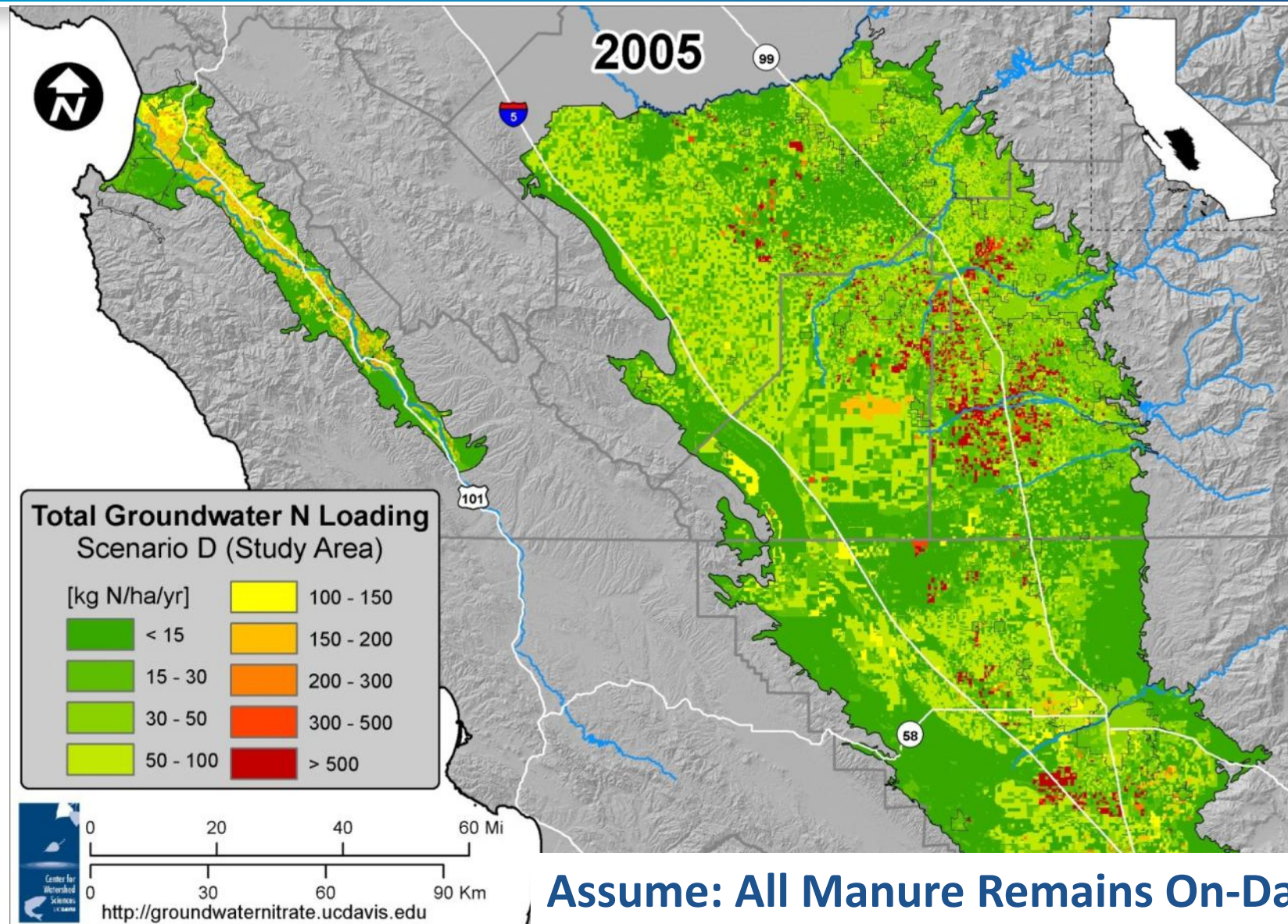
# Historic Nitrogen Fluxes

tons N/yr

Cropland Area

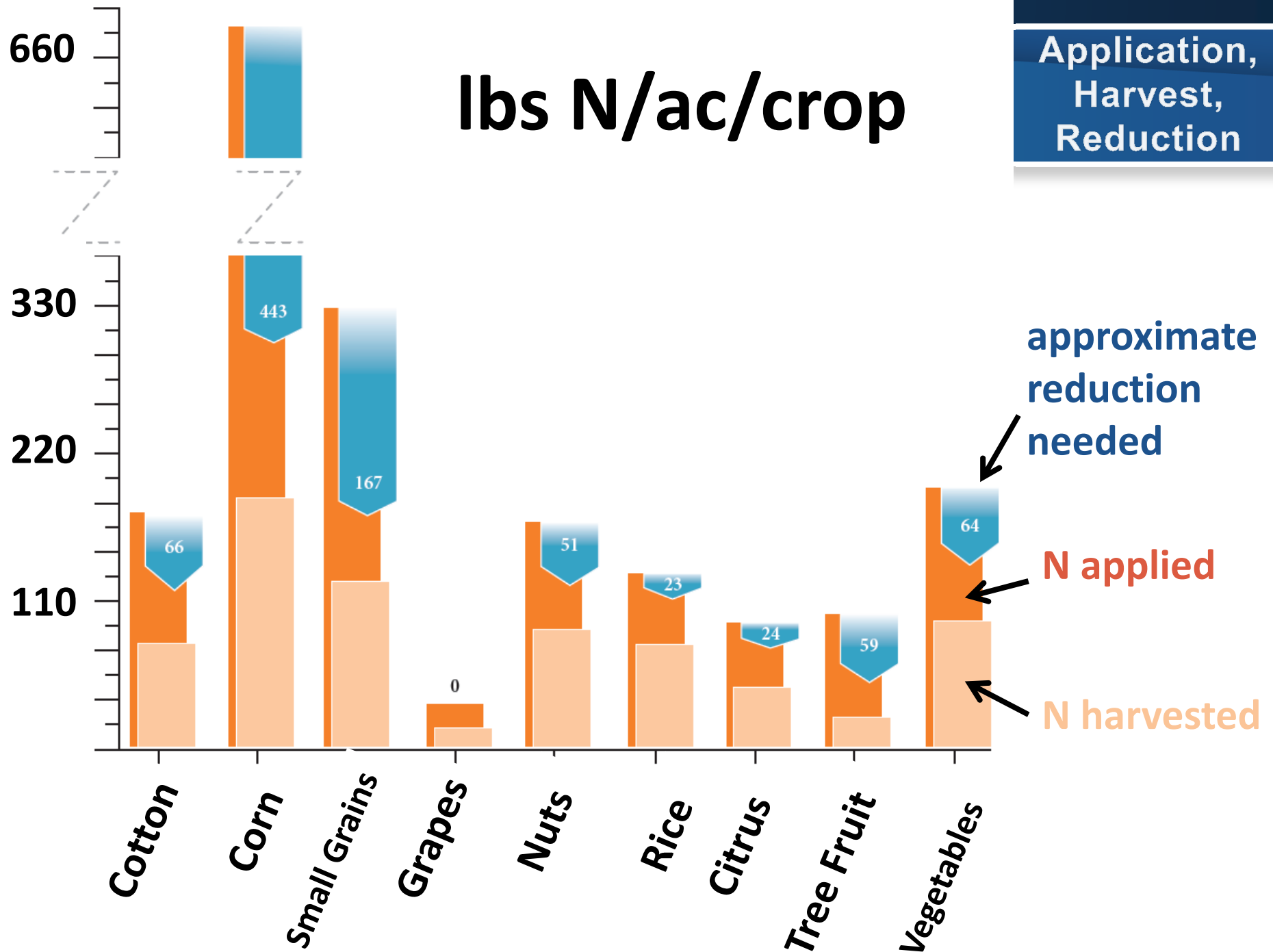


# Estimated Groundwater Nitrate Loading



# Ibs N/ac/crop

Application,  
Harvest,  
Reduction





**SBX2 1**

# **Addressing Nitrate in California's Drinking Water**

## **TECHNICAL REPORT 3: NITRATE SOURCE REDUCTION**

SWRCB Hearing  
May 23, 2012

Kristin Dzurella, Thomas Harter, Vivian Jensen, Aaron King, Josue Medellin-Azuara, Stuart Pettygrove



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[thharter@ucdavis.edu](mailto:thharter@ucdavis.edu)



# Agricultural Source Reduction

**Increase crop N-use efficiency -- Decrease deep percolation**

Basic Components	Management Measures	50 Practices
<b>Improve irrigation and drainage systems</b>	✓ Perform system evaluation and monitoring	3
	✓ Improve Irrigation scheduling	4
	✓ Improve irrigation system design and operation	13
	✓ Other irrigation infrastructure improvements	2
<b>Improve fertilizer and manure use</b>	✓ Improve rate, timing, and placement	15
<b>Change crop rotation</b>	✓ Modify crop rotation or grow cover crops	4
<b>Improve storage and handling</b>	✓ Avoid fertilizer material and manure spills during transport, storage and application	9



# FINDINGS: Cropland Source Reduction

- Recommended practices can increase N in the harvested crop to ~**60-80%** of N inputs
  - Current averages as low as ~30-40%
- Some practices are already in use:
  - Rate of adoption, regional impact unknown
- Suite of practices will be the most effective:
  - Tailored to specific soils and crops
- Barriers to expanded adoption:
  - Logistics, education, costs





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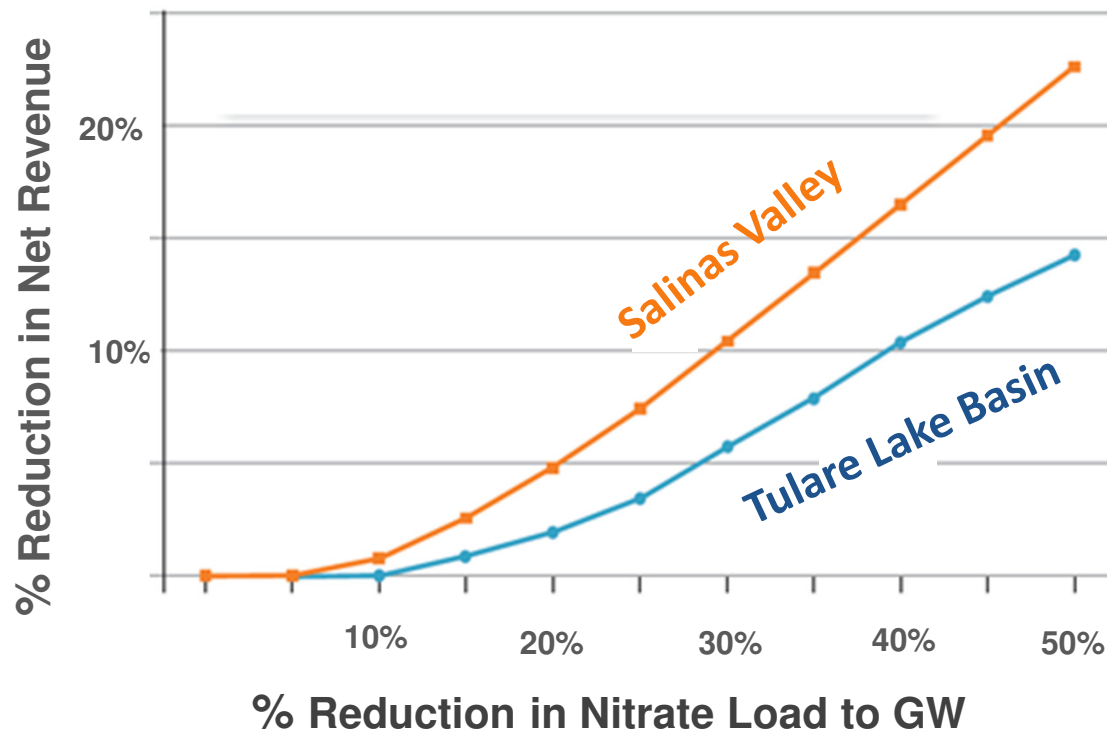
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# Economics of Source Reduction

- Cost of improving crop N use efficiency is uncertain but likely low for small improvements.
- Load reductions of half or more may come at a significant cost, potential reduction in irrigated crop area.





# Cropland Source Reduction **PROMISING ACTIONS**

- Expand efforts to promote adoption of N-efficient practices:
  - Grower education
  - Adaptive research
- Support development of N accounting methods:
  - Grower evaluation of improvements in crop N-use efficiency
- Fine-tune nitrate leaching risk assessment methods:
  - Identify associated monitoring requirements







# Cropland Source Reduction **PROMISING ACTIONS**

- Expand efforts to promote adoption of N-efficient practices:
  - Grower education
  - Adaptive research
- Support development of N accounting methods:
  - Grower evaluation of improvements in crop N-use efficiency
- Fine-tune nitrate leaching risk assessment methods:
  - Identify associated monitoring requirements





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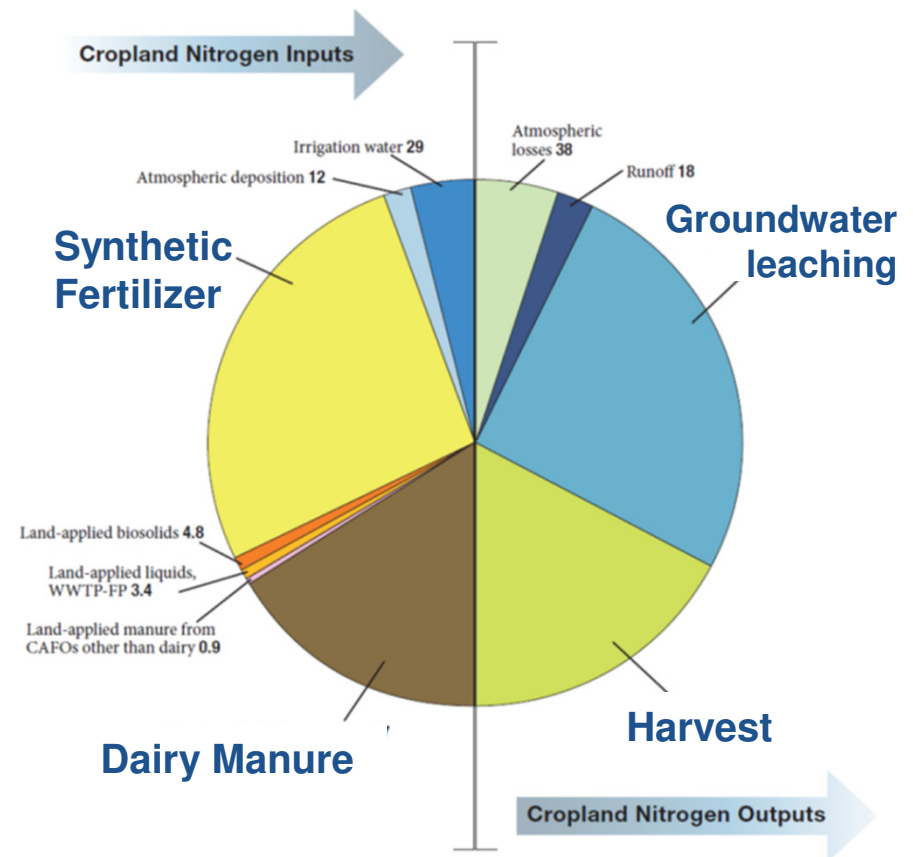




# Livestock Operations

## Dairy manure now regulated...to comply:

- Exporting excess manure off-farm
- Receiving farms not reducing synthetic N enough
  - Improve methods for determining fertilizer value
  - Alternative Forms
- Guidance in co-managing organic and conventional N



**SBX2 1**

# **Addressing Nitrate in California's Drinking Water**

## **TECHNICAL REPORT 4: GROUNDWATER QUALITY**

SWRCB Hearing  
May 23, 2012



Dylan Boyle, Aaron King, Giorgos Kourakos, Graham Fogg, Thomas Harter

Center for Watershed Sciences  
University of California, Davis  
Contact: [dbboyle@ucdavis.edu](mailto:dbboyle@ucdavis.edu)  
[thharter@ucdavis.edu](mailto:thharter@ucdavis.edu)



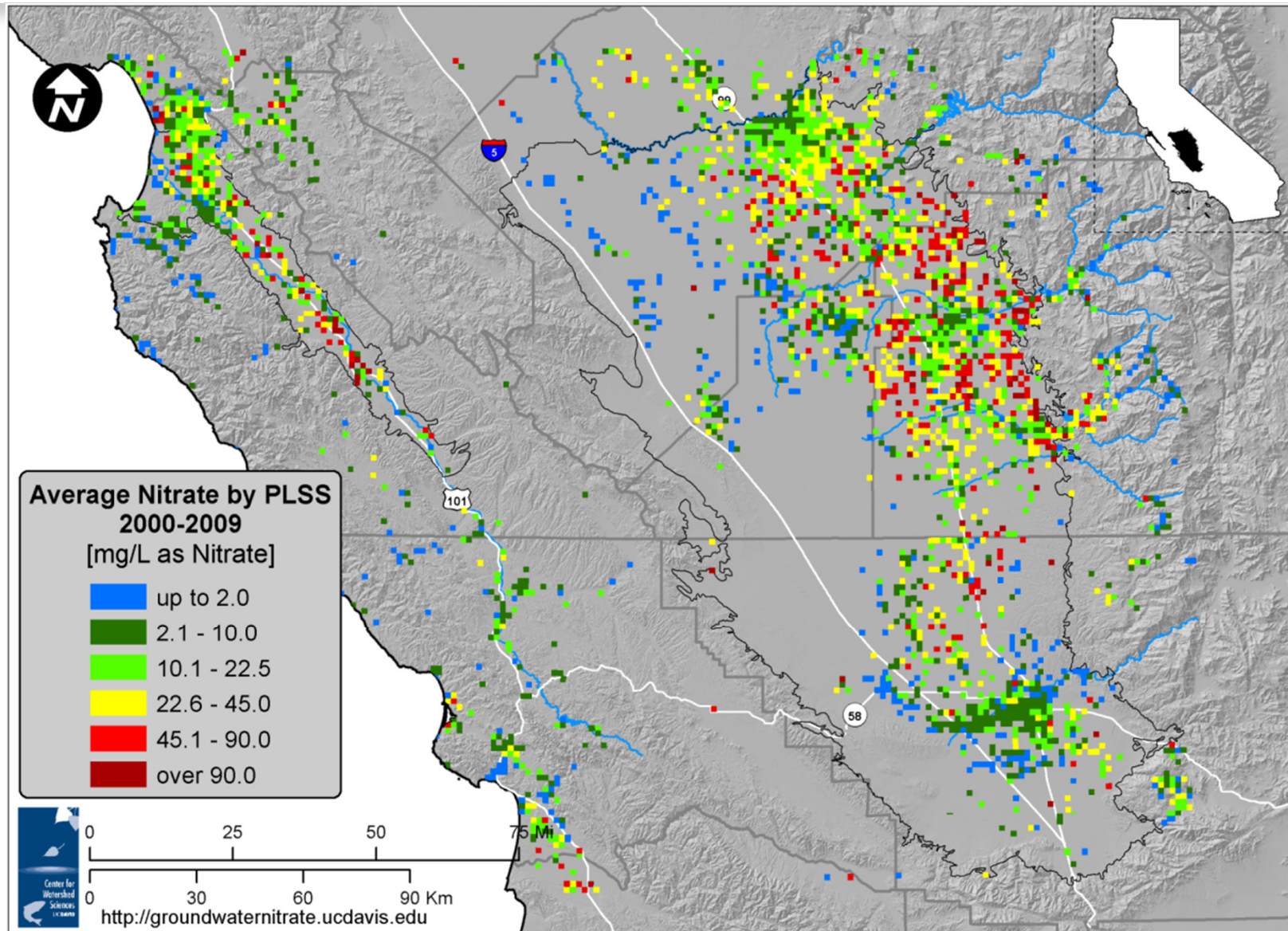


# Key Findings

- Widespread nitrate contamination
  - Eastern TLB and Salinas Valley most affected
- Lack of long-term historic water quality datasets
  - Majority of data 2000→present.
- Future: nitrate expected to increase in many areas



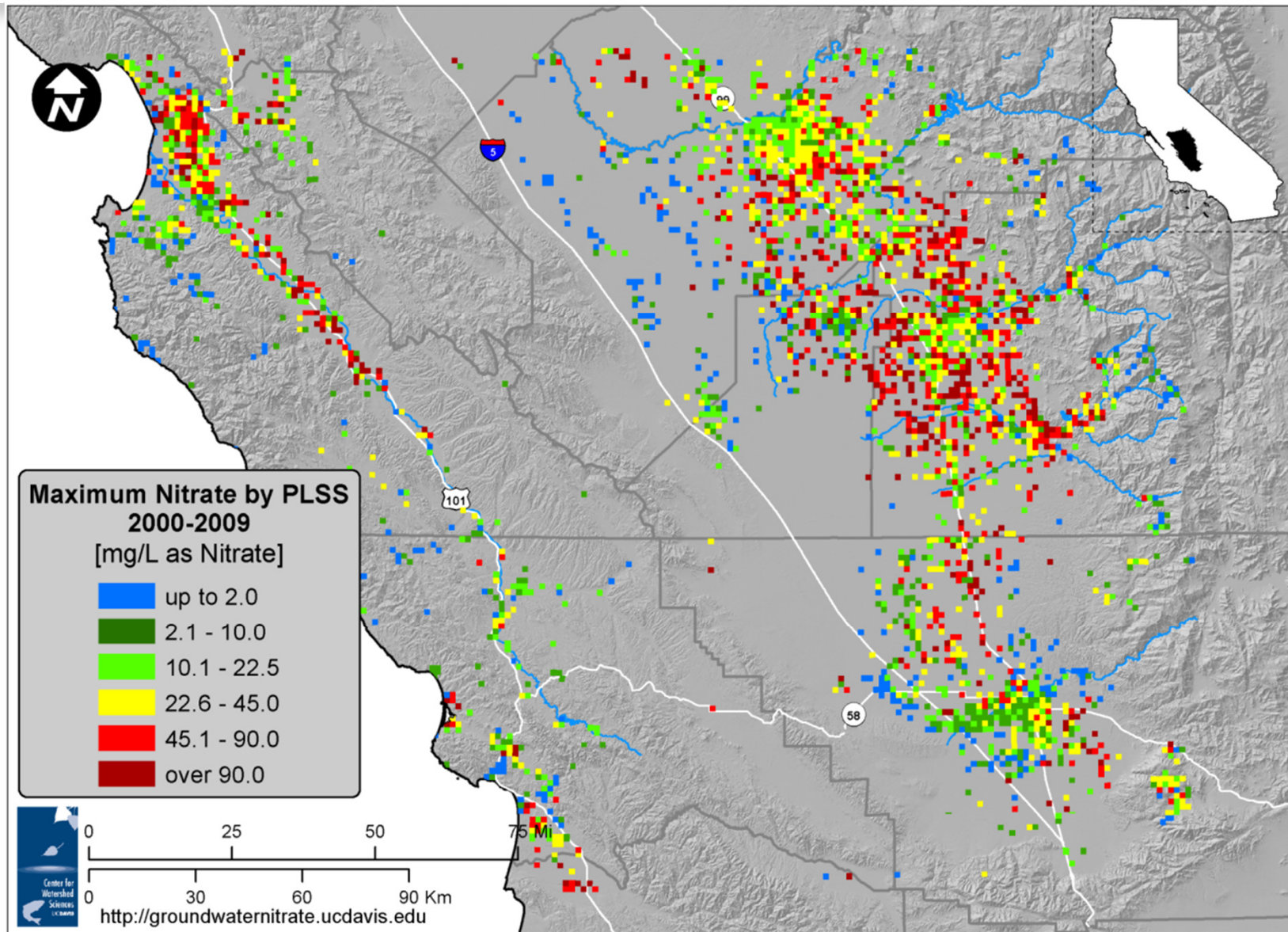
# Average Nitrate Concentrations by Section







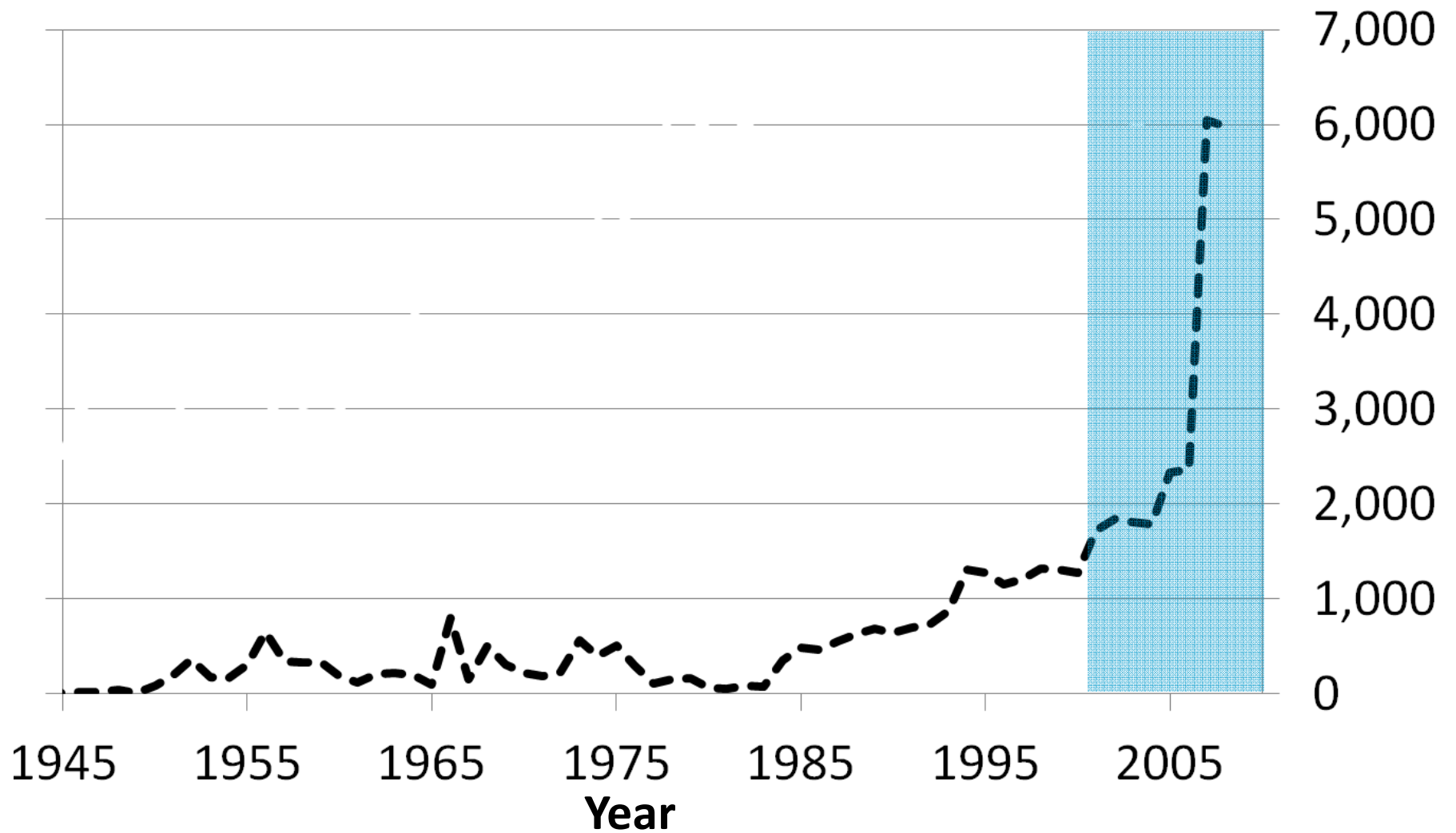
# Maximum Nitrate Concentrations by Section





# Number of Wells Sampled

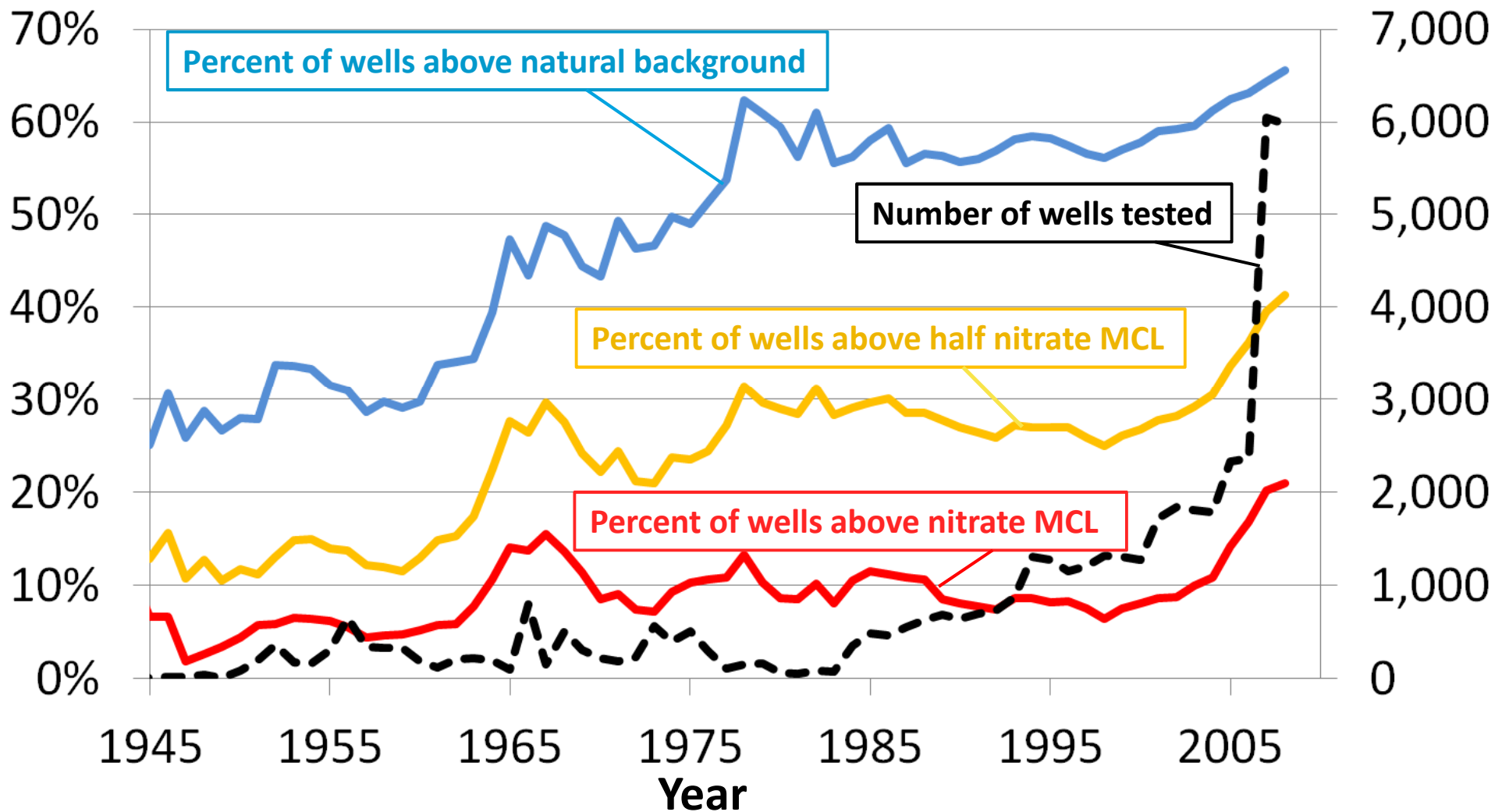
## CASTING Database







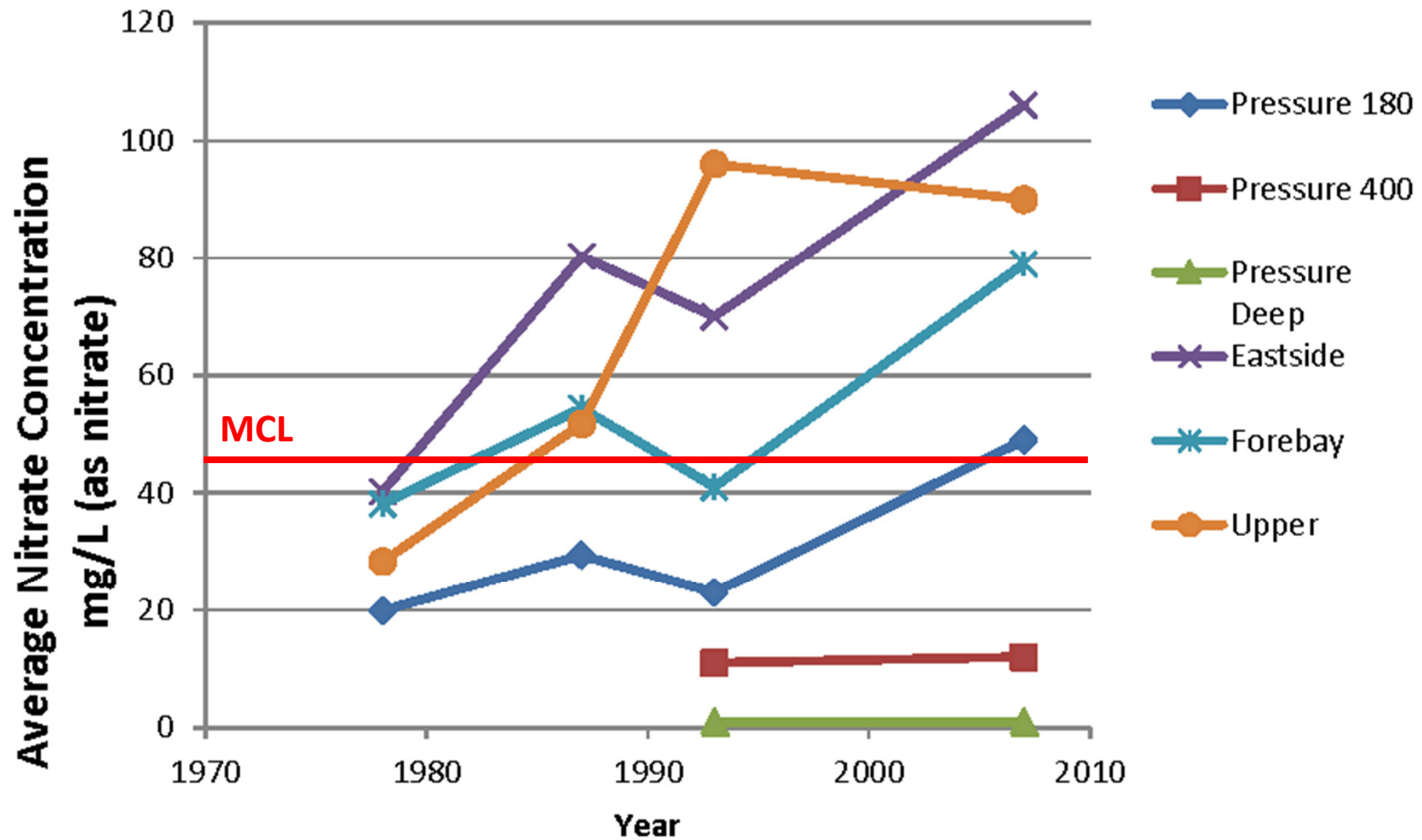
# Historic Nitrate Trends, TLB: Exceedance Rate





## Nitrate Trends, Salinas Valley

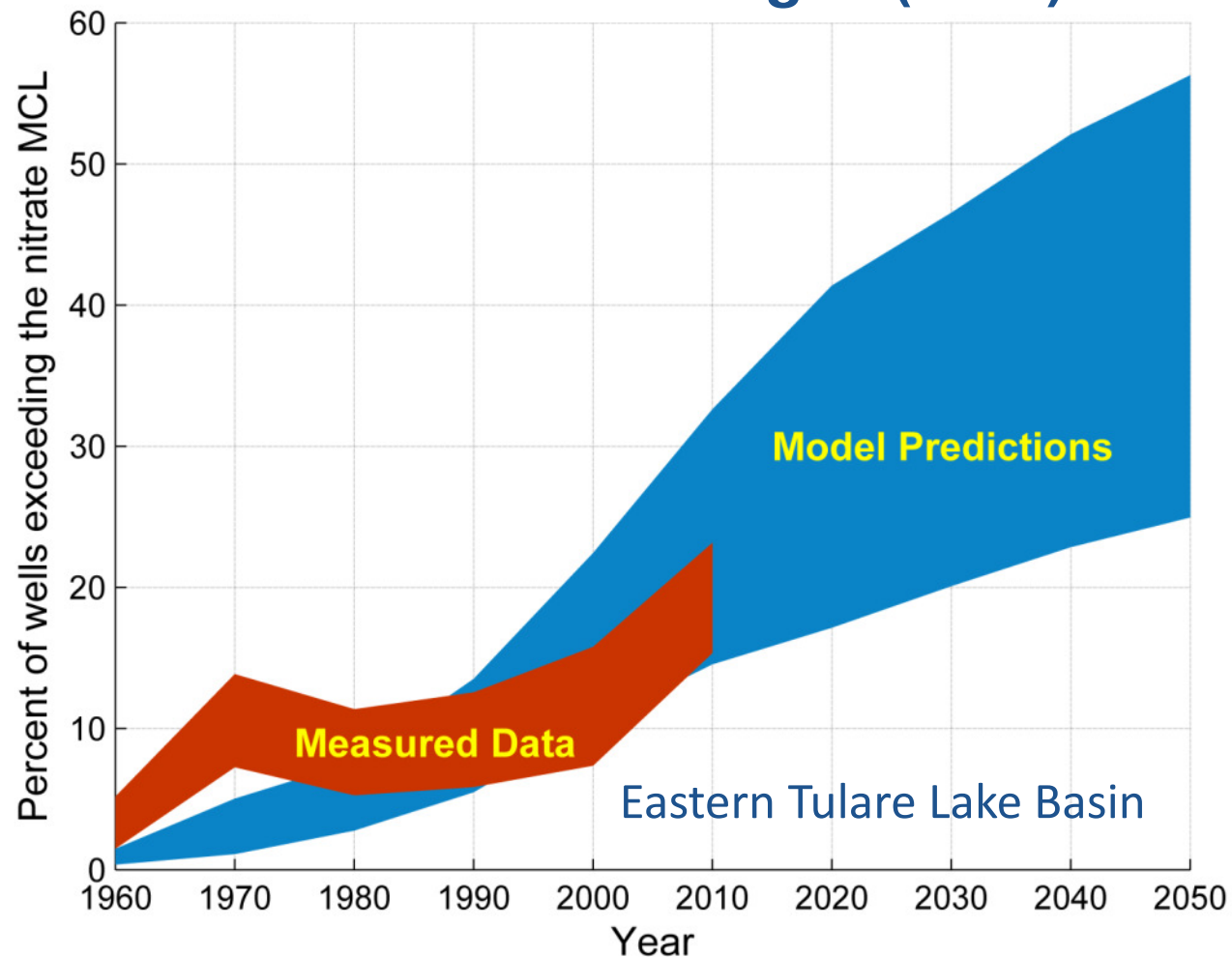
(MCWRA Published Regional Well Network Data)





# Predictions Using Groundwater Nitrate Loading

**Exceedance Probability,  
Nitrate above 45 mg/L (MCL)**



**SBX2 1**

# **Addressing Nitrate in California's Drinking Water**

## **TECHNICAL REPORT 5: GROUNDWATER REMEDIATION**

SWRCB Hearing  
May 23, 2012



Aaron King, Graham Fogg, Vivian Jensen, Thomas Harter

Center for Watershed Sciences  
University of California, Davis  
Contact: [amking@ucdavis.edu](mailto:amking@ucdavis.edu)  
[thharter@ucdavis.edu](mailto:thharter@ucdavis.edu)





# Key Findings

- Basin-wide conventional remediation is not feasible
  - Expensive (>\$14-30 billion) (volume: 35-88 million acre feet)
  - Technically infeasible – time, inefficiency
- Local remediation is appropriate
  - Clean up of nitrate hot spots with plume-scale remediation methods
    - In situ (e.g. Permeable Reactive Barriers)
    - Ex situ (e.g. Pump and Treat)
- Basin-wide groundwater quality management needed
  - Source reduction
  - Regional adoption of Pump and Fertilize
  - Recharge with higher quality water



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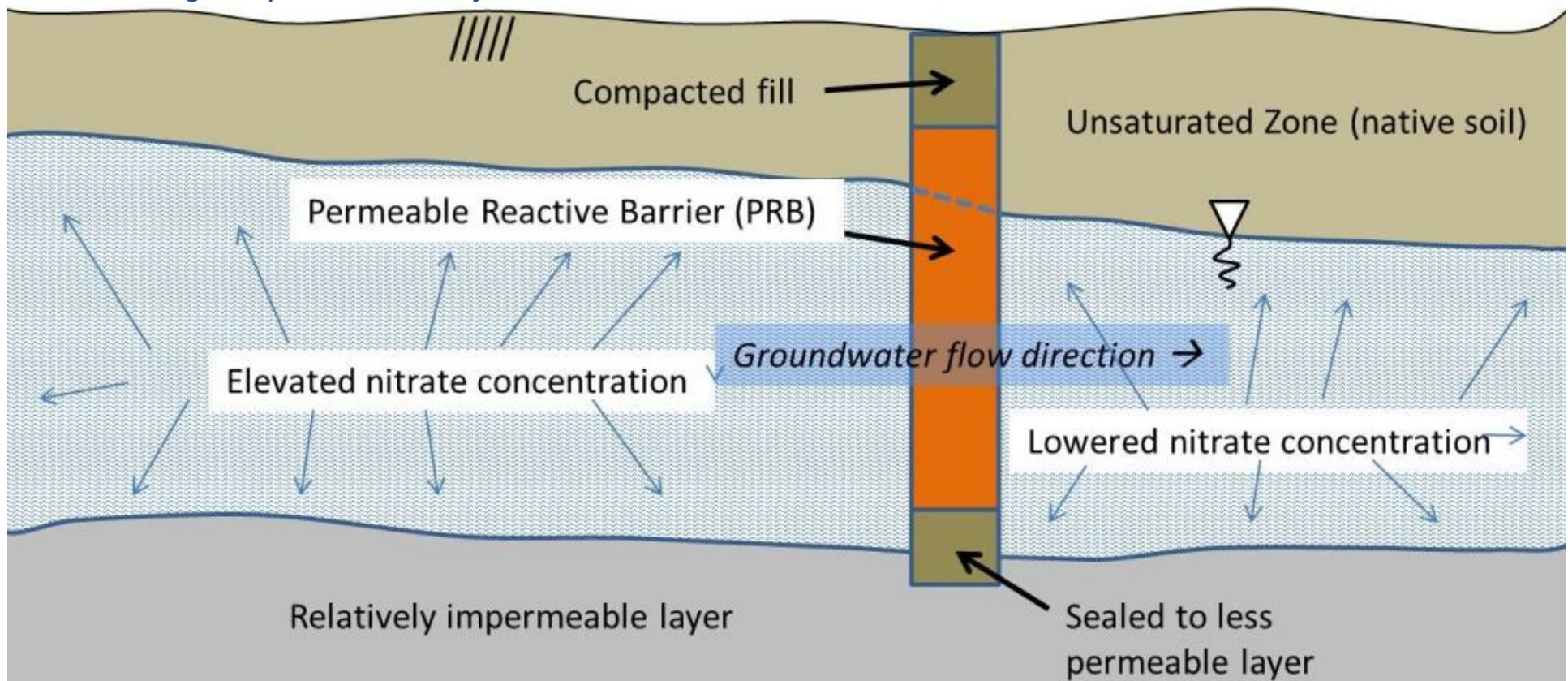
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# Local-Scale Remediation Options

- Permeable Reactive Barriers
  - Maximum cost-effective depth 50-100 feet
  - Enhance denitrification to protect specific wells
  - Intercept high nitrate subsurface flows
  - High capital cost, very low O&M cost

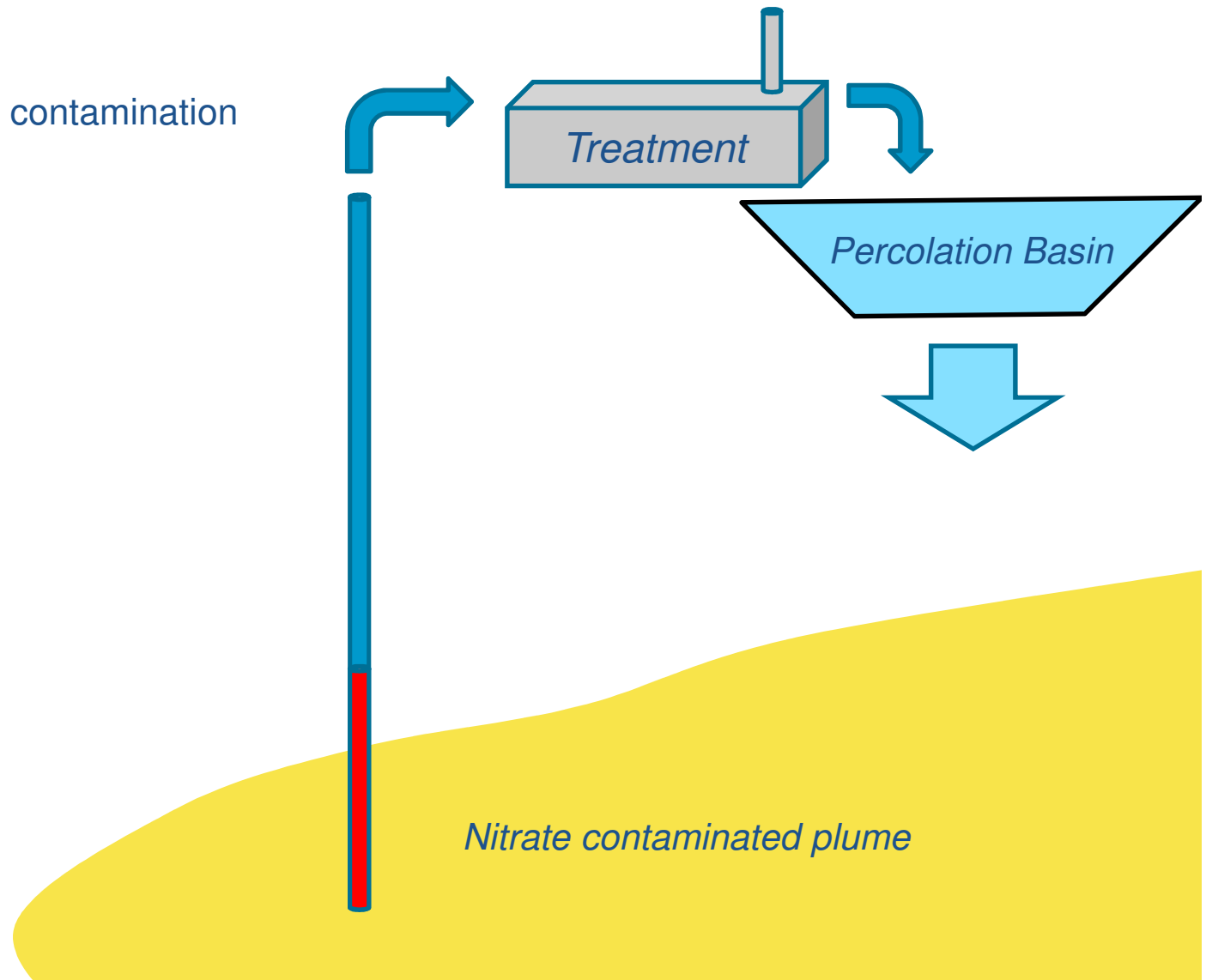






# Local-Scale Remediation Options

- Pump and Treat
  - Can target deeper contamination
  - High Capital cost
  - High O&M cost





# Pump and Fertilize (PAF)

- Current irrigation pumping captures more than current recharge
- Crops remove nitrogen from irrigation water
- N in irrigation water
  - Consider in fertilizer calculations
  - 32,000 short tons (\$30 M fertilizer value)
  - Potential for 15% reduction in applied synthetic fertilizer
- Implementation
  1. Education and outreach
    - Monitoring of well nitrate costs \$150 per well per year
  2. Regional groundwater quality management modeling
  3. Redistribution of irrigation pumping to shallower depths



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# Groundwater Quality Management

- Any remediation requires source reduction
- Increase fraction of high quality recharge
  - Groundwater banking
  - River recharge management
- Preferential pumping
  - High N → irrigation (pump and fertilize)
  - Low N → drinking water
- New groundwater management paradigms
  - Basin-wide strategies
  - Joint management water quantity and quality



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- New groundwater management paradigms
  - Basin-wide strategies
  - Joint management water quantity and quality
- Near-term solutions to supply safe water now

# SBX2 1

## Addressing Nitrate in California's Drinking Water

### **TECHNICAL REPORTS 6 & 7: DRINKING WATER TREATMENT & ALTERNATIVE WATER SUPPLY**

SWRCB Hearing

May 23, 2012

Kristin Honeycutt, Vivian Jensen, Holly Canada, Jeannie Darby,  
Mimi Jenkins, Jay Lund

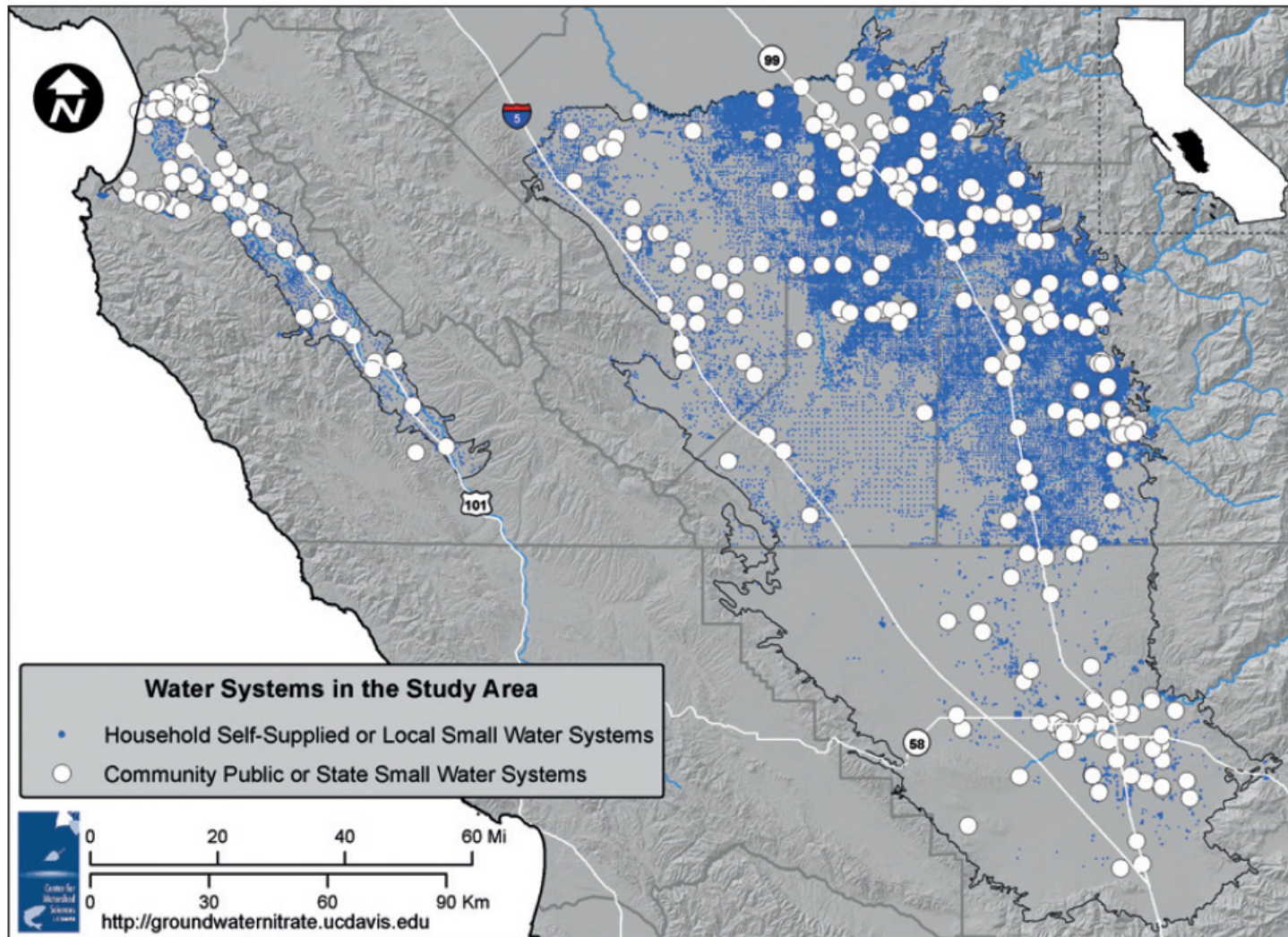


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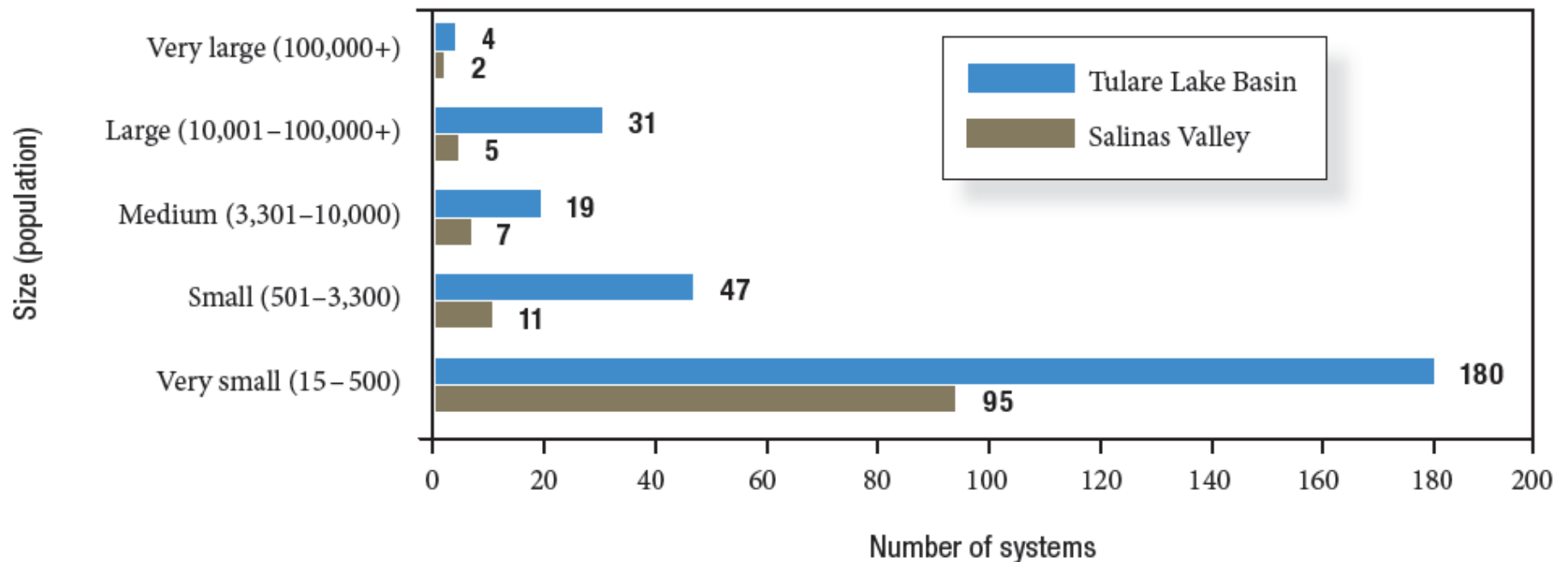
# All Water Systems



*Estimated locations of the area's roughly 400 regulated community public and state-documented state small water systems and of 74,000 unregulated self-supplied water systems. Source: Honeycutt et al. 2012; CDPH PICME 2010.*



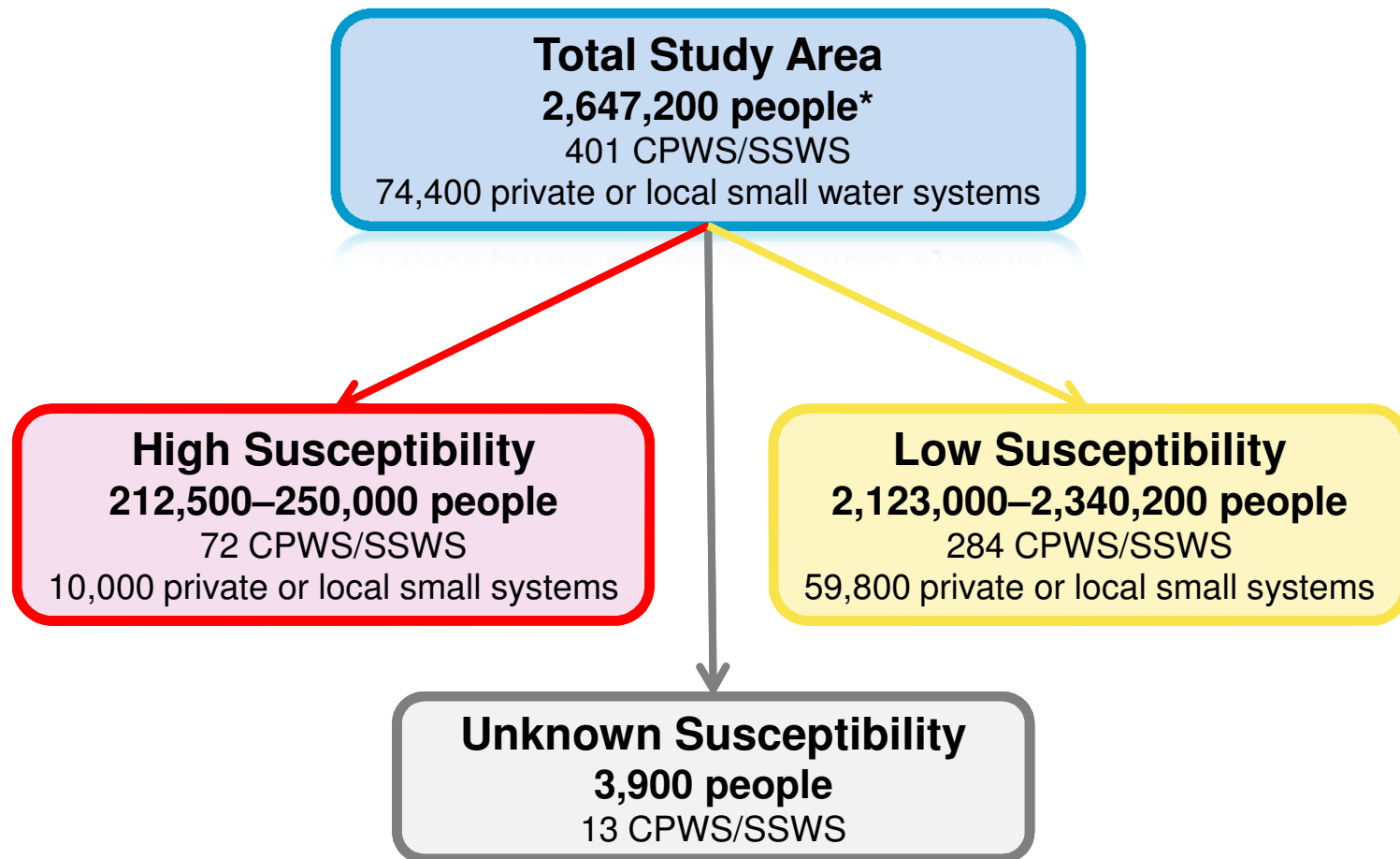
# Community Public & State Small Water Systems



*Community public and state-documented state small water systems of the Tulare Lake Basin and Salinas Valley.  
Source: CDPH 2010.*



# Susceptible Population

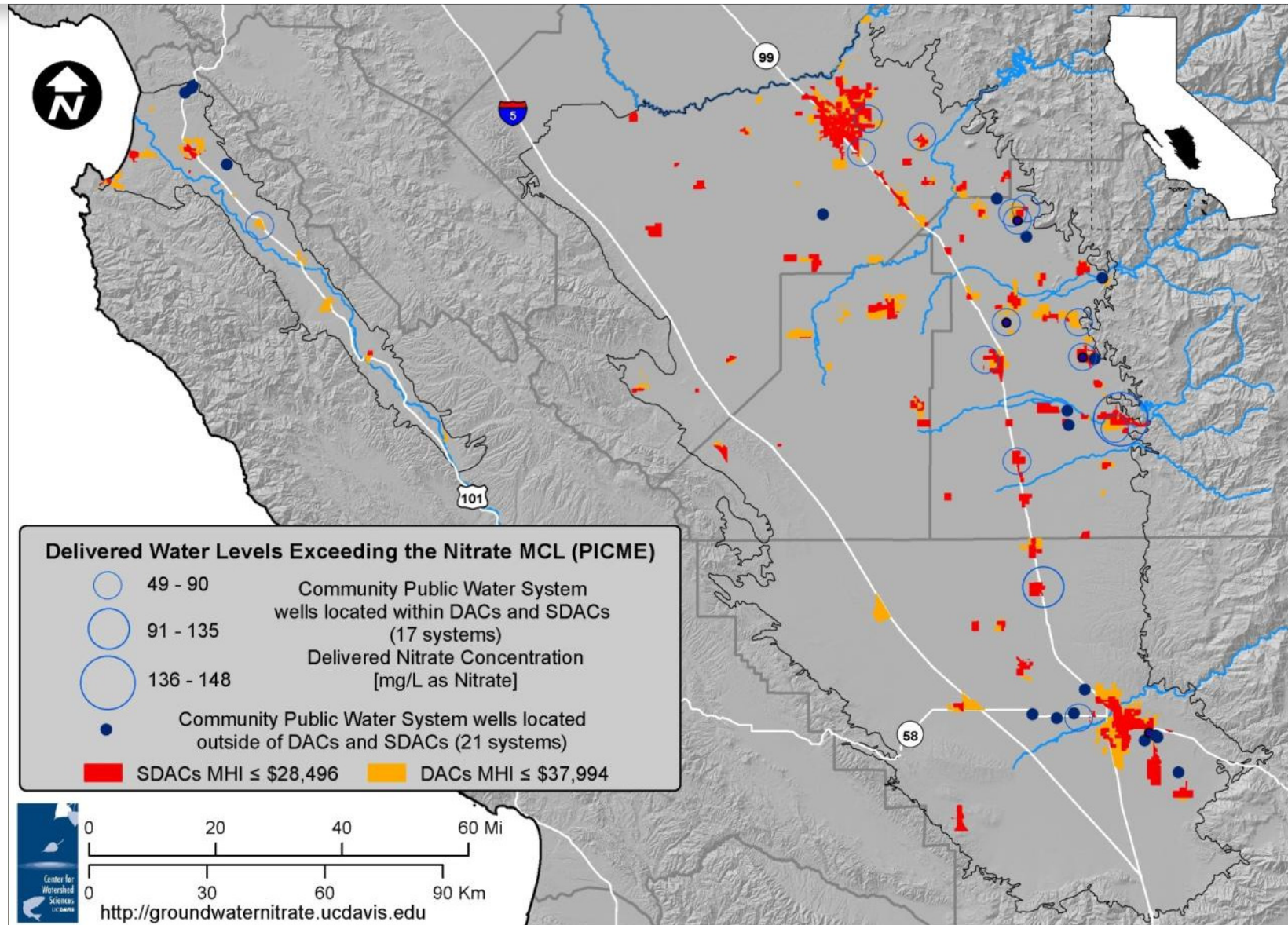


*\*Total study area population includes population served by surface water systems which is not susceptible to groundwater nitrate contamination and is not included in the subsequent susceptibility classifications.*





# DACs and Delivered Water Quality

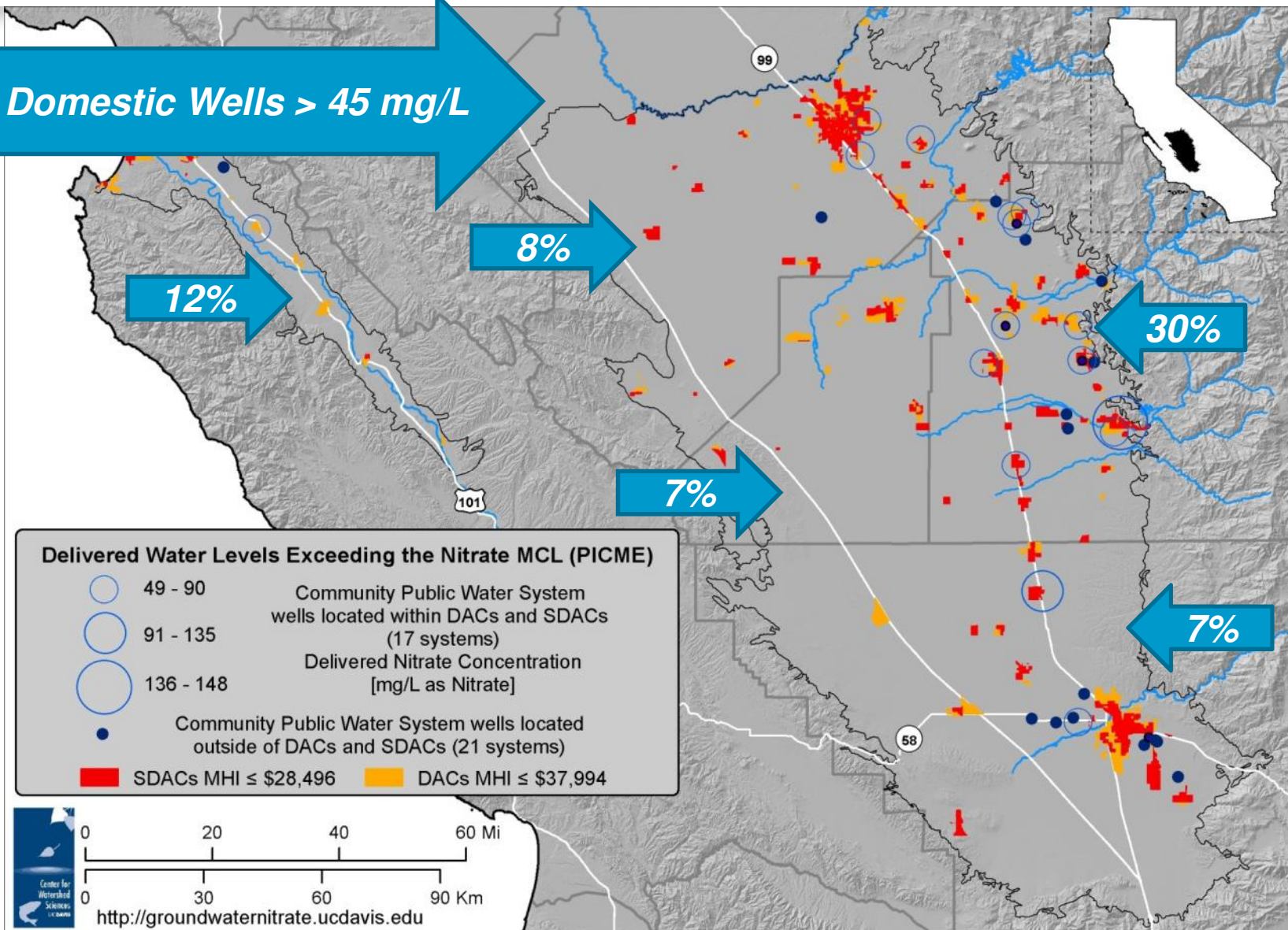






# DACs and Delivered Water Quality

% of Domestic Wells > 45 mg/L





# Alternative Water Supply Options

**Improve  
Existing  
Source**



Deeper Well or New Well  
Blending  
Treatment

**Use  
Alternative  
Supply**



Surface Water  
Connection to Another System  
Regionalization and Consolidation  
Trucked Water and Bottled Water



# Treatment Options

## REMOVAL TECHNOLOGIES – Disposal concern



Source: Siemens



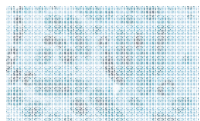
Source: Dow Chemical



Source: PC Cell

- Ion Exchange
  - Nitrate displaces chloride on resin, resin recharge with brine solution.
- Reverse Osmosis
  - Water molecules pushed through membrane, contaminants left behind.
- Electrodialysis
  - Electric current governs ion movement through membranes.

## REDUCTION TECHNOLOGIES – Limited full-scale application to date



Source: AnoxKaldnes



Source: Hepure Technologies

- Biological Denitrification
  - Bacteria transform nitrate to nitrogen gas.
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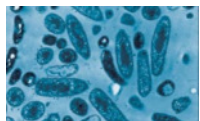
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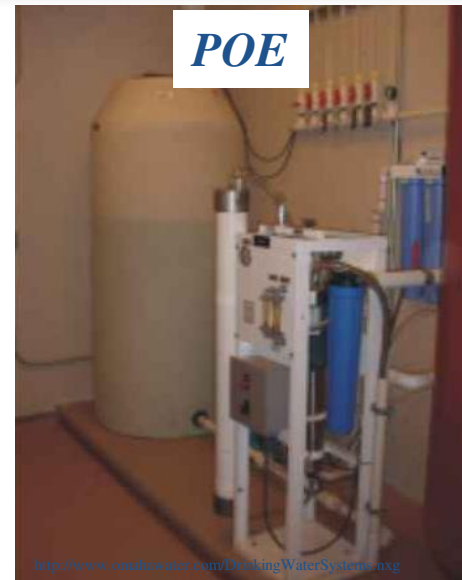
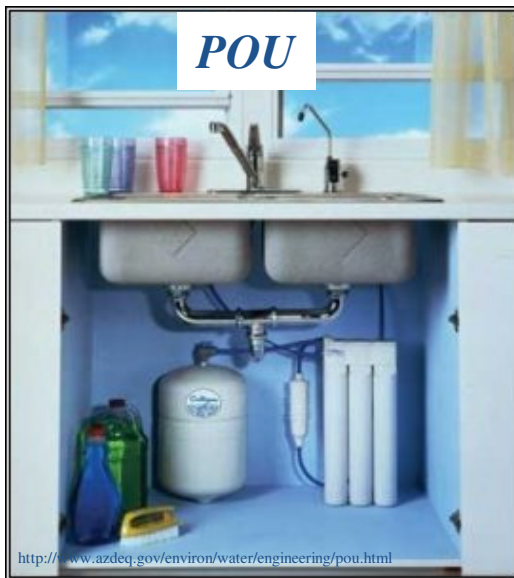
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# POU/POE



- Point-of-Use (POU)
  - Under the sink, treatment of only potable water
- Point-of-Entry (POE)
  - Household treatment, treatment of all water
- CDPH regulations limit POU treatment for water systems
- Primary option for household self-supply treatment



# Costs for Alternative Supply Options

Option	Estimated Annual Cost Range (\$/year)	
	Self-Supplied Household	Small Water System (1,000 households)
<b>Improve Existing Water Source</b>		
Blending	N/A	\$85,000–\$150,000
Drill deeper well	\$860–\$3,300	\$80,000–\$100,000
Drill a new well	\$2,100–\$3,100	\$40,000–\$290,000
Community supply treatment	N/A	\$135,000–\$1,090,000
Household supply treatment (POU)	\$250–\$360	\$223,000
<b>Alternative Supplies</b>		
Piped connection to an existing system	\$52,400–\$185,500	\$59,700–\$192,800
Trucked water	\$950	\$350,000
Bottled water	\$1,339	\$1.34 M
Relocate households	\$15,090	\$15.1 M
<b>Ancillary Activities</b>		
Well water quality testing	\$15–\$50	N/A
Dual distribution system	\$575–\$1,580	\$260,000–\$900,000



# Estimated Annualized Basin Wide Costs

## Alternative Supply Costs for CPWS/SSWS (220,000 people)

- Short-term Solutions: **\$13 - \$17 million/year** (includes POU and new well)
- Long-term Solutions: **\$34 million/year** (excludes POU and new well)

## Alternative Supply Costs for Households (34,000 people)

- POU: \$2.5 million/year

## Alternative Supply Costs for TOTAL Susceptible Population (254,000)

- Short-term Solutions: \$20 million/year
- Long-term Solutions: \$36 million/year



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# Major Findings

- 254,000 people susceptible or potentially susceptible.
- Individual engineering and financial analyses for each system.
  - Not one solution for all, but necessary technology is available.
- Significant potential for consolidating small systems.
- Multiple contaminant removal technologies promising.
- Obstacles and hurdles do exist.
  - Small systems, unincorporated regions, lack of local water board
  - Technical, Managerial & Financial capacity, O&M costs.



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# Major Findings

- **Promising Options for Community Public Water Systems**
  - Consolidate
  - Ion exchange
  - New well
  - Blending
- **Promising Options for Self-Supplied Households**
  - Point-of-Use
  - New well
- **Overall Cost = \$20 - \$36 million/year**
  - \$80 - \$142 / year per SUSCEPTIBLE PERSON
  - \$5 - \$9 / year per IRRIGATED ACRE
  - \$100 - \$180 / year per TON OF FERTILIZER NITROGEN
  - \$8 - \$14 / year per PERSON



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**SBX2 1**

# **Addressing Nitrate in California's Drinking Water**

## **TECHNICAL REPORT 8: REGULATORY & FUNDING OPTIONS**

SWRCB Hearing  
May 23, 2012



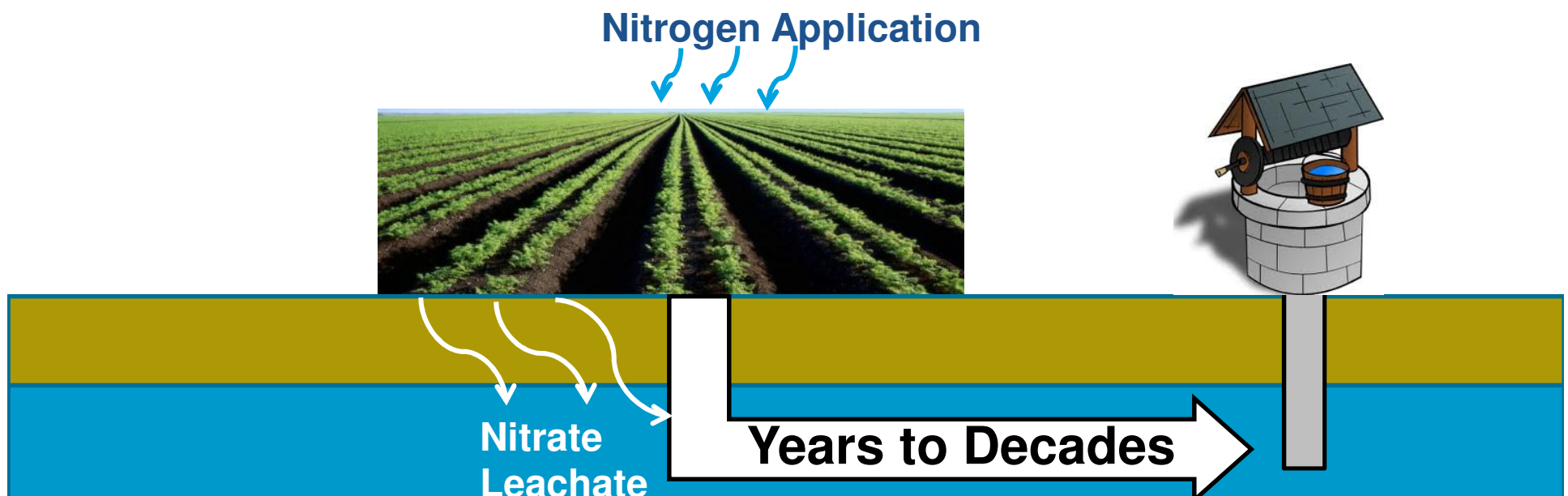
Holly Canada, Thomas Harter, Kristin Honeycutt,  
Katrina Jessoe, Mimi Jenkins, Jay Lund

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[thharter@ucdavis.edu](mailto:thharter@ucdavis.edu)



## Major Findings: Current Regulatory Programs

- Drinking water problem is most urgent
- Regulations have been insufficient to control groundwater nitrate contamination
- Drinking water source quality will improve only after many years of nitrate source reductions





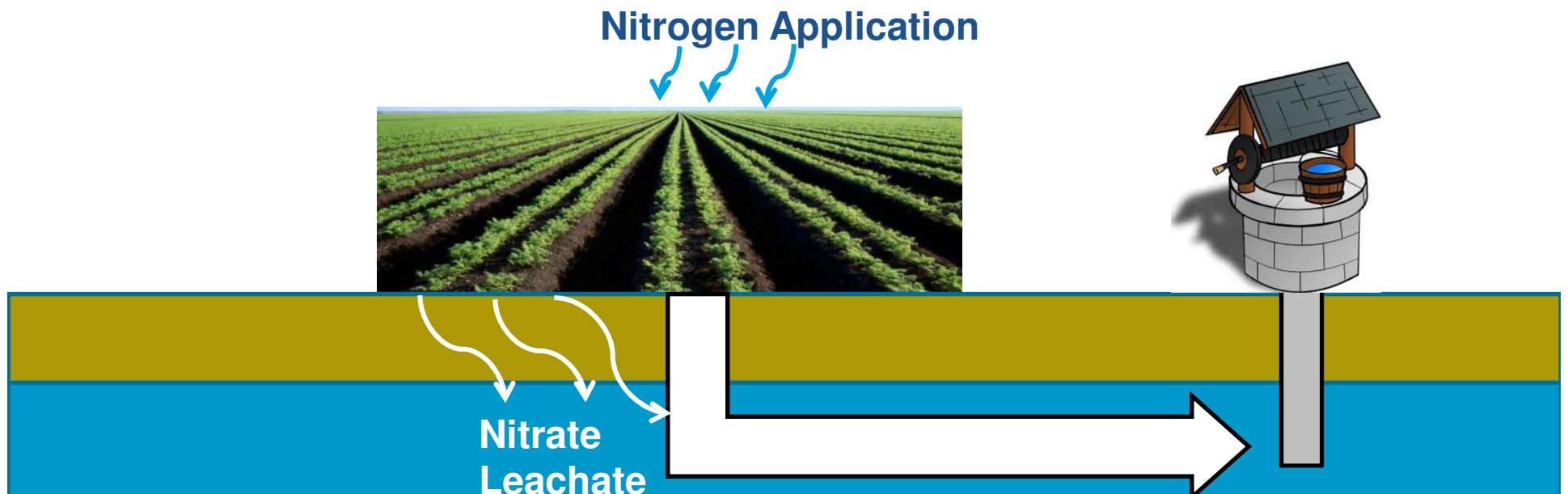
# Regulatory Options Considered

- Technology Mandate
- Performance Standard
- Fee
- Cap and Trade
- Information Disclosure
- Liability Rules
- Negotiation or Payment for Service
- De-designation of Beneficial Use



# Ways to regulate nitrate?

- Technology Mandate
- Performance Standard
- Fee
- Cap and Trade

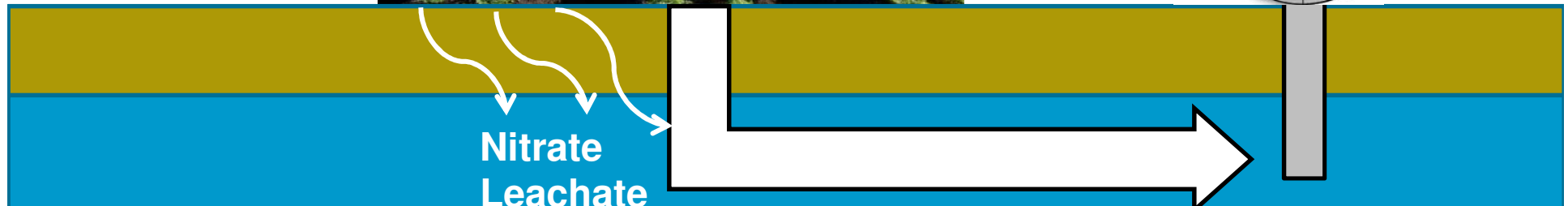




# Regulating Nitrogen Application Preferred

Regulated Entity	Abatement Costs (costs to reduce loading to achieve a nitrate standard)	Monitoring / Enforcement Costs	Information Requirements	Revenue Raising
Nitrate Leachate	Lower – regulate pollutant	High	High	Maybe
Nitrogen Application	Higher – regulate input	Low	Low	Maybe

## Nitrogen Application







# Promising Regulatory Options

- 1. Nitrate dischargers pay for the additional drinking water costs - authorized under Section 13304 of CA Water Code.**
- 2. Regulate nitrogen use rather than nitrate leachate.**
- 3. Consider market-based instruments for long-term regulation.**
- 4. Learn from successful Department of Pesticide Regulation programs.**



# Chronic Funding Problems

1. Small, rural communities
2. Communities are spread-out

**higher infrastructure costs  
= higher household costs**

3. Lack economies of scale
4. Less Technical, Managerial, Financial (TMF) resources

**difficulty with:  
loans  
funding applications  
operation & maintenance**



# Funding Options



**Cap and Trade  
with Auctioned  
Permits**

**Fee on  
Bottled Water**



**Food Tax**

**Fixed or  
Volumetric  
Fee on  
Agricultural  
Water**



**Nitrogen Fee**

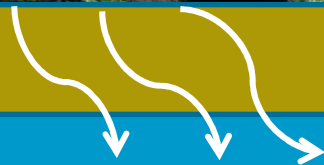


**Agricultural  
Property Tax**

**Fixed or  
Volumetric  
Fee on  
Drinking  
Water**



**Nitrate Leachate Fee**



**Groundwater  
Pumping Fee**





# Promising Funding Options for Affected Communities

- 1. Where appropriate, combine funding programs.**
- 2. Fund long-term drinking water solutions, particularly regionalization of small systems.**
- 3. Increase financial assistance to small systems.**
- 4. Create state funding programs for domestic well owners and for small water systems.**



# Promising Statewide Funding Options

- 1. Increase CDFA's mill assessment rate on nitrogen fertilizer sales to its full authorized amount.**
  - Raises additional \$1 Million / year statewide.
- 2. Introduce a statewide nitrogen fertilizer sales fee, perhaps equivalent to sales tax**
  - Could generate \$28 Million / year in study area.
- 3. Section 13304 of CA Water Code, compensation**
- 4. Consider a more comprehensive statewide water use fee**





# Key Take Home Messages

- Safe drinking water is the most pressing issue
  - Challenges: organization and funding
- Nitrate loading can be reduced, long-term
  - Challenges: training, research, investment, compliance, and funding
- State needs to collect and organize data to allow for better assessment
  - Challenges: institutional silos, organization, privacy issues/data security, and funding



# Promising Actions

- See back page of the “Executive Summary”

**Addressing Nitrate in California's Drinking Water**  
With a Focus on Tulare Lake Basin and Salinas Valley

Report for the State Water Resources Control Board Report to the Legislature

**EXECUTIVE SUMMARY**

This Report and its associated eight Technical Reports were prepared by:  
Thomas Hunter and Jay R. Lund (Principal Investigators)  
Katharine Darby, Graham E. Fogg, Richard Hewitt, James K. Jensen, G. Stuart Pettygrove, James E. Quinn, and Joshua H. Viers (Co-Investigators)

Maximum Nitrate in Wells (mg/L as Nitrate)  
2000-2009  
10-15  
15-20  
20-25  
25-30  
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Action	Safe Drinking Water	Groundwater Degradation	Economic Cost
No Legislation Required			
<b>Safe Drinking Water Actions</b>			
D1: Point-of-Use Treatment Option for Small Systems +	♦♦		low
D2: Small Water Systems Task Force +	♦		low
D3: Regionalization and Consolidation of Small Systems +	♦♦		low
<b>Source Reduction Actions</b>			
S1: Nitrogen/Nitrate Education and Research +		♦♦♦	low-moderate
S2: Nitrogen Accounting Task Force +		♦♦	low
<b>Monitoring and Assessment</b>			
M1: Regional Boards Define Areas at Risk +	♦♦♦	♦♦♦	low
M2: CDPH Monitors At-Risk Population +	♦	♦	low
M3: Implement Nitrogen Use Reporting +		♦♦	low
M4: Groundwater Data Task Force +	♦	♦	low
M5: Groundwater Task Force +	♦	♦	low
<b>Funding</b>			
F1: Nitrogen Fertilizer Mill Fee		♦♦♦	low
F2: Local Compensation Agreements for Water +	♦♦	♦	moderate
New Legislation Required			
D4: Domestic Well Testing *	♦♦		low
D5: Stable Small System Funds	♦		moderate
Non-tax legislation could also strengthen and augment existing authority.			
Fiscal Legislation Required			
<b>Source Reduction</b>			
S3: Fertilizer Excise Fee	♦♦	♦	moderate
S4: Higher Fertilizer Fee In Areas at Risk	♦	♦	moderate
<b>Funding Options</b>			
F3: Fertilizer Excise Fee	♦♦	♦♦	moderate
F4: Water Use Fee	♦♦	♦♦	moderate



# Key Take Home Messages

- Safe drinking water is the most pressing issue
  - Challenges: organization and funding
- Nitrate loading can be reduced, long-term
  - Challenges: training, research, investment, compliance, and funding
- State needs to collect and organize data to allow for better assessment
  - Challenges: institutional silos, organization, privacy issues/data security, and funding

**SBX2 1 (2008, Perata)**

**UC Davis Report to State Water Board  
for its Report to the Legislature**

**ADDRESSING NITRATE IN  
CALIFORNIA'S DRINKING WATER,  
TULARE LAKE BASIN AND SALINAS VALLEY**

**SWRCB Public Hearing**

**May 23, 2012**

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