Salts & Nutrients in Groundwater: Considerations for Regulatory Actions

North Coast Regional Water Quality Control Board Meeting

Item No. 6 May 18, 2017

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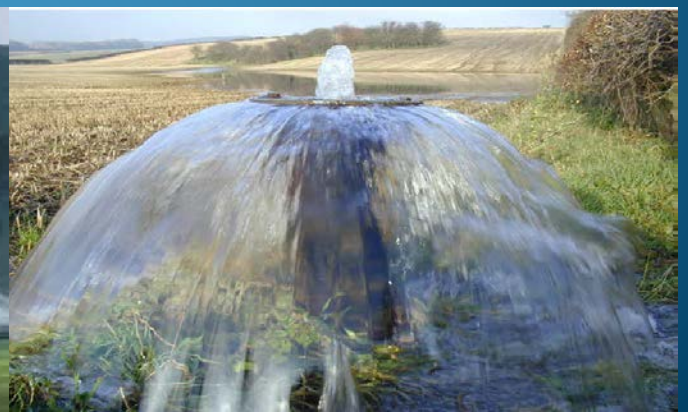


Purpose

- Explanation of the various levels/concentrations for water quality objectives related to salts and nutrients in groundwater
- Explain how permit limitations are developed for salts and nutrients
- Providing basin-wide groundwater data analysis for a few high priority basins to establish background concentrations, existing conditions, and trends

Outline

- Brief overview defining narrative and numeric objectives and recent revisions to Basin Plan
- Conceptual illustration of objectives, antidegradation, and limitations
- In depth look at nitrate and TDS objectives and trends in four priority basins
- Examples of effluent and receiving water limitations in permits

Water Quality Objectives

- Limits or levels of water quality constituents or characteristics established for the
  - Reasonable protection of beneficial uses of water or the
  - Prevention of nuisance within a specific area

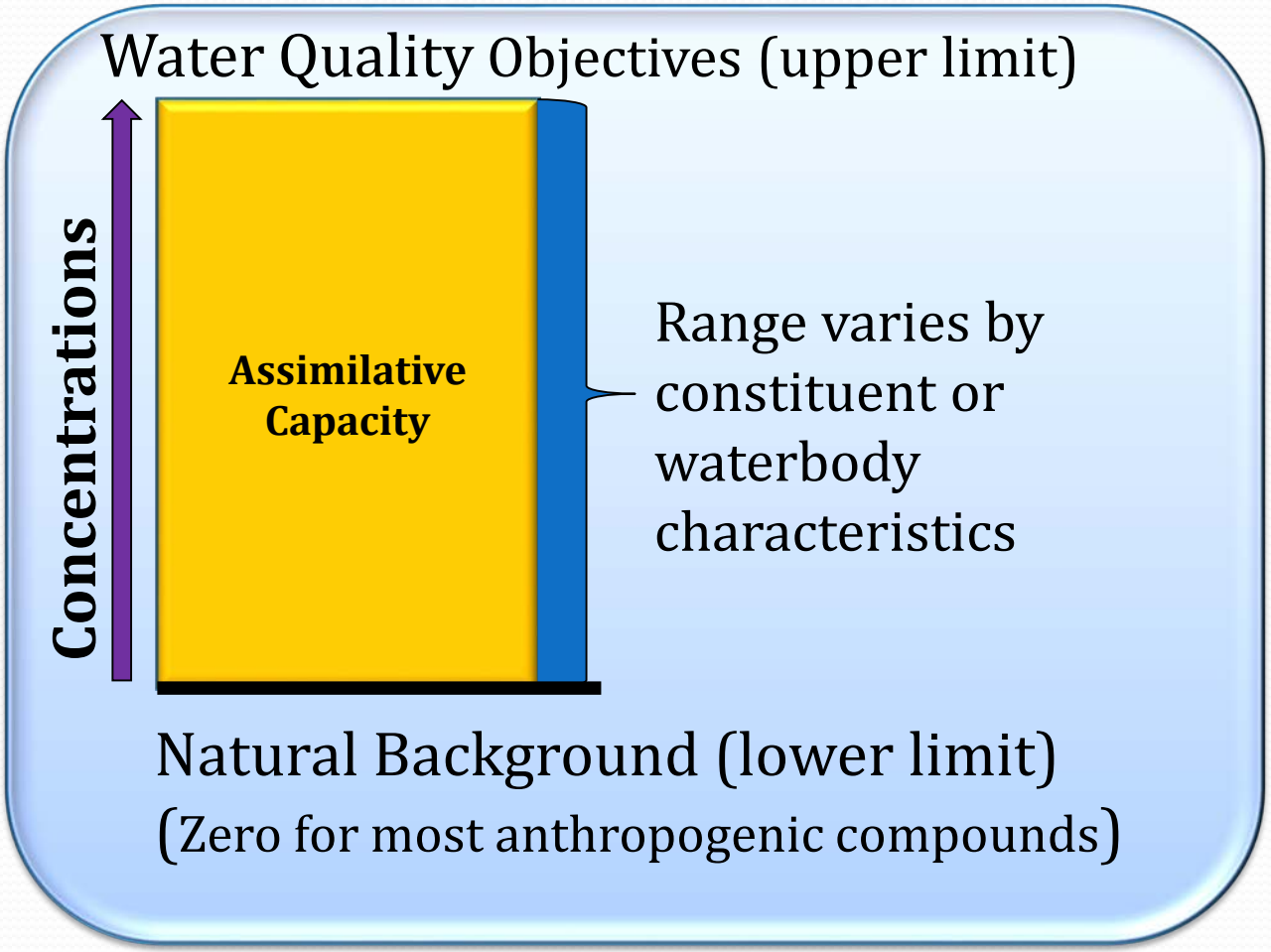
- Come in two forms
  - Numeric – specific concentration limit
  - Narrative – describes a requirement or prohibits a condition harmful to beneficial uses

Compliance with Water Quality Objectives

North Coast Region Basin Plan Chapter 3, §3.6.1, *Discharge Limitation and Cleanup Levels*

- In setting waste discharge requirements the Board will consider
  - water quality objectives &
  - the Antidegradation Policy
- In setting discharge limitations and cleanup levels the Board
  - need not authorize the utilization of the full assimilative capacity
  - may adopt limitations more stringent

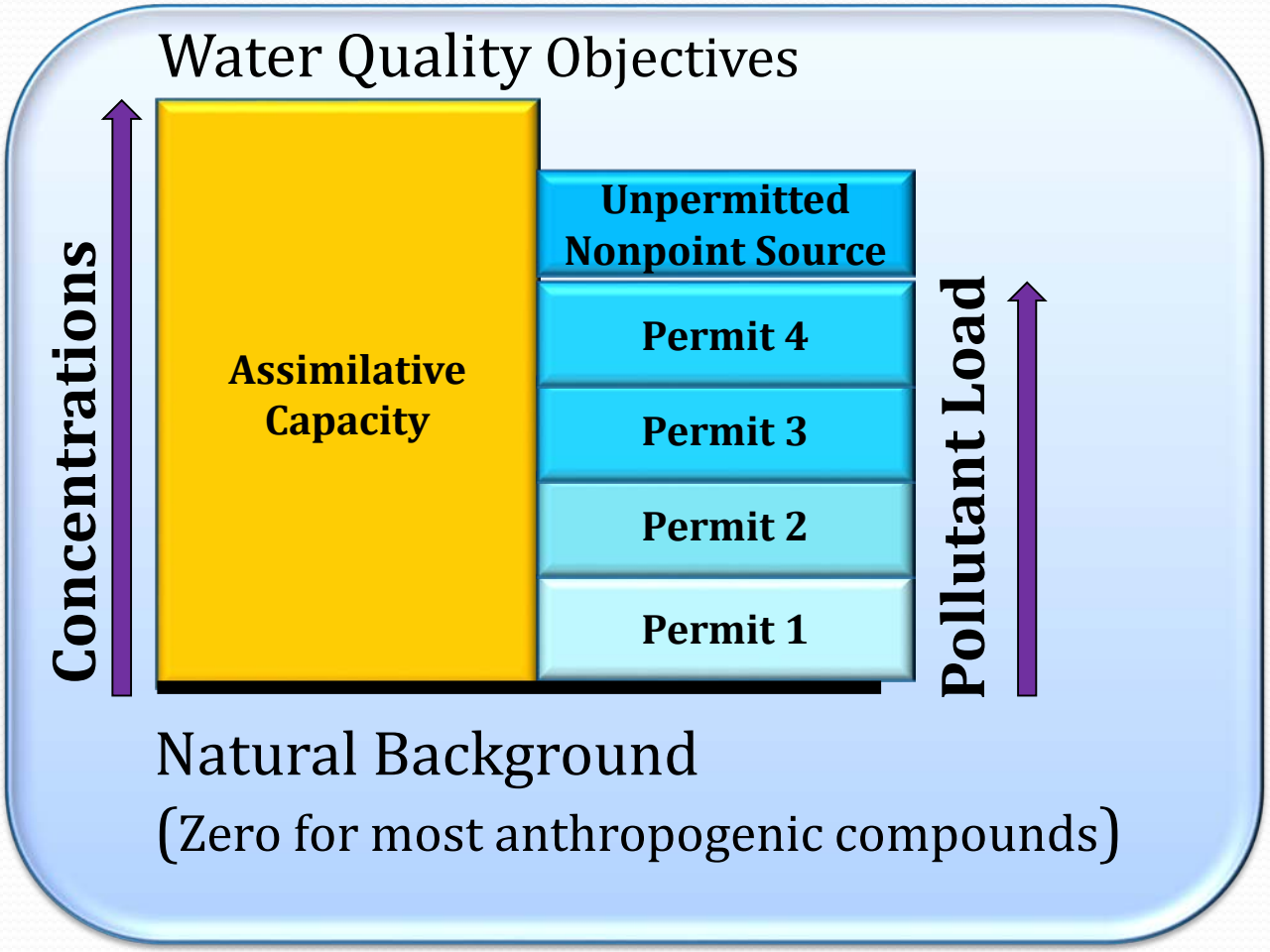
Discharge Limits & Cleanup Levels



Protect Beneficial Uses

Antidegradation Policy (Maintain High Quality Waters)

Discharge Limits & Cleanup Levels

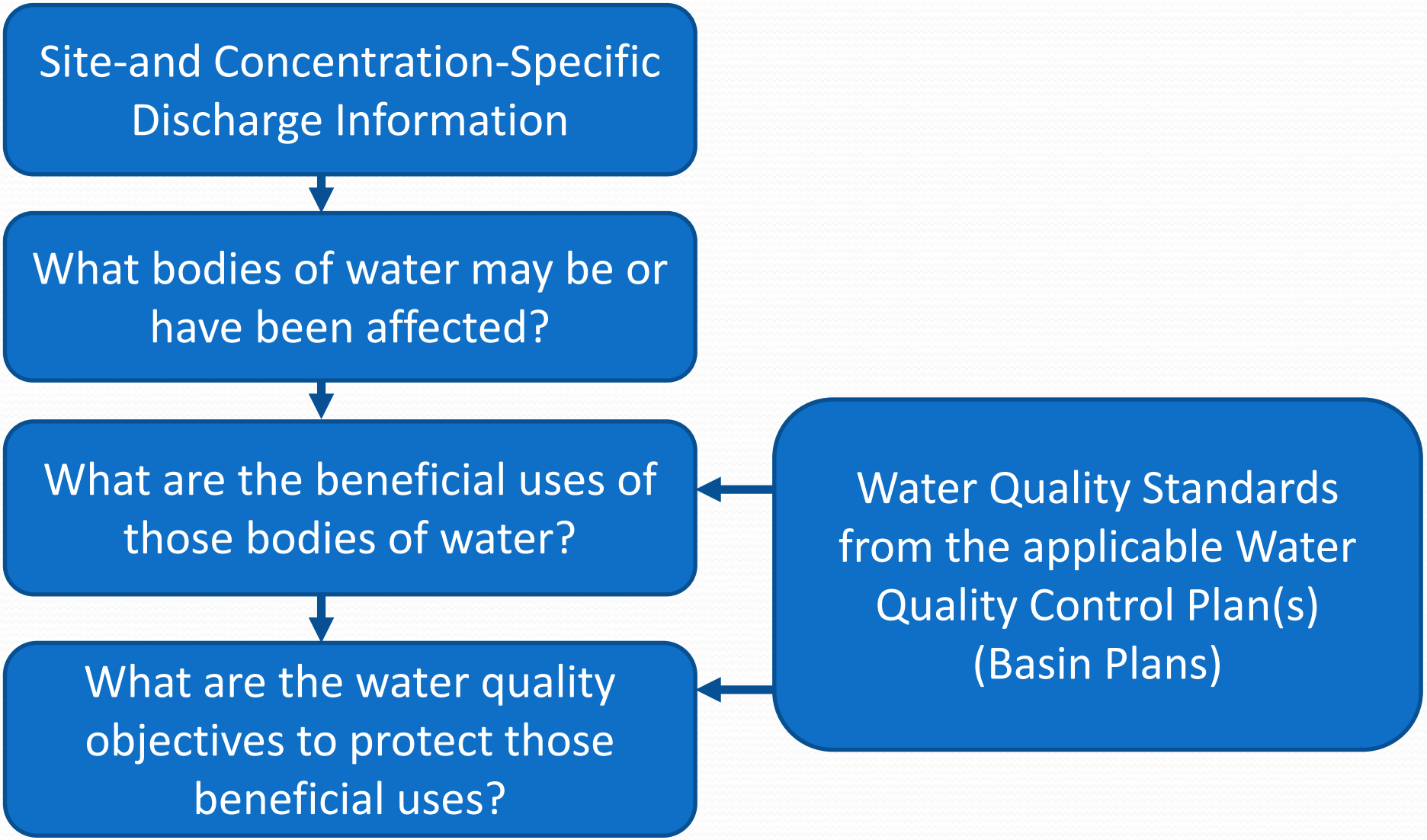


Water Code §13263

Water Quality Objective for Nitrate

Primary Maximum Contaminant Levels	
Nitrate	10 mg/L as Nitrogen
	45 mg/L as Nitrate

Determining Limitations



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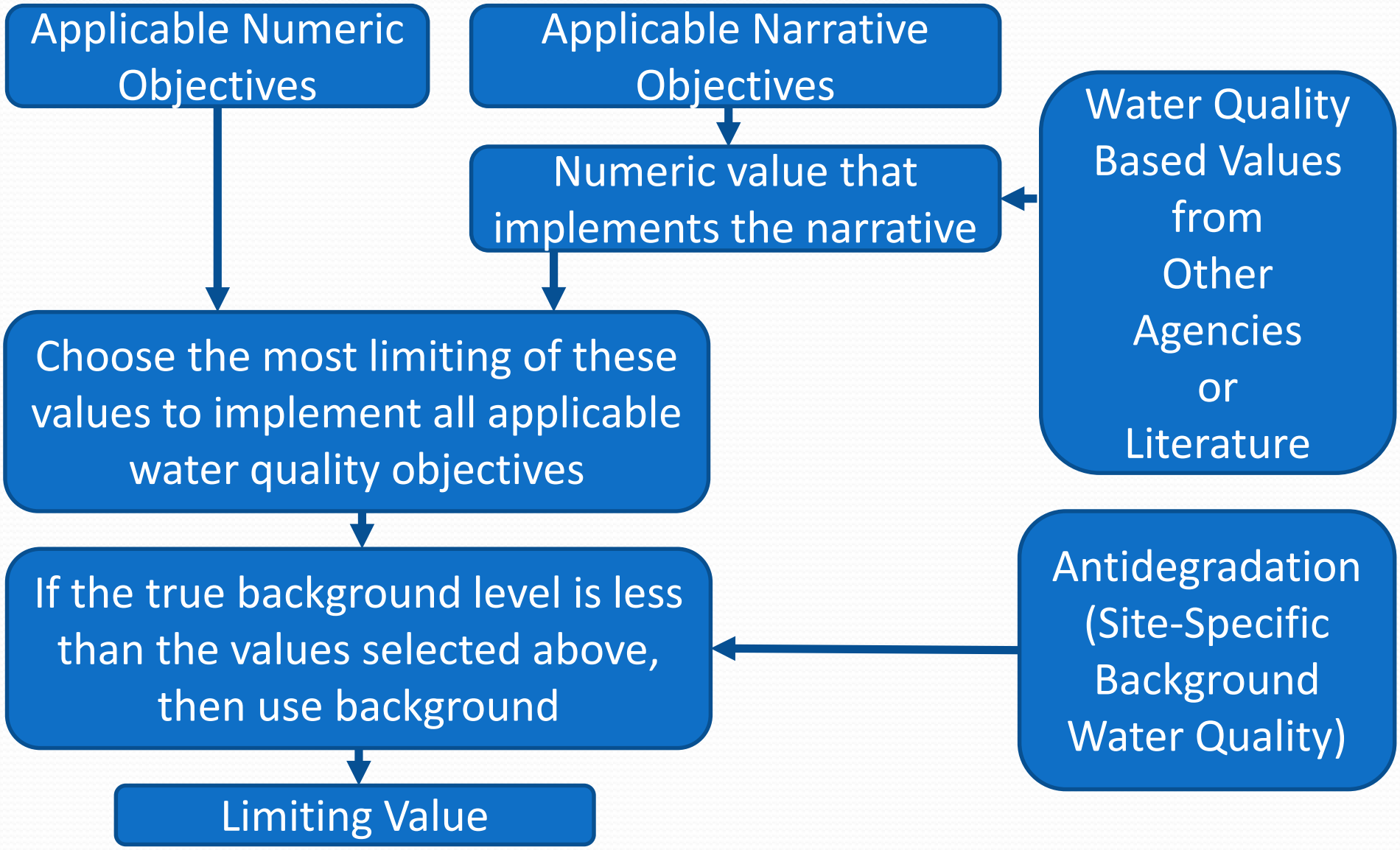
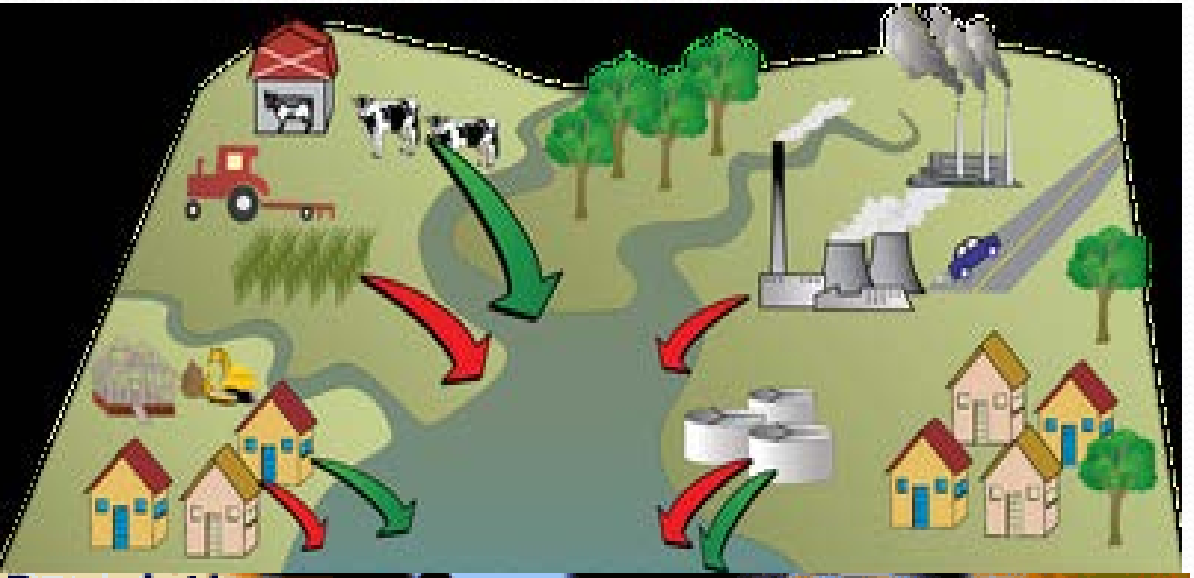
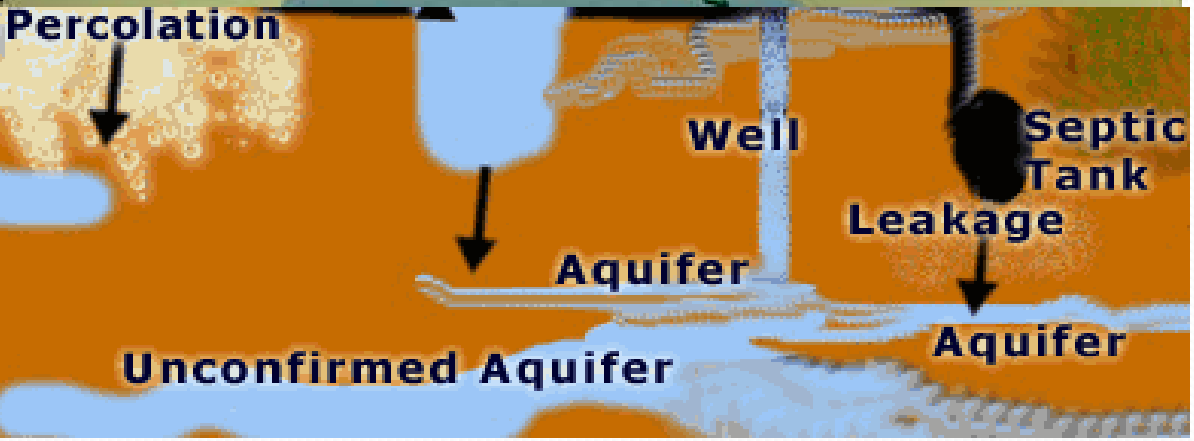
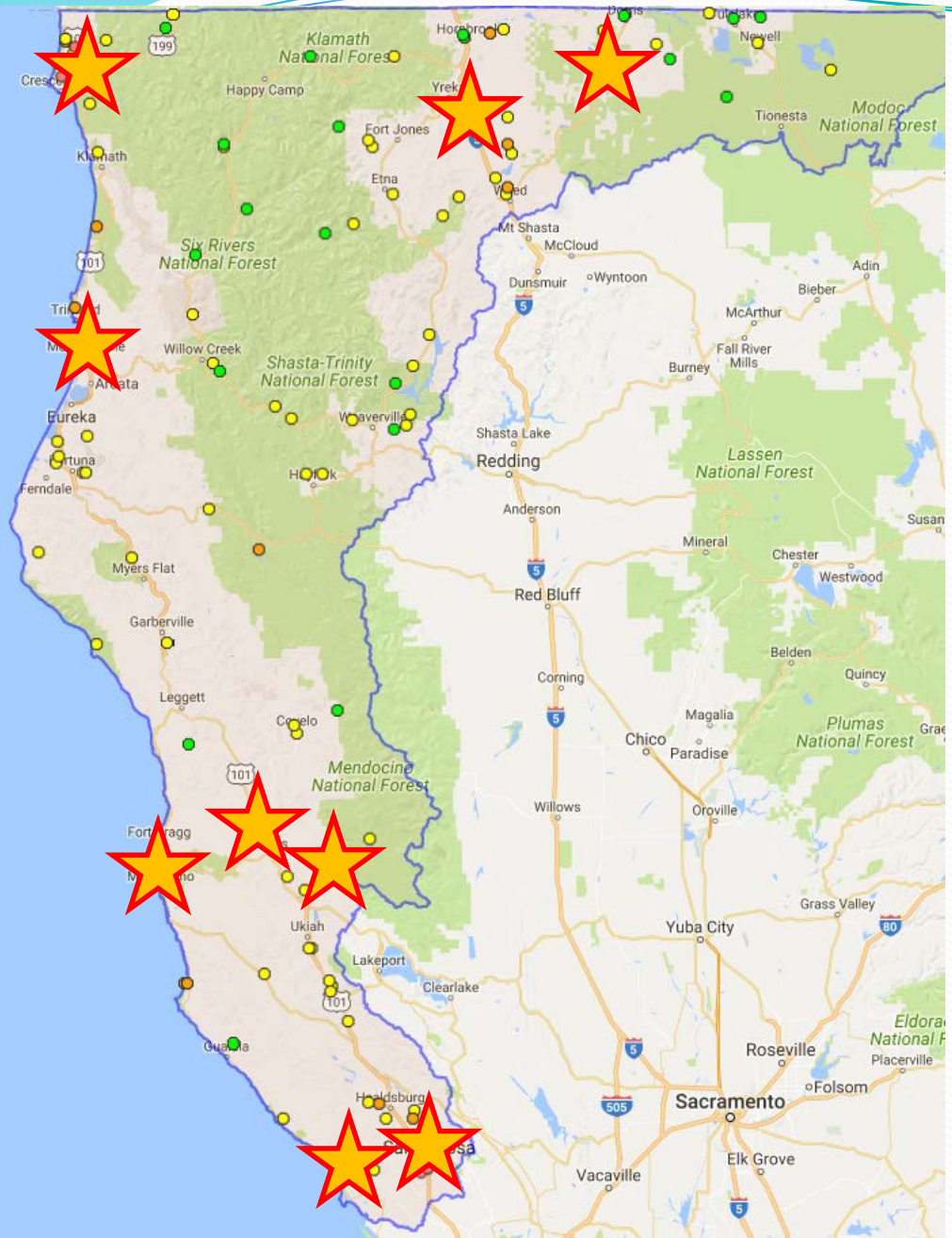


Sources of Nitrate





- Fertilizers
- Septic Systems
- Municipal Wastewater
- Irrigated Agriculture
- Dairies and CAFOs
- Manure
- Leaky Sewer Lines
- Natural & other animals



Drinking Water Supply Wells with Nitrate Exceedances:

- Smith River Plain
- Shasta Valley
- Butte Valley
- Mad River – Dows Prairie School Area
- Potter Valley
- Little Lake Valley (Willits)
- Fort Bragg Terrace
- Santa Rosa Plain
- Wilson Grove Formation

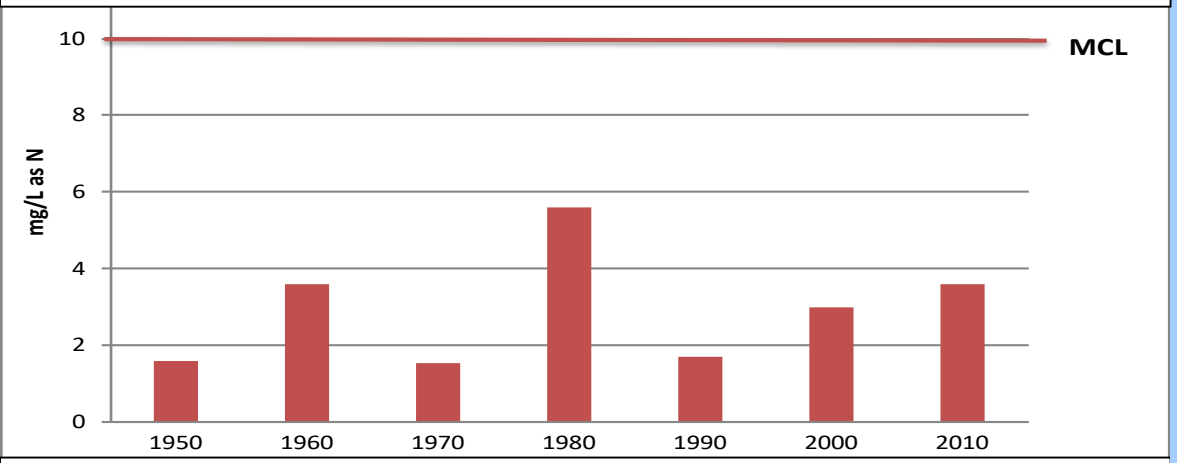
Groundwater Ambient Monitoring and Assessment Database

GeoTracker / GAMA datasets include:

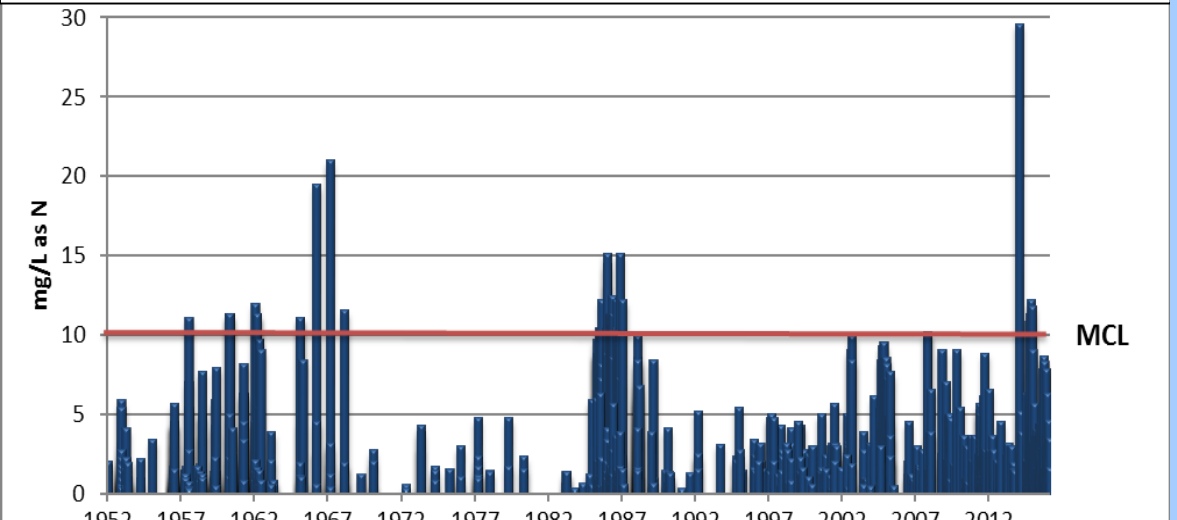
- Public Water System Wells
- Department of Pesticide Regulation
- Department of Water Resources Data Library
- National Water Information System
- GAMA/USGS – Special Studies
- GAMA/USGS – Priority Basin Project
- GAMA – Domestic Wells

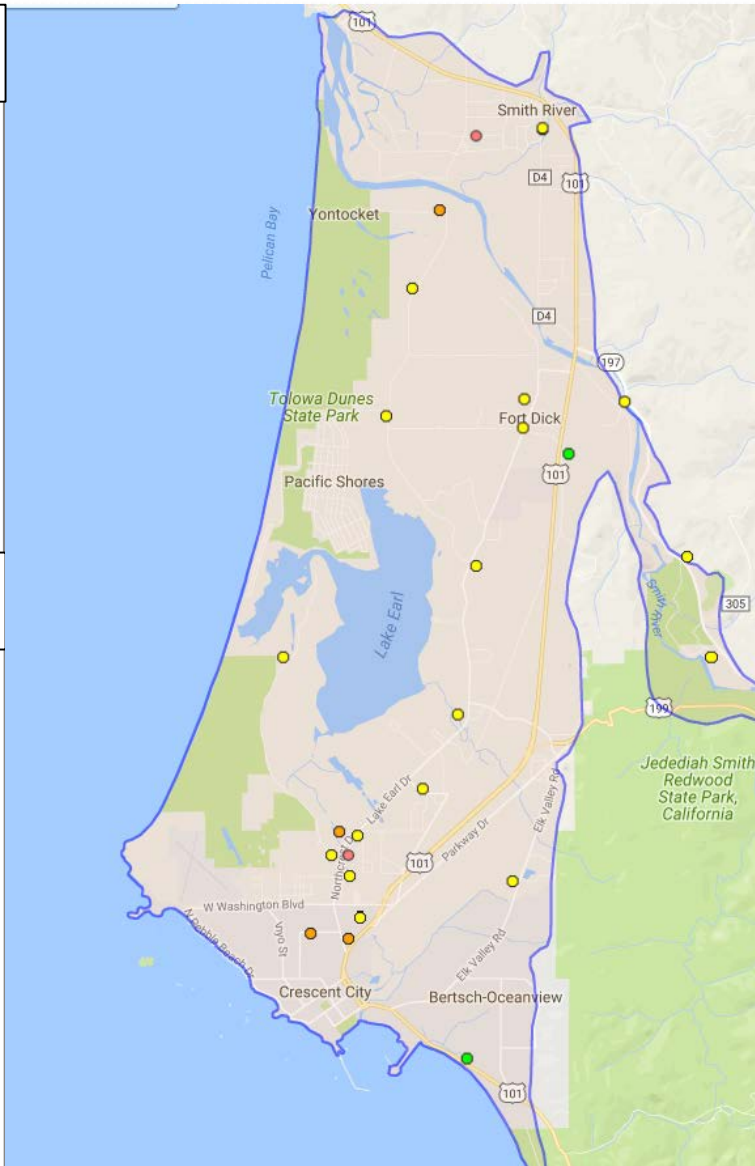
Smith River Plain

Nitrate Average Per Decade



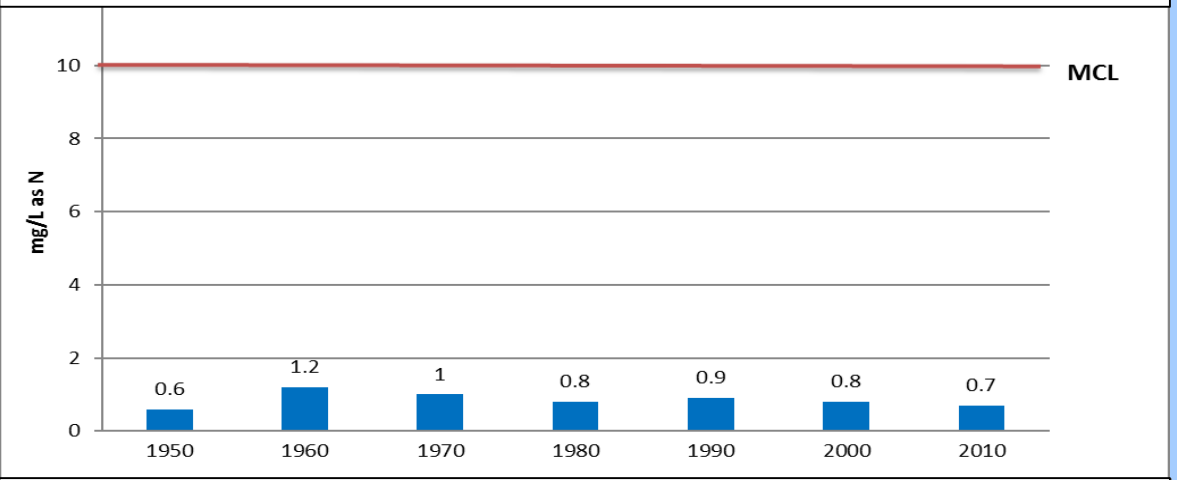
Individual Nitrate Samples





Eel River Valley

Nitrate Average Per Decade



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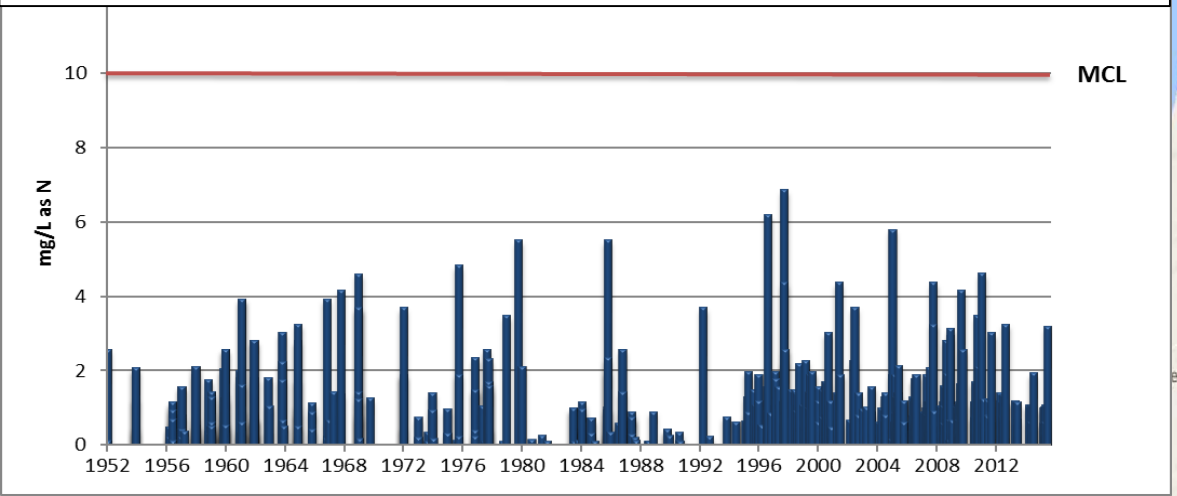

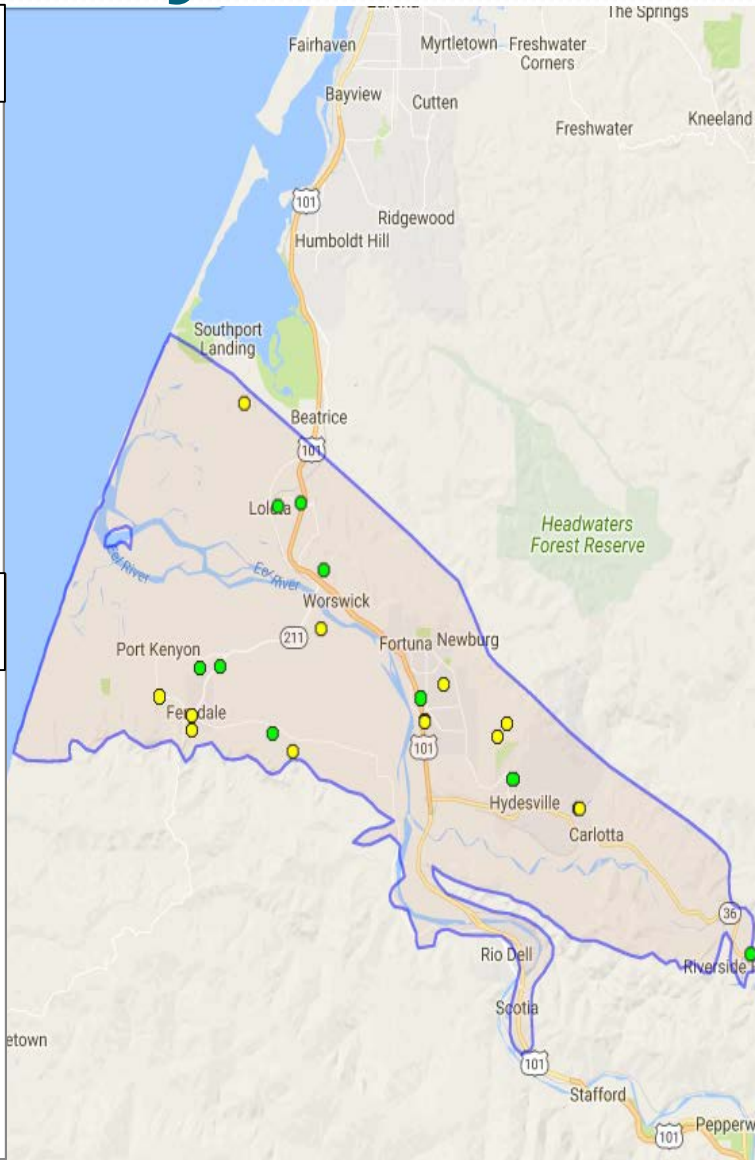

Eel River Valley

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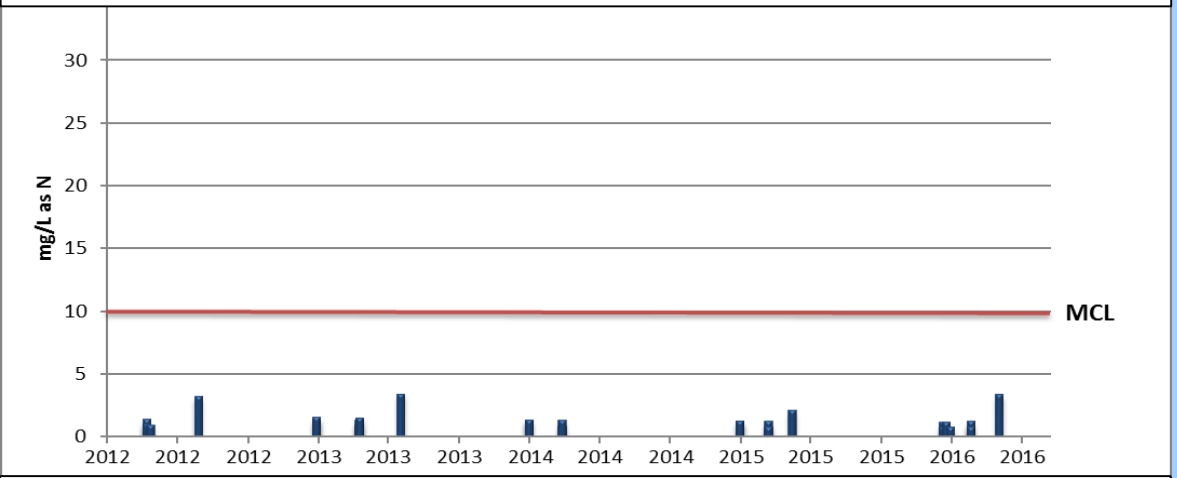

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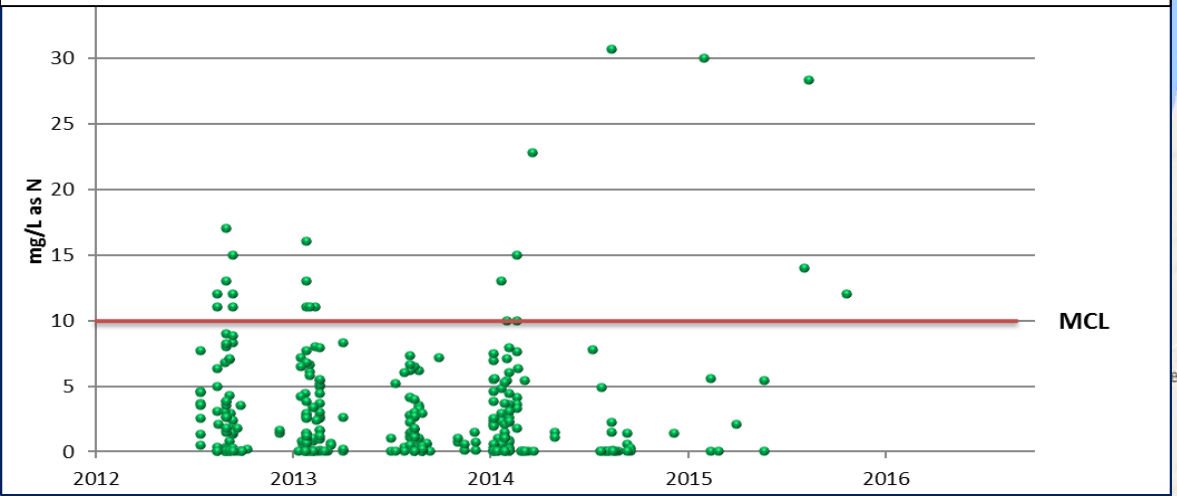
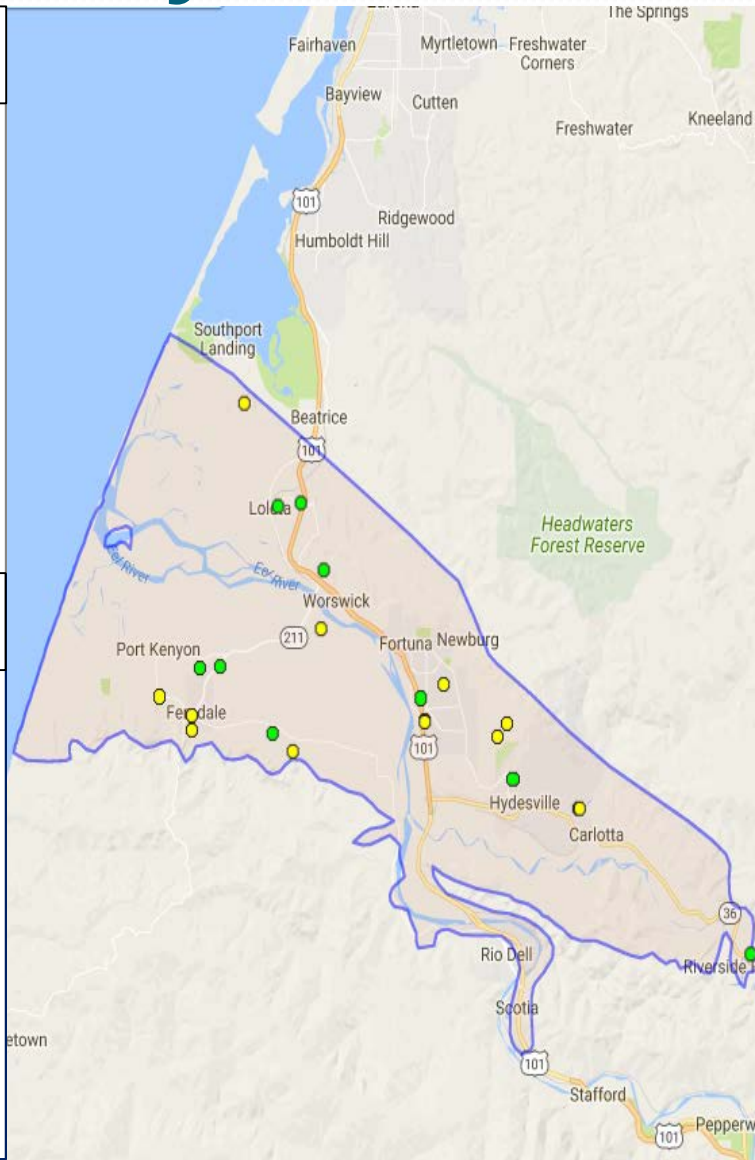
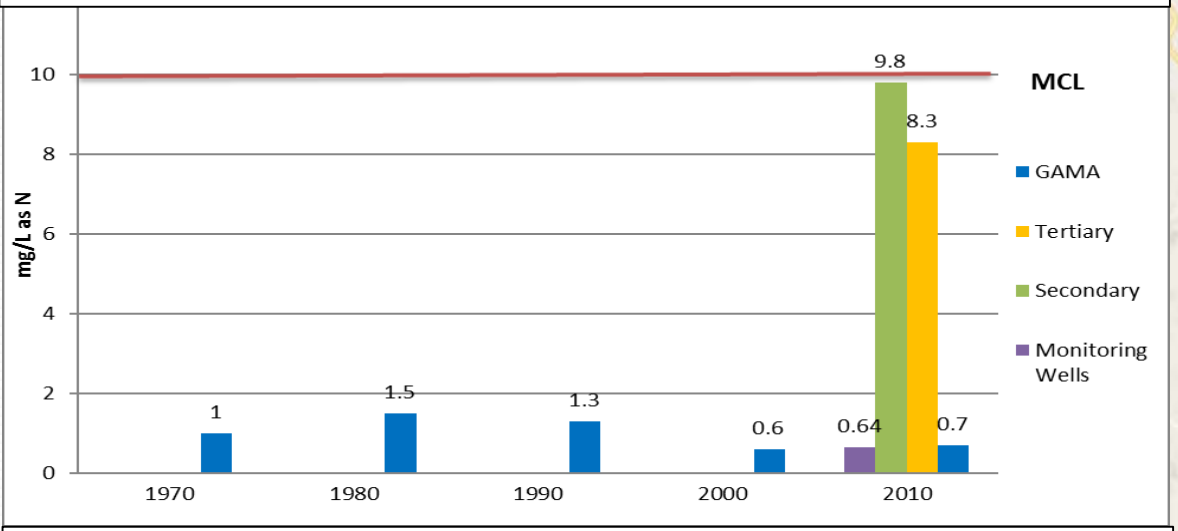




Ukiah Valley

Nitrate Average Per Decade



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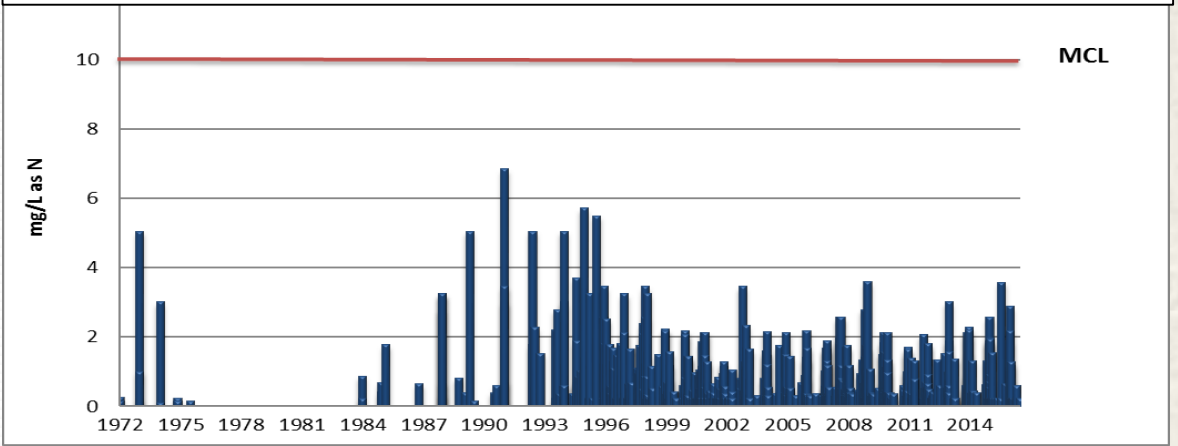
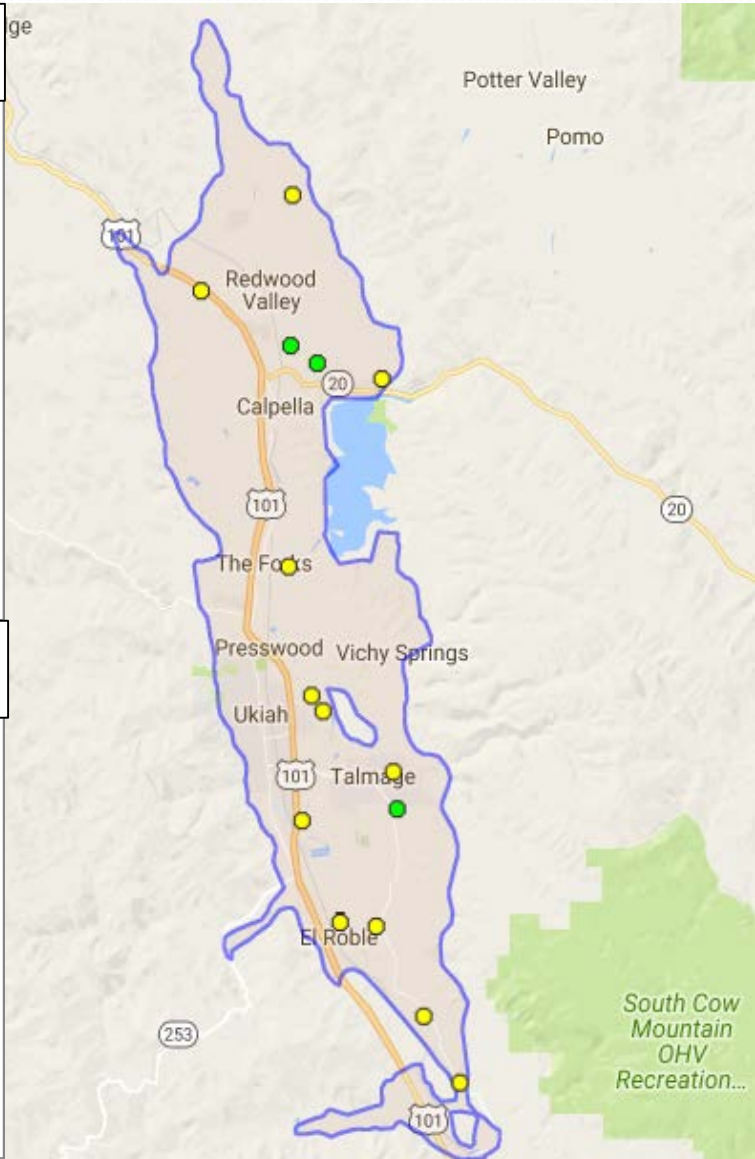
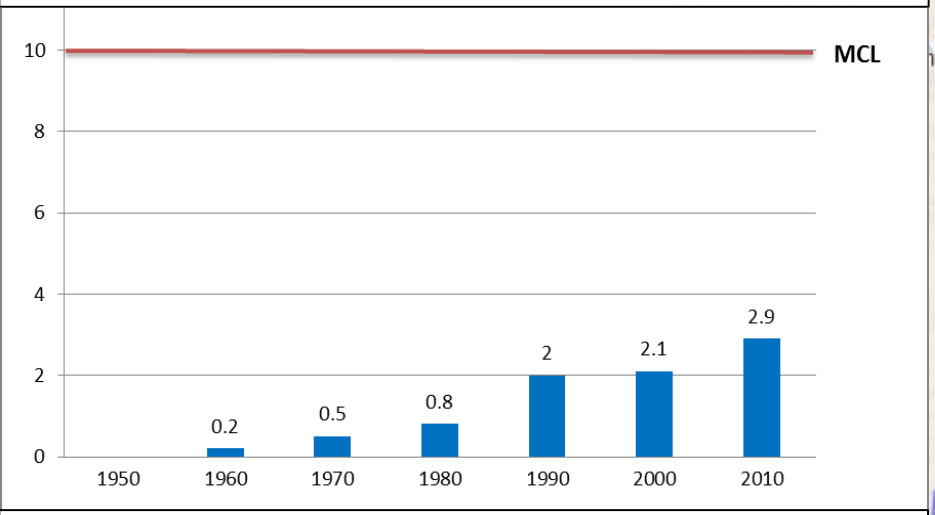




Wilson Grove Formation

Nitrate Average Per Decade



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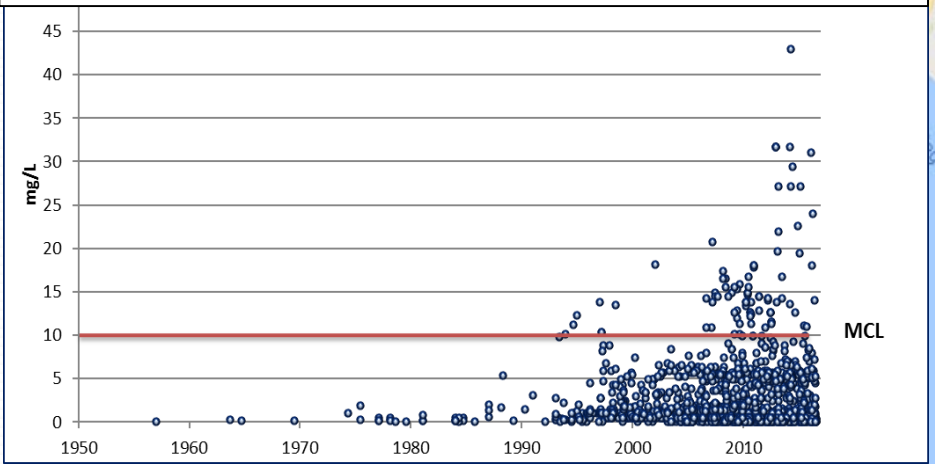
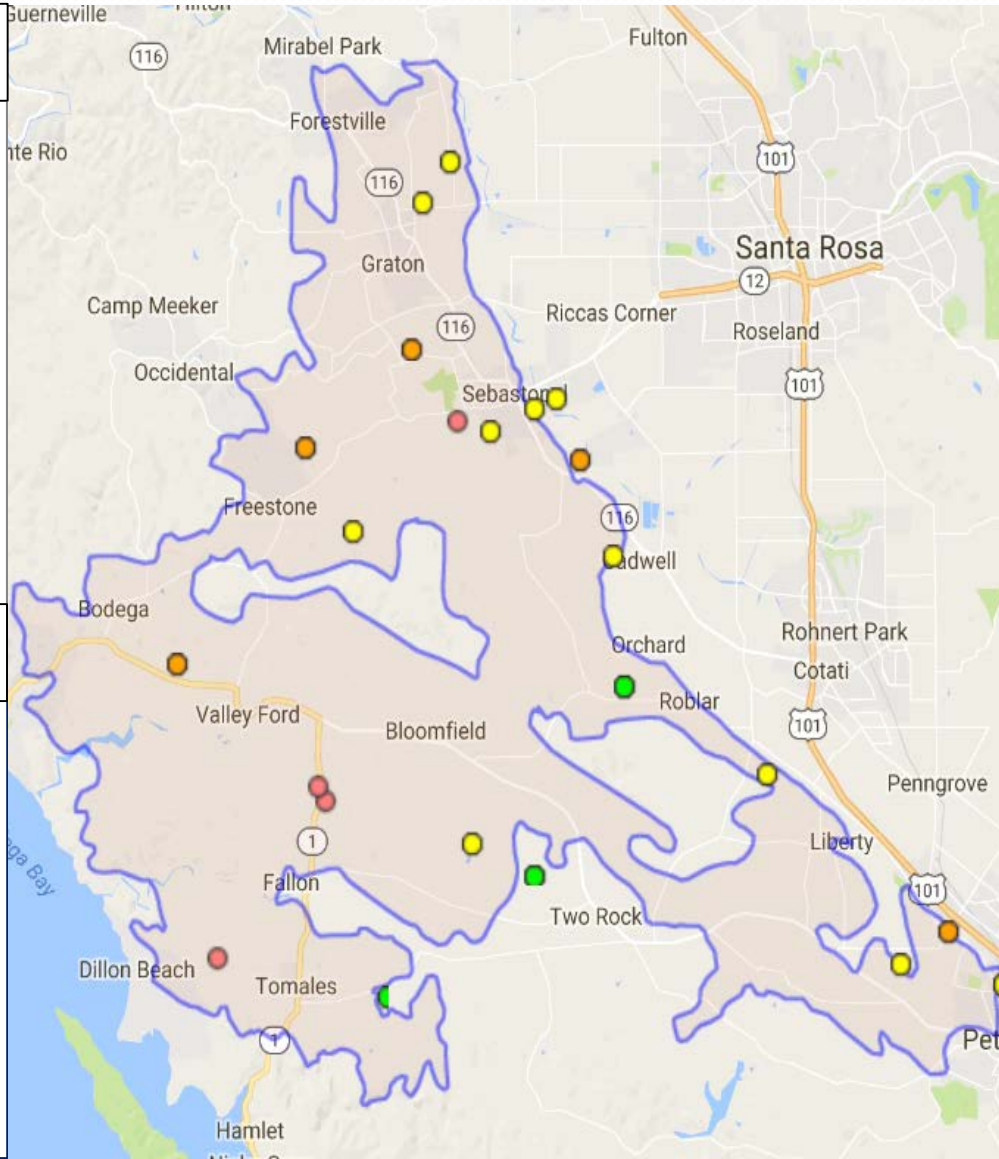




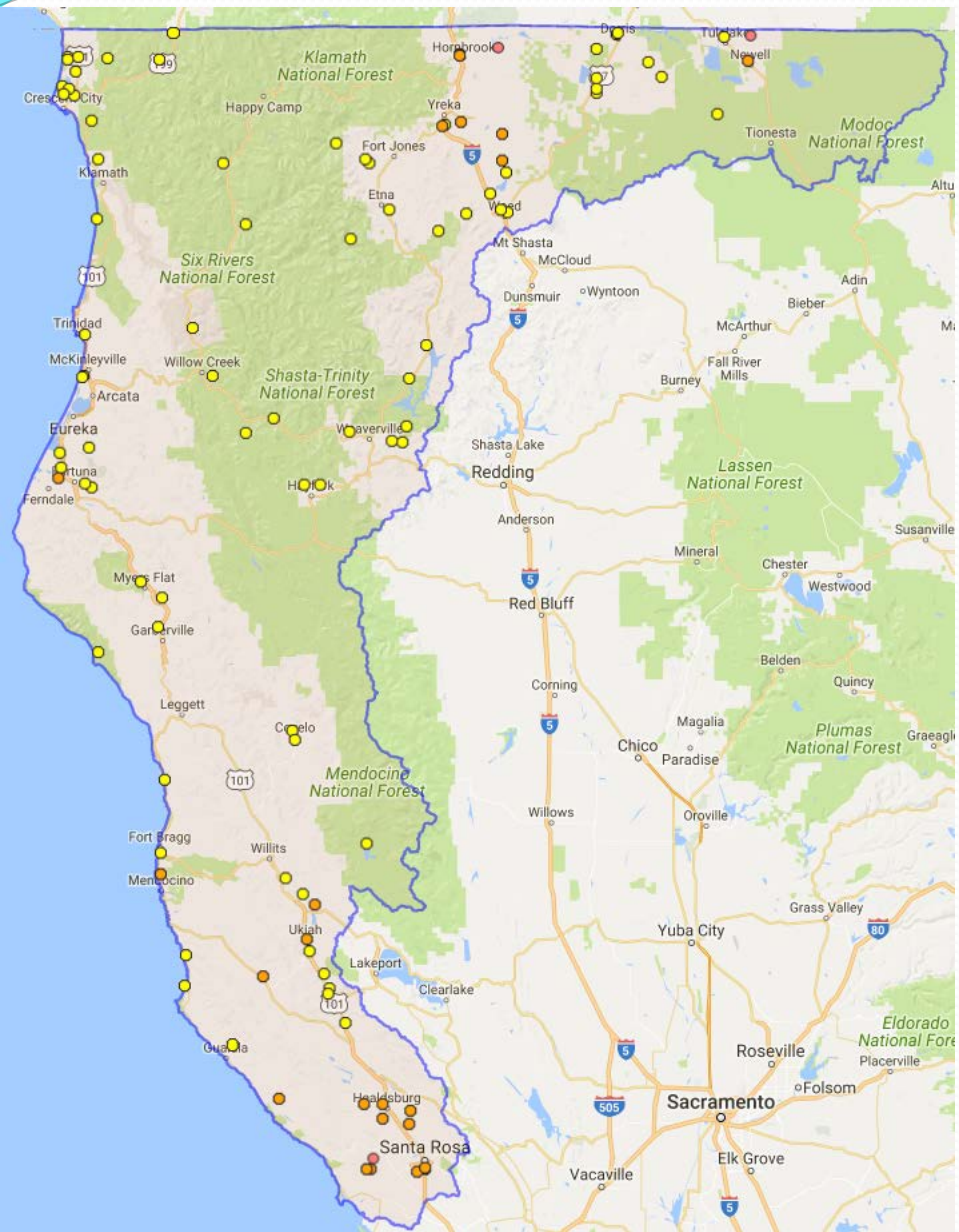
Wilson Grove Formation

Samples that exceed the nitrate MCL of 10 mg/L						
Decade	1960	1970	1980	1990	2000	2010
Number of samples >10	0	0	0	7	24	54
Total Samples	4	11	18	154	680	756
Percent of Samples >10	0%	0%	0%	4.5%	3.5%	7.1%

Nitrate Limits in Permits

- Most permits for groundwater & discharge limits = 10 mg/L
- Some may be higher accounting for agronomic rates and nitrogen uptake by plants

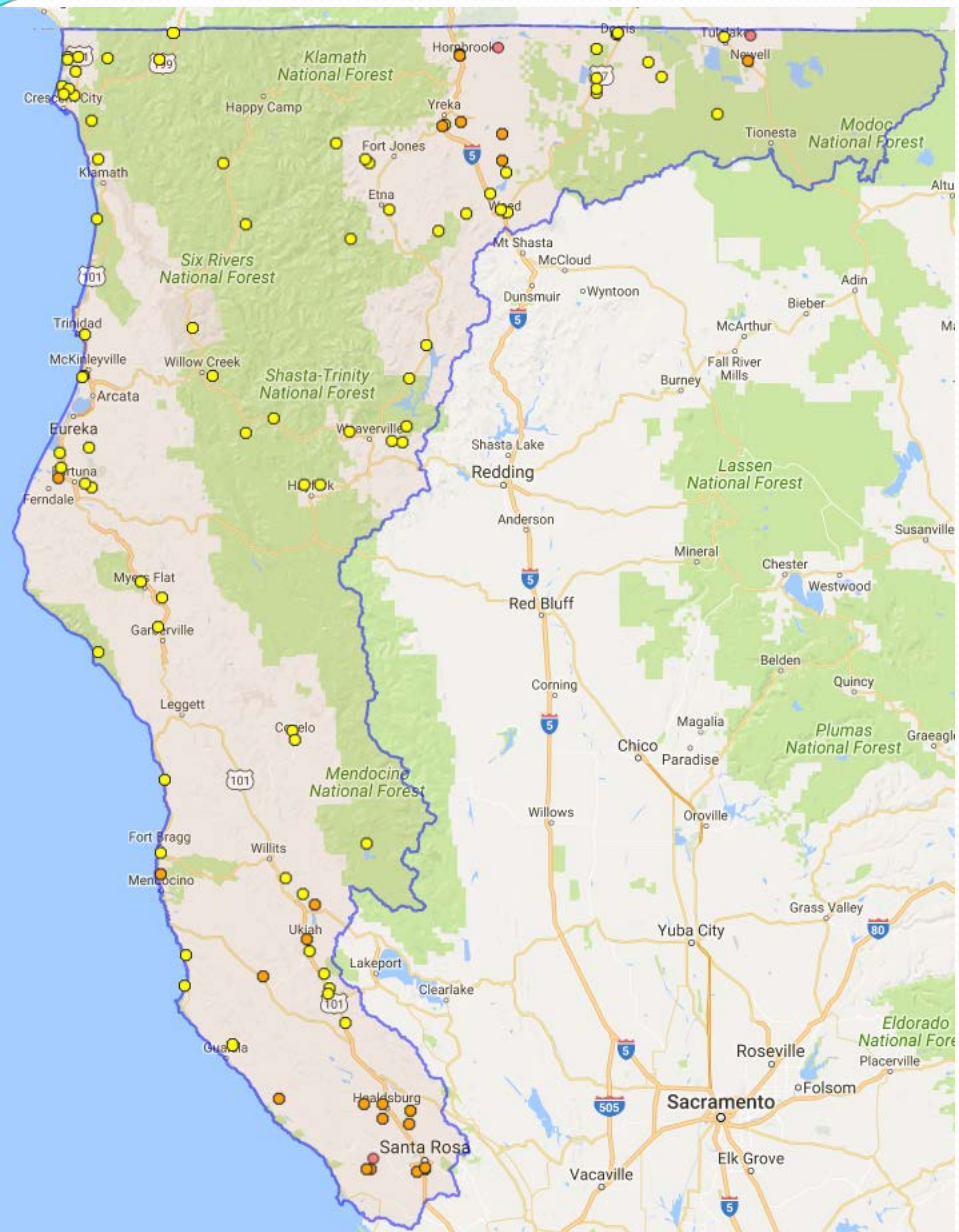
Salts



Typically measured as Total Dissolved Solids (TDS)

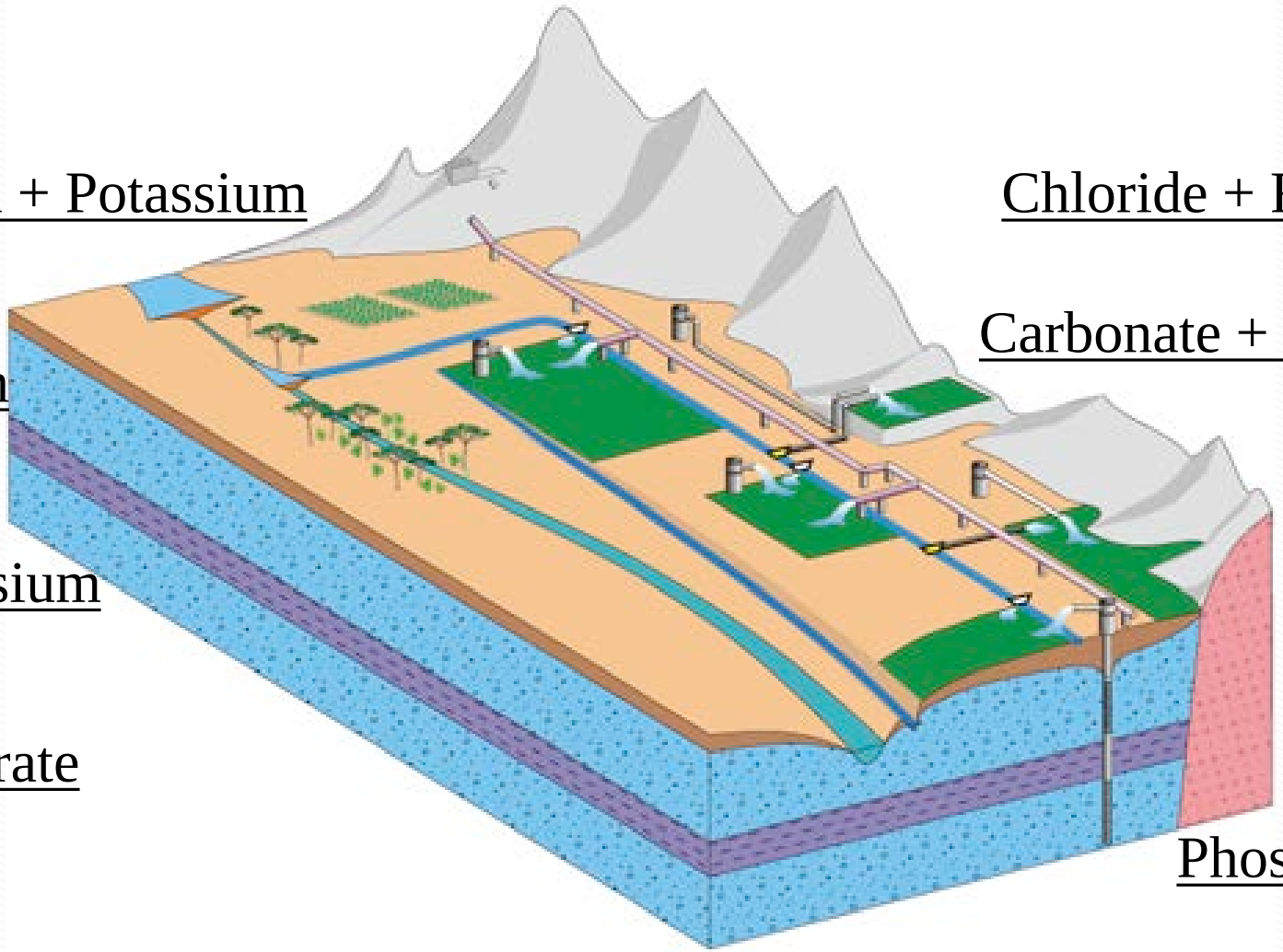
- Precipitation 10 mg/L
- Pristine Freshwater Lakes and Rivers 10 to 200 mg/l
- Agricultural Impact to Sensitive Crops 450 mg/l
- Avg. Seawater 35,000 mg/L
- Brines >50,000 mg/L
- Groundwater 100 to >50,000 mg/L

Sources of Salinity



- Natural geology
- Irrigation
- Synthetic fertilizers
- Manures
- Wastewater (municipal POTWs & food processors)
- Water Softeners
- Seawater Intrusion

Total Dissolved Solids



Sodium + Potassium

Calcium

Magnesium

Nitrate

Chloride + Fluoride

Carbonate + bicarbonate

Sulfate

Phosphate

Numeric Water Quality Objectives for Chemical Constituents

Title 22 of the California Code of Regulations: Secondary Maximum Contaminant Levels Taste, Odor & Nuisance			
Constituent	**Recommended**	**Upper**	**Short Term**
TDS mg/L	500	1,000	1,500
Chloride mg/L	250	500	600
Sulfate mg/L	250	500	600

Narrative Water Quality Objectives for Groundwaters

Chemical Constituents and Tastes and Odors

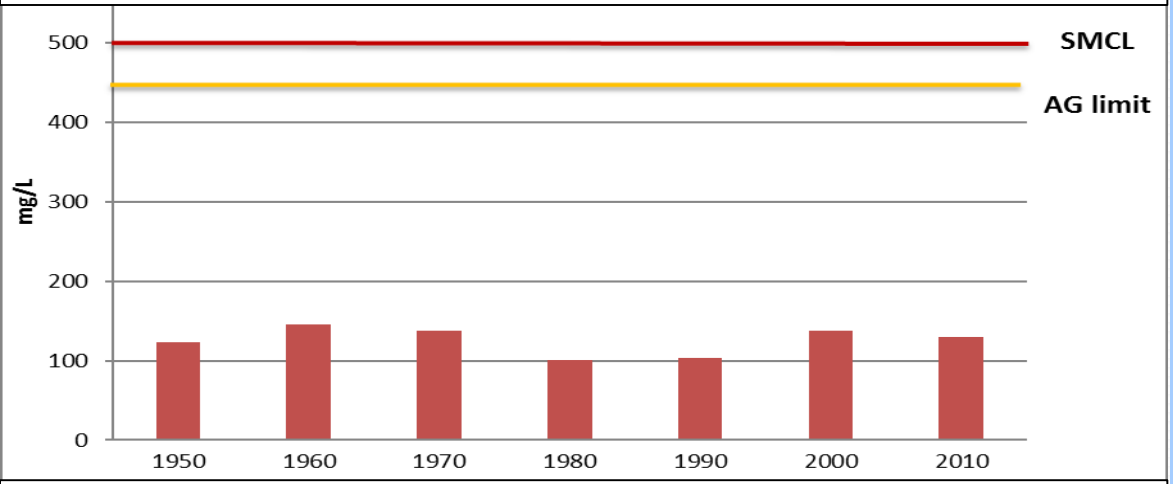
Groundwaters shall not contain concentrations of chemical constituents in amounts that cause nuisance or adversely affect beneficial uses.

Water Quality Objectives for Salinity

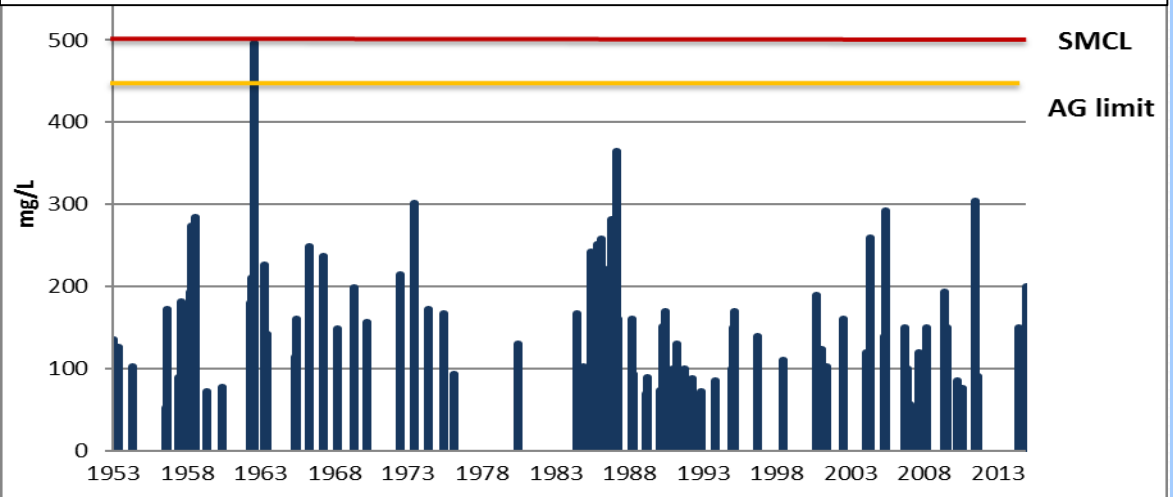
Secondary Maximum Contaminant Levels				Numeric Values Implementing Narrative Objectives	
Constituent	**Recommended**	**Upper**	**Short Term**	**Agricultural Impacts**	**Taste & Odor Thresholds**
TDS mg/L	500	1,000	1,500	450	500
Chloride mg/L	250	500	600	106	250
Sulfate mg/L	250	500	600	NA	250
Sodium mg/L	NA	NA	NA	69	30-60

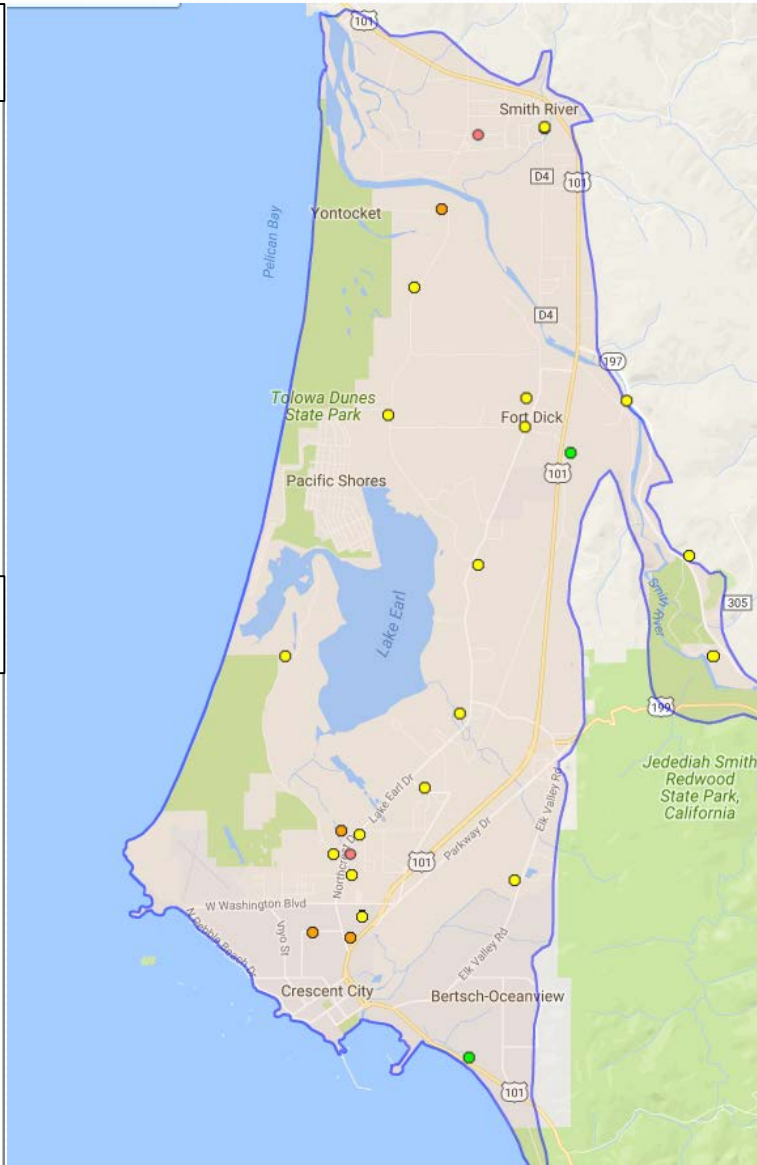
Smith River Plain

TDS Average Per Decade



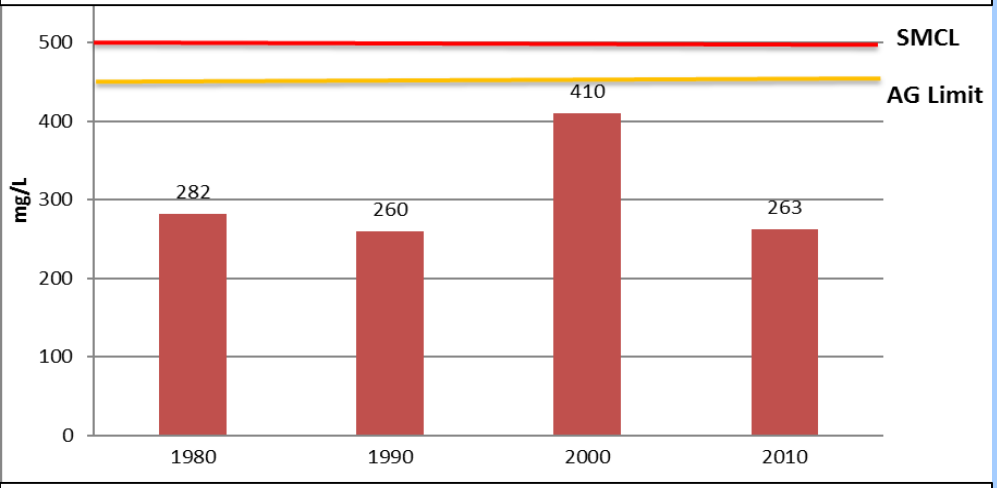
TDS Individual Samples





Eel River Valley

TDS Average per Decade



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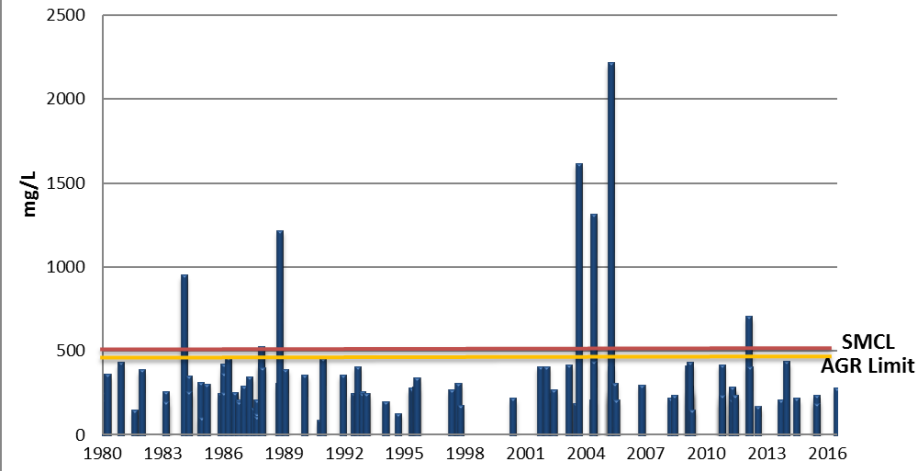
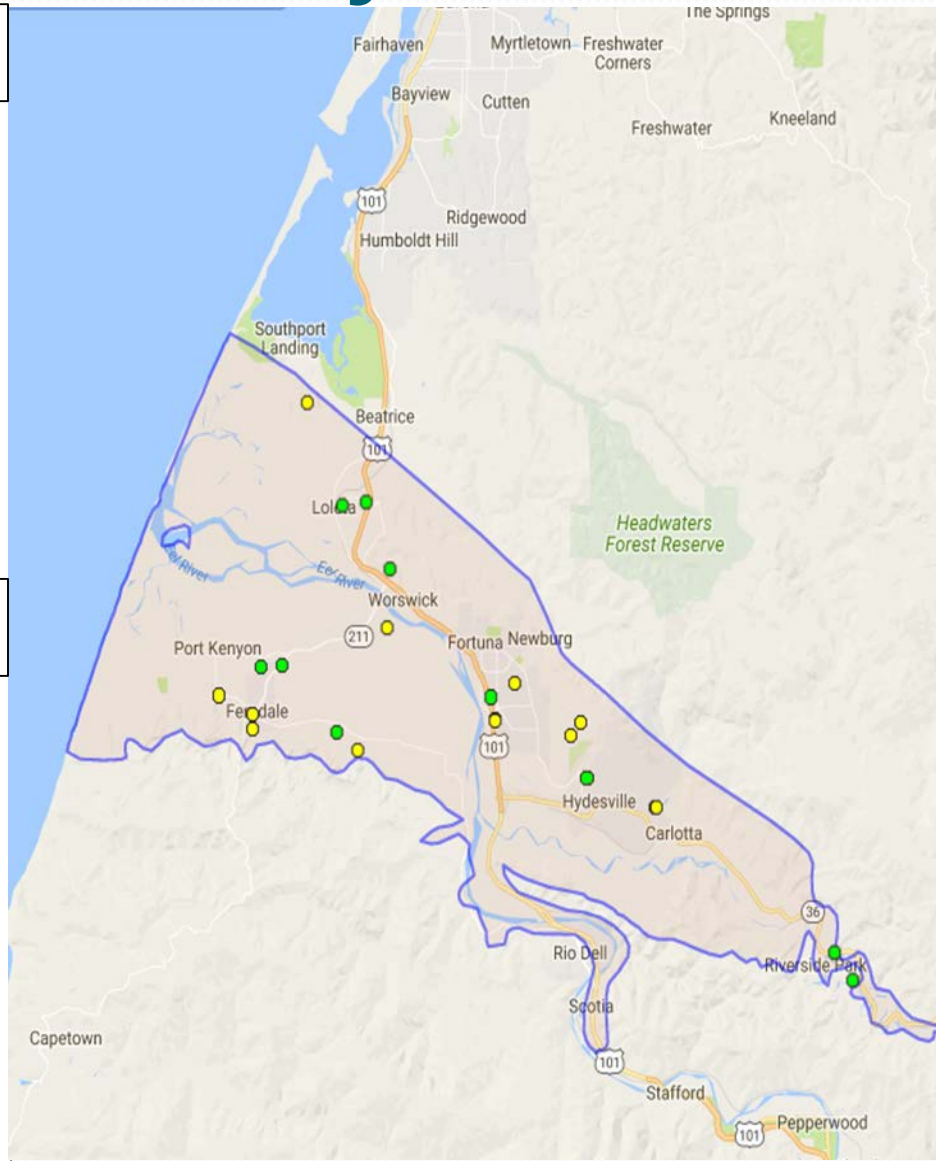
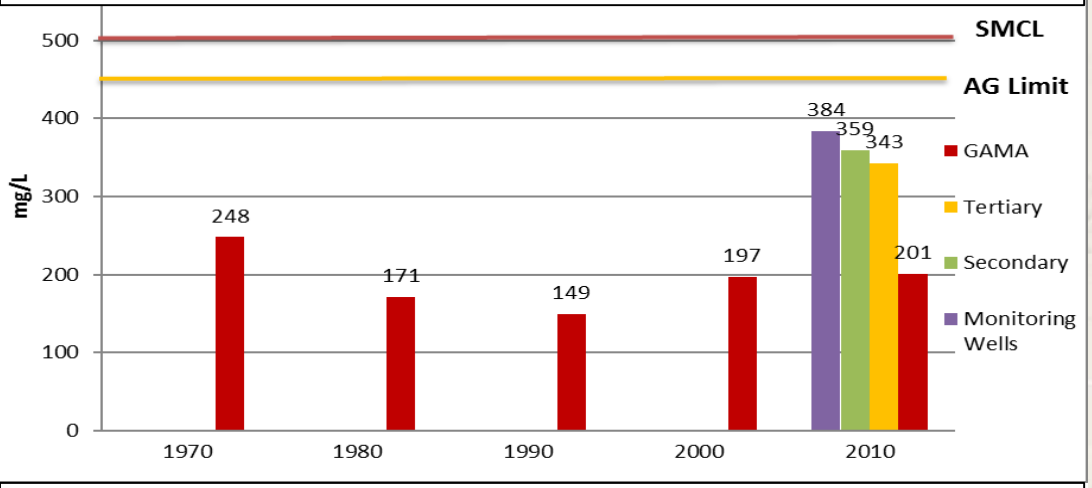




Ukiah Valley

TDS Average per Decade



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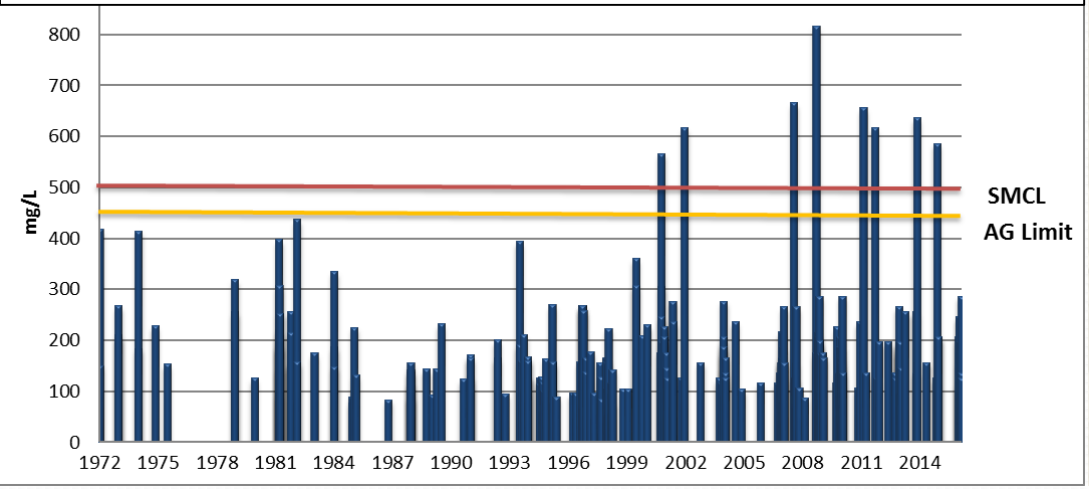
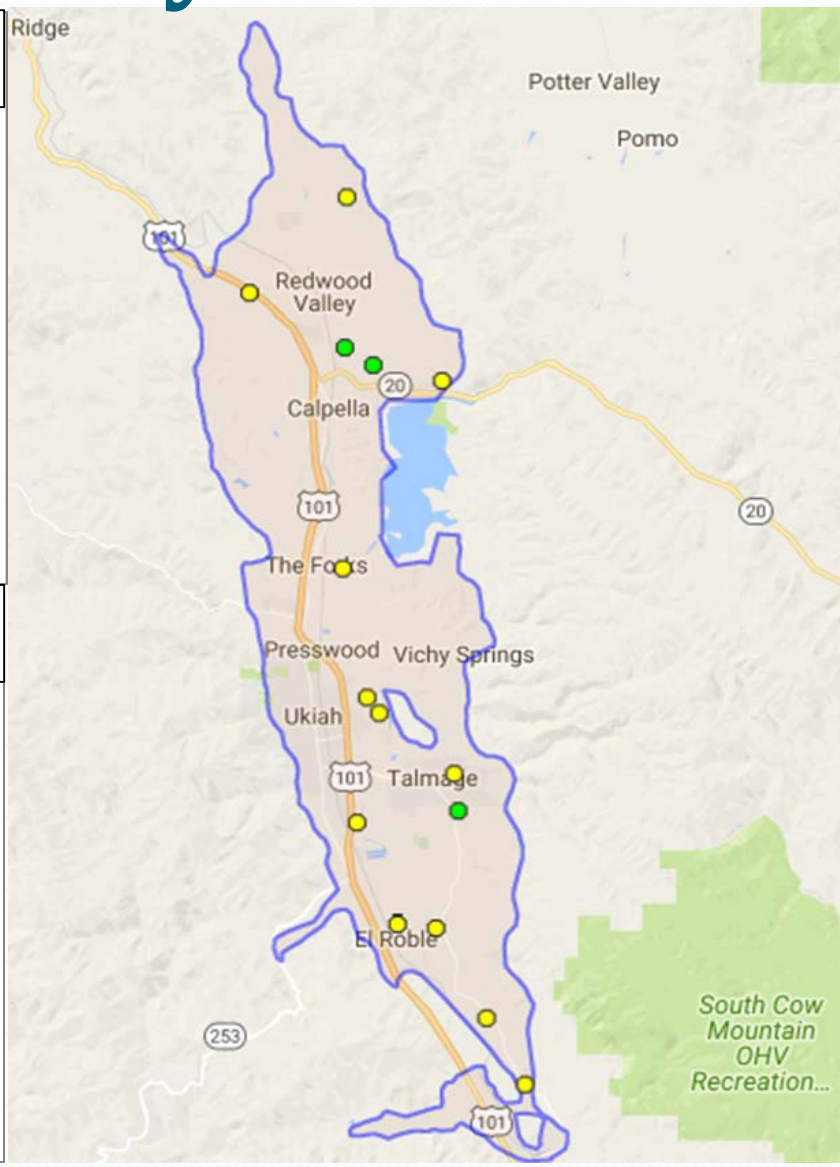
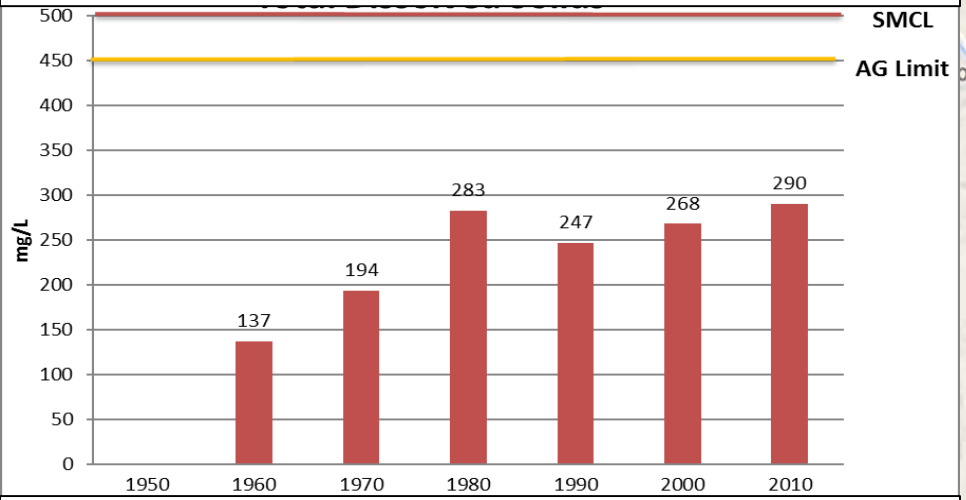




Wilson Grove Formation

TDS Average per Decade



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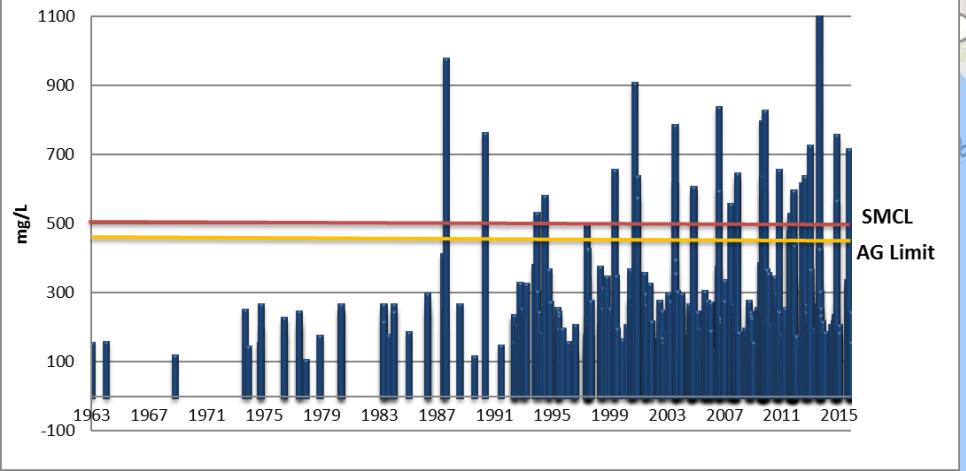

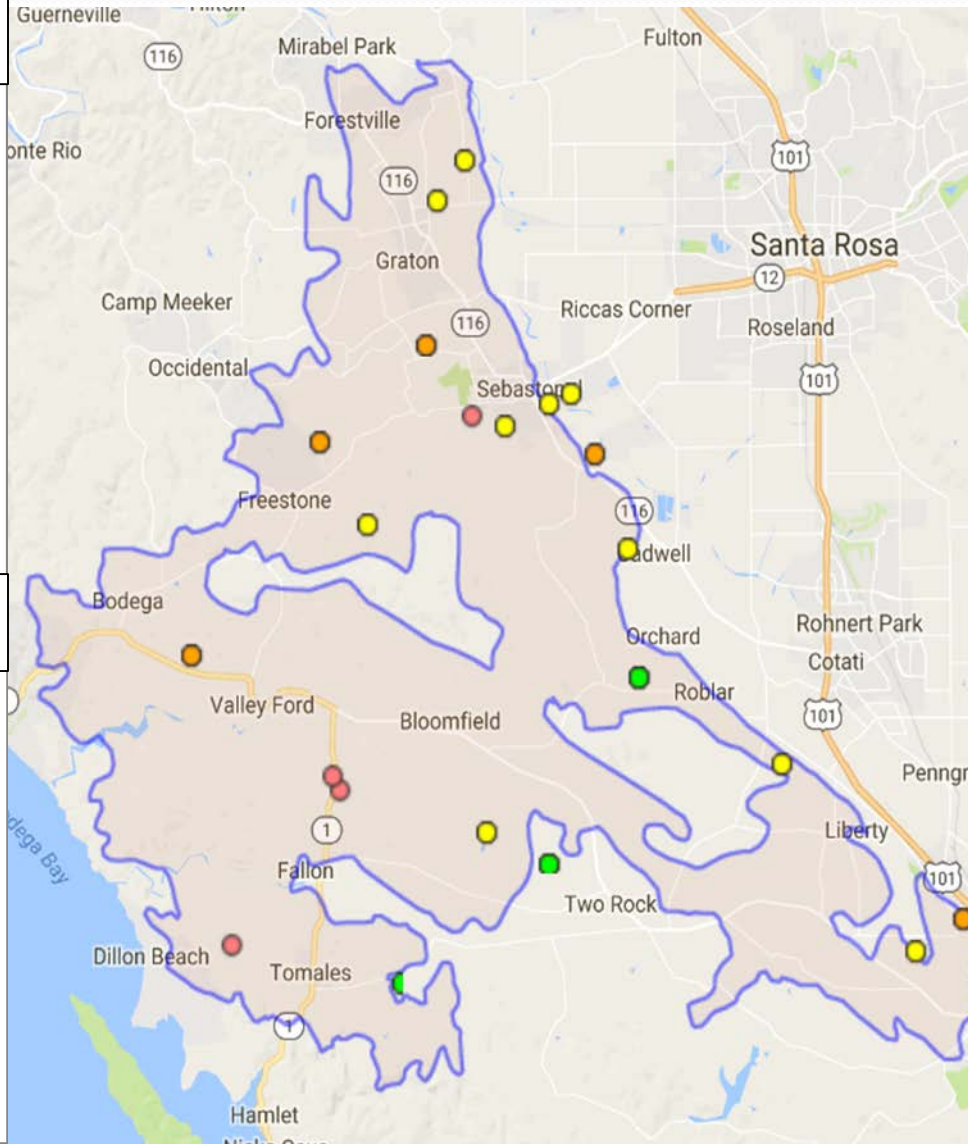

Individual WDR

Discharge
TDS = 350-1,200
TDS Avg. = 863

Upgradient
TDS = 290 - 360

Numeric
TDS = 500

Narrative
TDS = 450

Downgradient wells
TDS = 230 – 2,600

Recommended
TDS Limit = 450

Wine, Beverage, & Food Processors

Discharge Chloride = ?

Background Chloride = 0.53 - 687

Numeric 250 – T.O.

Narrative 106 - AGR

Downgradient wells Chloride = ?

Recommended Chloride Limit = 106

Key Points

- Effluent & groundwater limitations and monitoring requirements in permits are the foundation of our protection efforts.
- Water quality standards (beneficial uses, objectives, and antidegradation) are complex.
- Determining effluent limits requires interpretation and judgement.

Questions or Comments