The Cooperative Monitoring Program

(helping Central Coast growers comply with the Ag Waiver)

Irrigation & Nutrient Meeting, Salinas

Central Coast Water Quality Preservation, Inc.
Executive Director: Kirk Schmidt (831-750-5449, kschmidt@ccwqp.org)
Program Manager: Sarah Greene (831-331-9051, sgreene@ccwqp.org)

February 19, 2008

Cooperative Monitoring History

- July, 2004: Ag Waiver
  - File Notice of Intent
  - Complete farm water quality plan
  - 15 hours of education
  - Implement management practices
  - Monitor water quality: individual or cooperative
- Central Coast Water Quality Preservation, Inc. ("Preservation, Inc.") formed to manage cooperative monitoring
- January, 2005: Monitoring began on Lower Salinas and Santa Maria watersheds
- January, 2006: Monitoring began on Pajaro, Santa Ynez, SLO creeks, and Santa Barbara creeks

Salinas area monitoring sites (began January, 2005)

Pajaro monitoring sites (began January, 2006)

Santa Maria area monitoring sites (began January, 2005)

Other southern monitoring sites (began January, 2006)

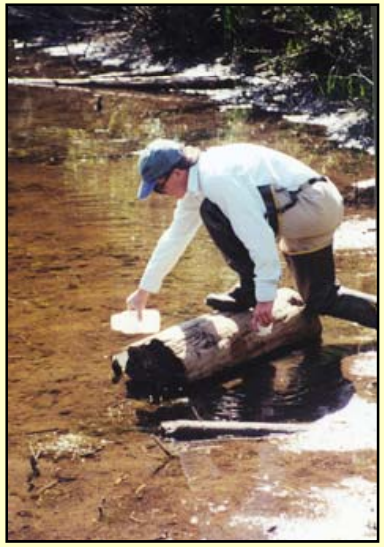
- San Luis Obispo creeks
- Santa Ynez River near Lompoc
- Santa Barbara creeks

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
  - Sediment
- Organophosphate pesticides
  - Lower Salinas & Santa Maria only
  - 4 months

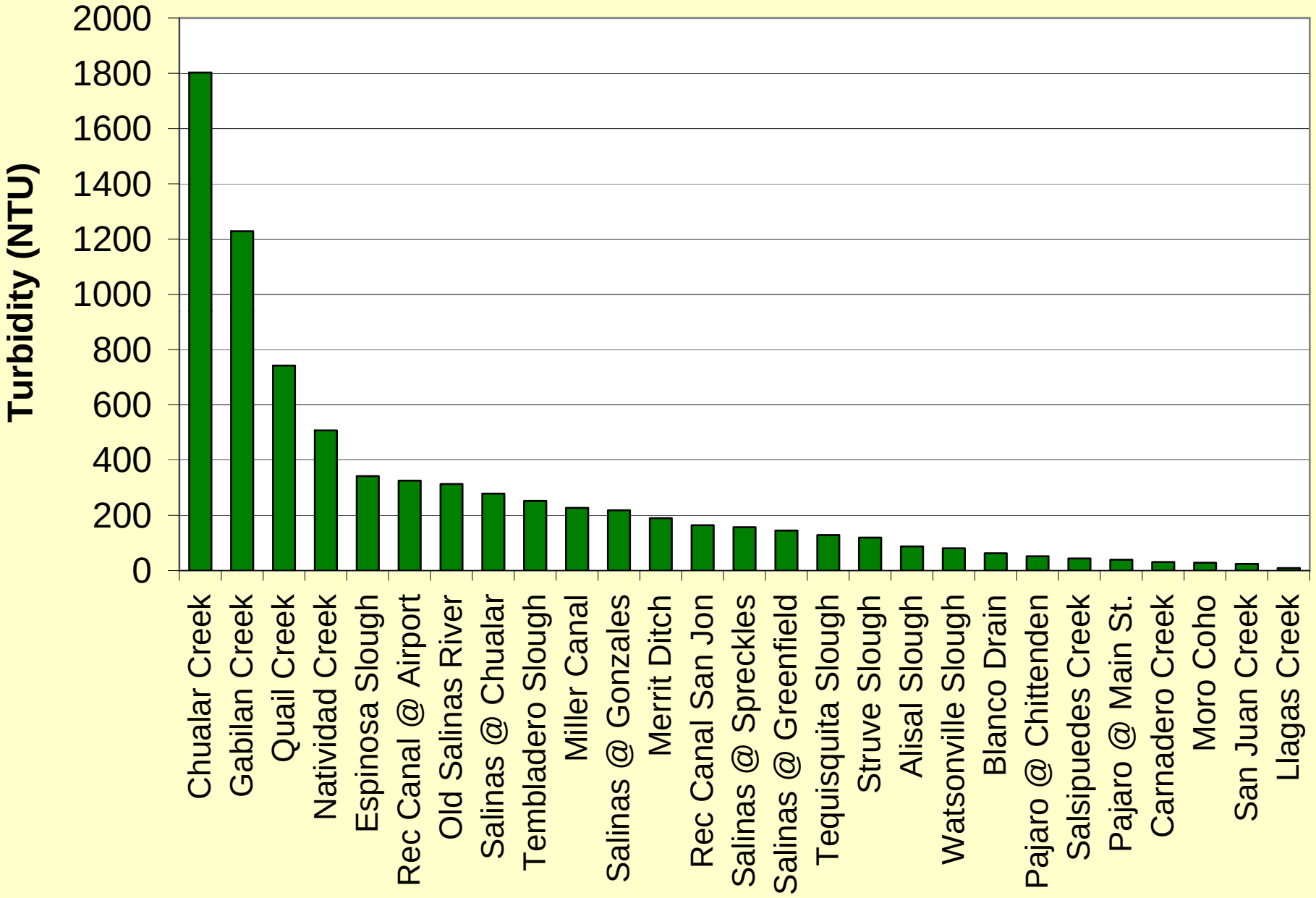
Components of Ag Runoff

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

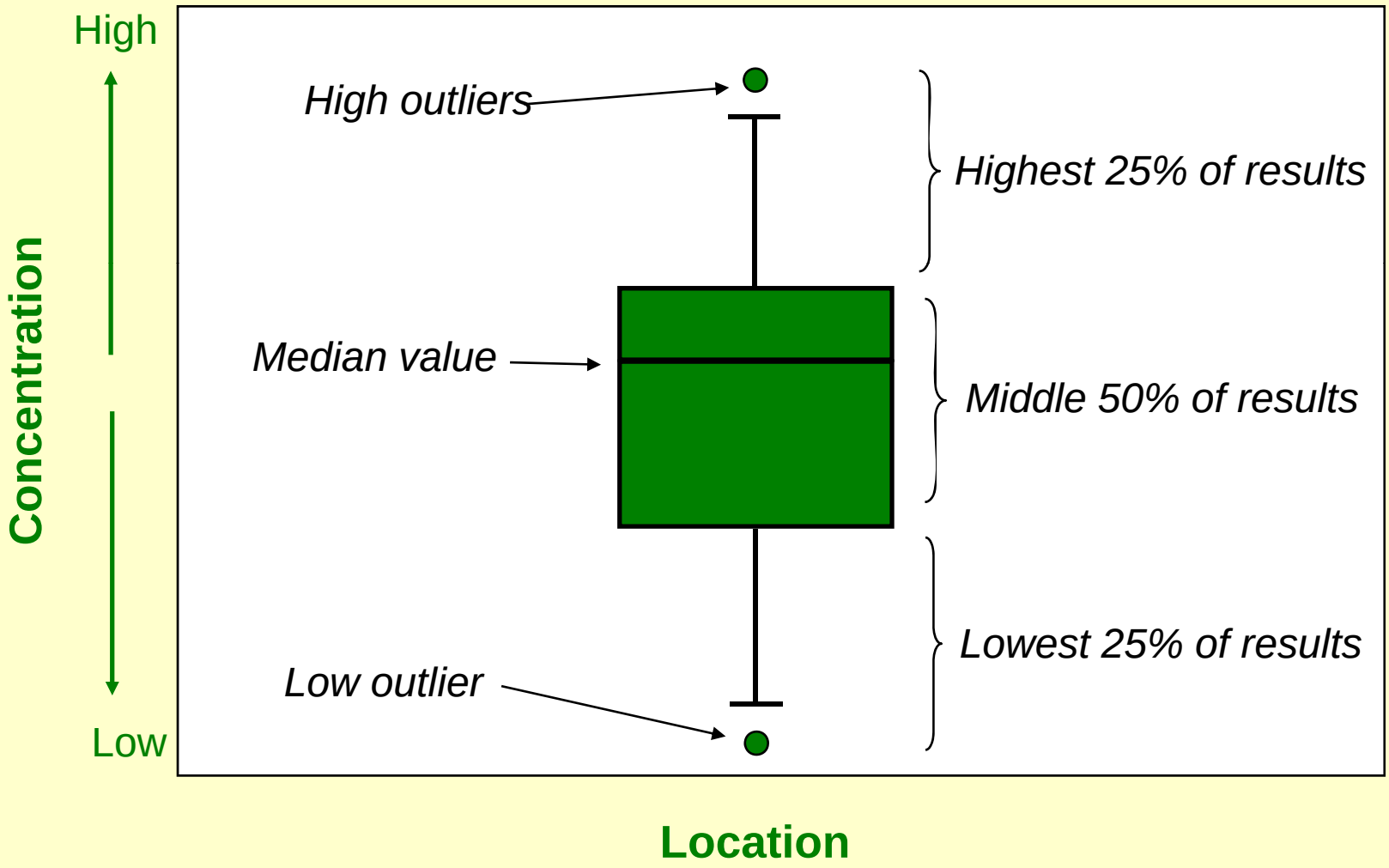
Effects of Ag Runoff

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

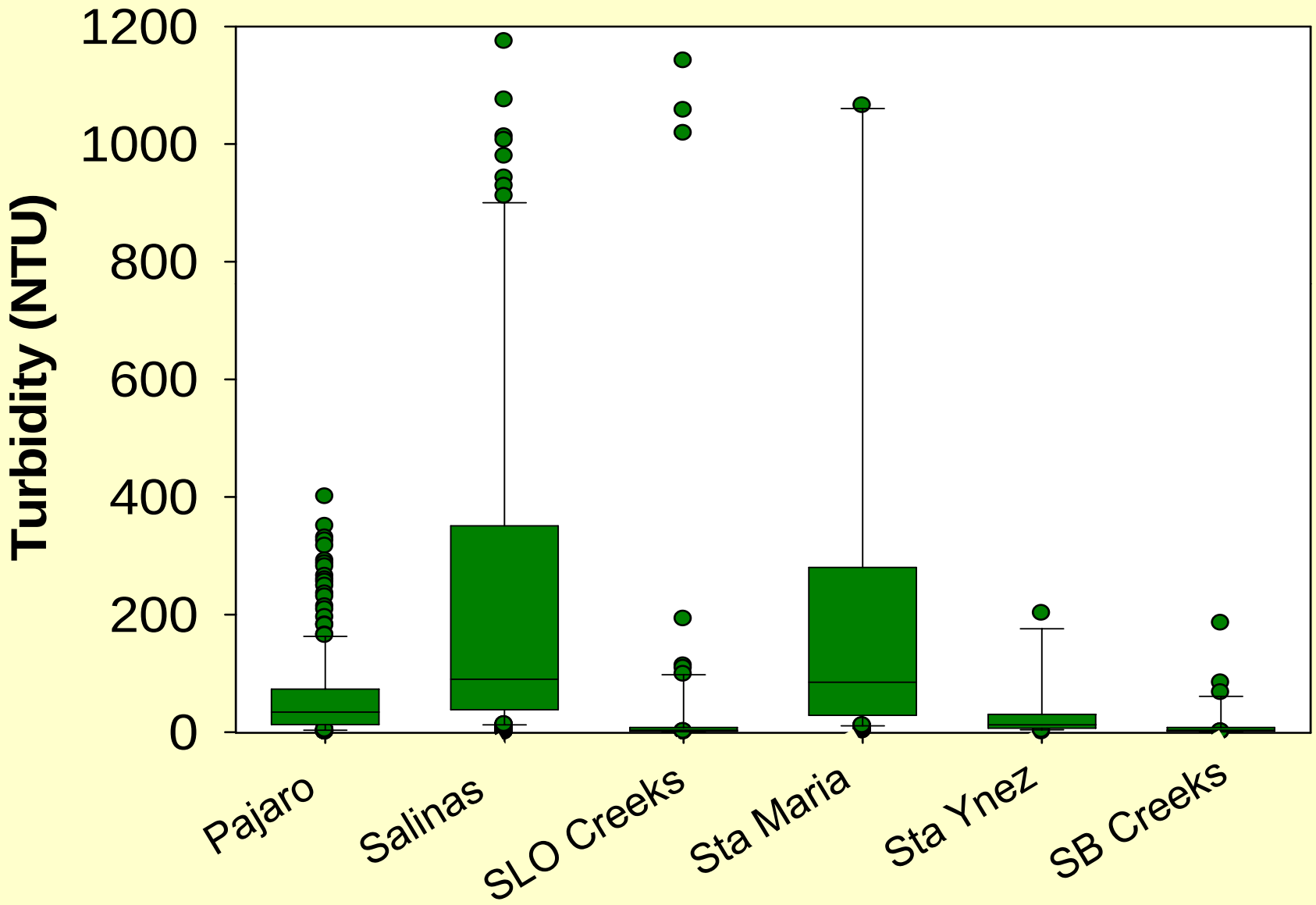
Average Turbidity Results by Site



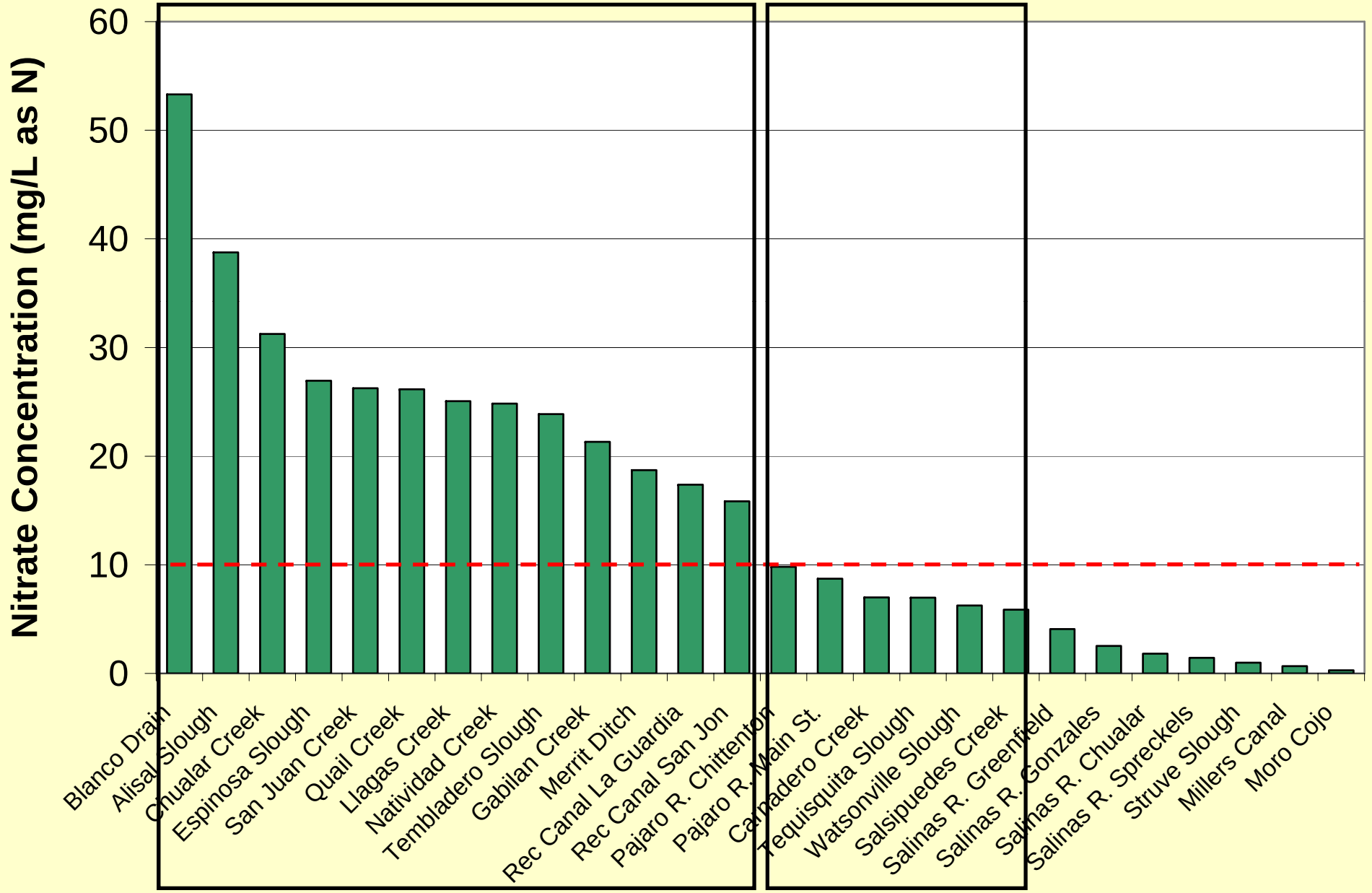
Box & Whisker Plots



Turbidity Results by Region



Average Nitrate Results by Site



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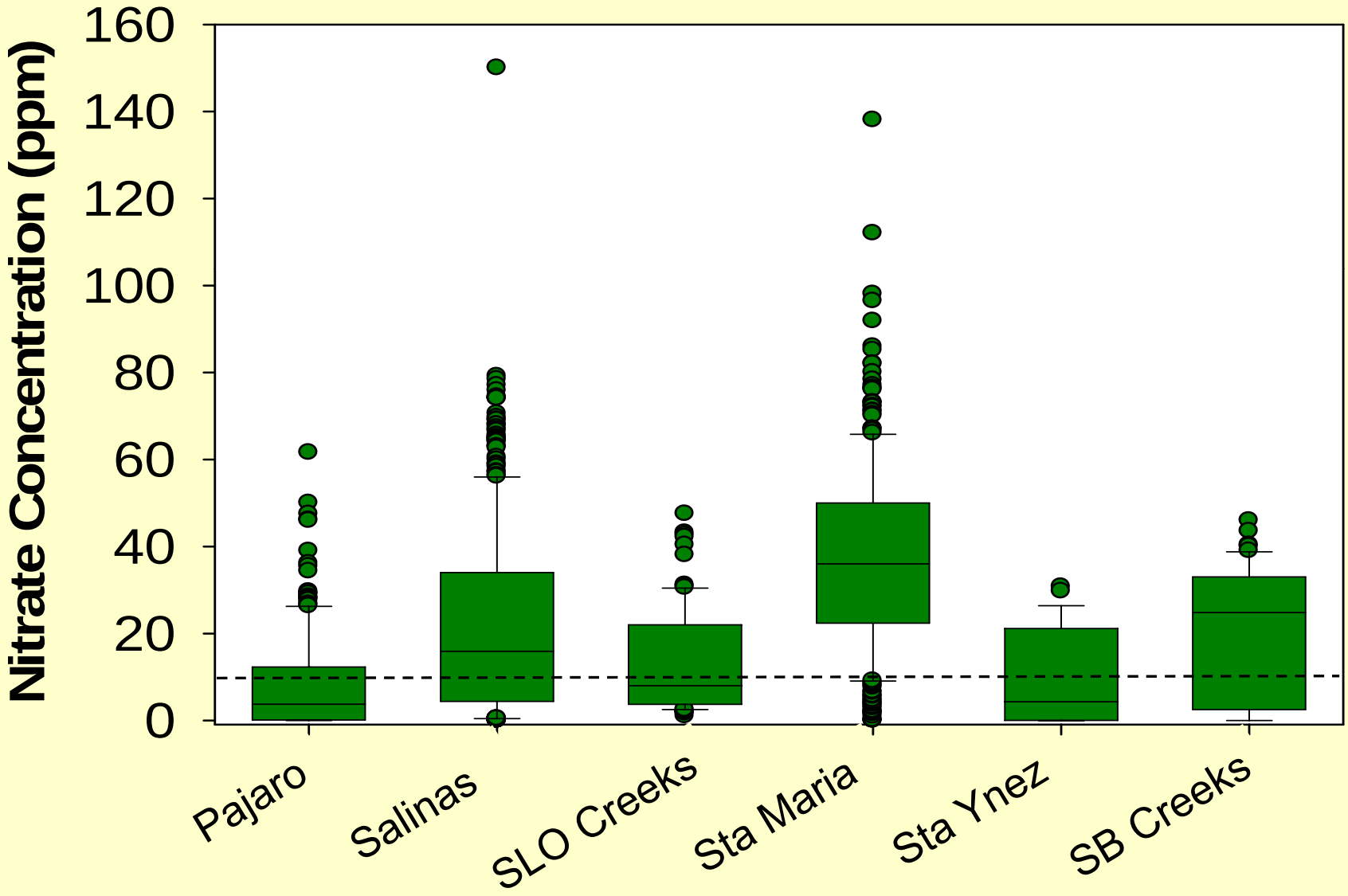
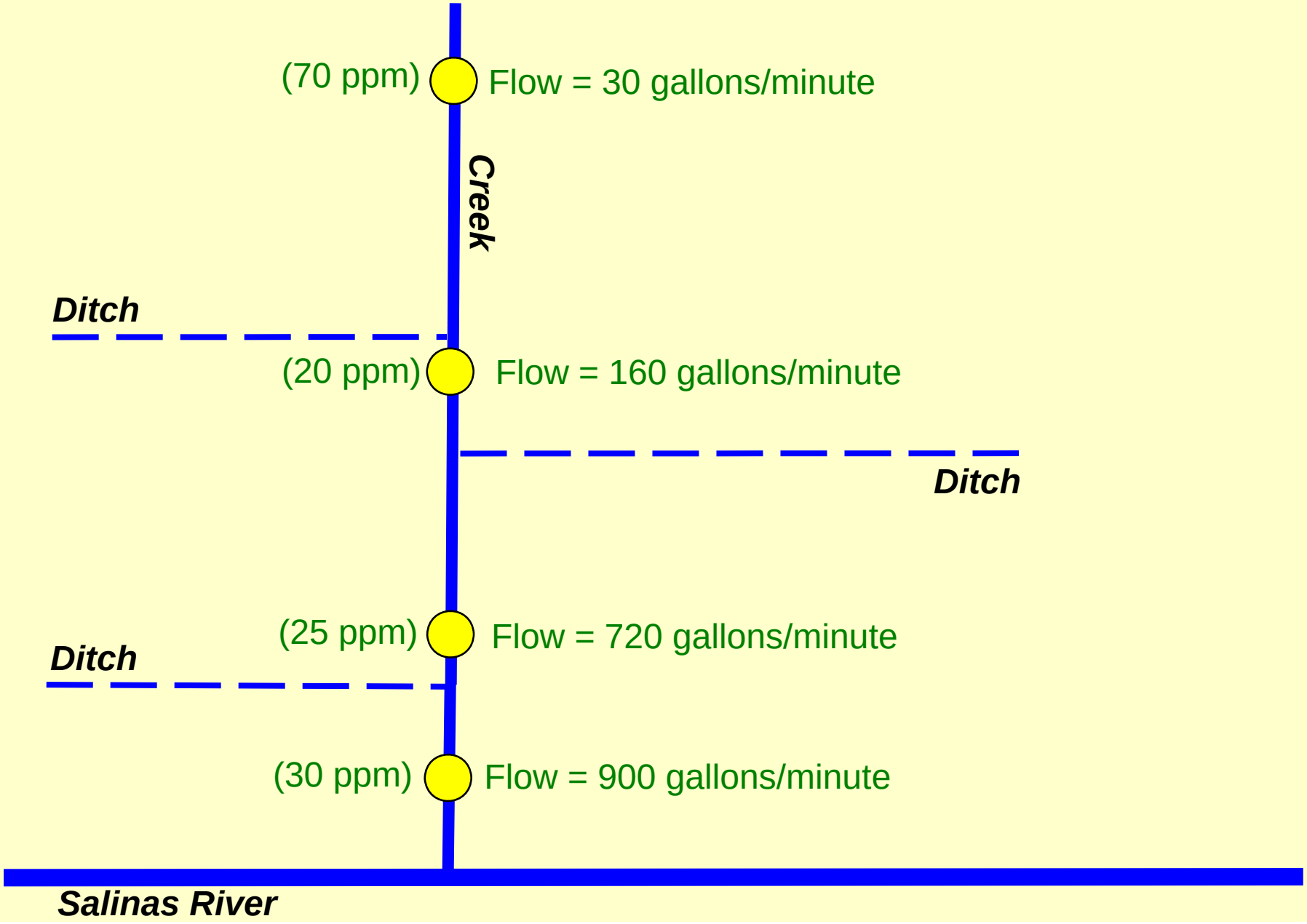


From “Concentration” to “Load”

Concentration	X	Flow	=	Load
$\frac{\text{Weight}}{\cancel{\text{Volume}}}$	X	$\frac{\cancel{\text{Volume}}}{\text{Time}}$	=	$\frac{\text{Weight}}{\text{Time}}$
$\frac{\text{milligrams}}{\text{liter}}$	X	$\frac{\text{gallons}}{\text{minute}}$	=	$\frac{\text{pounds}}{\text{hour}}$

Nitrate concentrations vary; **flows** are additive



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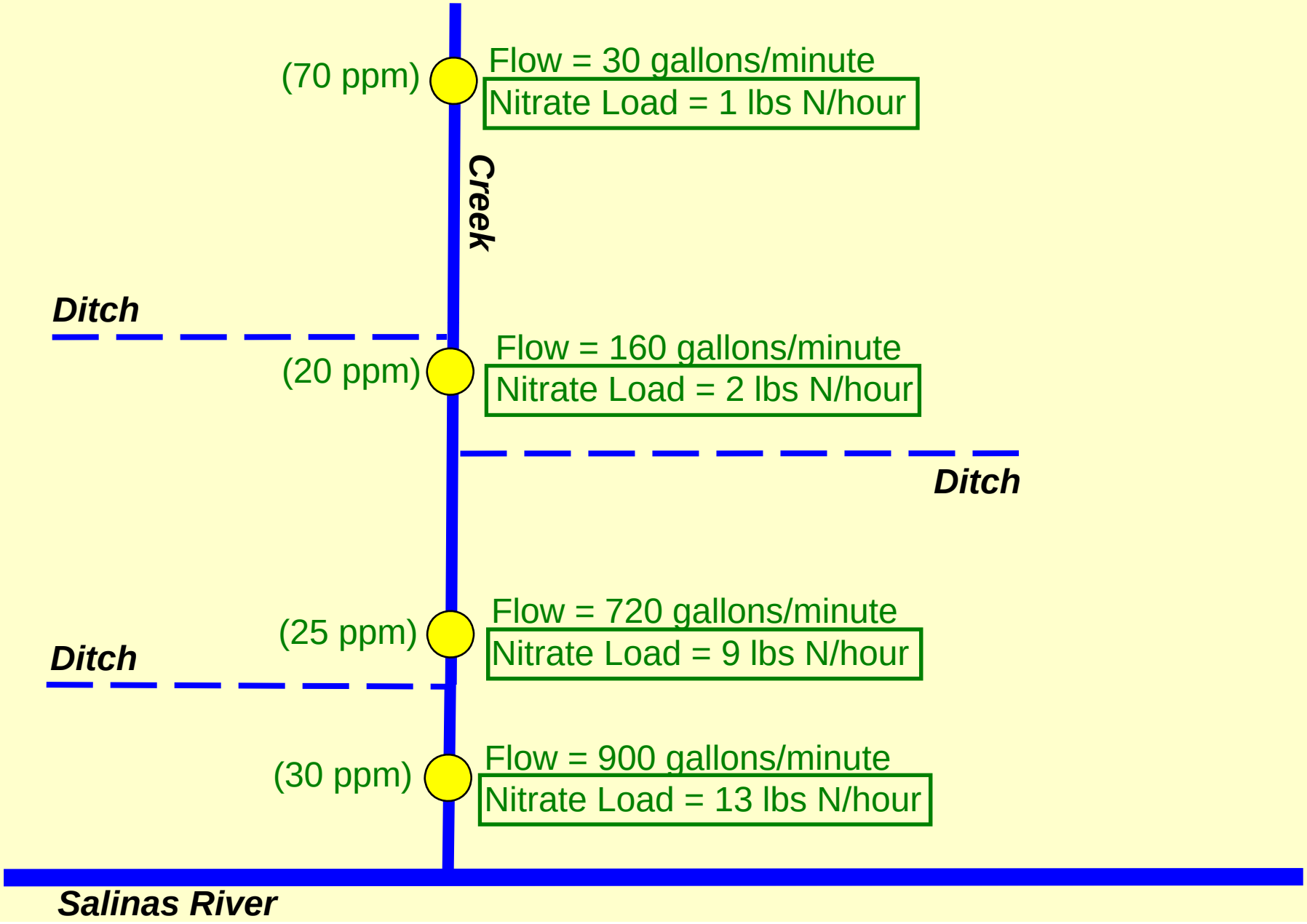
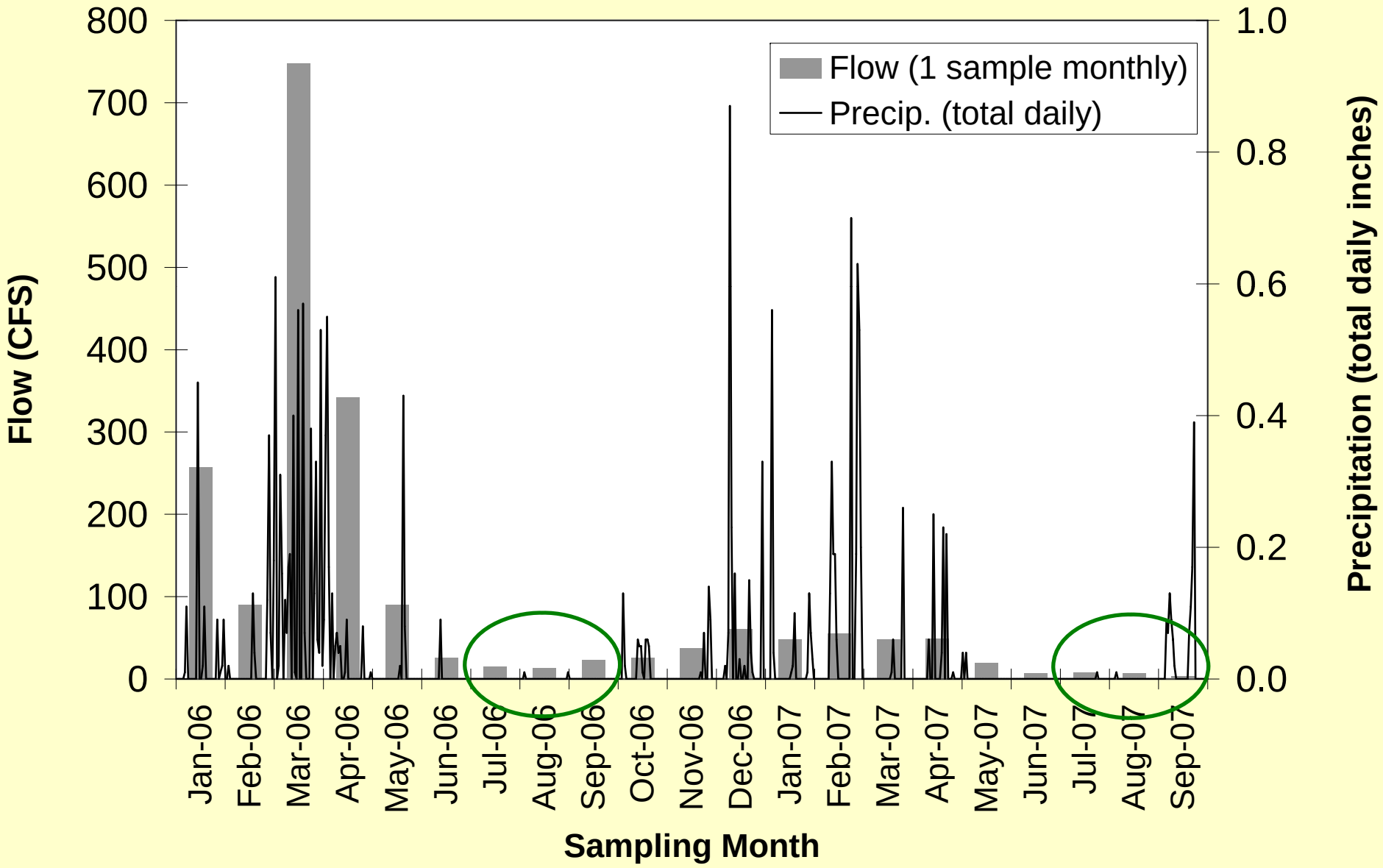
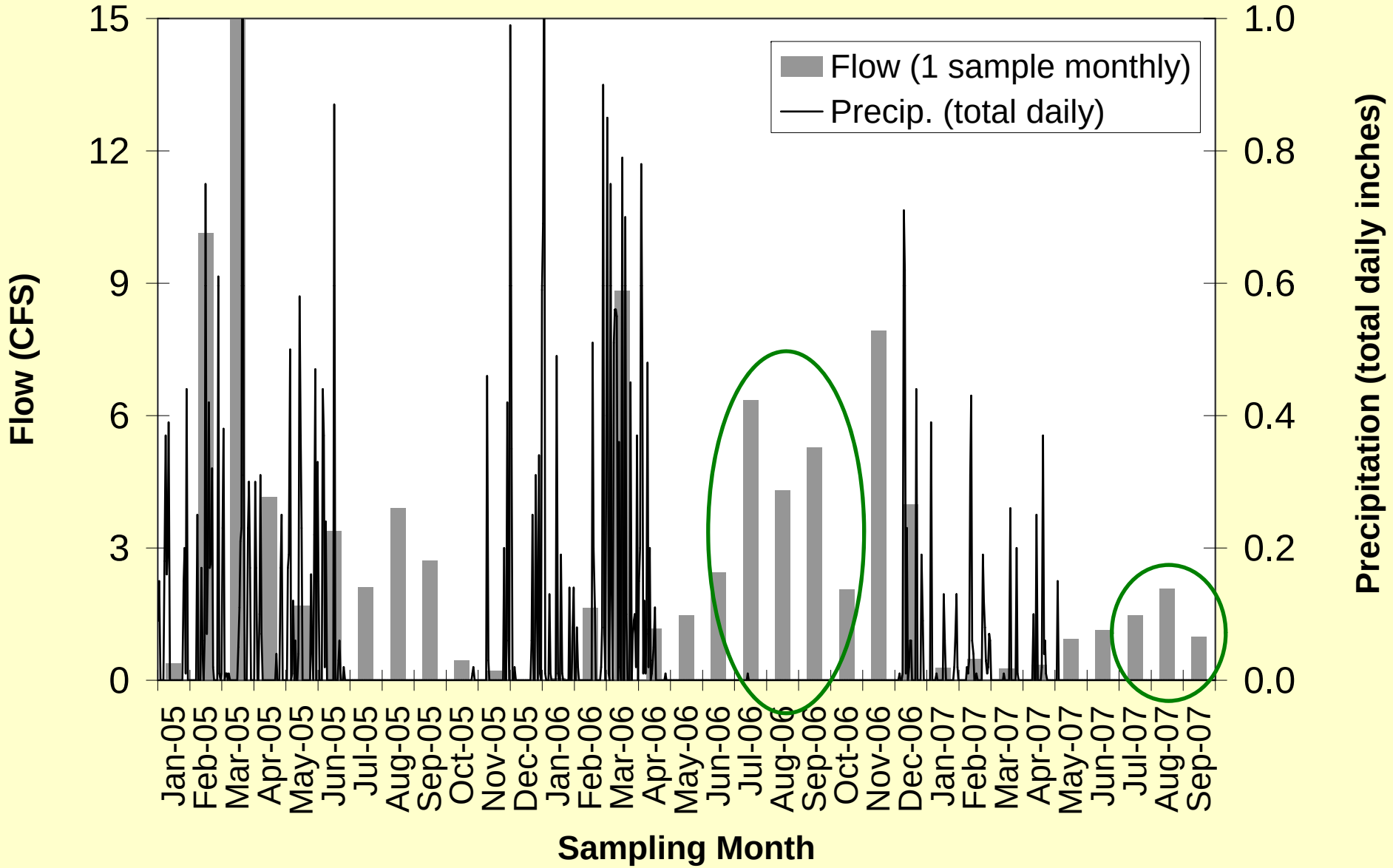


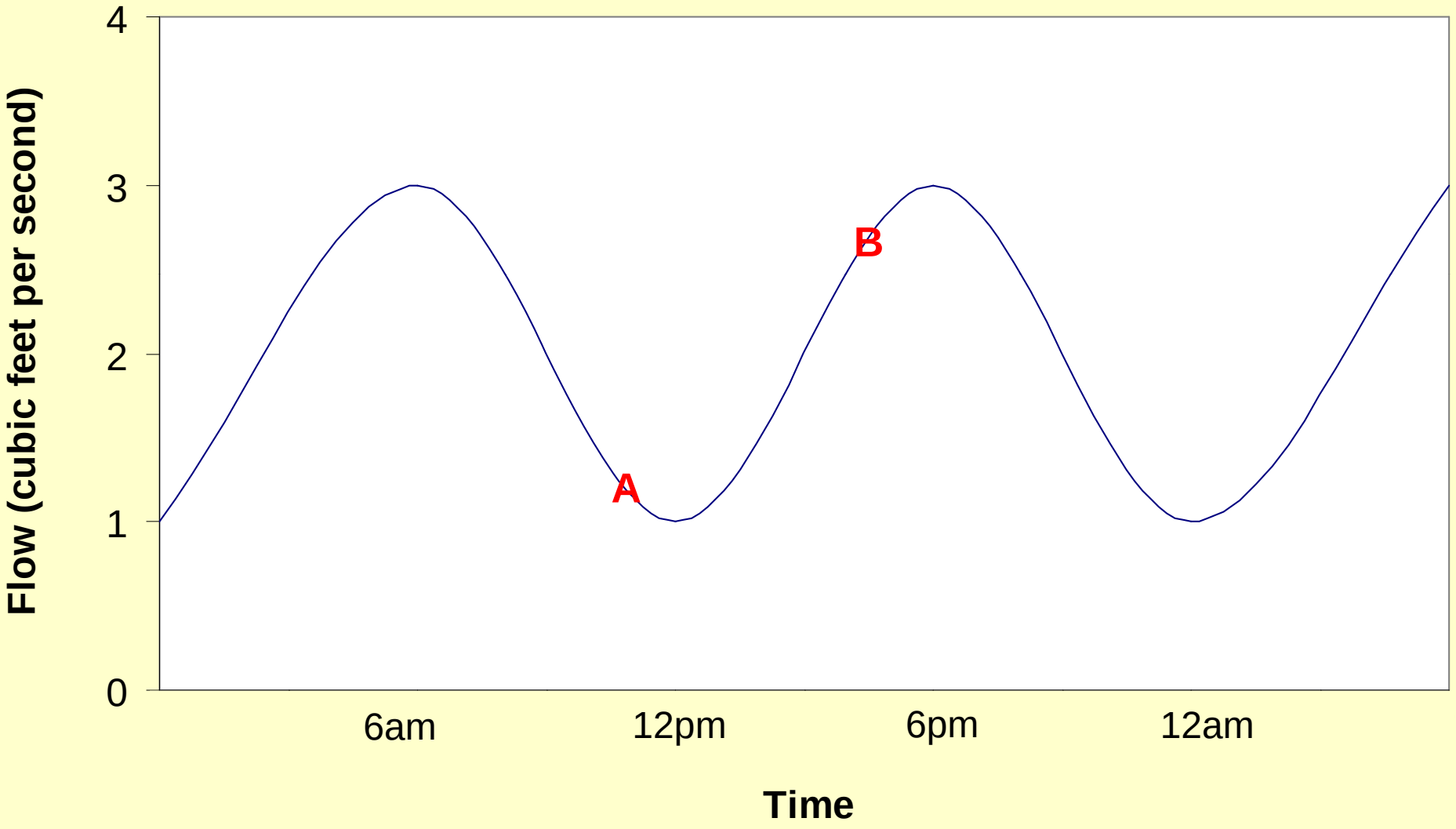
Flows & Rainfall at Pajaro River, Chittenden



Flows & Rainfall in Salinas Rec Canal at Airport



Continuous Sampling of Flows



This is not real data

Summary

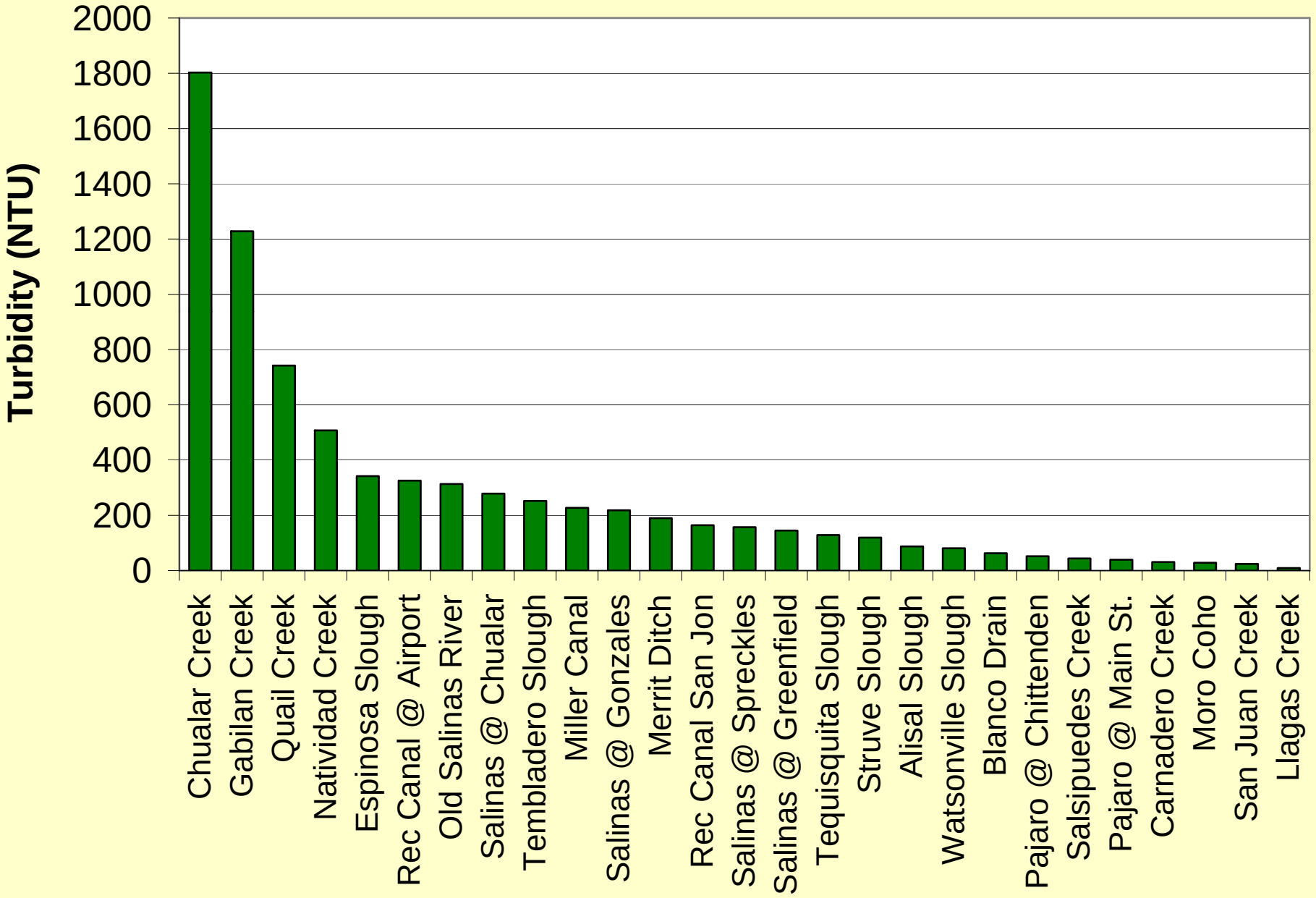
- Cooperative monitoring results to date:
  - High nitrate levels in creeks and ditches around Salinas and upper Pajaro
  - High turbidity levels (i.e. sediments)
  - Flows often highest in mid-summer
- 2008 Follow-up
  - Upstream monitoring to understand where loads come from
  - Continuous flow monitoring to understand daily flow patterns
  - Outreach to provide confidential, farm-specific water quality info

For cooperative monitoring results from your area, contact:

- Sarah Greene, Preservation Inc.
- 831-331-9051
- sgreene@ccwqp.org

END

Average Turbidity Results by Site



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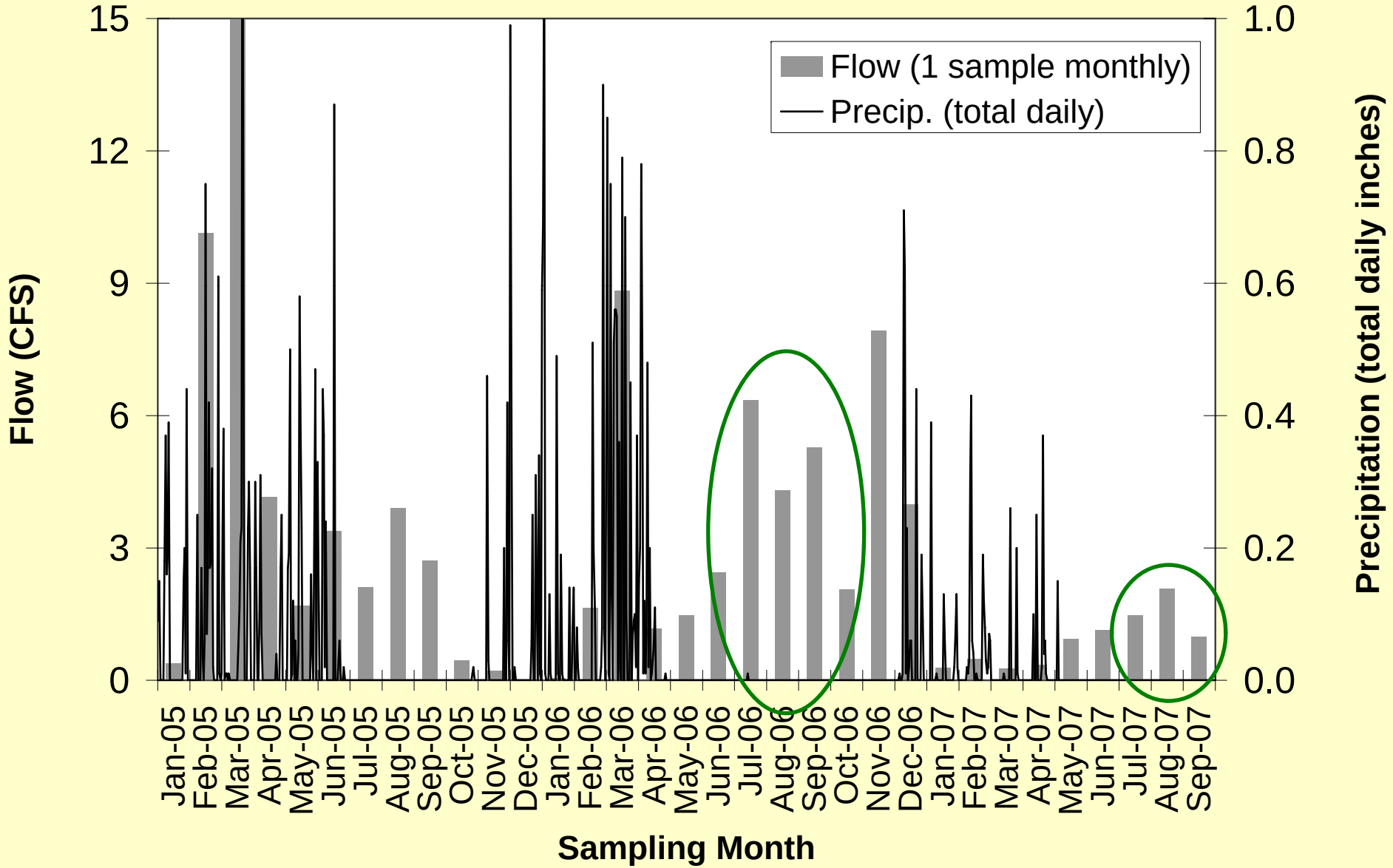


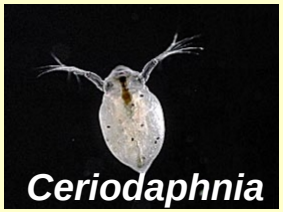
Toxicity Tests

- How well do sensitive invertebrates, fish, and algae survive (or grow or reproduce) in the water we sample?

- Sources of toxicity
  - Pesticides, Herbicides
  - Heavy Metals
  - Ammonia (depends on pH of water)

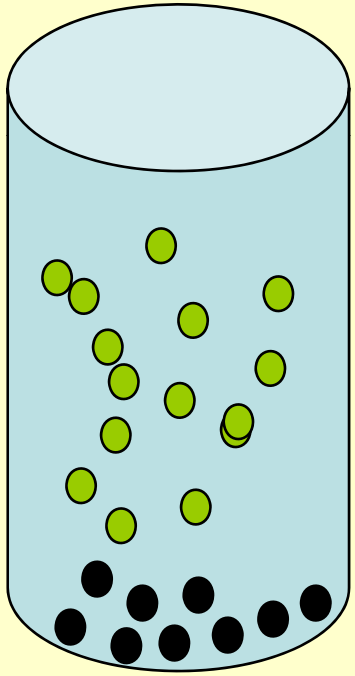
- Tests do not identify sources of toxicity

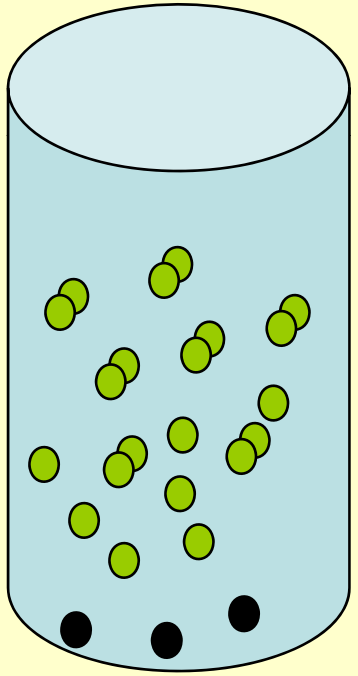
How Toxicity Tests Work



Monitoring Sample

Laboratory Water
(known to be non-toxic)





"Control": Ensures that we attribute deaths ONLY to sample toxicity, and not other factors

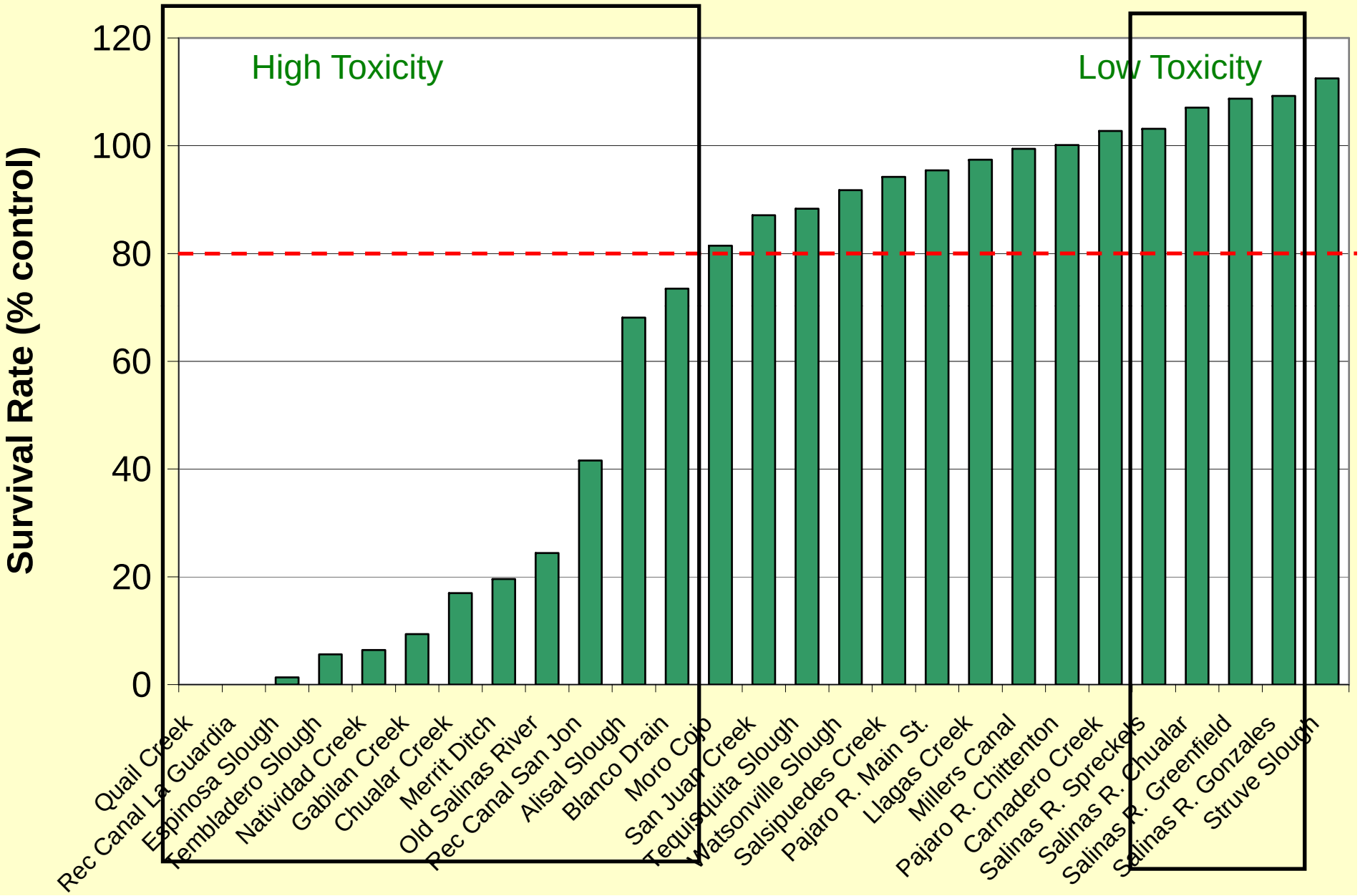
at start = 12

of surviving invertebrates = 3

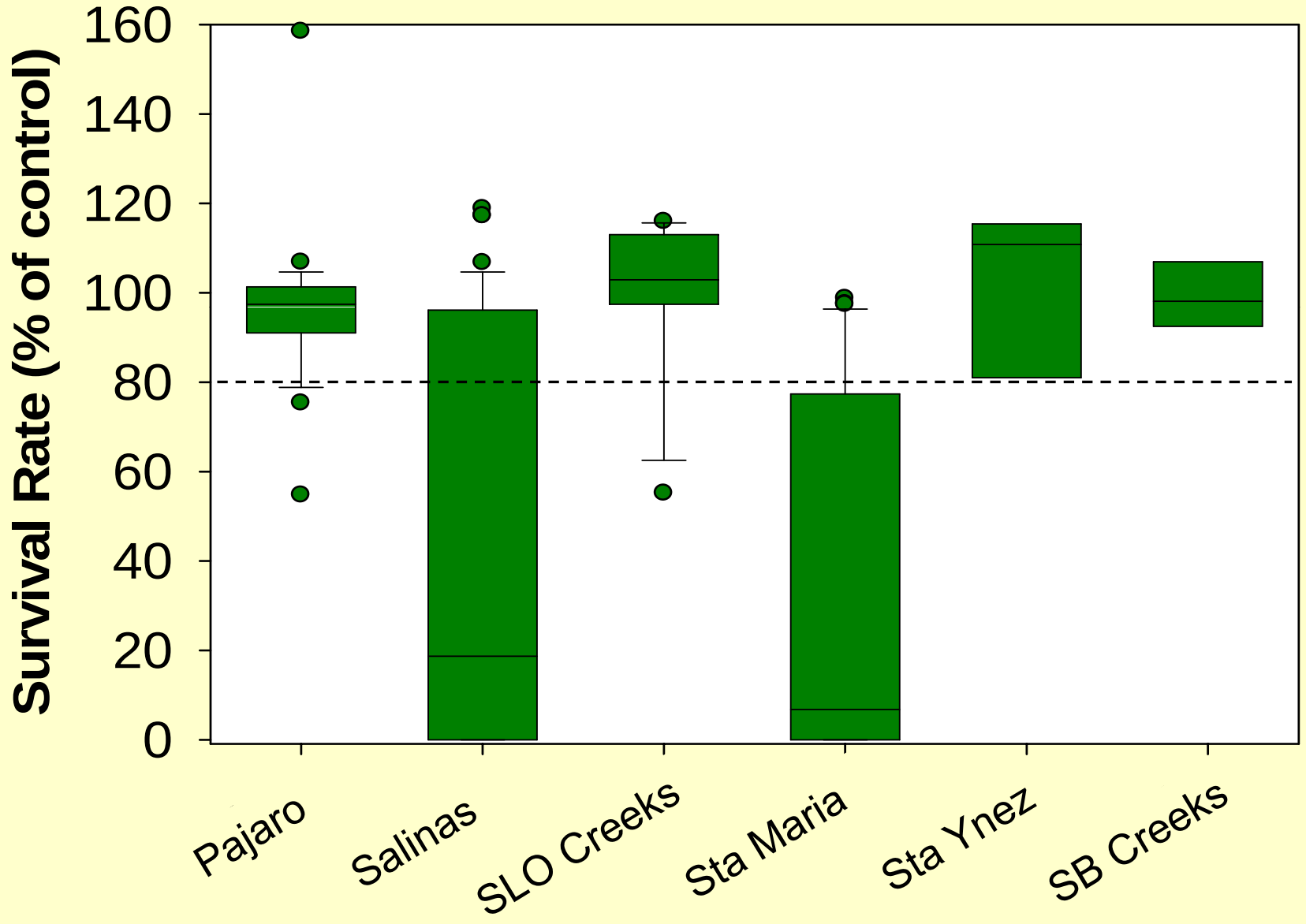
# of surviving invertebrates = 9

Survival Rate = 33%

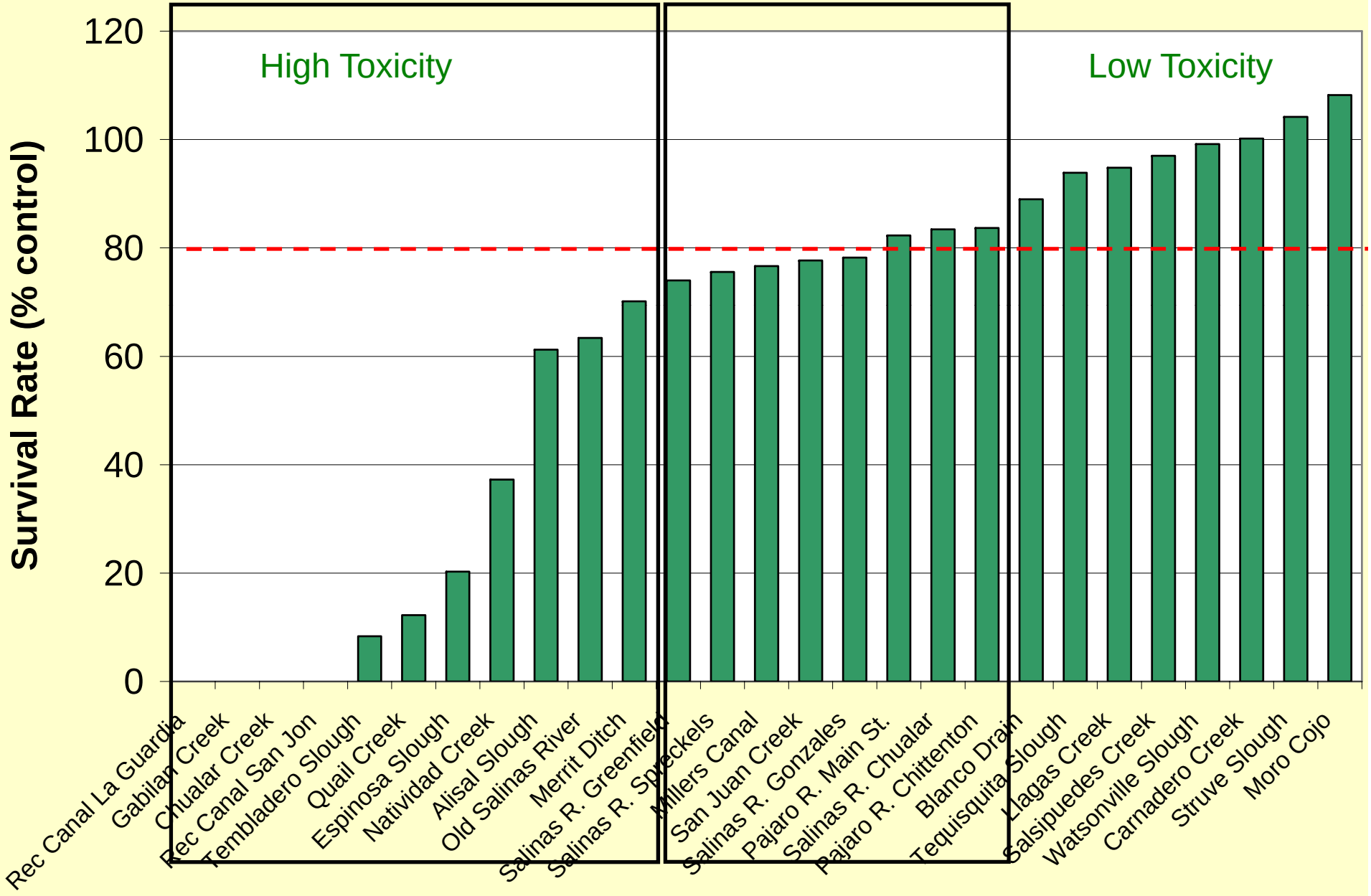
Sediment Toxicity Results by Site



Sediment Toxicity Results by Region



Water Toxicity Results by Site



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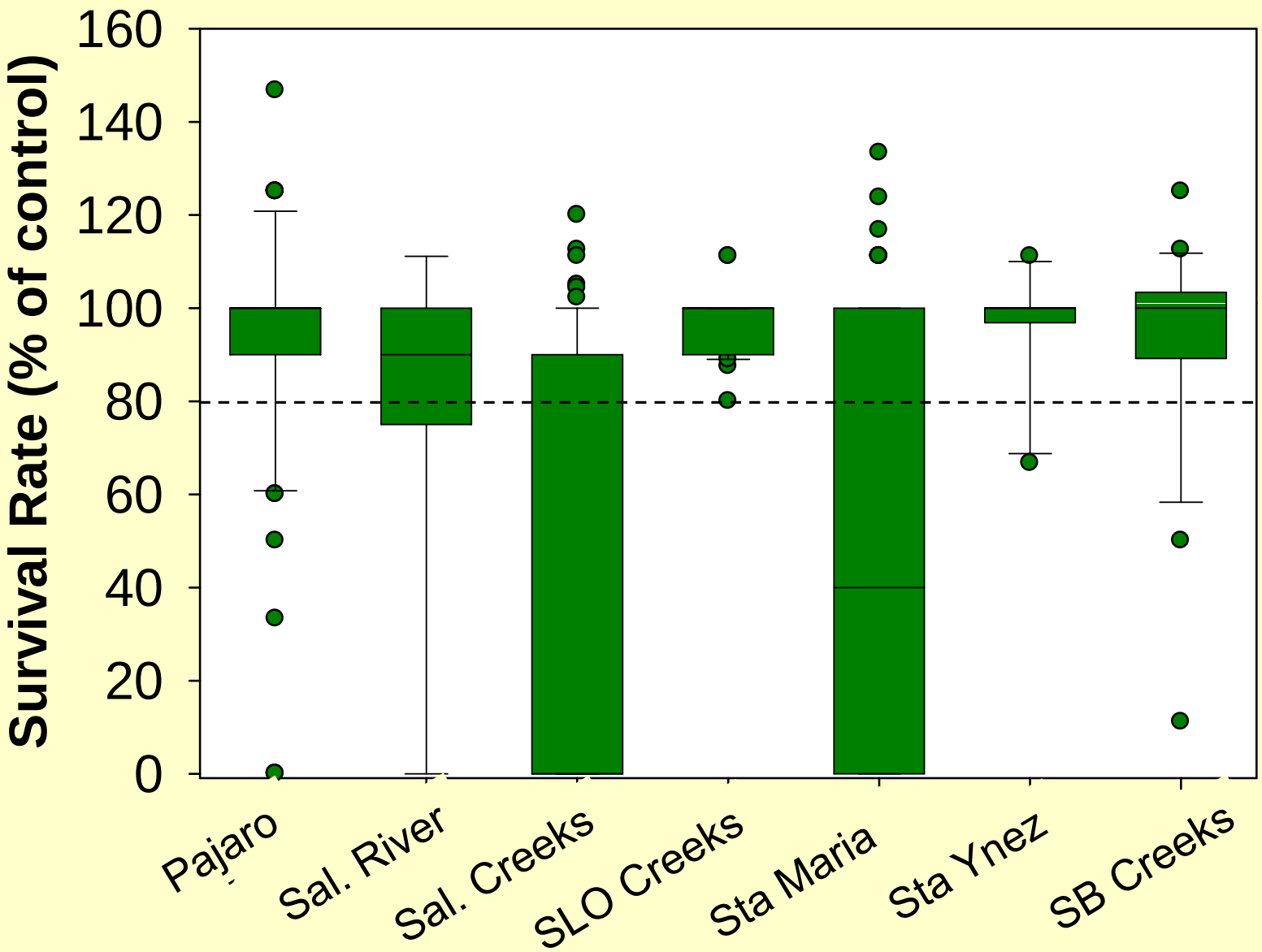


Phase I Follow-up

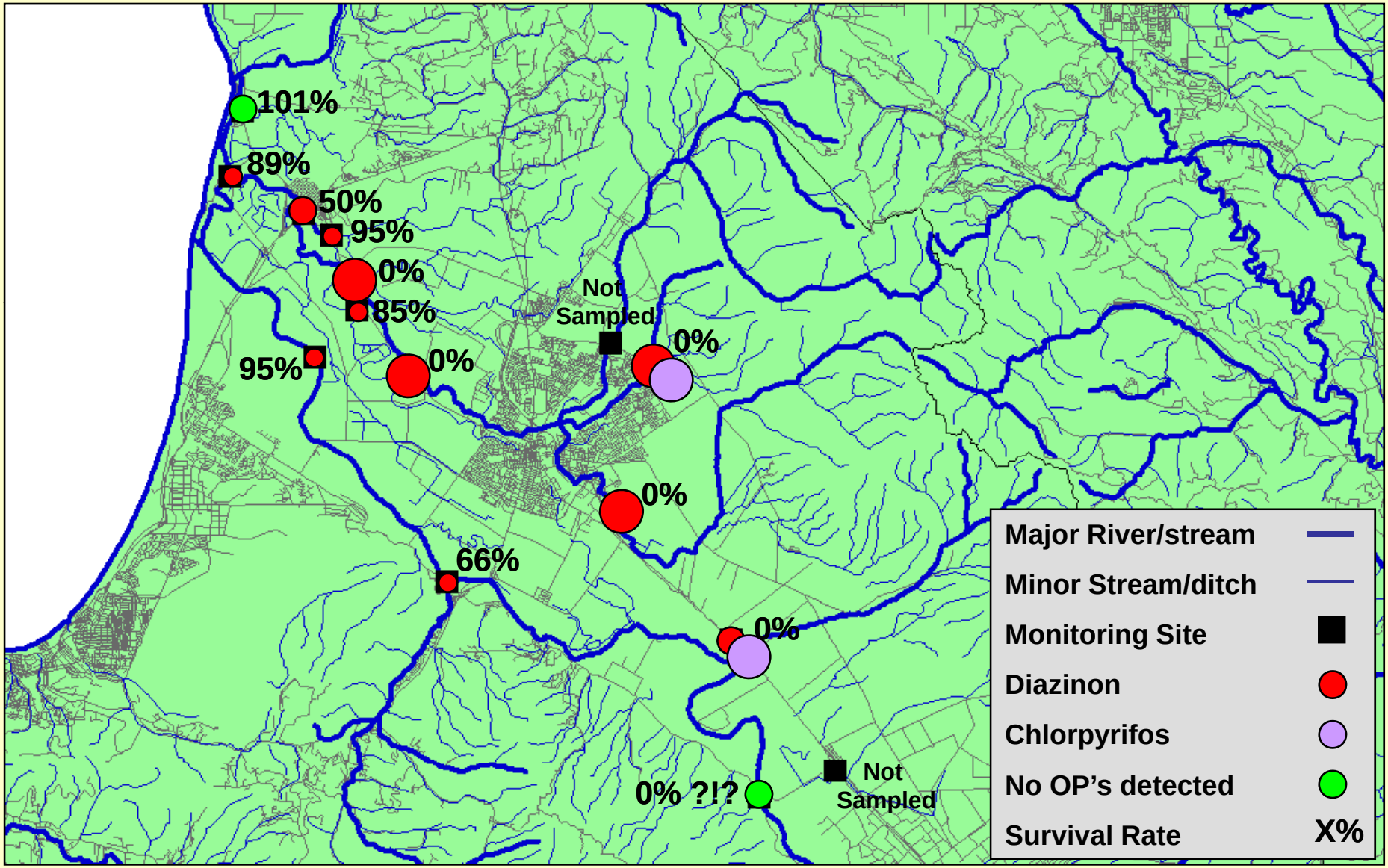
- Organophosphate pesticide tests
  - Aug & Sept, 2006
  - Feb & Mar, 2007
  - Lower Salinas & Santa Maria regions
  - Close relationship between OP's and toxicity when high concentrations of OP's are present

OP's detected in Lower Salinas Region

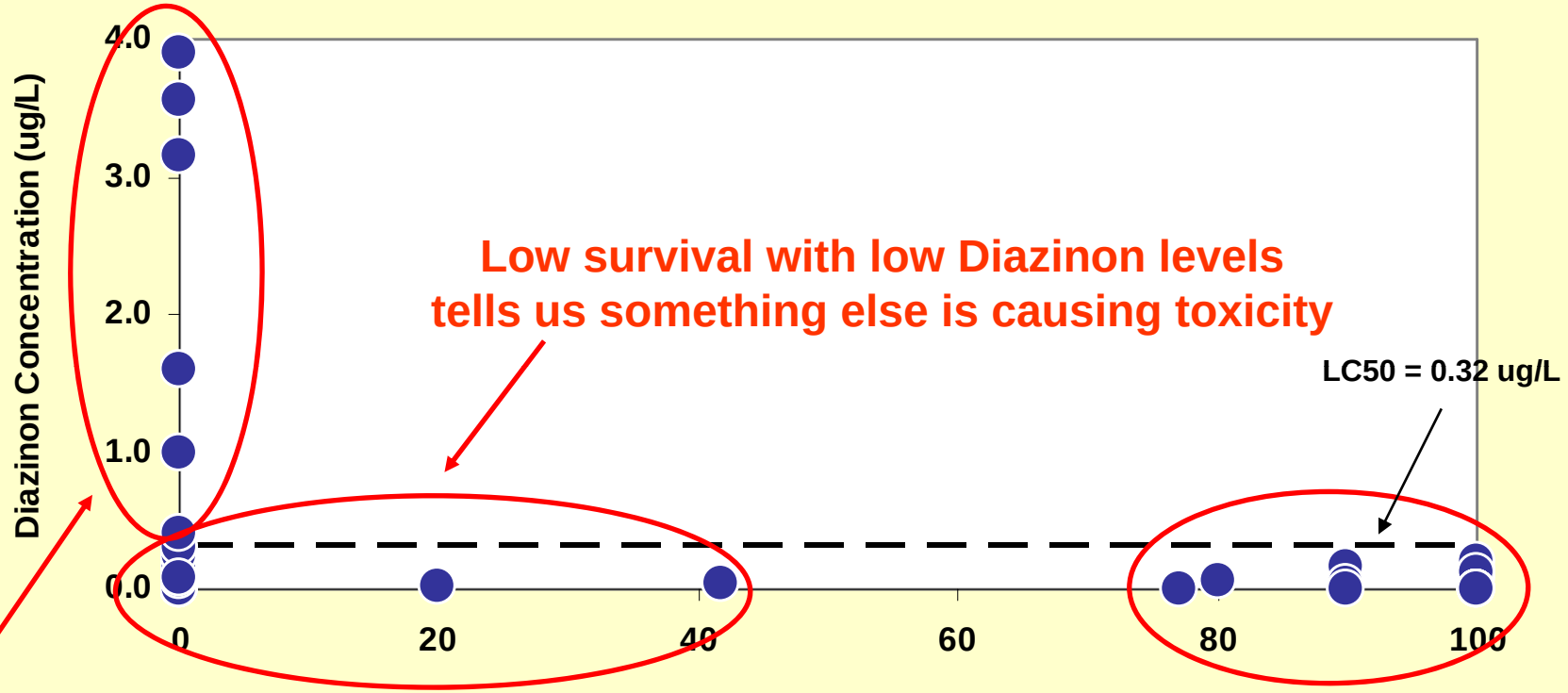
Organophosphates not detected at any site
Demeton Disulfoton Fensulfothion Fenthion Merphos Methyl Parathion Mevinphos Phorate Sulprofos Tetrachlorvinphos Tokuthion Trichloronate

	Aug, 06	Sept, 06	Feb, 07	Mar, 07
OP's detected	Chlorpyrifos Diazinon Dimethoate Malathion	Chlorpyrifos Diazinon Dimethoate	Chlorpyrifos Diazinon Dimethoate Ethoprop Malathion	Chlorpyrifos Diazinon Dimethoate Ethoprop Fenchlorphos Malathion

Salinas-Castroville OP Results, 2006



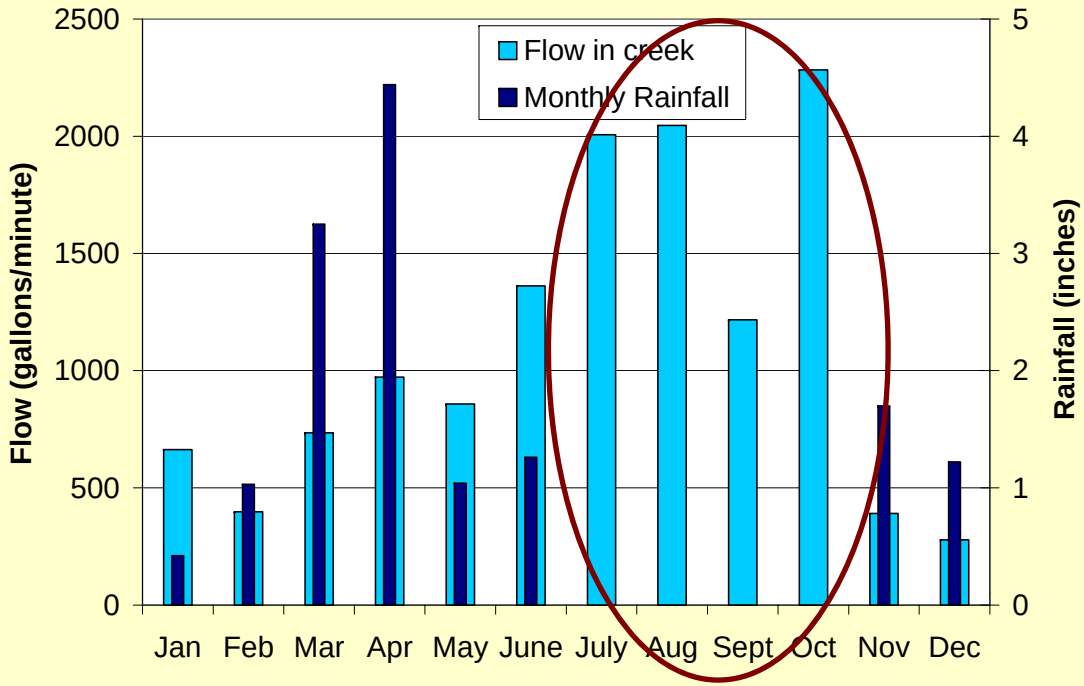
Relationship Between OP's and Toxicity

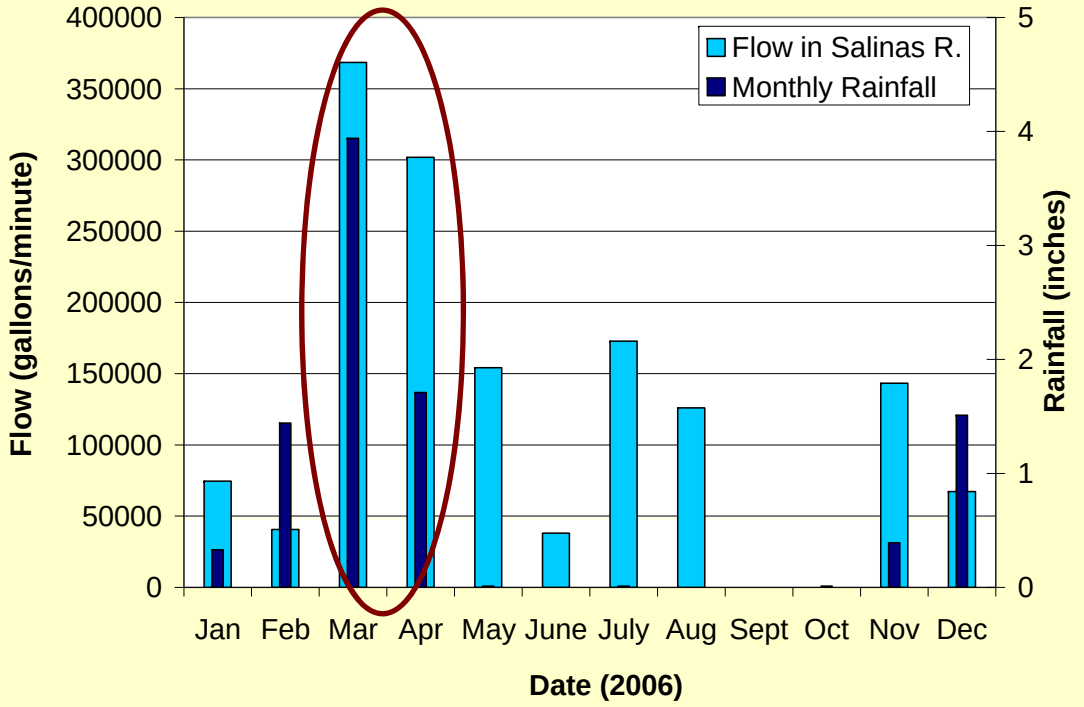


Always **low survival if Diazinon concentration was above lethal level**

High survival rates *only* if Diazinon concentration was below lethal level


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



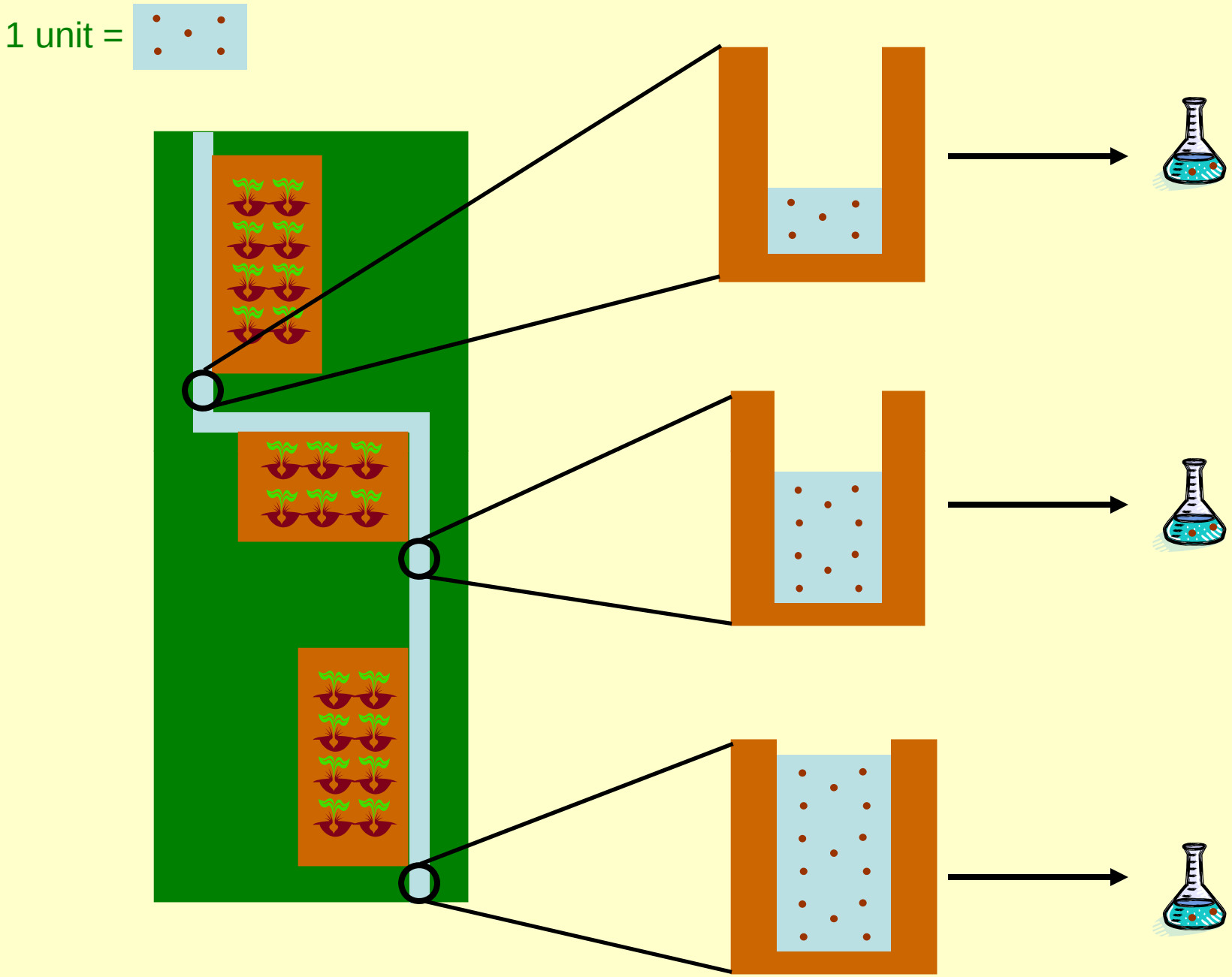


Small creek in Santa Maria watershed:

Lots of irrigation here. Flows increase during the driest months.

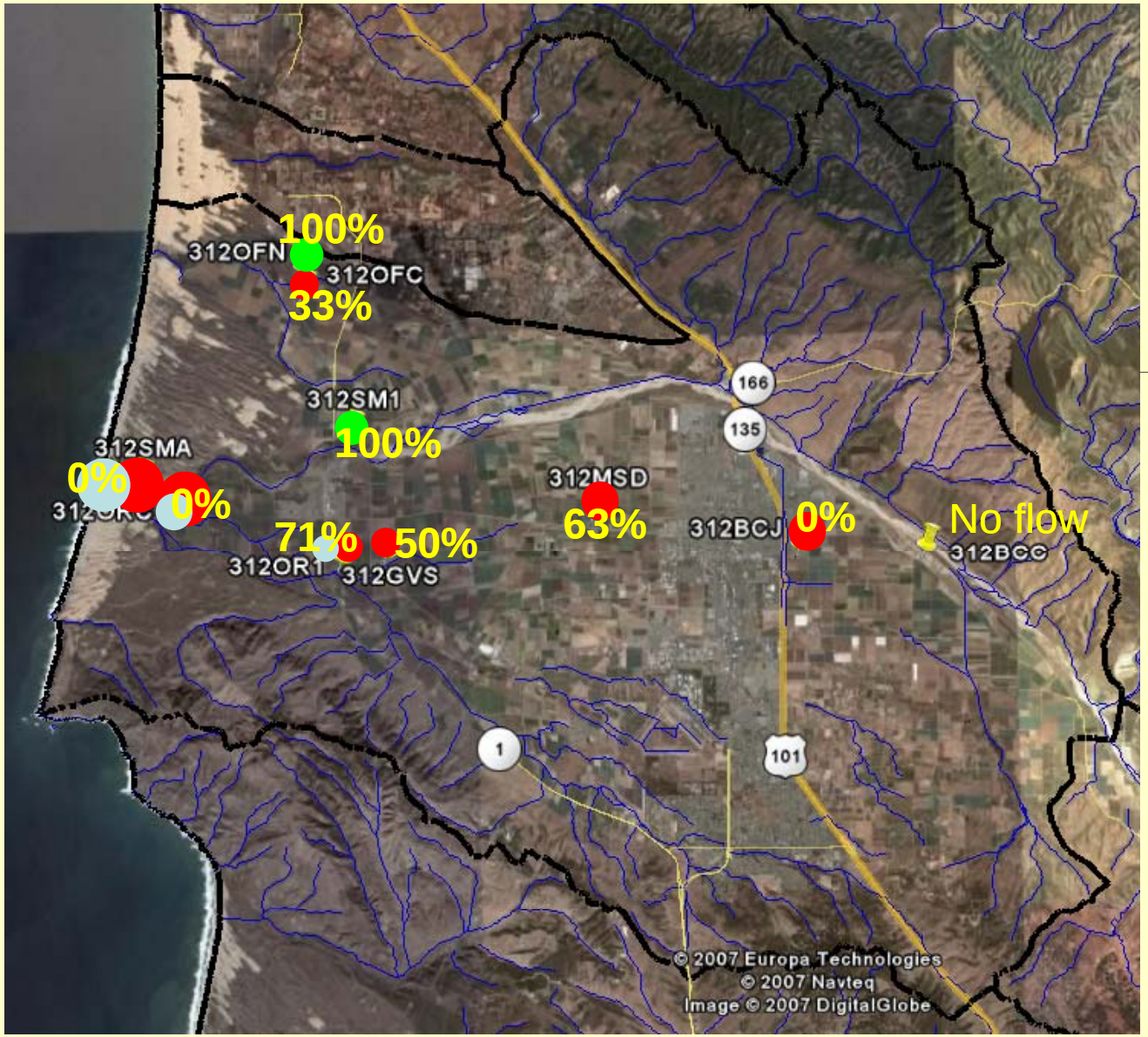
Mainstem Lower Salinas River:

Flows highest during months with rain and/or dam release. No flow in October (compare with small creek, which had highest flow in October).

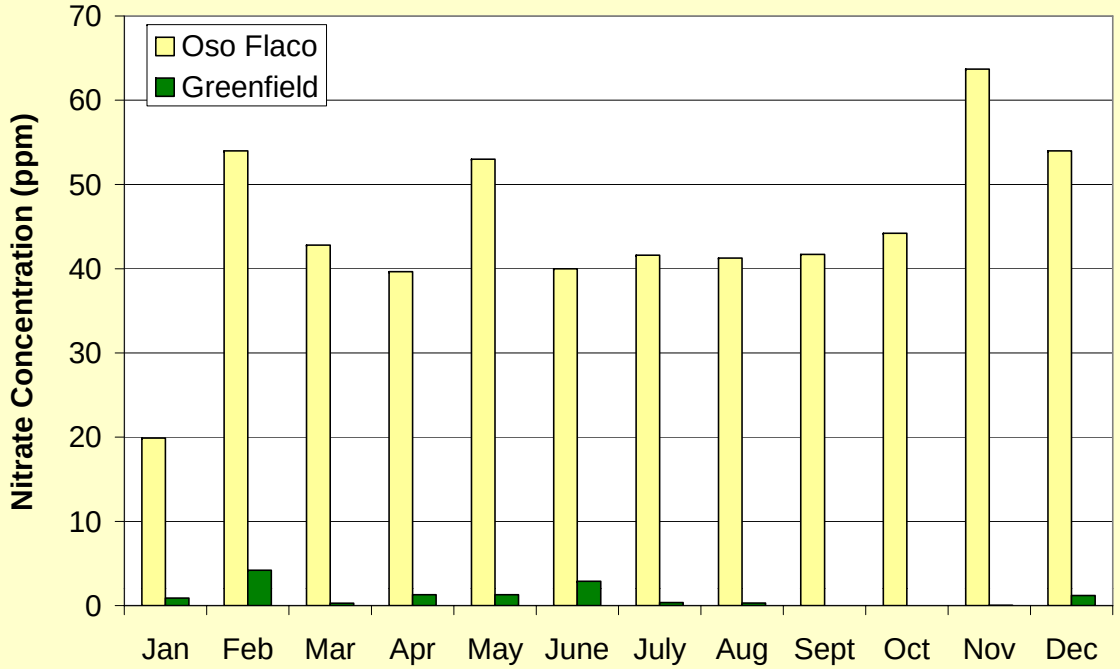


All inputs contribute to load, regardless of concentration

Santa Maria OP results, 2006

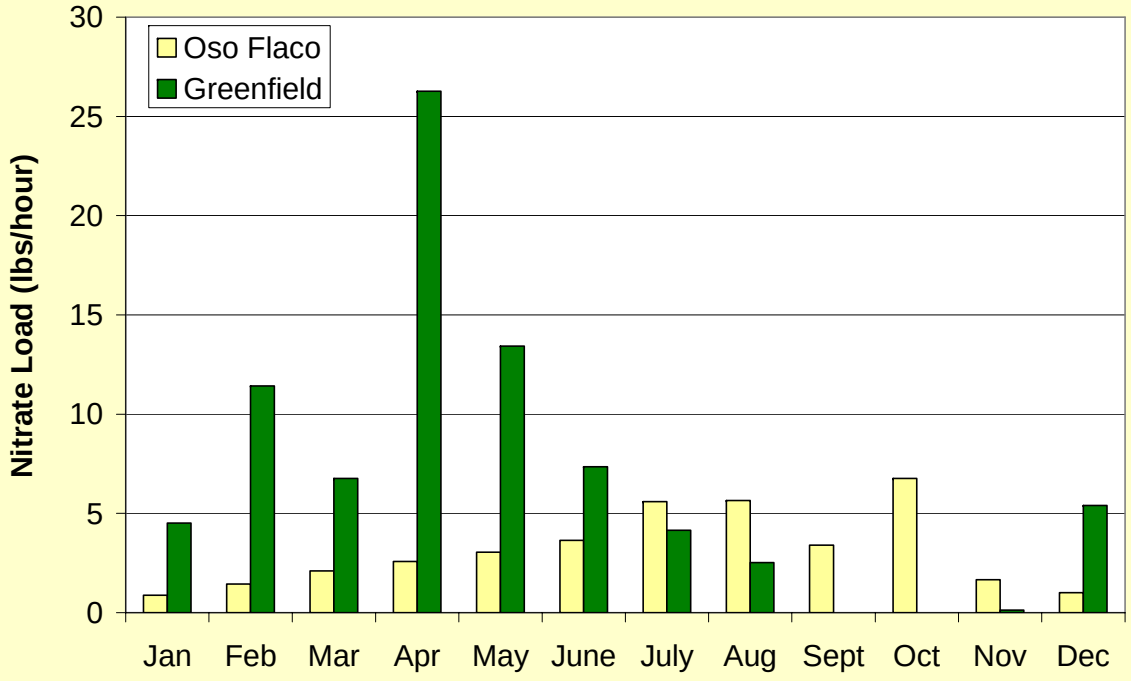


Watershed Boundary	
Stream/ditch	
Monitoring Site	
Chlorpyrifos	
Diazinon	
No OP's detected	
Survival Rate	X%



Nitrate Concentrations:

Much higher in Oso Flaco, where we're meausuring direct irrrigation runoff, than at Greenfield, where any runoff is diluted.



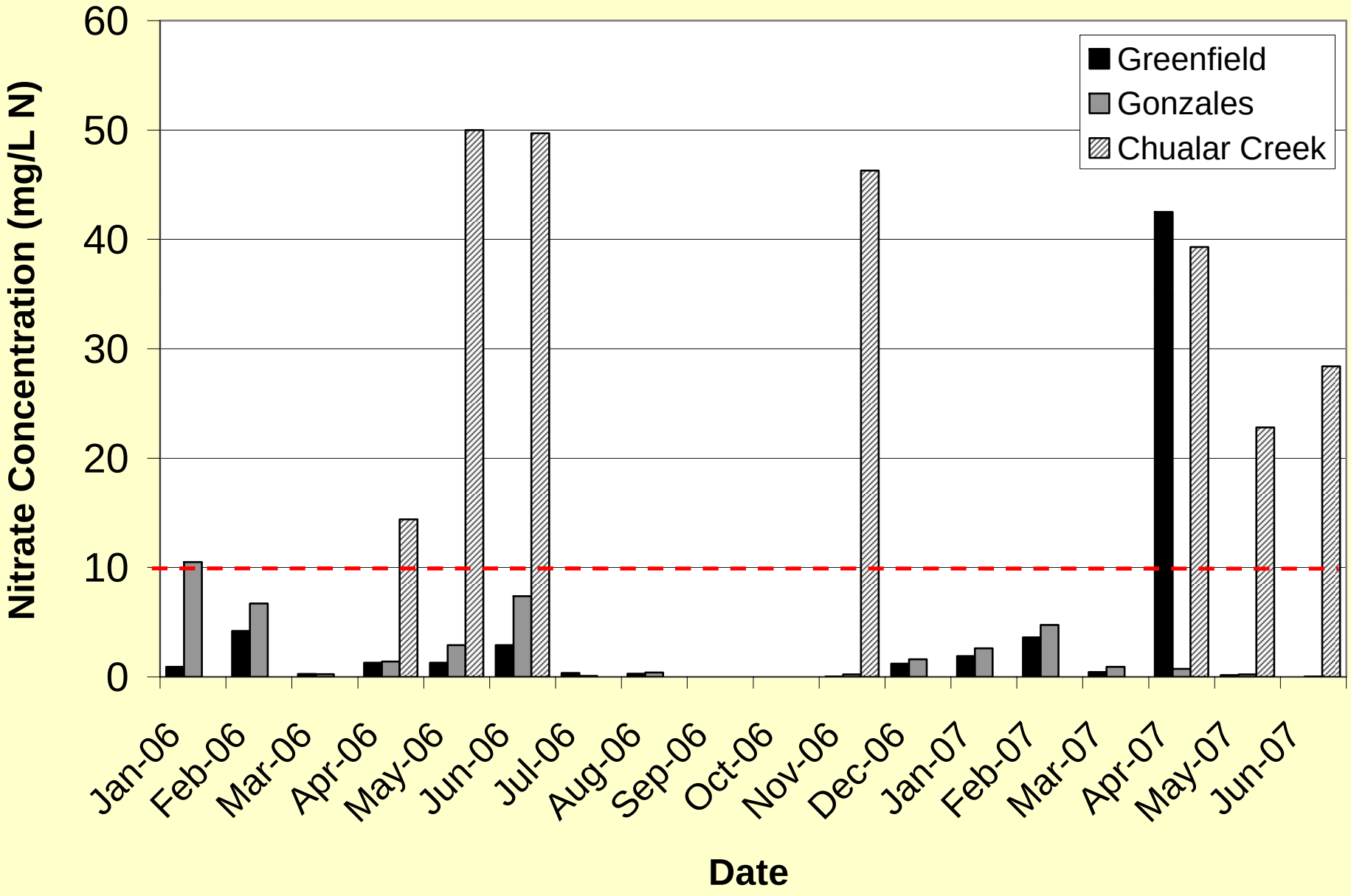
Nitrate Loads:

Generally higher in mainstem Salinas, where flows are larger.

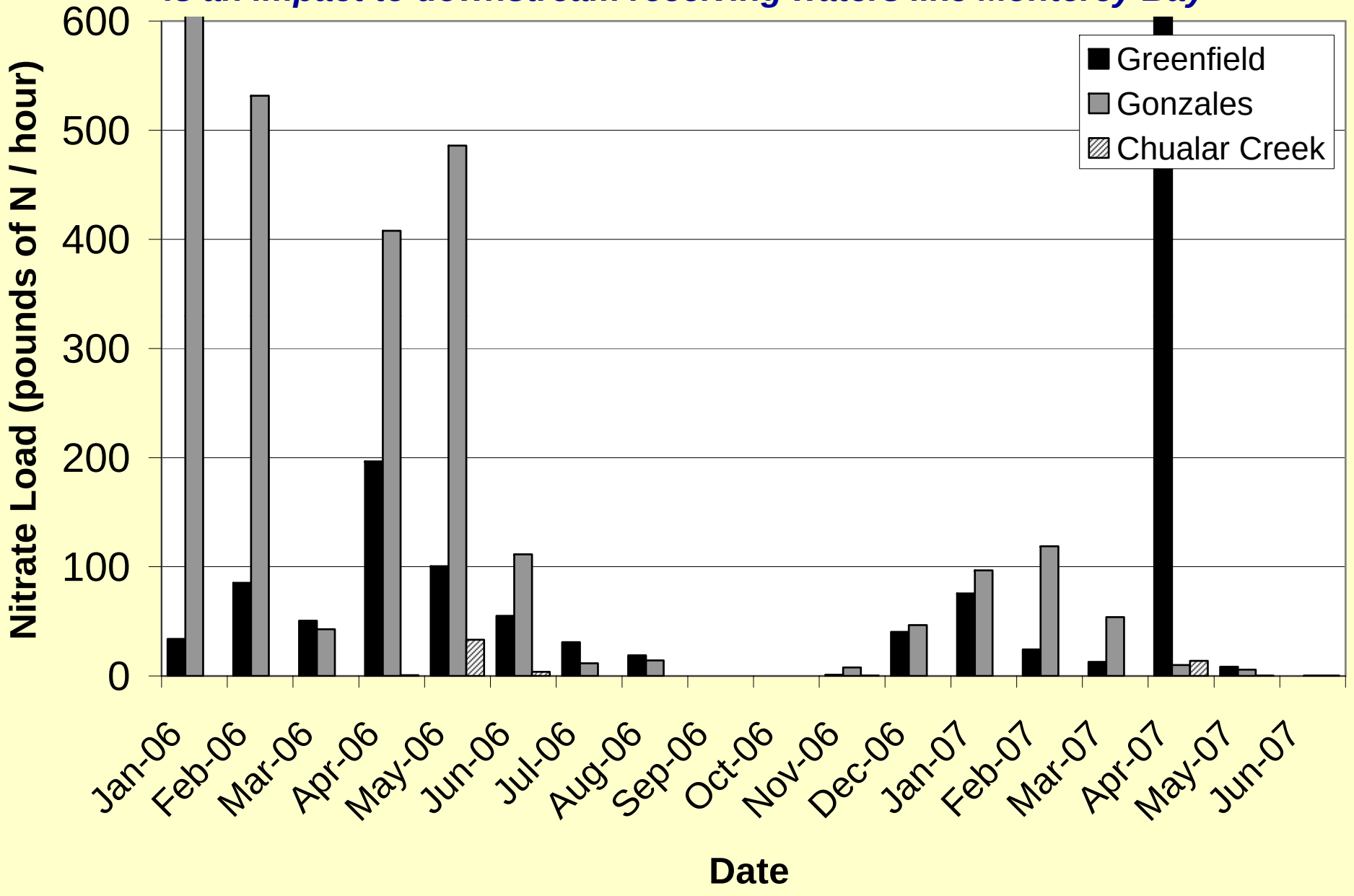
In Sept & Oct, no flow at Greenfield (so load = 0).

In July, Aug, Nov, *concentrations* were so much higher at Oso Flaco that the lower flows didn't matter.

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



Even though concentrations are very low at Greenfield and Gonzales, nitrate loads are high due to high flows. The local water quality looks good, but there is an impact to downstream receiving waters like Monterey Bay



Flows

(Flows for Greenfield & Gonzales are divided by 100)