

**MEETING THE NATION'S NEED FOR WATER-QUALITY INFORMATION IN THE NEXT
DECADE: PLANNED CONTRIBUTIONS FROM THE NAWQA PROGRAM**

GROUNDWATER MONITORING & MODELING

GROUNDWATER MONITORING & MODELING OBJECTIVES

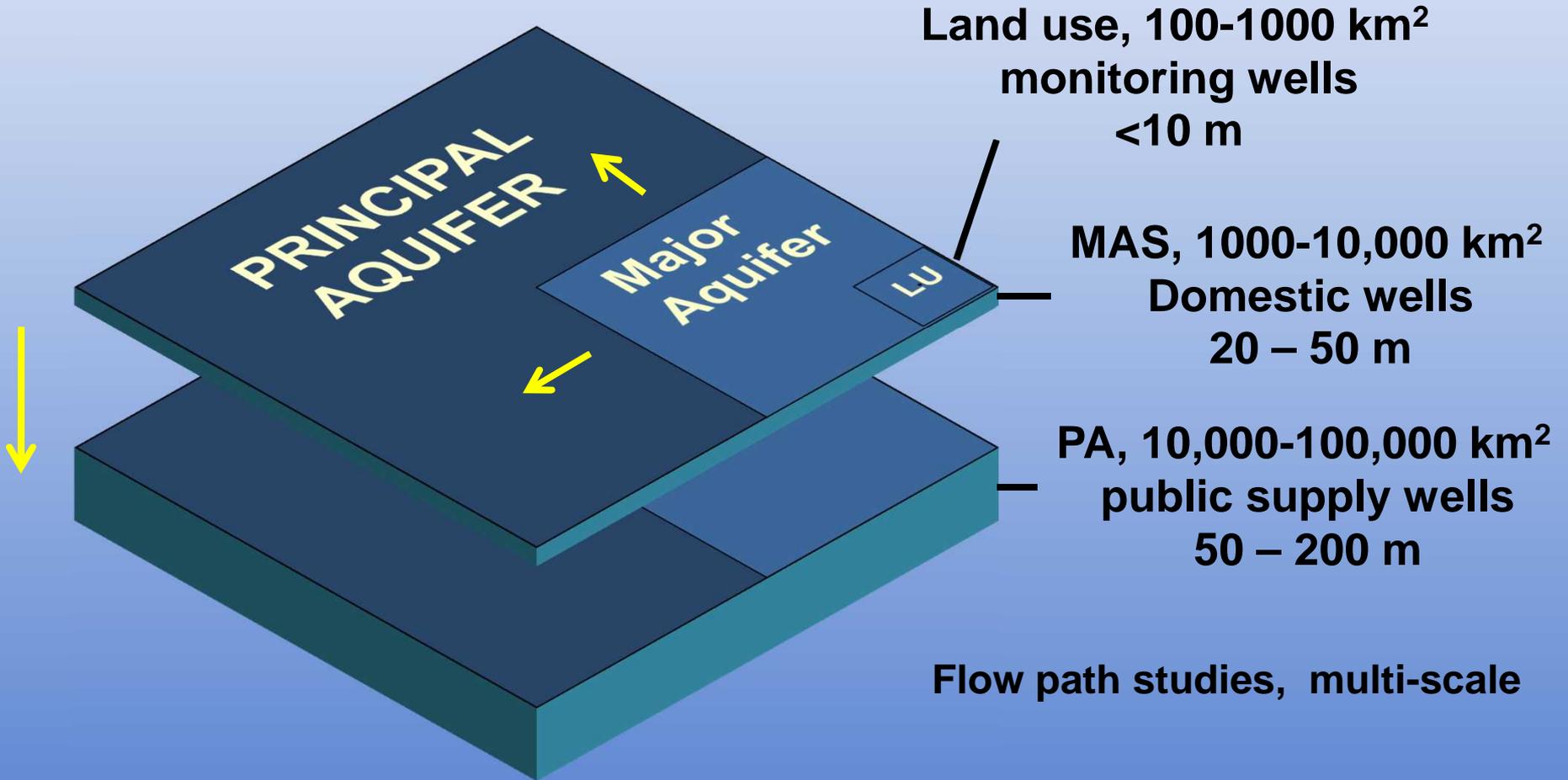
- **Assess the quality of groundwater used for domestic and public supply**
- **Assess the impact of legacy contamination on the quality of surface water**
- **Assess changes in groundwater quality**

GROUNDWATER MONITORING & MODELING APPROACH

- **Monitoring of groundwater in new and existing NAWQA networks**
monitoring wells, domestic wells, public supply wells
- **Modeling at multiple scales**
statistical, flow & transport, hybrid
National, Principal Aquifers, Regional, Local
- **Time series sampling in selected networks**
continuous monitoring and periodic sampling

GROUNDWATER MONITORING & MODELING

SCALE



GROUND WATER RESOURCE: 82% PUBLIC SUPPLY, 18% DOMESTIC

GROUNDWATER MONITORING & MODELING

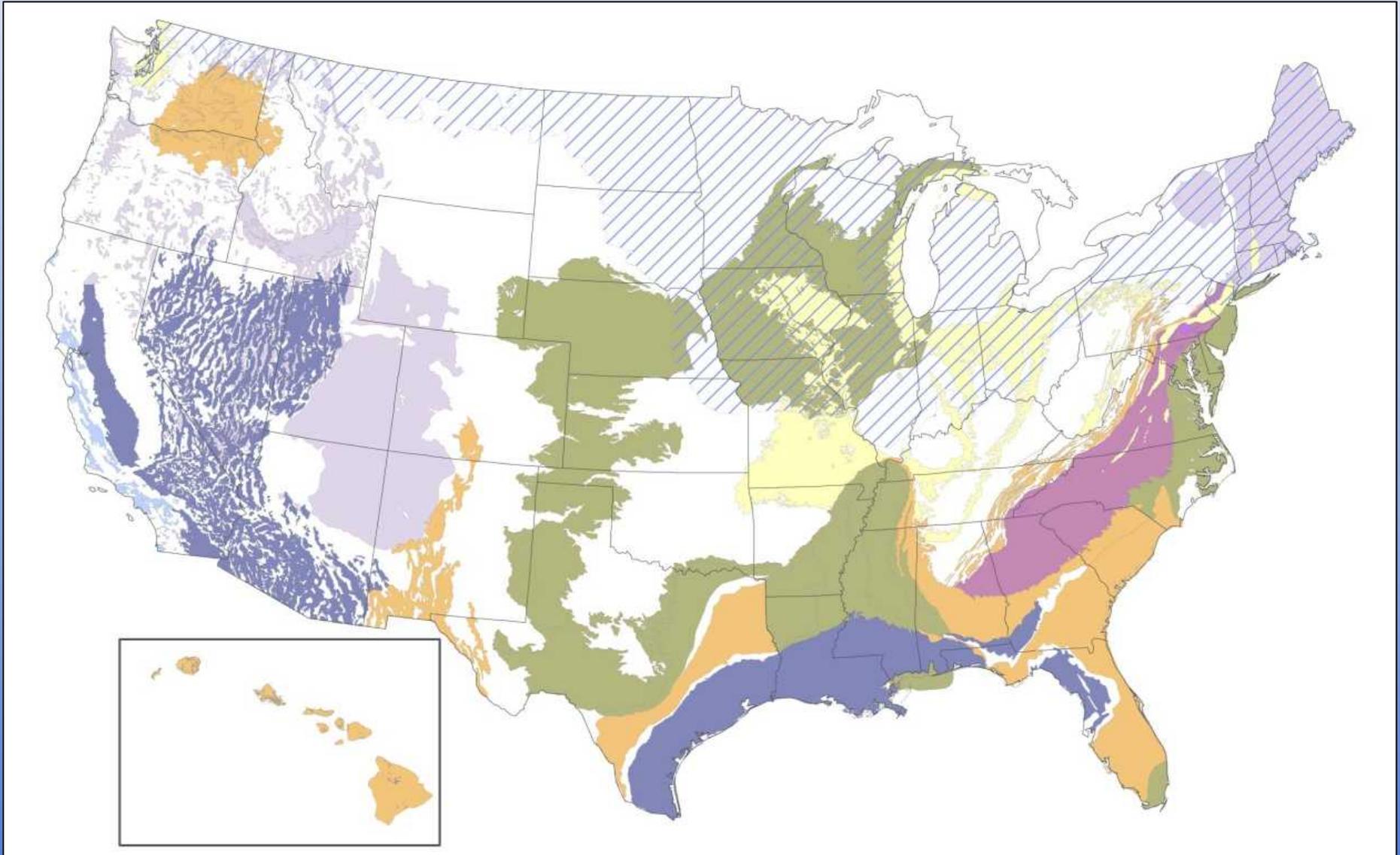
SCIENCE PLAN

- 24 Principal Aquifers
 - ~ 2880 public supply wells
 - Multi-scale models: 16 PAs
- *42 Major Aquifer & 52 Land Use Studies (~2820 wells)*
- 40 Flow Path Studies(*~800 wells*)
- Time Series Sampling
 - 20 networks @ 5 wells ea
 - ~3300 samples
- Finished water sampling
 - ~ 400 samples
- Full analytical schedule
- ~12,000 groundwater samples

CURRENT FUNDING

- 16 Principal Aquifers
 - ~ 1440 public supply wells
 - Multi-scale models: 4 PAs
- *39 Major Aquifer & 47 Land Use Studies (~2580 wells)*
- 8 Flow Path Studies(*~160 wells*)
- Time Series Sampling
 - 8 networks @ 3 wells ea
 - ~640 samples
- Finished water sampling
 - none
- Targeted analytical schedule
- ~5,000 groundwater samples

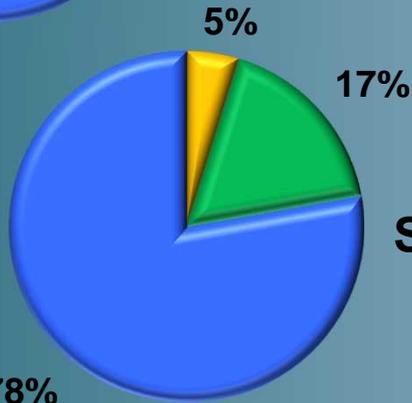
PRINCIPAL AQUIFERS ARE THE PRIMARY ORGANIZATIONAL UNIT



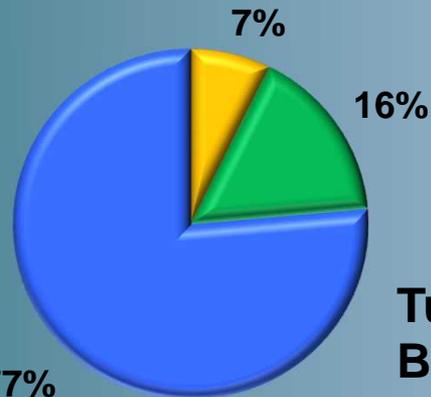
ASSESS QUALITY OF GROUND WATER USED FOR DOMESTIC AND PUBLIC SUPPLY



Sacramento Valley

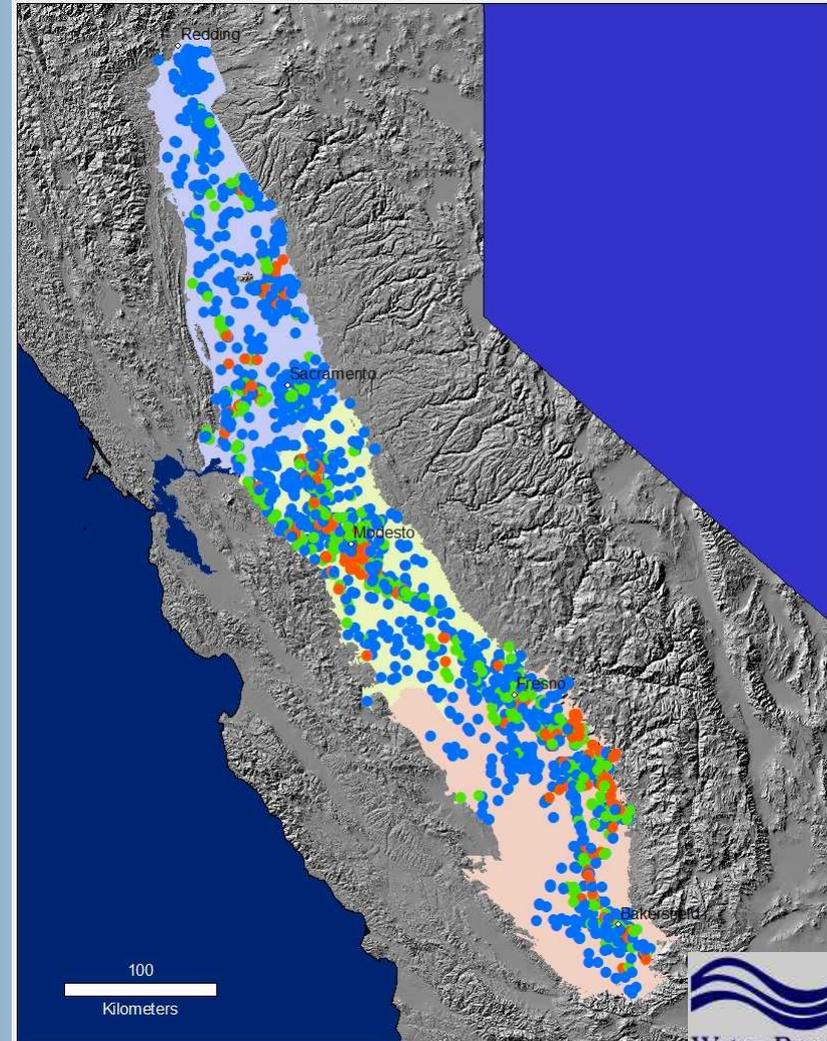


San Joaquin Valley



Tulare Basin

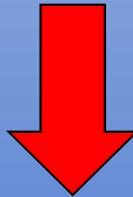
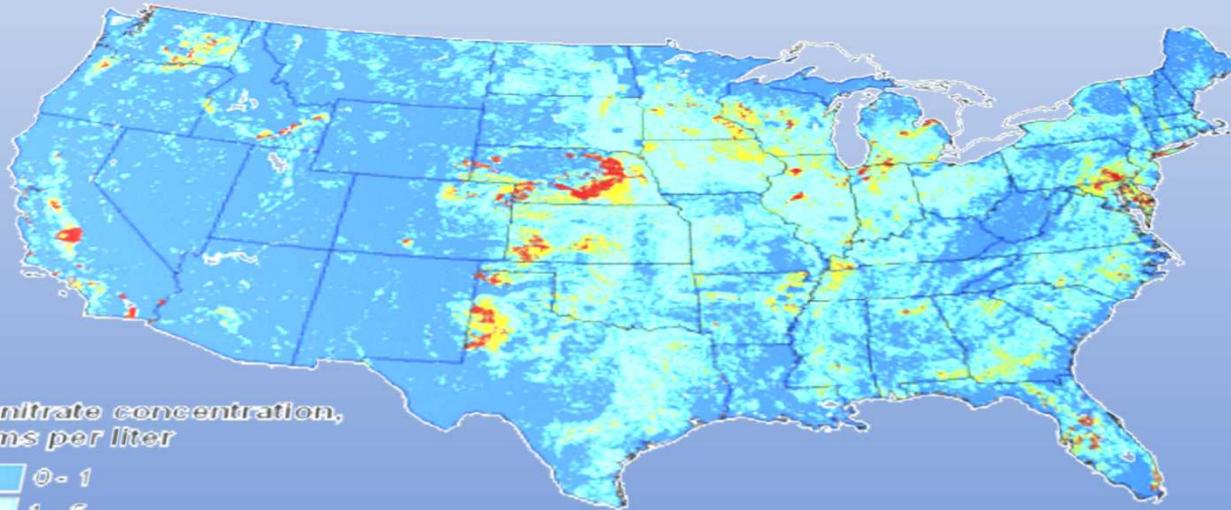
NITRATE, "PUBLIC SUPPLY AQUIFER"



- High
- Moderate
- Low

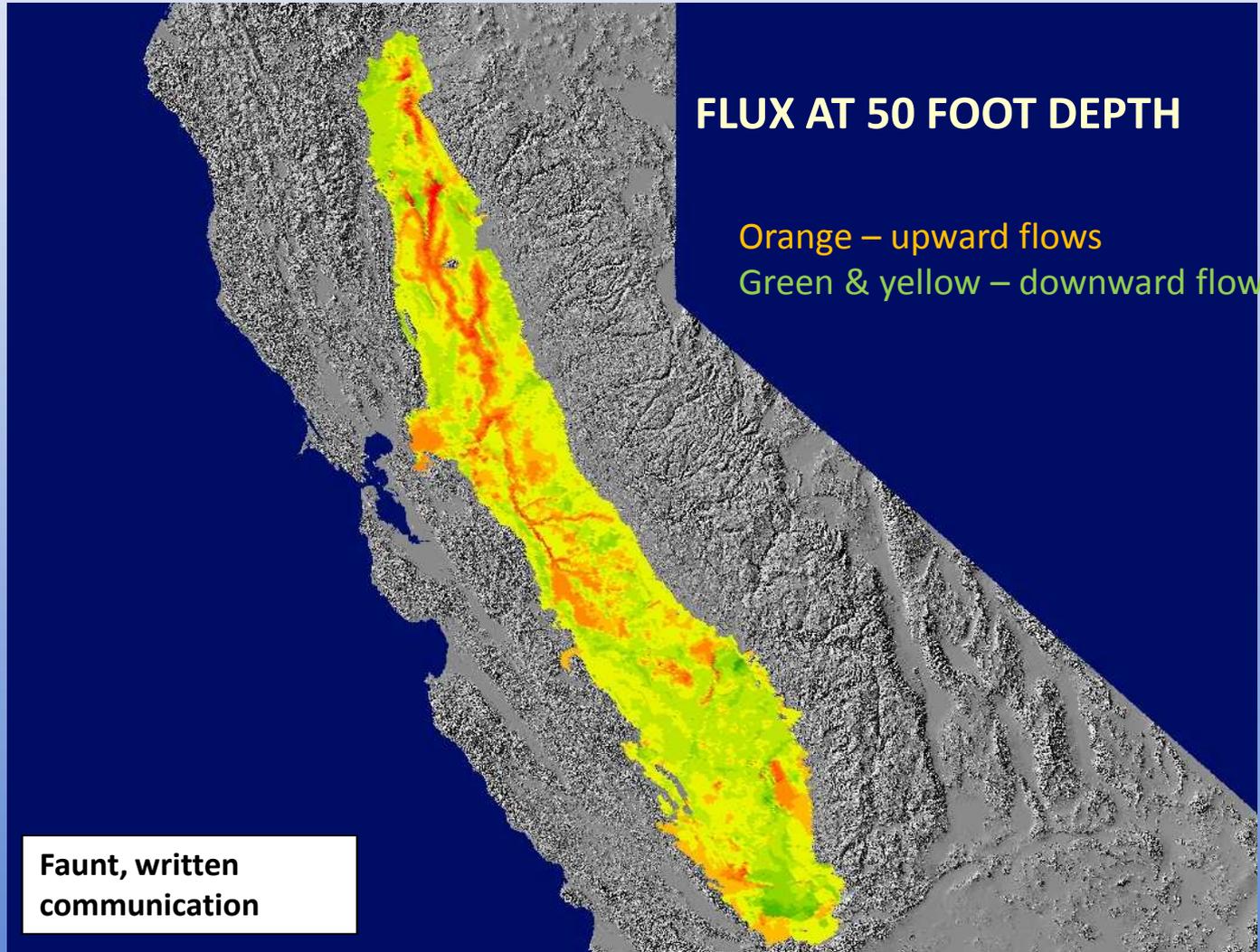
ASSESS QUALITY OF GROUND WATER USED FOR DOMESTIC AND PUBLIC SUPPLY

NITRATE CONCENTRATIONS IN SHALLOW GROUNDWATER (Nolan and Hitt, 2006)



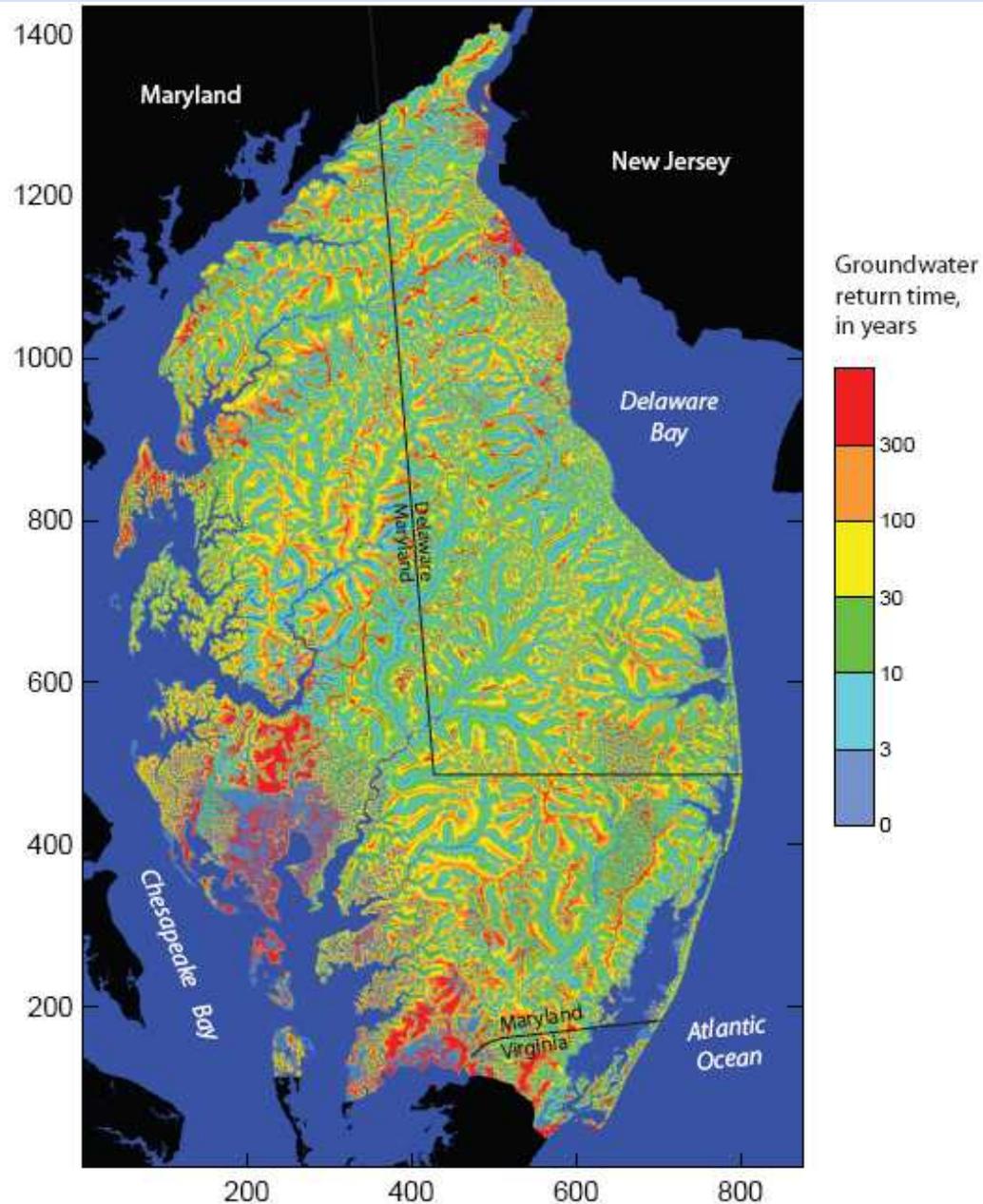
WHAT IS THE DISTRIBUTION OF NITRATE IN GROUNDWATER USED FOR PUBLIC SUPPLY?

FLOW MODELS PROVIDE INPUT FOR STATISTICAL MODELS



STATISTICAL MODELS ARE IMPROVED IF DATA FROM FLOW MODELS IS INCORPORATED

ASSESS THE IMPACT OF LEGACY CONTAMINATION ON STREAMS
REGIONAL SCALE FLOW MODELS PROVIDE ESTIMATES OF ARRIVAL TIME DISTRIBUTIONS TO STREAMS



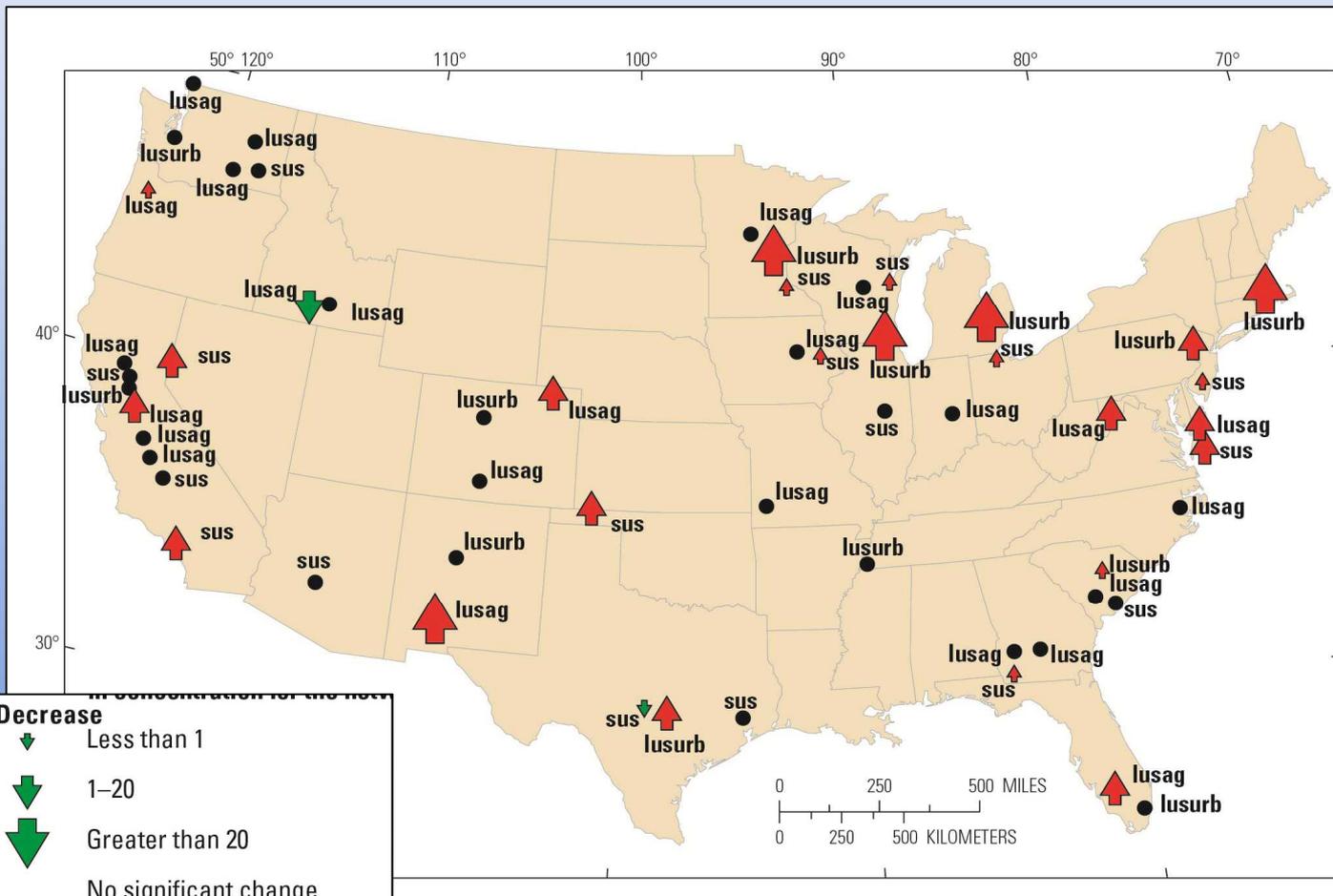
MODELS + DATA
FPS / IWS

Sanford, written
communication

KEY OUTCOMES FOR ALL GW MODELING STUDIES

- **Use models to identify factors that have explanatory power for mapping groundwater quality**
- **Explanatory factors (ideally) should be identifiable in the absence of quantitative groundwater flow (& transport) models**
- **What are the surficial/landscape surrogates for the explanatory factors?**
- **Develop maps at regional, Principal Aquifer, & National scales**

ASSESS CHANGES IN GROUNDWATER QUALITY



Increase	Decrease	
		Less than 1
		1-20
		Greater than 20
		No significant change
Network type lusag agricultural land-use study lusurb urban land-use study sus major aquifer study		

**STATISTICALLY SIGNIFICANT CHANGES
IN CHLORIDE, DECADAL SAMPLING**

GROUNDWATER MONITORING AND MODELING

- Data + modeling will be used to map the quality of groundwater at the depth zone used for domestic supply and the depth zone used for public supply
- Data + modeling will be used to assess impacts of legacy contamination on streams → *Integrated Watershed Studies*
- Data + models will be used to assess changes in groundwater quality with time
- Models will be used to forecast groundwater quality under different scenarios of projected change in driving forces → *Forecasting*

GROUNDWATER MONITORING AND MODELING QUESTIONS?