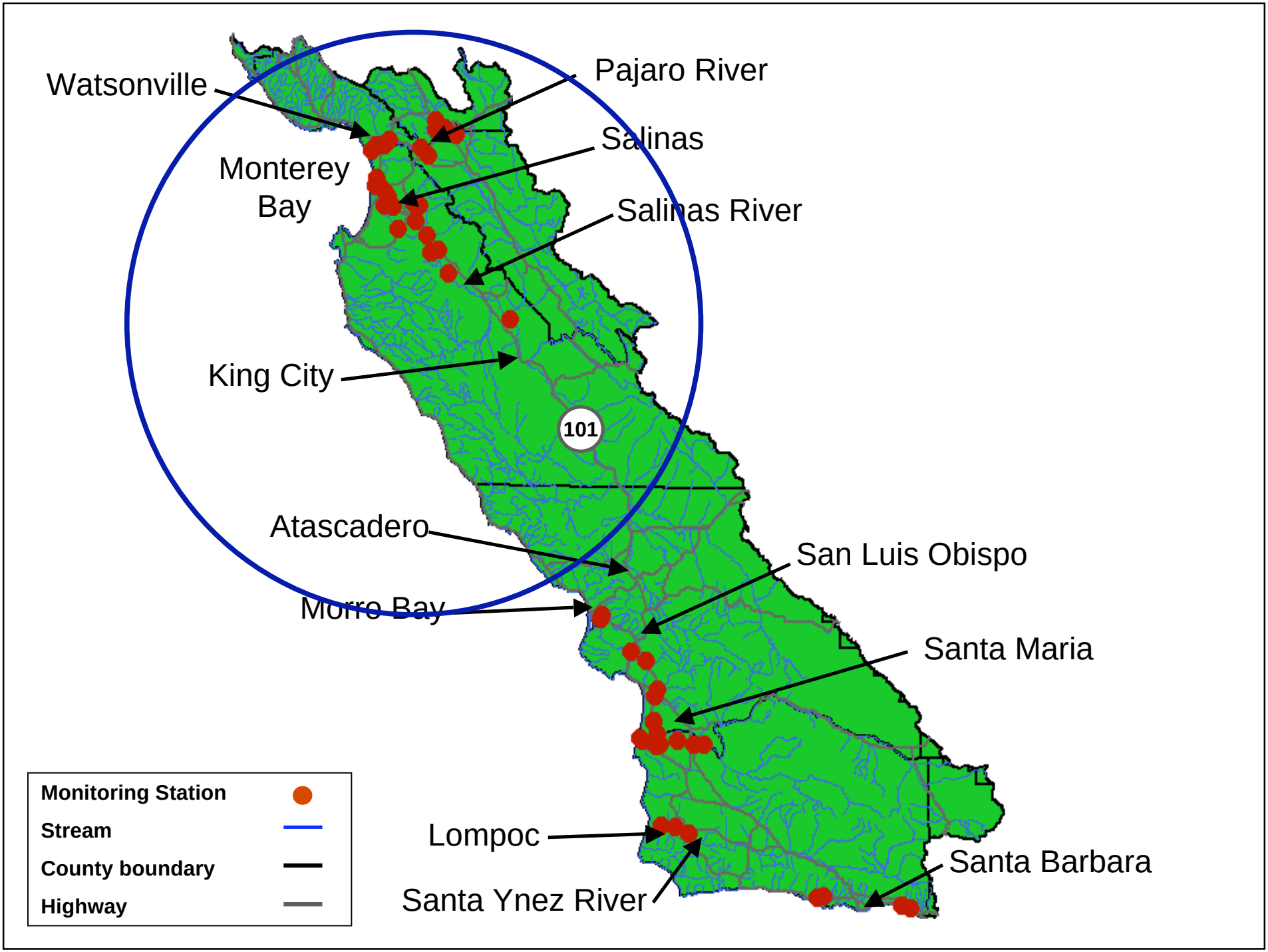
Agricultural Water Quality
Central Coast of California

Monterey Bay
National Marine Sanctuary
Advisory Council

April 18, 2008

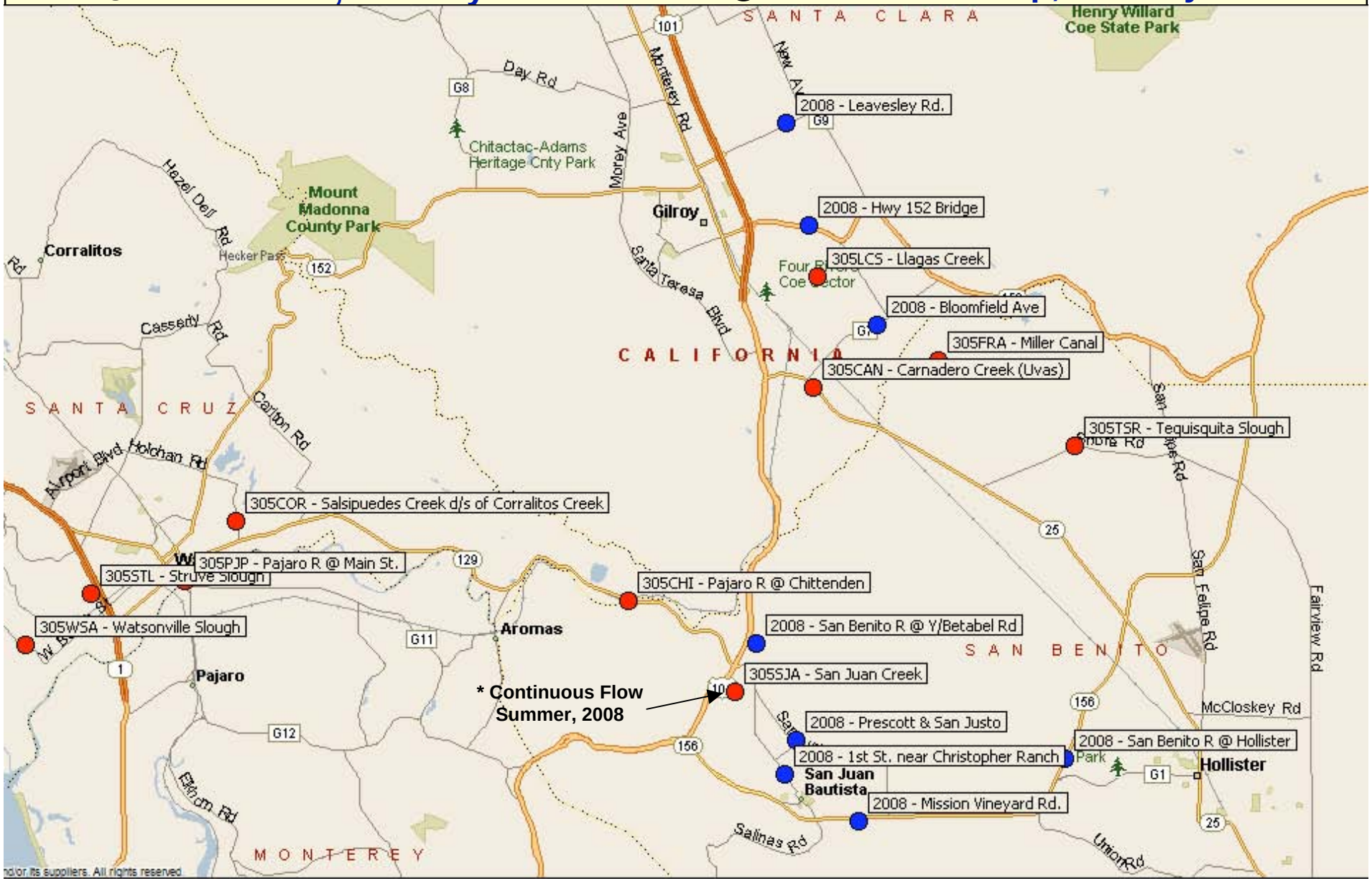

Watsonville
Pajaro River
Salinas
Monterey
Bay
Salinas River
King City
101
Atascadero
San Luis Obispo
Morro Bay
Santa Maria
Lompoc
Santa Barbara
Santa Ynez River
Monitoring Station
Stream
County boundary
Highway

Timeline

- October, 1999: MMNMS Agriculture and Rural Lands Action Plan
    - Central Coast 6 County Farm Bureau Coalition implements
        - Voluntary programs and
        - Watershed groups
- July, 2004: First "Ag Waiver" implemented by Region 3 Water Board
    - Enrollment, Education, On Farm Management and Water Monitoring
- January, 2005: Monitoring began at 25 sites on Salinas and Santa Maria
  January, 2006: Monitoring began at 25 additional sites on the Pajaro, Santa Ynez, SLO creeks, Santa Barbara creeks
- 2006-07 : Follow-up monitoring for OP pesticides at first 25 Phase I sites
- January 2008: Follow-up monitoring began at "upstream" sites in several watersheds of concern
- April 2008: Continuous monitoring of flows began in 6 watersheds of concern and watershed outreach to growers in same watersheds.

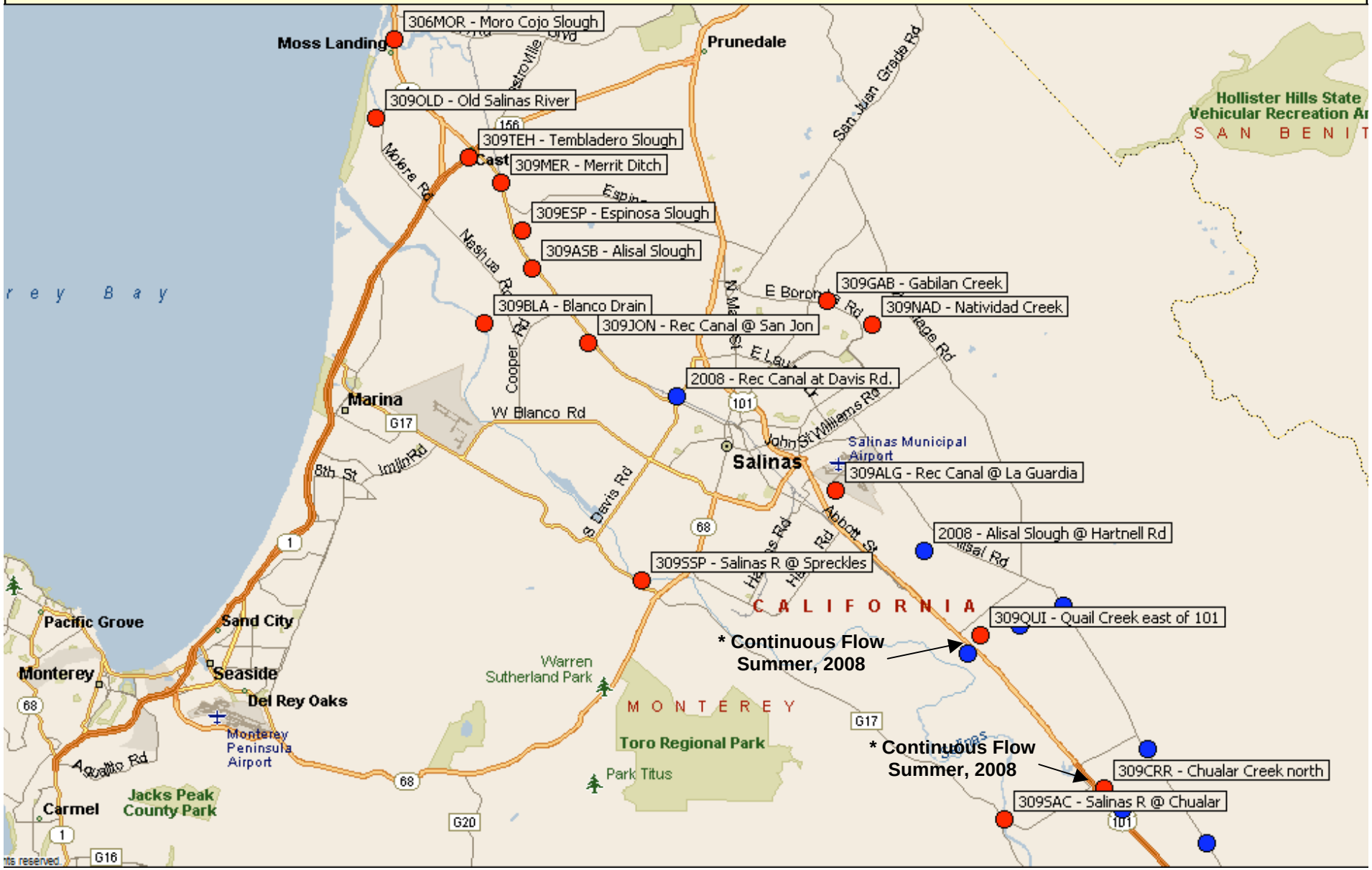
Pajaro Watershed Sites

● = core CMP, monthly since 2006 ● = 2008 Follow-up, monthly in '08



Lower Salinas Watershed Sites

● = core CMP, monthly since 2005 ● = 2008 Follow-up, monthly in '08



Salinas River

Blanco Drain

Warden Creek

Oso Flaco Creek

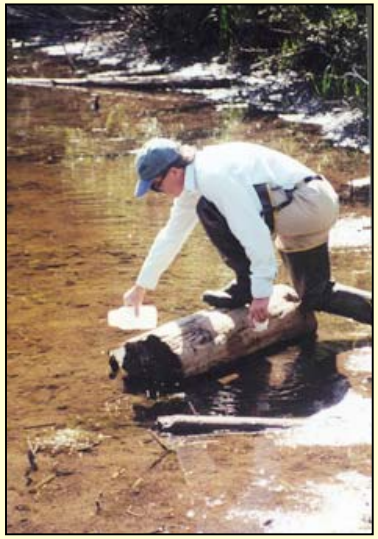
Franklin Creek

Water Quality Constituents

Hydrolab instrument

(image from www.hydrolab.com)

- Water temperature
- pH
- Dissolved Oxygen
- Conductivity
- Salinity
- Turbidity
- Chlorophyll
- Dissolved Solids



Water samples to lab

(image from www.co.water.usgs.gov)

- Nitrogen
  - Nitrate
  - Ammonia
  - Ammonium
- Phosphorus
  - Orthophosphate
- Toxicity
  - Water (4x/yr)
  - Sediment (1x/yr)
- Organophosphate pesticides
  - Lower Salinas & Santa Maria only
  - 4x only

Components of Ag Runoff

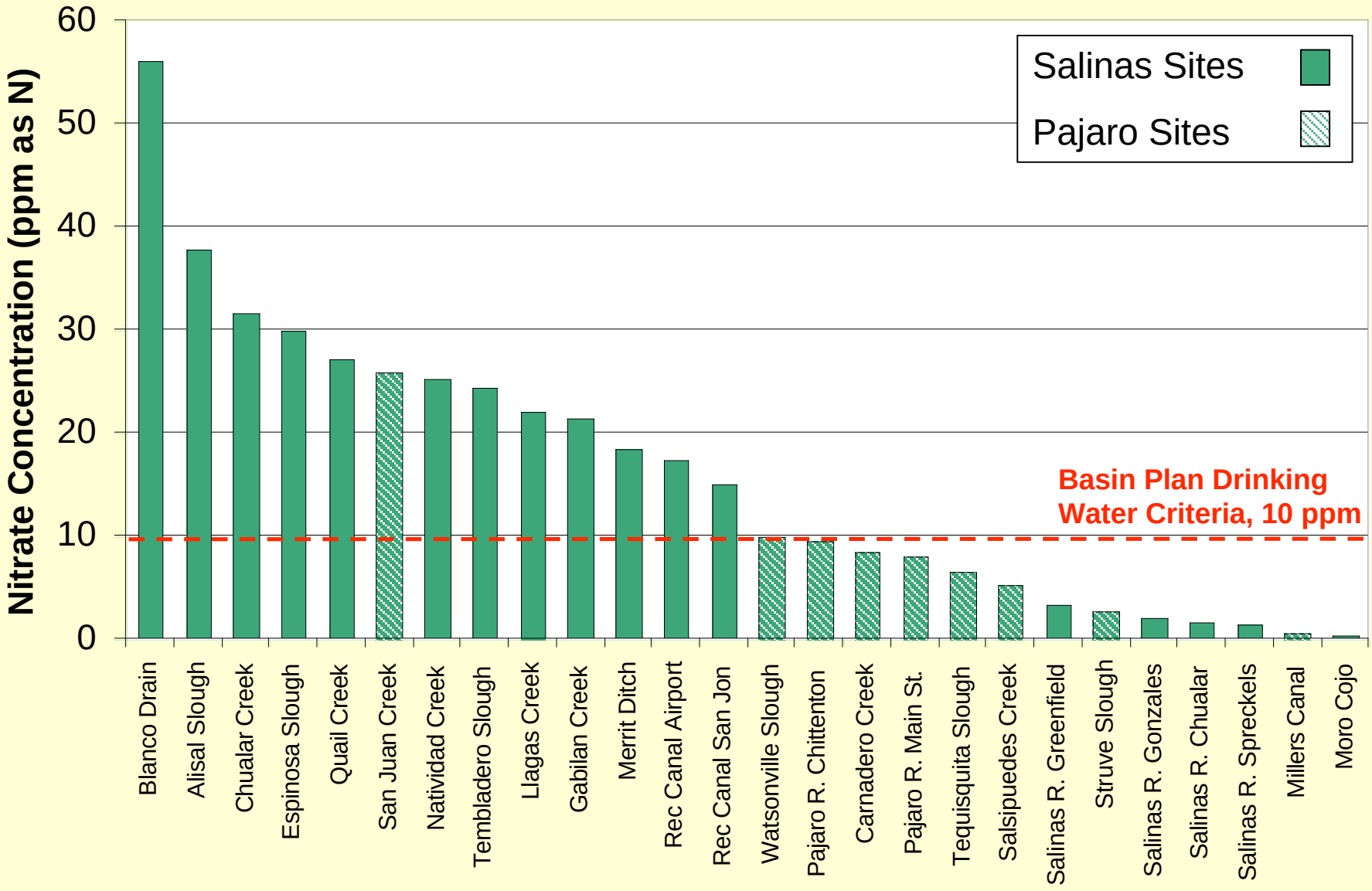
- Fertilizer (*nitrate, ammonium, phosphate*)
- Pesticides (*toxicity*)
- Sediment (*turbidity*)

Effects of Ag Runoff

- Algae growth *(Chlorophyll, % algal cover)*
- Low oxygen *(dissolved oxygen)*
- Ammonia (*calculated from ammonium & pH*)

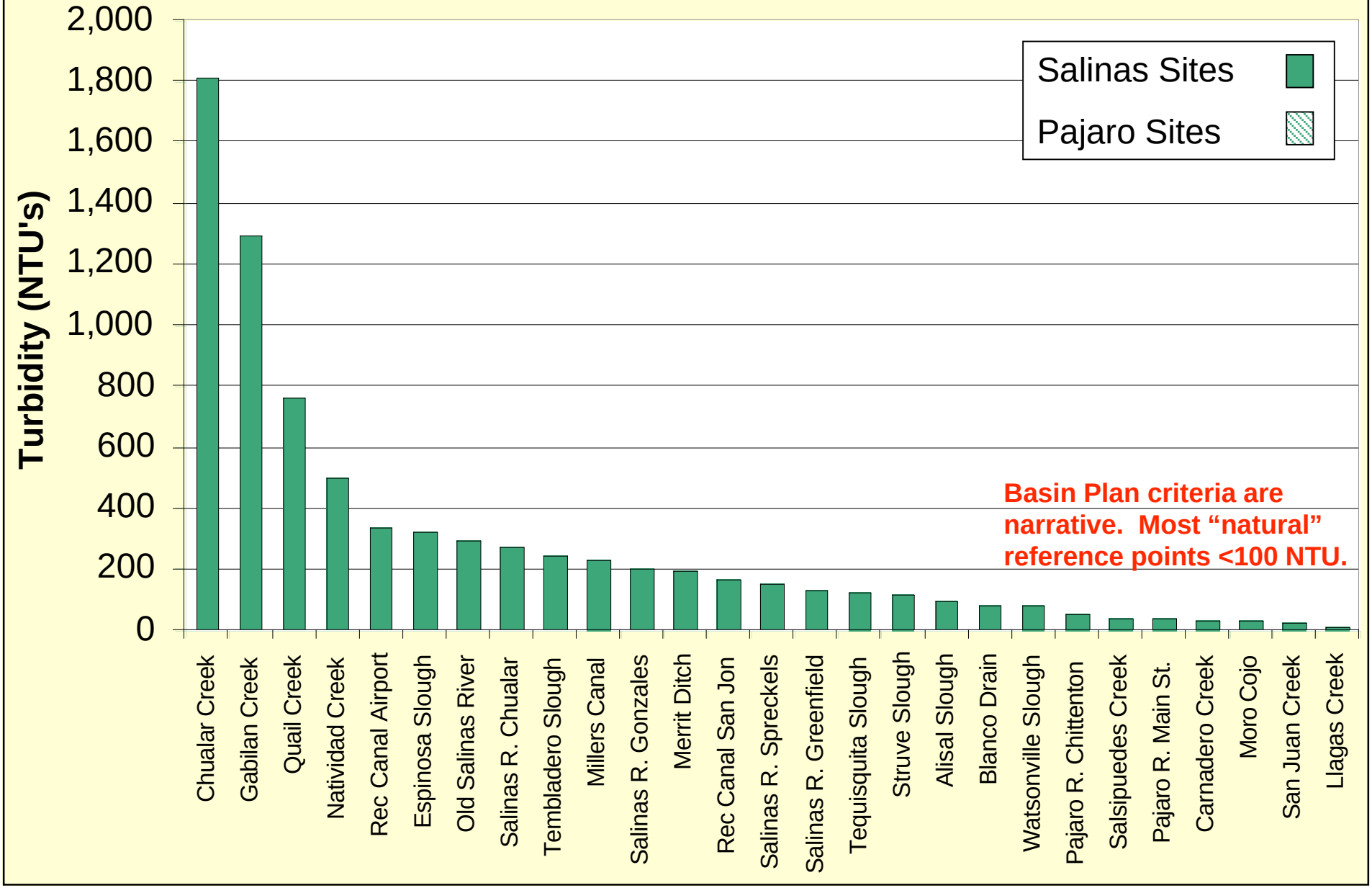
Nitrate Results for Northern Sites

(averages of all monthly samples, Jan '05 or '06 – Dec '07)



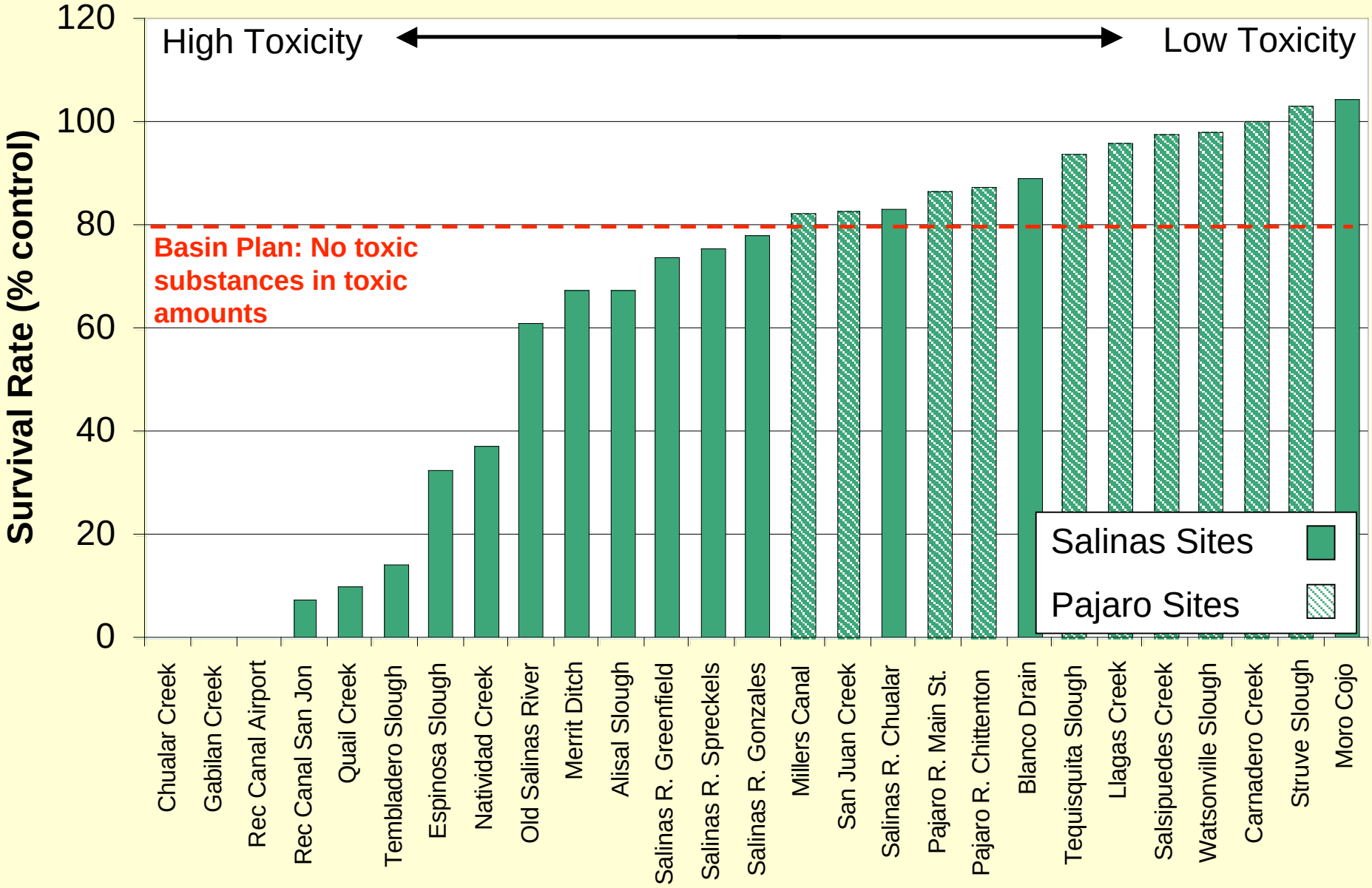
Turbidity Results for Northern Sites

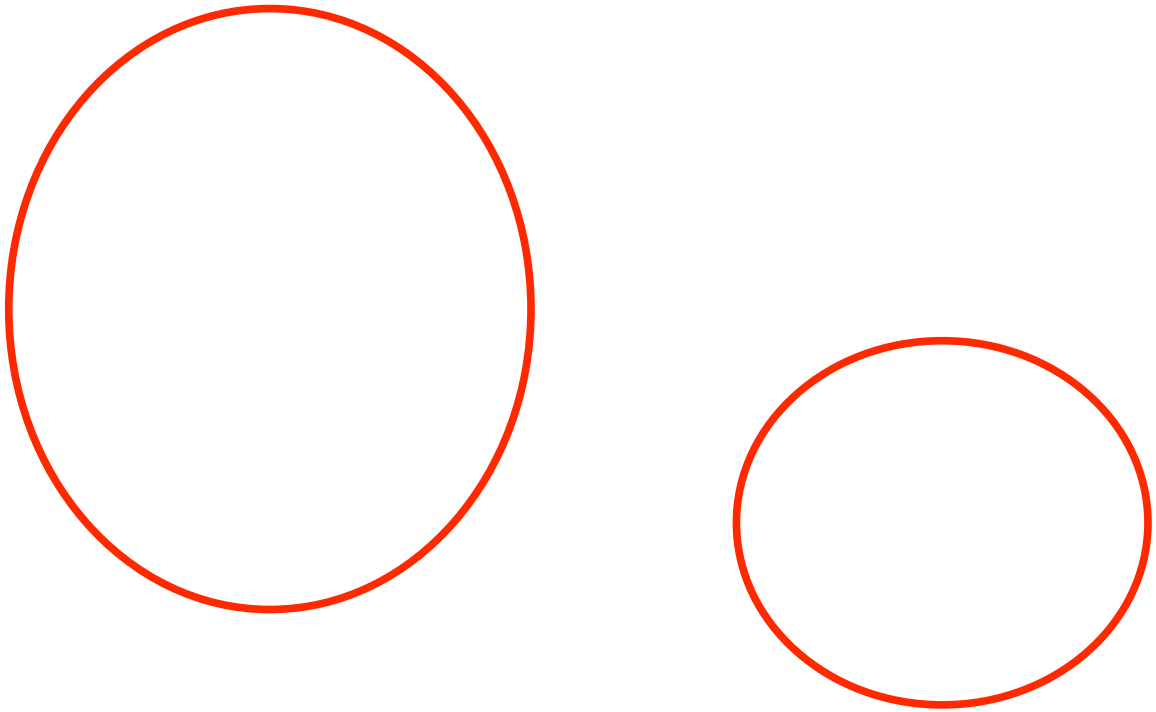
(averages of all monthly samples, Jan '05 or '06 – Dec '07)



Invert. Tox in Water Results for Northern Sites

(averages of 4x/year samples, '05 or '06 – '07)





Central Coast Water Quality Preservation

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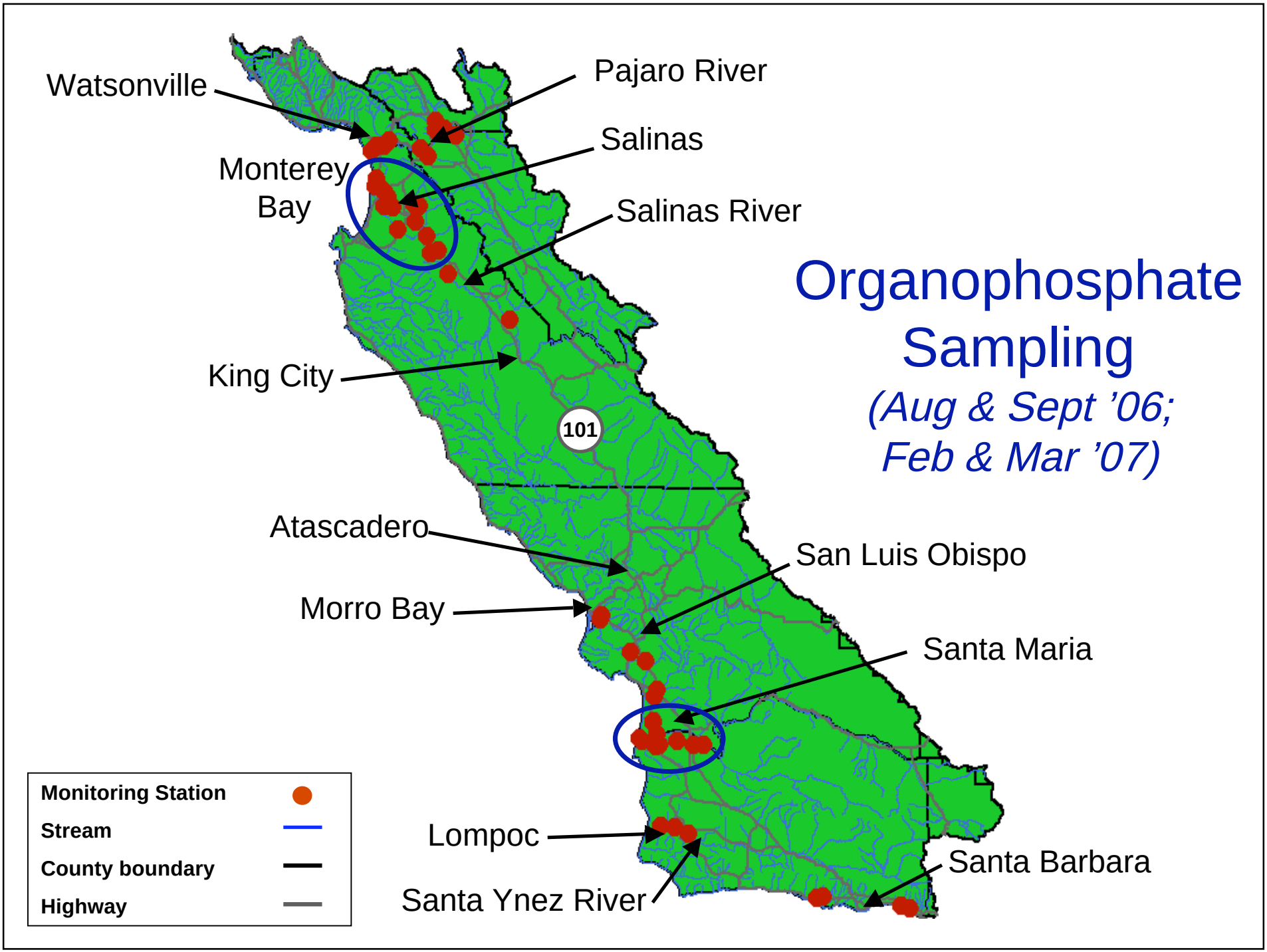
Invert Tox/Sediment Results for Northern Sites

(averages of 1x/year samples, '05 or '06 –'07)

Basin Plan: No toxic substances in toxic amounts

Salinas Sites

Pajaro Sites



Organophosphate Sampling

(Aug & Sept '06; Feb & Mar '07)

Tested for 25 different organophosphate pesticides at Salinas & Santa Maria sites:

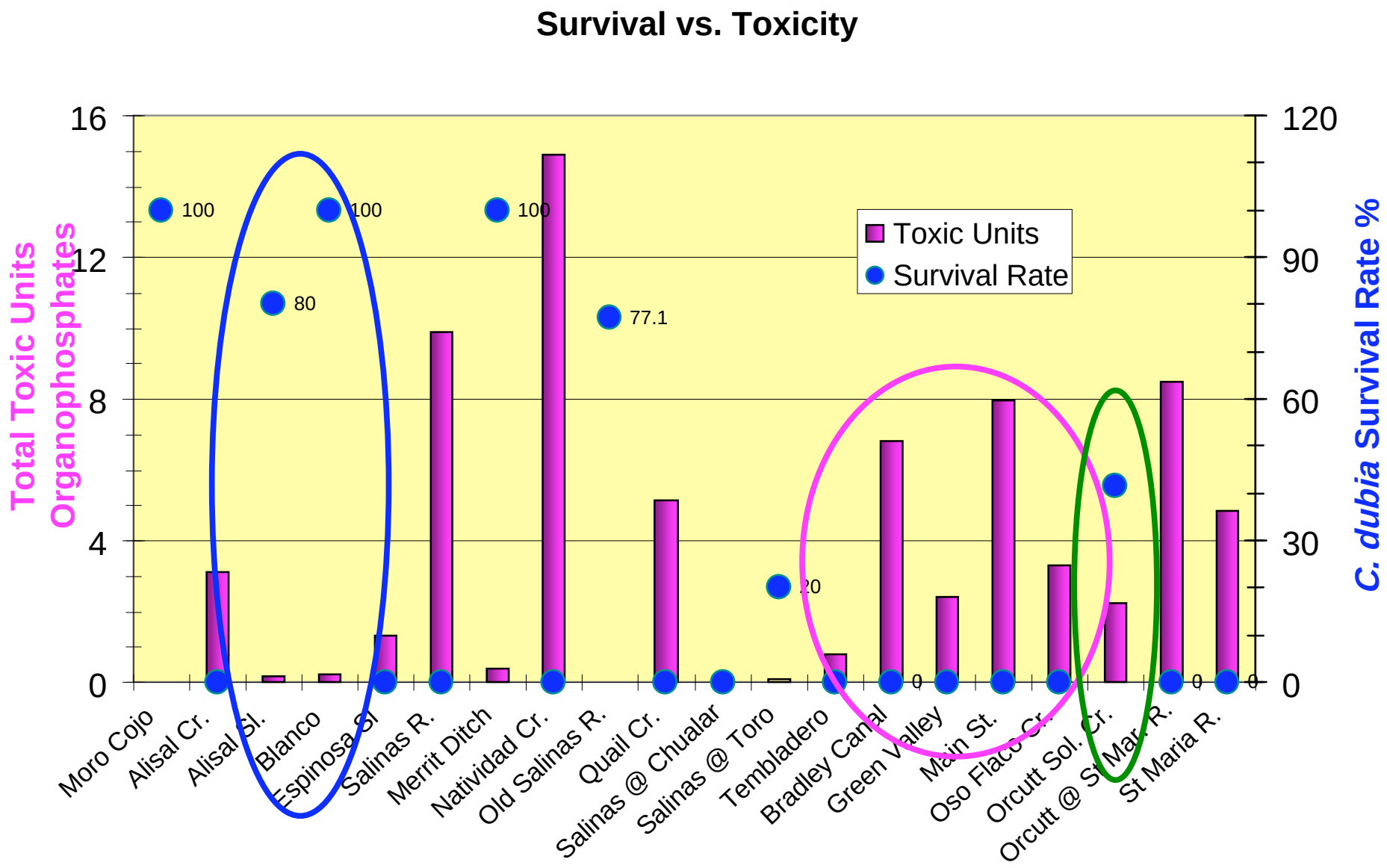
Demeton
Disulfoton
Fensulfothion
Fenthion
Merphos
Methyl Parathion
Demeton
Disulfoton
Fensulfothion

Fenthion
Merphos
Methyl Parathion
Mevinphos
Phorate
Sulprofos
Tetrachlorvinphos
Tokuthion
Trichloronate

Chlorpyrifos (Lorsban)
Diazinon
Dichlorvos
Dimethoate
Ethoprop
Fenchlorphos
Malathion

Only 7 OP's detected

Only 2 detected at concentrations "lethal" to aquatic invertebrates


Survival vs. Toxicity
Total Toxic Units
Organophosphates
C. dubia Survival Rate %
Toxic Units
Survival Rate
16
12
8
4
0
120
90
60
30
0
100
80
100
100
77.1
20
0
0
0
Moro Cojo
Alisal Cr.
Alisal Sl.
Blanco
Espinosa Sl
Salinas R.
Merrit Ditch
Natividad Cr.
Old Salinas R.
Quail Cr.
Salinas @ Chualar
Salinas @ Toro
Tembladero
Bradley Canal
Green Valley
Main St.
Oso Flaco Cr.
Orcutt Sol. Cr.
Orcutt @ St Mary R.
St Maria R.

- “Chlorpyrifos – Toxicity” relationship?
  - Yup. Looks similar to Diazinon.
- “Chlorpyrifos+Diazinon – Toxicity” relationship?
  - How to talk about more than 1 “toxin” at a time?
- “Toxic Units” seem useful, but we didn’t measure all potential “toxins”… only OP’s
  - “OP-related Toxic Units”
  - LC50 = “median lethal concentration” (for *Ceriodaphnia*)
- Examples:
  - Diazinon, 1x its LC50 = 1 OP-related TU
  - Diazinon, 1x its LC50 + Chlorpyrifos at 2x its LC50 = 3 OP-related TU’s

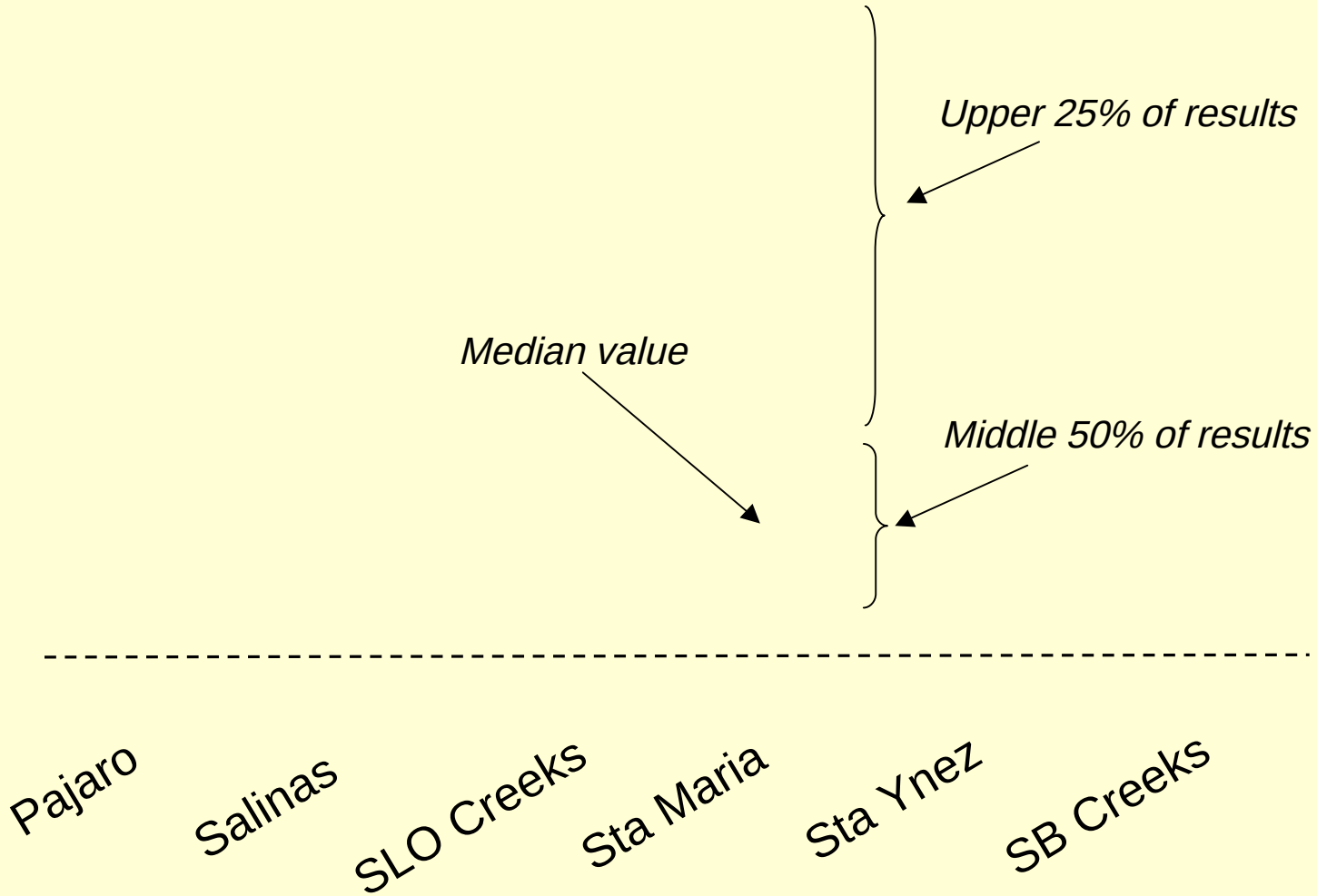
Measured as <u>concentration</u>, nitrate levels are very high at sites where we directly measure ag runoff (like Chualar Creek), compared to sites where any runoff is diluted by a large river (like Greenfield & Gonzales)

Flows

(Flows for Greenfield & Gonzales are divided by 100)

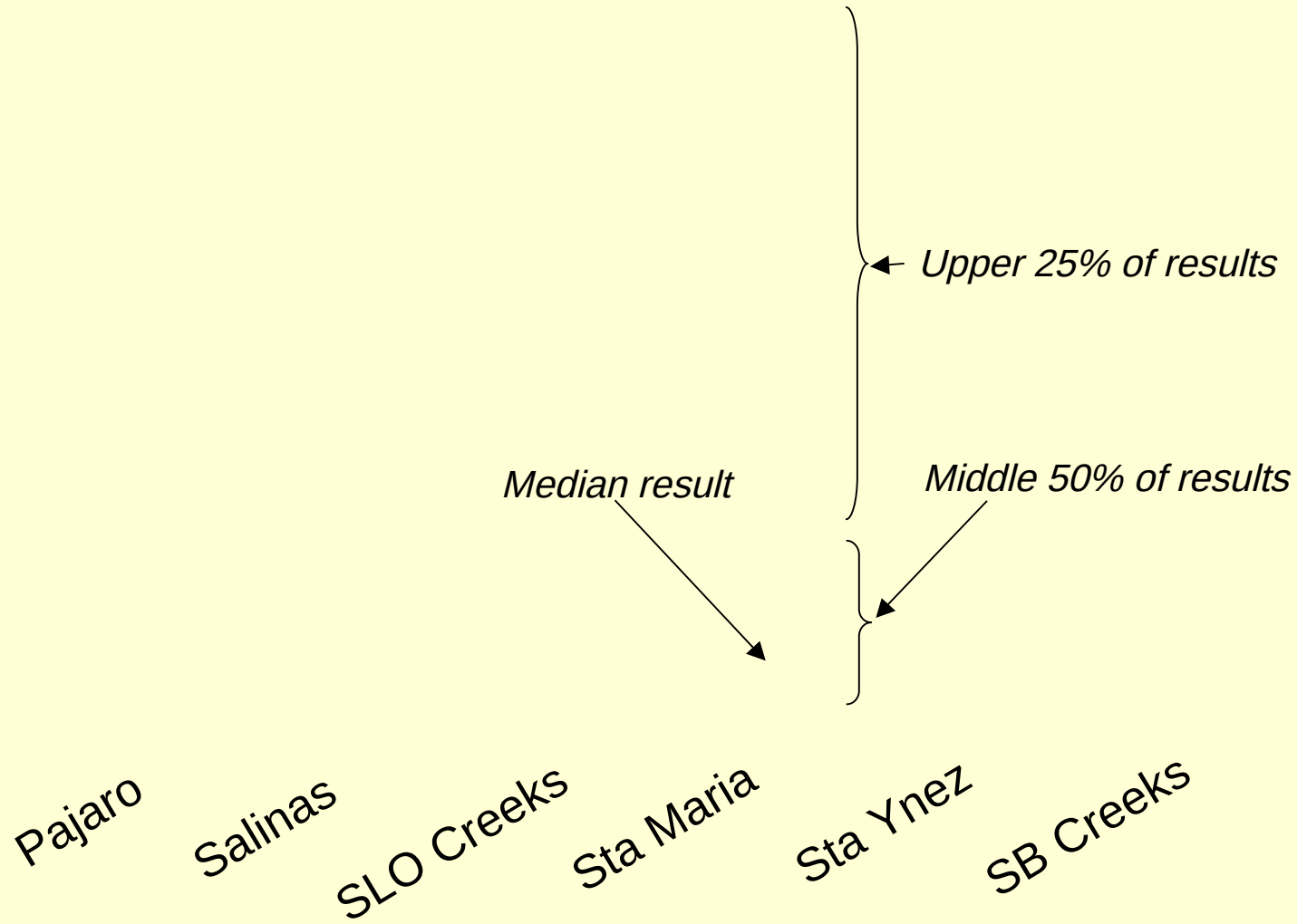
Nitrate Results by Region

(each "box & whisker" represents all results from Jan '05 or '06, through Sept '07)



Turbidity Results by Region

(each "box & whisker" represents all results from Jan '05 or '06, through Sept '07)



Toxicity to Invertebrates in Water by Region

(each "box & whisker" represents all results from Jan '05 or '06, through Sept '07)

Pajaro

Sal. River

Sal. Creeks

SLO Creeks

Sta Maria

Sta Ynez

SB Creeks