Status and Implications of Stormwater Quality Monitoring in the Cache Slough Watershed (2010-2014)

Solano County Water Agency, Cache Slough Watershed Group

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SOLANO WATER
BE GREEN, SAVE BLUE

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Introduction/Background

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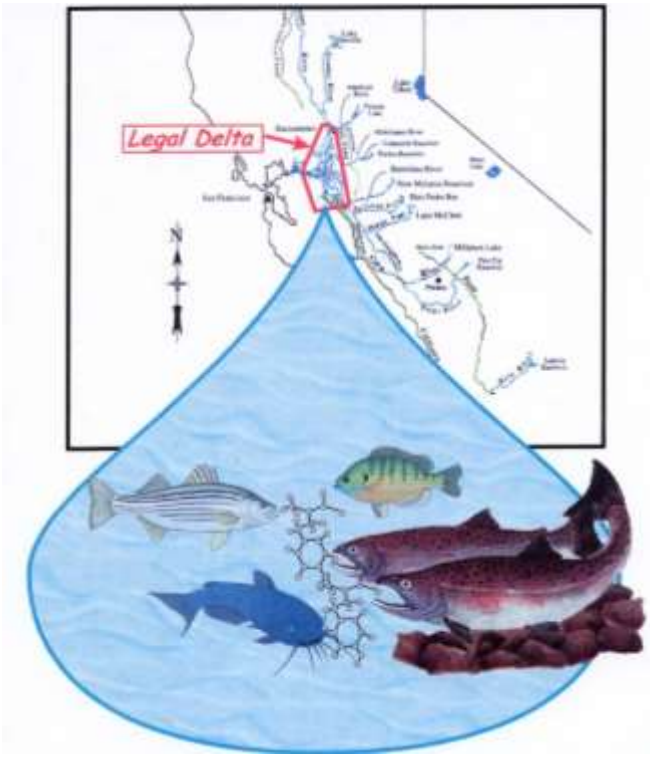
Cache Slough Overview

- Deltaic/alluvial floodplain where Cache Slough and Yolo Bypass meet (backwater tidal region)
- ~45,000 acres open water, marsh, floodplain, and riparian habitat
- Agriculture is the dominant land use; urbanized areas are also a key influence in the contributing watershed
- Important spawning and nursery areas for Sacramento splittail and threatened Delta smelt (targeted for habitat restoration)
- Water quality toxicity observed and linked to pelagic organism decline (POD) (DWR 2007, Werner et al. 2010)



"Degraded water quality has been implicated as one of the possible causes for the decline of native species, along with various other and seemingly interconnected issues facing the Delta, such as water diversions and water habitat." (DRMP, 2011)

Imagine the result

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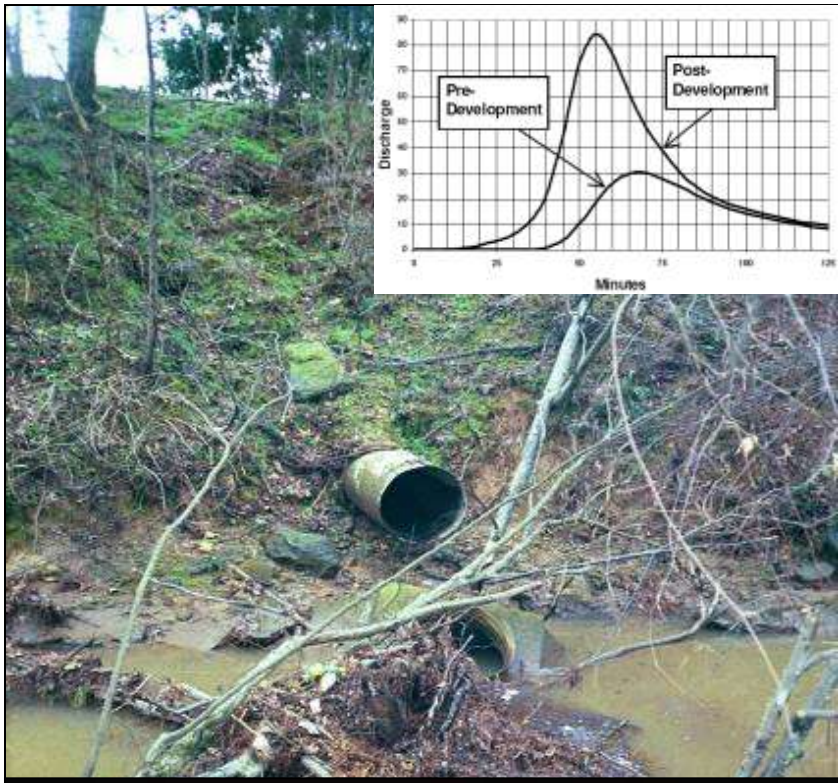
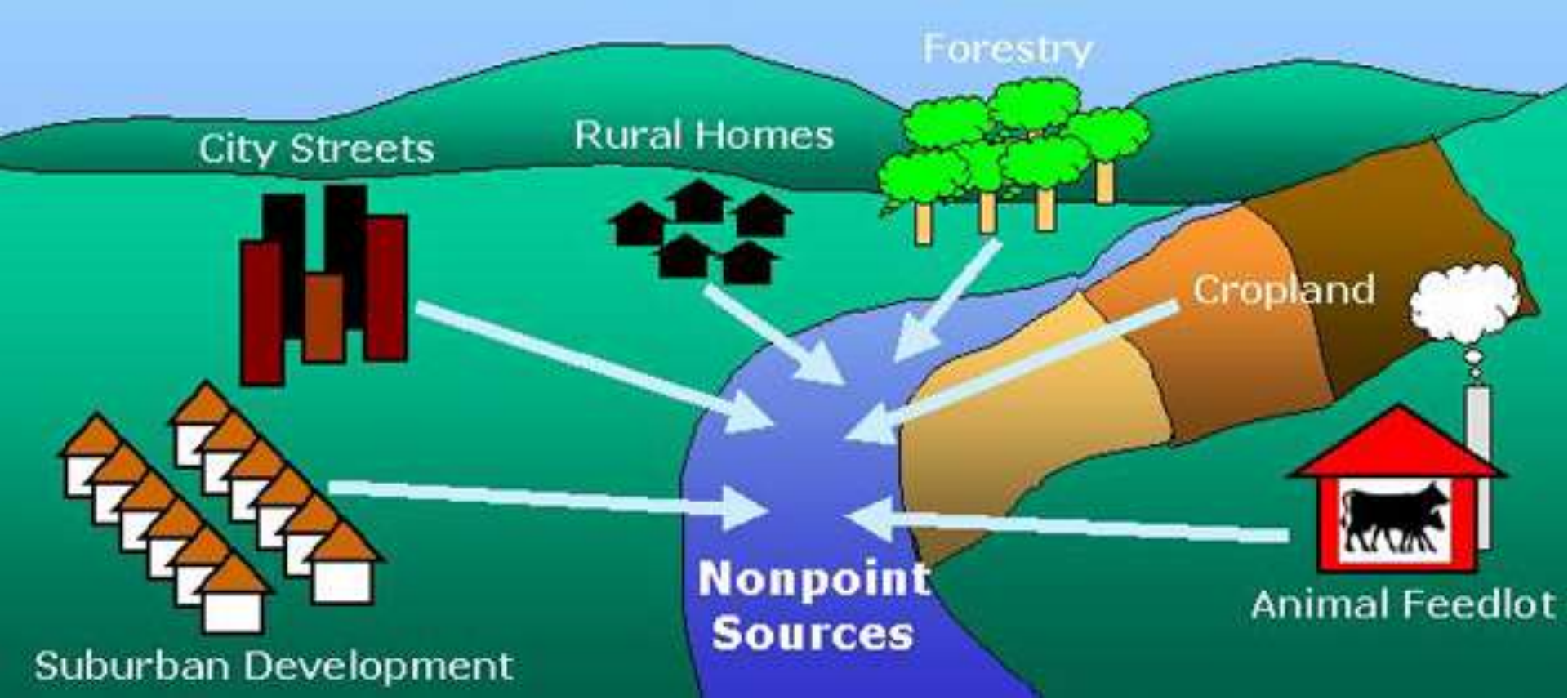
Background Regarding Stormwater Runoff Impacts

- Hydromodification
- Aquatic ecosystem degradation
- Contaminants
- Biological effects on native species
- Discharge Sources:
  - stormwater runoff, irrigation return flow, tail water, operational spills, WWTPs, subsurface drainage



Imagine the result



- Non-point source (NPS) pollution from diffuse land-based activities
- Includes runoff from agriculture/forestry, urban areas, roads, septic systems, etc.
- Runoff over the land surface picks up pollutants (sediments, nutrients, organic matter, bacteria, oils, metals and other toxic chemicals) prior to entering receiving waters.

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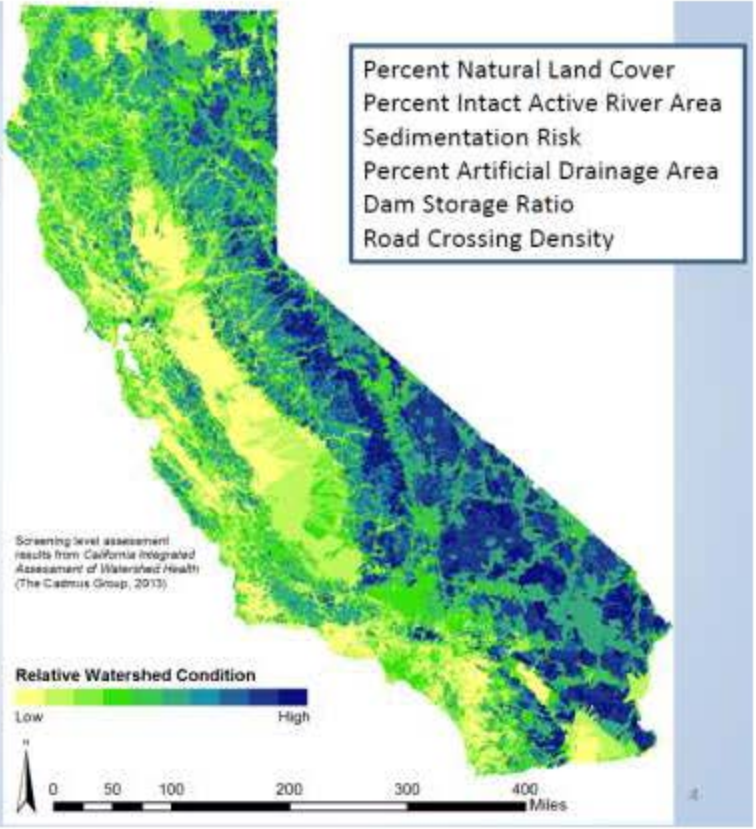
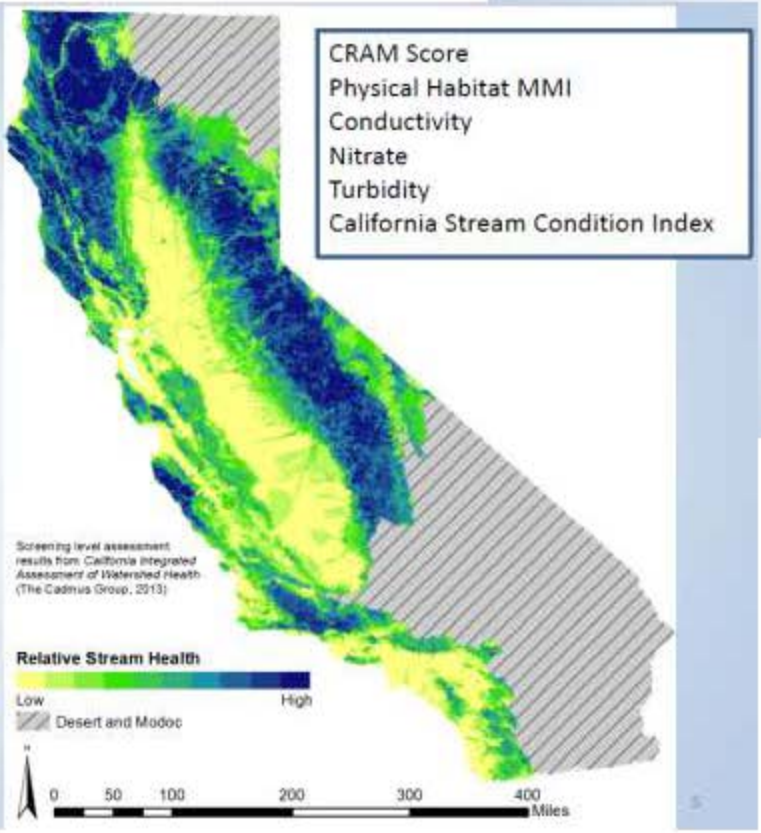
Relative Watershed Condition Index



Relative Stream Health Index



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Water Quality Problems and Contaminants of Concern in the Delta

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Bay-Delta Water Quality Problems

- Toxicity impacts → influence on aquatic organisms
- Bioaccumulation of “Legacy” pesticides, methyl mercury, PCBs → fish unsafe to eat
- OC, OP and Pyrethroid Pesticides
- High levels of nutrients and TOC → requires treatment
- Total Salts and Selenium
- Non-native aquatic vegetation
- Excessive algae growth, water export, and ammonia → low dissolved oxygen → fish kills
- Contaminants of Emerging Concern (CECs)

Bay-Delta Water Quality Problems

- Decline of fish food organisms → shrinking fisheries
- Sediments → effect on toxicity
- Pathogens/Bacteria → potential disease contraction from consumption/contact
- Metals → impacts to organisms through food web bioaccumulation
- Former mining activities and current stormwater & wastewater discharges throughout Delta → discharges of hazardous chemicals at trace concentrations

↓

Potentially Contributing to Pelagic Organism Decline

Pollutants of Concern

1. Sediment (Total Suspended Solids)
2. Oxygen-depleting substances such as sewage, other carbon-based waste, and dissolved carbon-based material
3. Metals:
   A. Aluminum
   B. Arsenic
   C. Chromium
   D. Copper
   E. Lead
   F. Mercury
   G. Selenium
4. Nutrients (nitrogen, phosphorus)
5. Pesticides (OCs, OPs, Carbamates, Pyrethroids, etc.)
6. Bacteria and viruses (pathogens)
7. Trash
8. Thermal discharges
9. Non-native species
10. CECs (pharmaceuticals & personal care products)

Ranking Delta Pollutants of Concern

Pollutant of Concern	Level of Concern		
	High	Medium	Low
Bacteria: Total Coliform Fecal Coliform E. Coli	X		
Boron	X		
Metals			
Aluminum	X		
Chromium			X
Copper			X
Lead			X
Mercury	X		
Selenium		X	
Nitrate		X	
TOC / DOC		X	
Pesticides & Herbicides			
OCs (DDE & DDT)		X	
Organophosphates		X	
Carbamates			X
Pyrethroids	X		
Salinity	X		
Total Suspended Solids (TSS)			X

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Recognized Pollutants of Concern in Cache Slough

Cache Slough is within the Delta Waterways (Northwestern portion), which is a 303(d) listed impaired water body for the following pollutants:

Pollutant / Stressor	Potential Source Cited by State	State TMDL Development Status
Chlorpyrifos	Agriculture Urban Runoff/Storm Sewers	TMDL Completed
DDT	Agriculture	TMDL Needed
Diazinon	Agriculture Urban runoff/storm sewers	TMDL Completed
Electrical Conductivity	Agriculture	TMDL Needed
Exotic Species	Source Unknown	TMDL Needed
Group A Pesticides	Agriculture	TMDL Needed
Mercury	Resource Extraction (Abandoned Mines)	Methyl Mercury TMDL Completed
Unknown Toxicity	Source Unknown	TMDL Needed

*All of the waters within the Bay Delta Estuary are listed as impaired by at least one factor

Previous and Ongoing Monitoring by Other Parties

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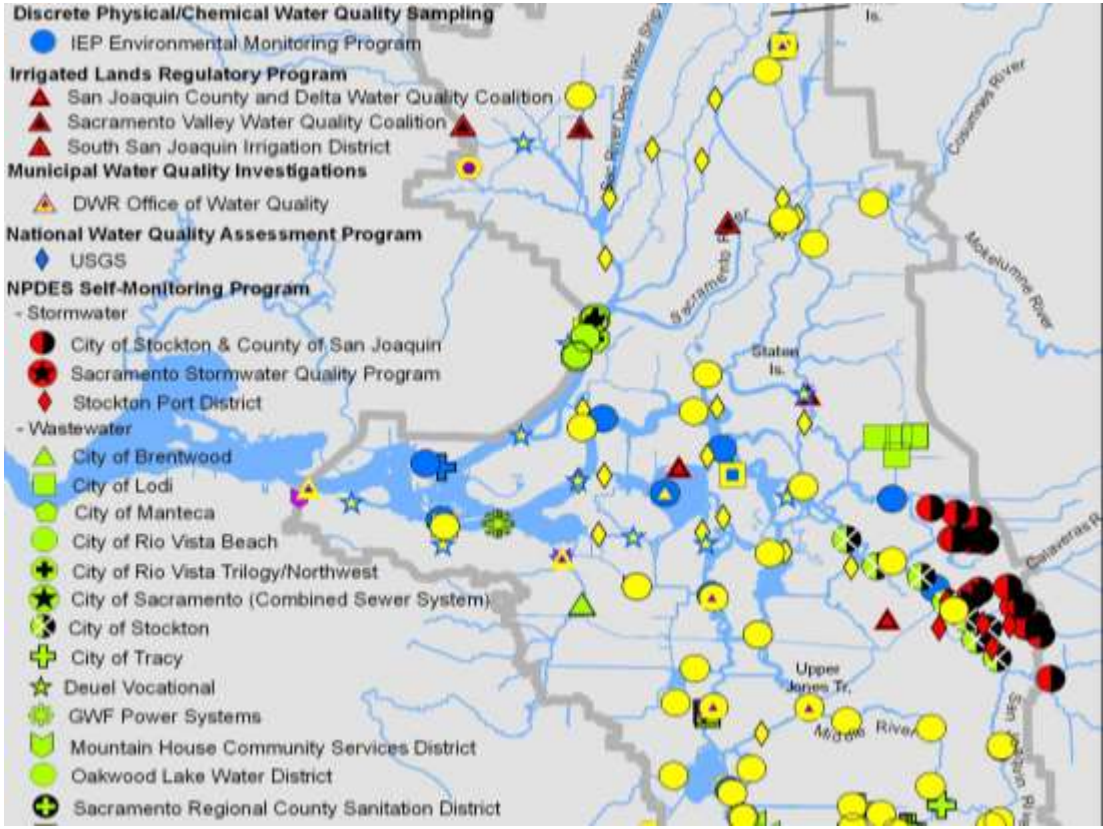
Monitoring Programs

- Over 37 Water Quality Monitoring Programs in the Delta: With more than 200 sites.



- Multiple Methods:
  - Continuous Monitoring
  - Receiving Water Monitoring
  - Water Supply Monitoring
  - Regional and Watershed Monitoring
- Drivers:
  - Specific regulatory statutes
  - Source water protection
  - Environmental management and policy support

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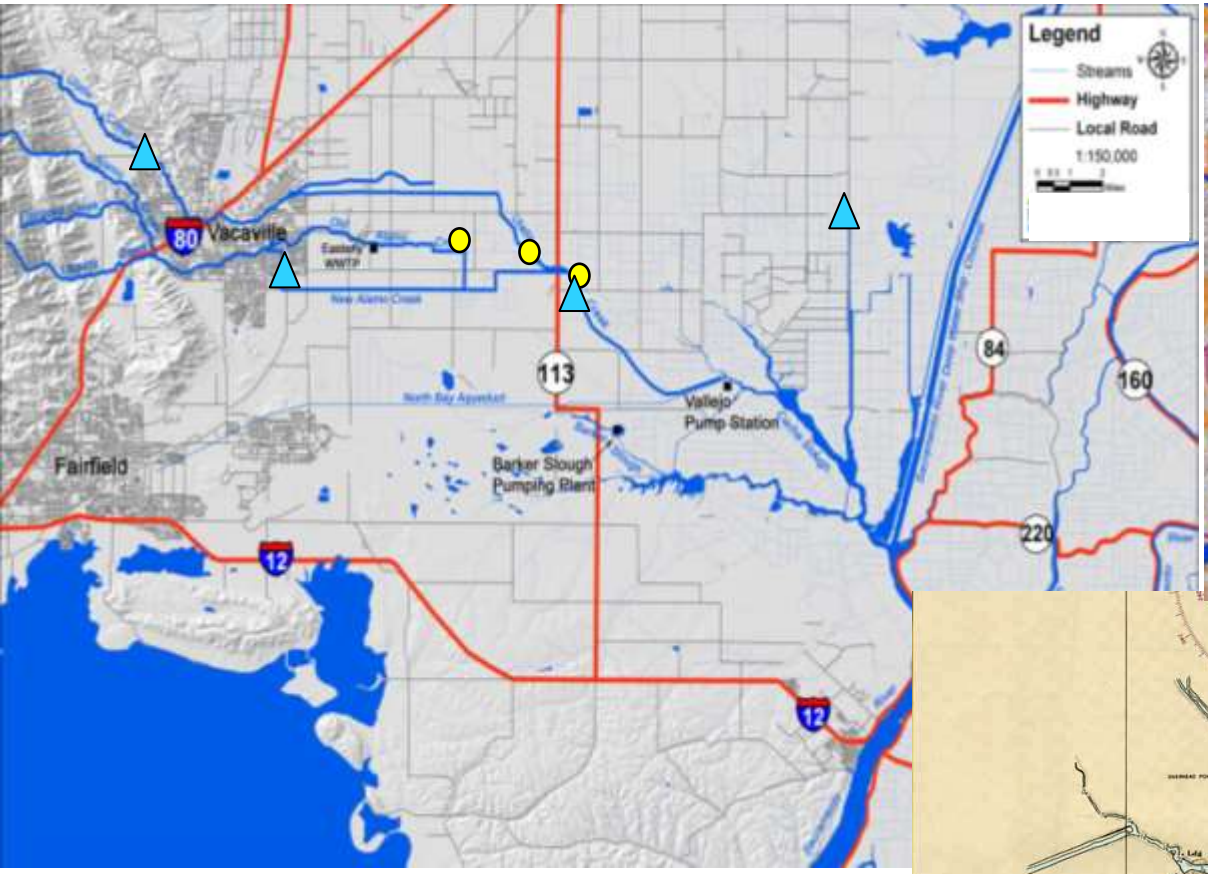
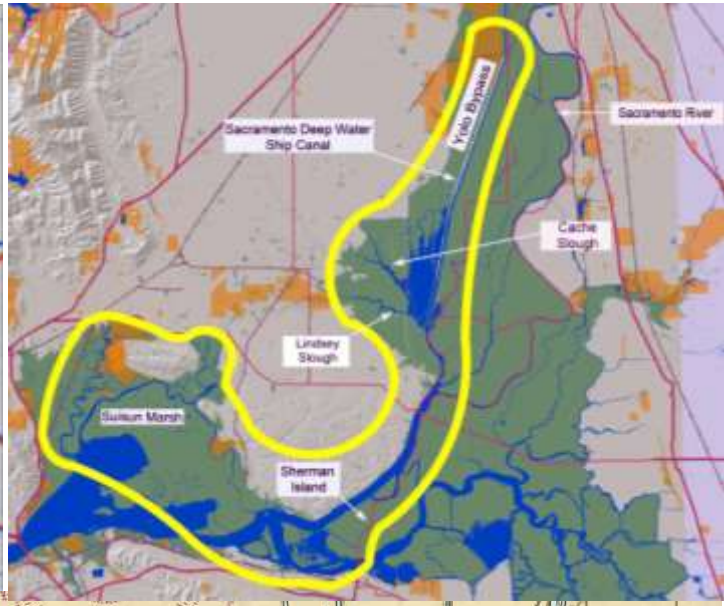
Delta Regional Monitoring Program:

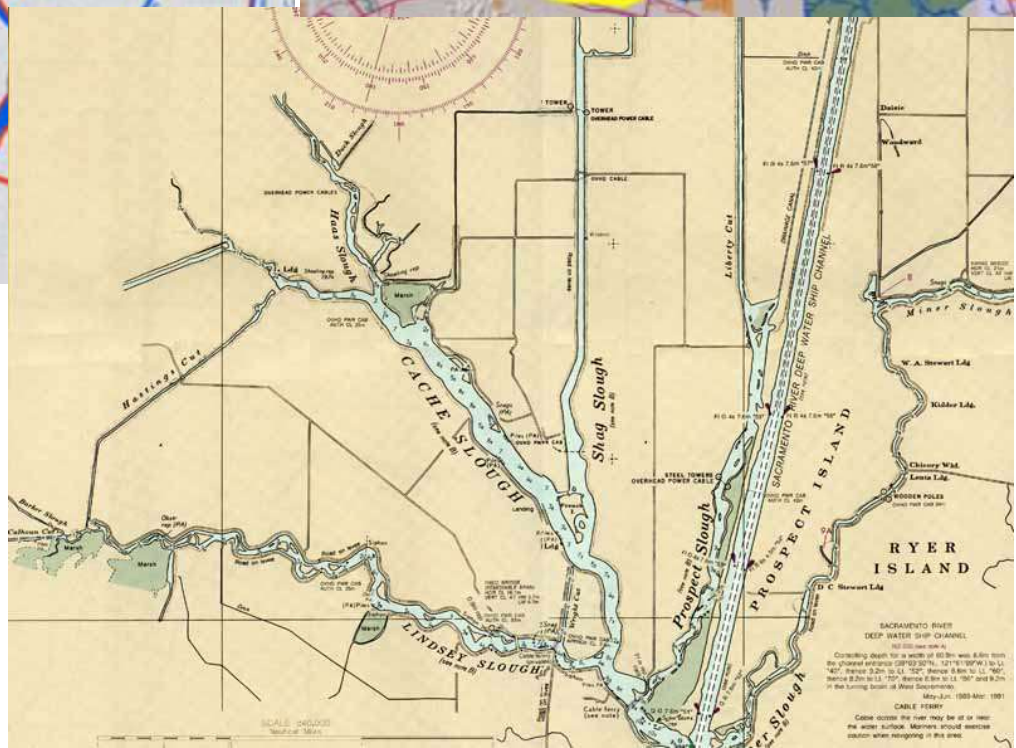
Re-Thinking Water Quality Monitoring in the Delta

- Numerous WQ monitoring programs in the Delta
- Each program is focused on its own specific needs, regulations and requirements
  - Consistent monitoring data over a particular time period is unavailable
- Proposed remedy for lack of integrated, comprehensive, and standardized monitoring & analysis is a Delta Regional Monitoring Program
- Water Boards and stakeholders currently working toward initial development of the program's governance, funding, data integration etc.

Local Cache Slough Watershed Sampling Locations







Watershed Monitoring Sites (2 not shown)

EWWTP Sites

Imagine the result

Previous ILRP Detections (2005-2009)*

Analyte	Conc.	WQO Value	Unit
Conductivity	1677	700	uS/cm
Dissolved Oxygen	3.5	5 (warm), 7 (cold)	mg/L
pH	9.38	6.5 - 8.5	-log[H+]
Total Dissolved Solids	1000	450	mg/L
E. coli	2400	235	MPN/100mL
Fecal coliform	1600	400	MPN/100mL
Boron	3100	700	µg/L
Selenium	11	5.0	µg/L
Carbofuran	0.72	0.4	µg/L
DDE(p,p')	0.0115	0.00059	µg/L
DDT(p,p')	0.0033	0.00059	µg/L
Diazinon	0.154	0.1	µg/L
Diuron	9.7	2.0	µg/L
Malathion	0.455	0.1	µg/L
Simazine	11.922	4.0	µg/L
Chlorpyrifos	0.083	0.015	µg/L
Bifenthrin*	29.8	0.6 (chronic), 4.0 (acute)*	ng/L

*Data only from Solano County and Yolo County locations.

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Ongoing Pesticide Concerns

- Actions to control OC & OP pesticides have led to increased use of pyrethroids and new WQ problems
- Pyrethroids toxic at extremely low concentrations
- Laboratory detection limits are often too high
- Toxic concentrations found in urban runoff in northern California (Weston 2010)
- Domestic/commercial pesticide use
- Pyrethroid toxicity is widespread but unnoticed because monitoring programs have not been looking for it or could not easily detect it
- Monitoring programs must adapt to changing mix of toxic threats or risk monitoring for the problems of yesterday

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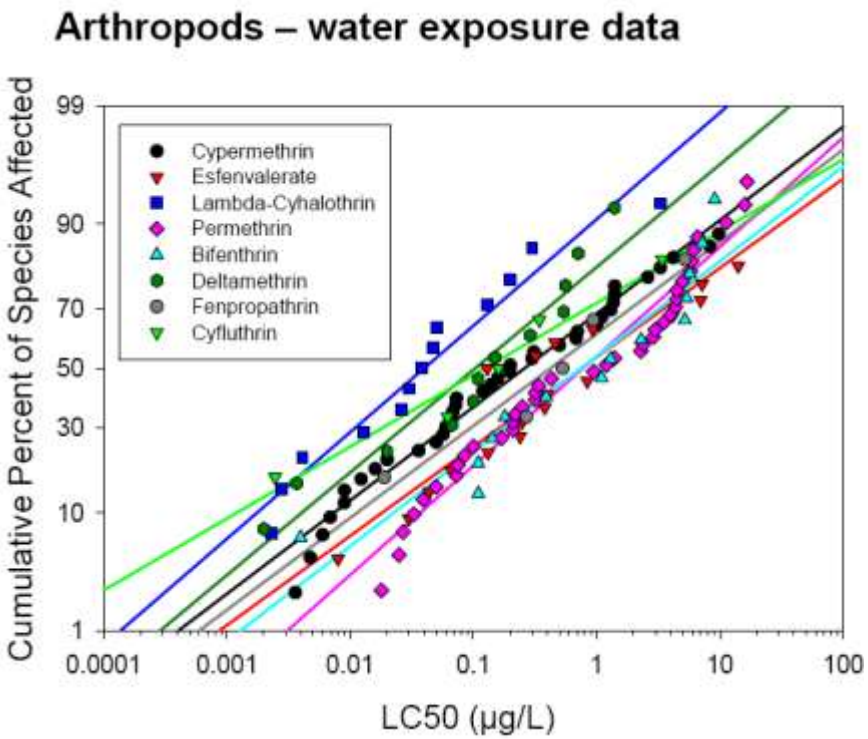
Pyrethroids

Summary of Pyrethroid Detections
2008-2009 Monitoring Study, D. Weston, UCB
Concentrations Measured (ng/L)

Source Type	Bifenthrin	Cyfluthrin	Cypermethrin	Deltamethrin	Esfenvalerate	Fenpropathrin	Lambda-Cyhalothrin	Permethrin	Chlorpyrifos
Urban Runoff	29.8	17.8	12.3	3.5	4.3	6.1	6.2	45.8	14.4
POTWs	6.3	1.7	17.0	2.7	3.7	0	5.5	17.2	24.1
Agricultural Drains	5.8	0	0	0	10.1	3.9	17.5	10.3	226

***Includes data from Ulatis Creek / Vacaville, CA**



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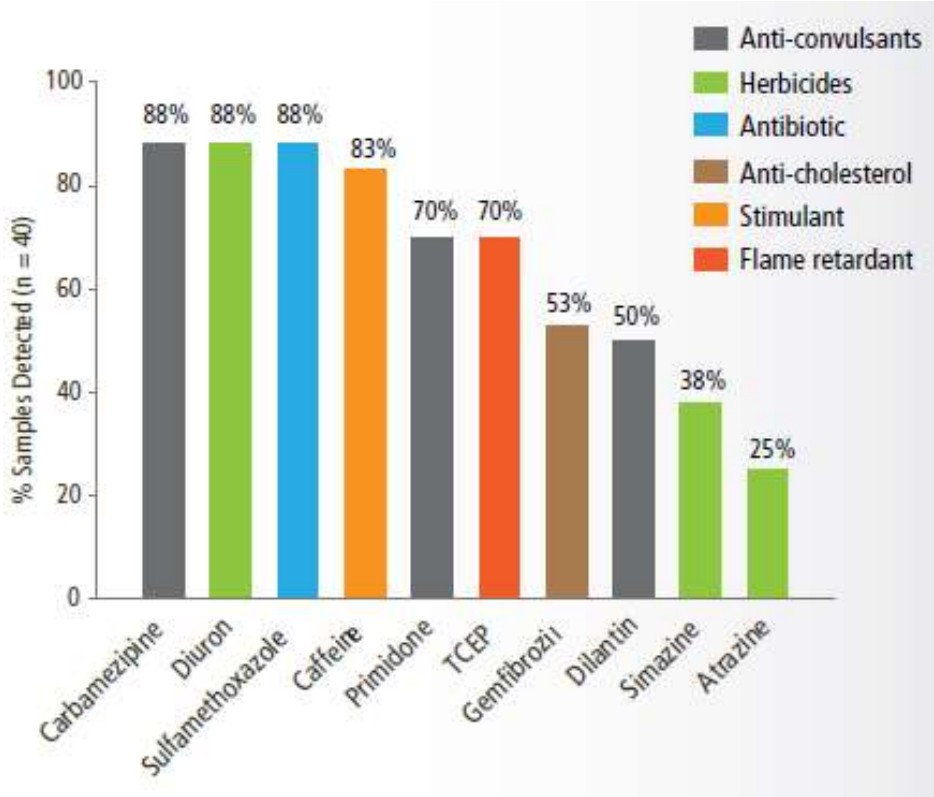
Contaminants of Emerging Concern (CECs)

- Potentially thousands of CECs
- Limited information available to assess their impact
- Endocrine disrupting chemicals
- New CECs exist, but occurrence, fate, and toxicity data is unavailable
- CEC impacts can be evaluated by using other state and regional agencies' strategies
- Trace quantities are frequently detected
- Water bodies that receive wastewater effluent and urban runoff are of concern



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Summary of Cache Slough Watershed Sampling Activities and Representative Locations

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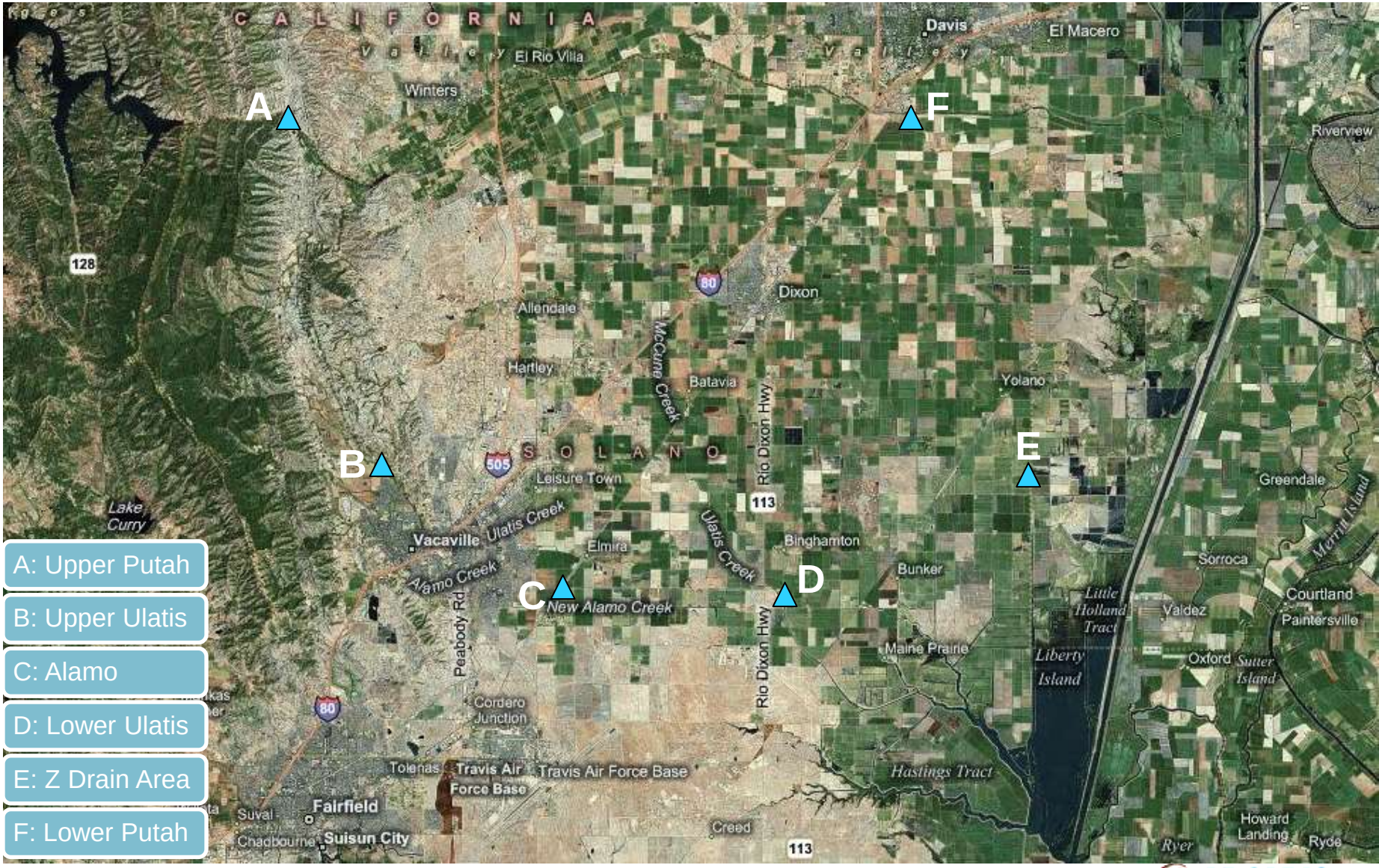
Locations



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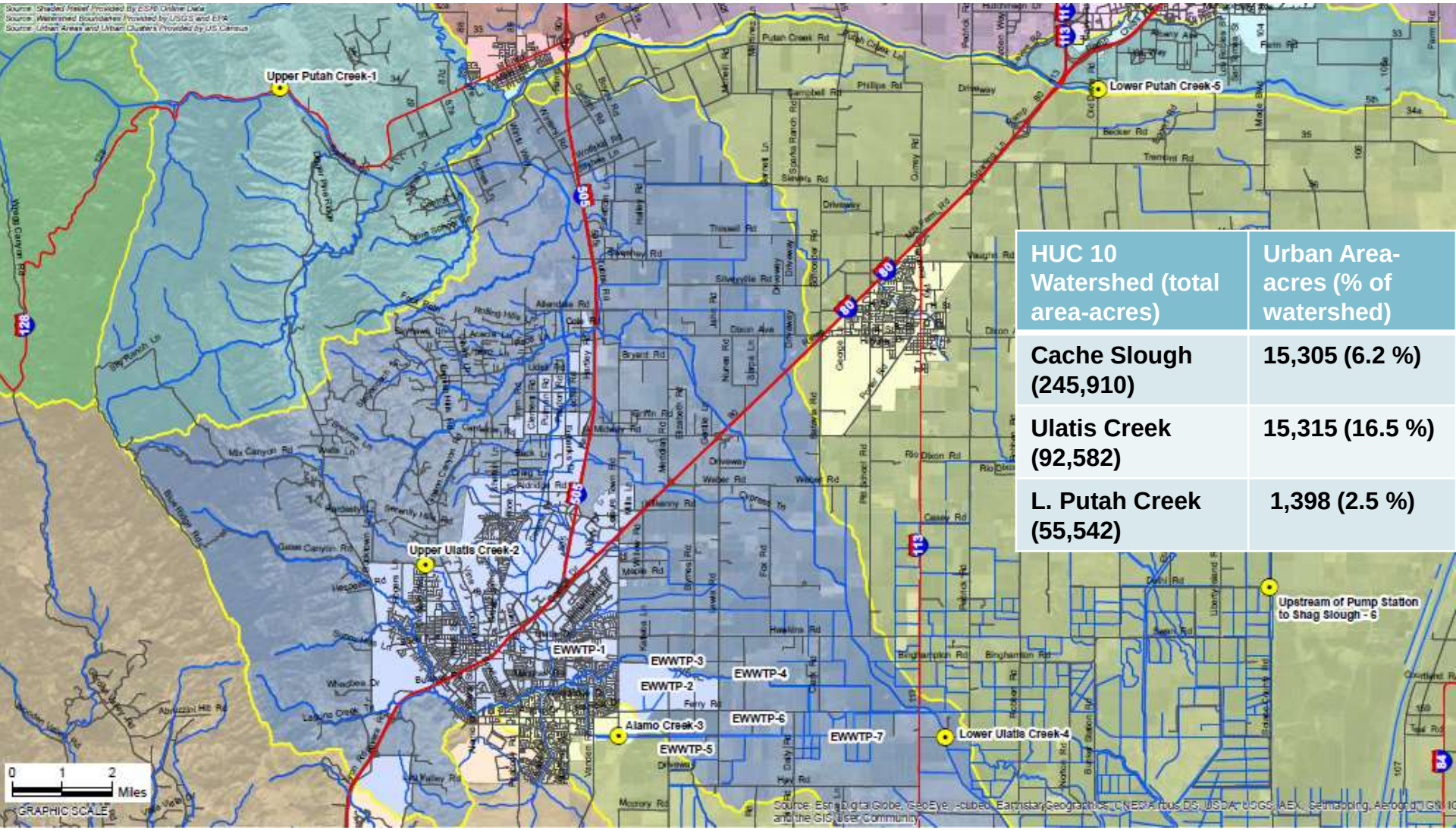
Watershed Context

HUC 10 BOUNDARIES
- Cache Slough
- Knights Landing Ridge Cut-Tule Canal
- Lower Putah Creek
- Middle Putah Creek
- Ulatis Creek
- Willow Slough
- Wooden Valley Creek-Frontal Suisun Bay Estuaries



HUC 10 Watershed (total area-acres)	Urban Area-acres (% of watershed)
Cache Slough (245,910)	15,305 (6.2 %)
Ulatis Creek (92,582)	15,315 (16.5 %)
L. Putah Creek (55,542)	1,398 (2.5 %)

Imagine the result

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Analytes

- Field readings
  - pH, Conductivity, Dissolved Oxygen, Temperature, Salinity
- Bacteria (E. Coli & Fecal Coli.)
- Organo-chlorine pesticides
- Organo-phosphate pesticides
- Carbamates
- Pyrethroids
- Metals
- General chemistry
  - Nitrate, Nitrite, Ammonia, Phosphorous, TSS
- 66 samples to date (11 events/6 locations)

Highlights of Sampling Results (2010-2014)

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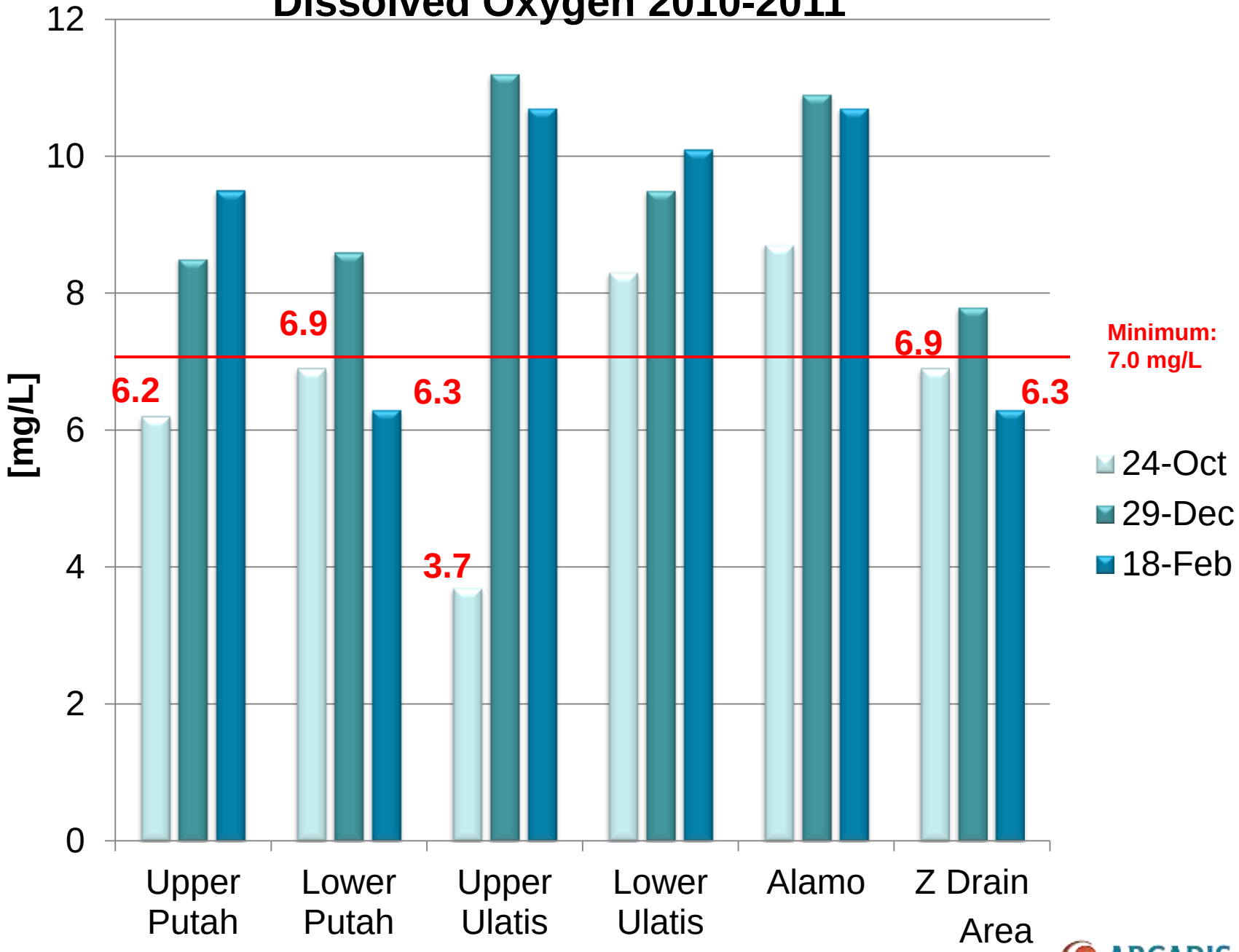
Dissolved Oxygen 2010-2011



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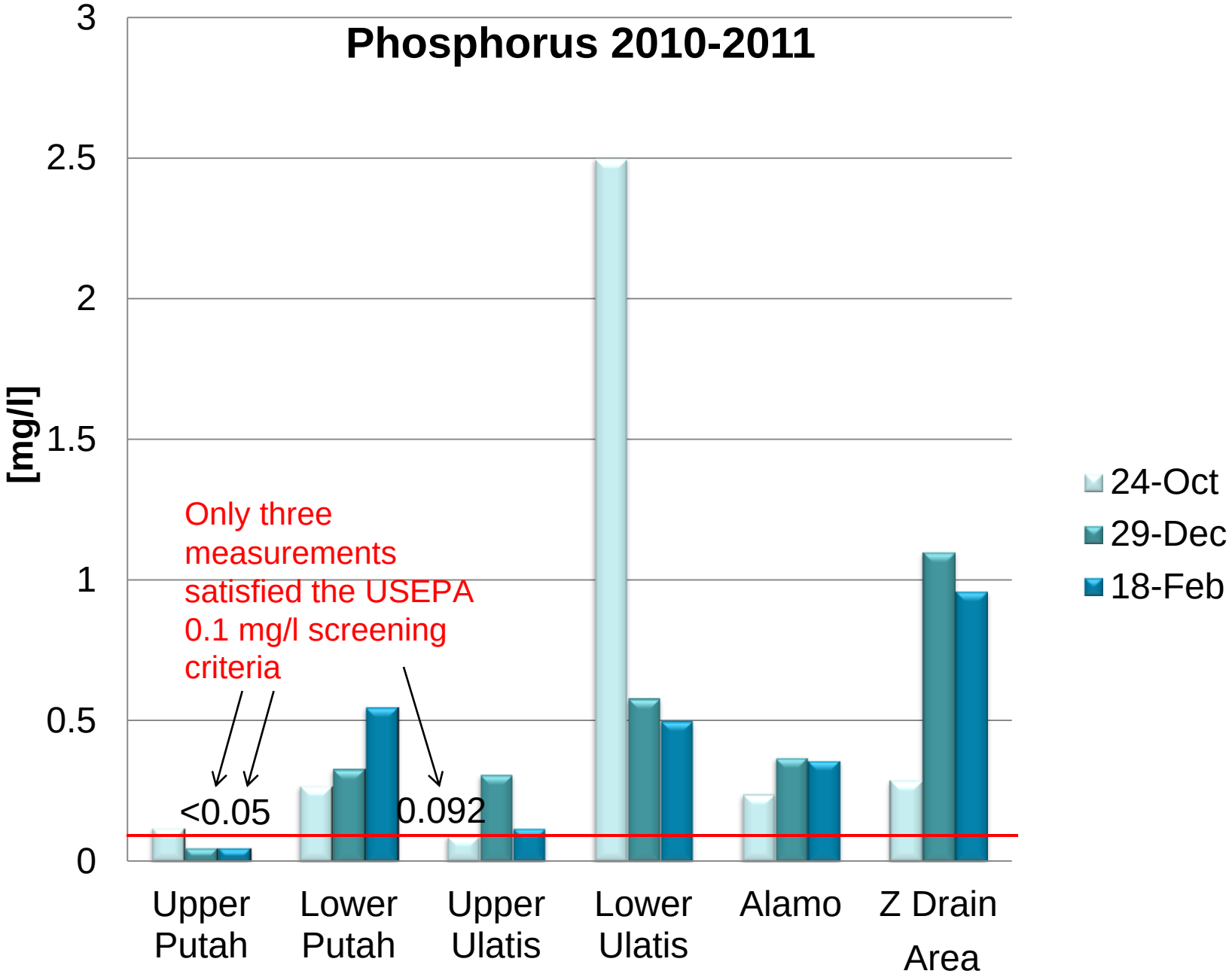

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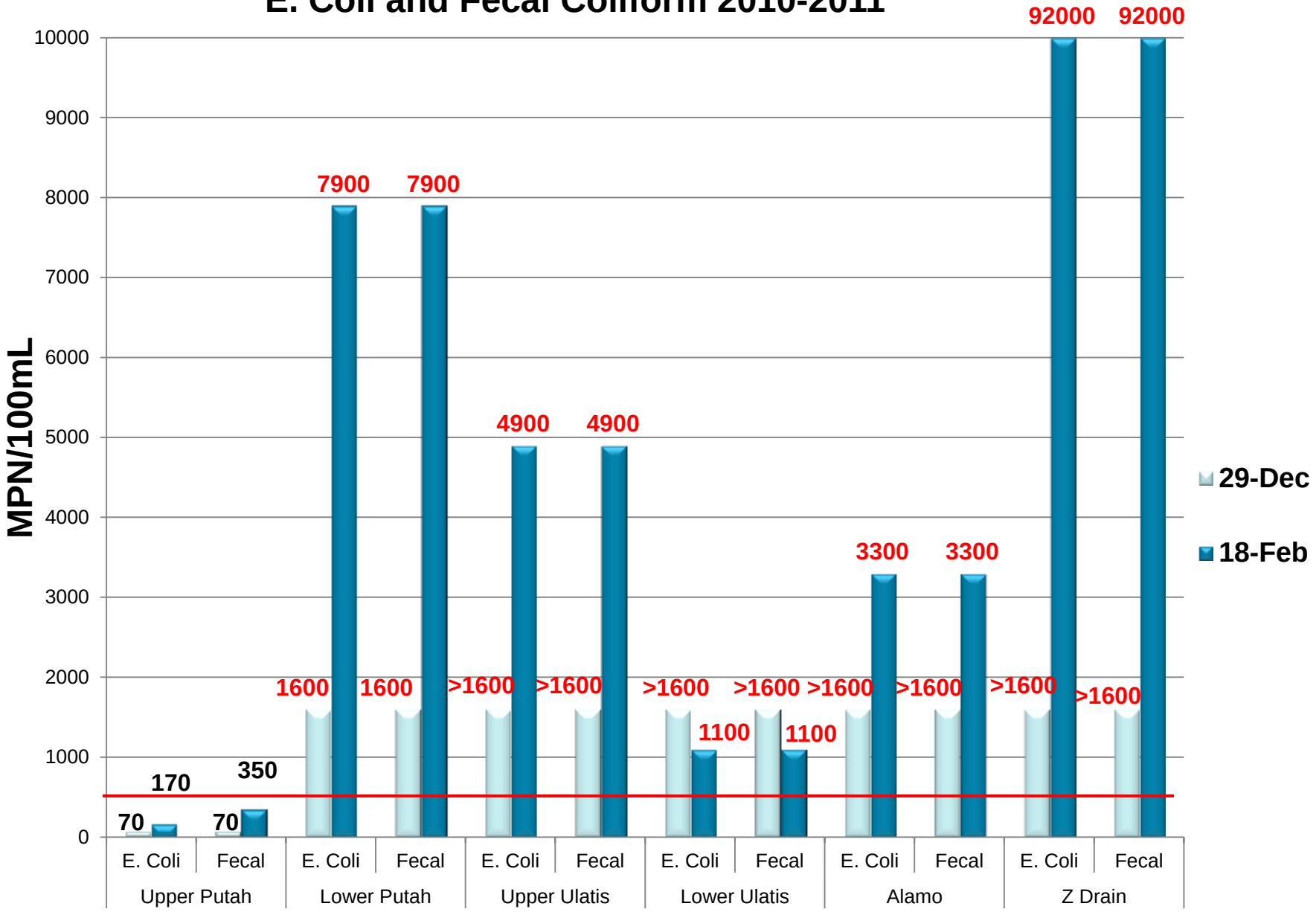
E. Coli and Fecal Coliform 2010-2011



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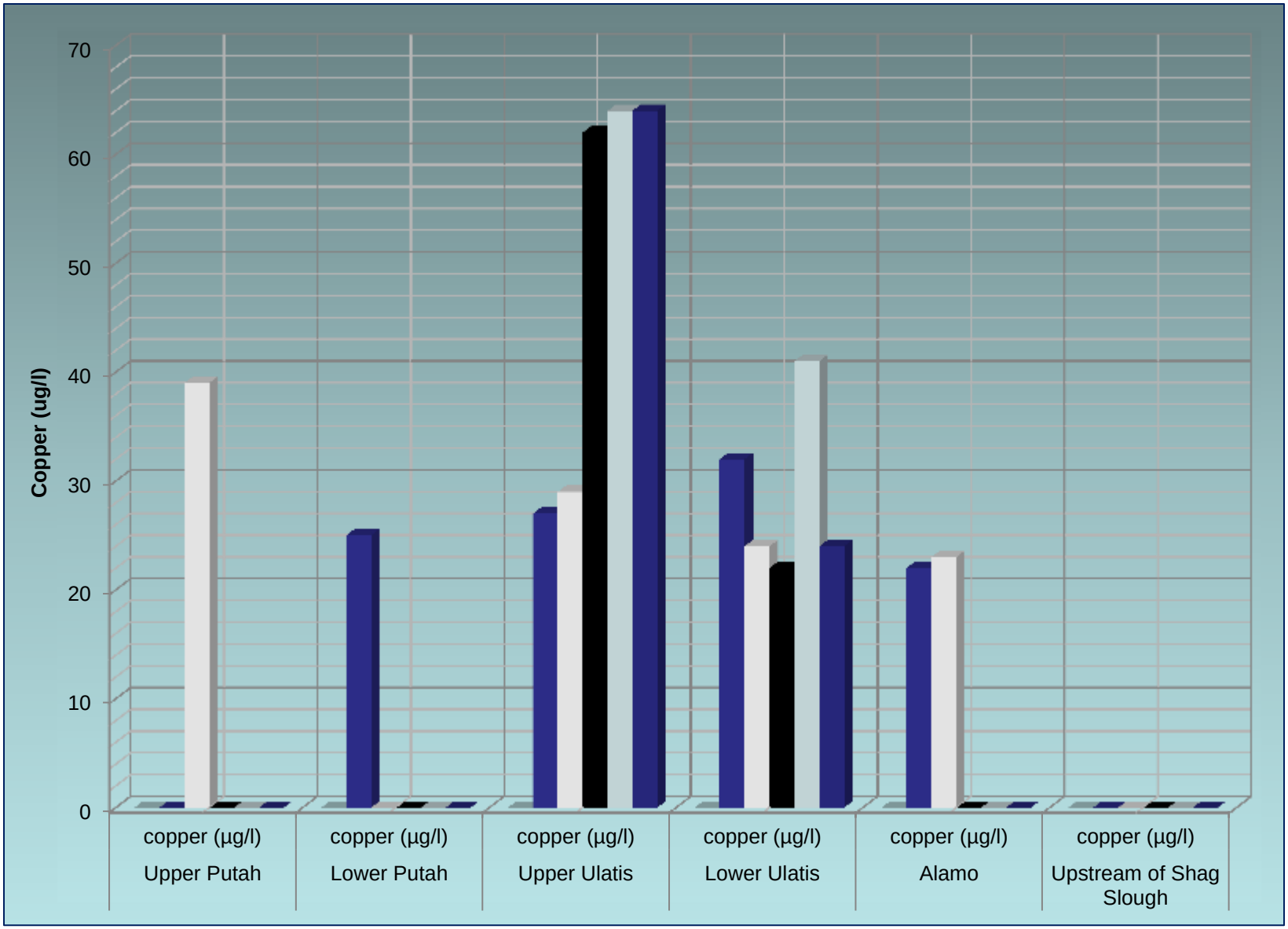
Copper Detections (2010-2014)



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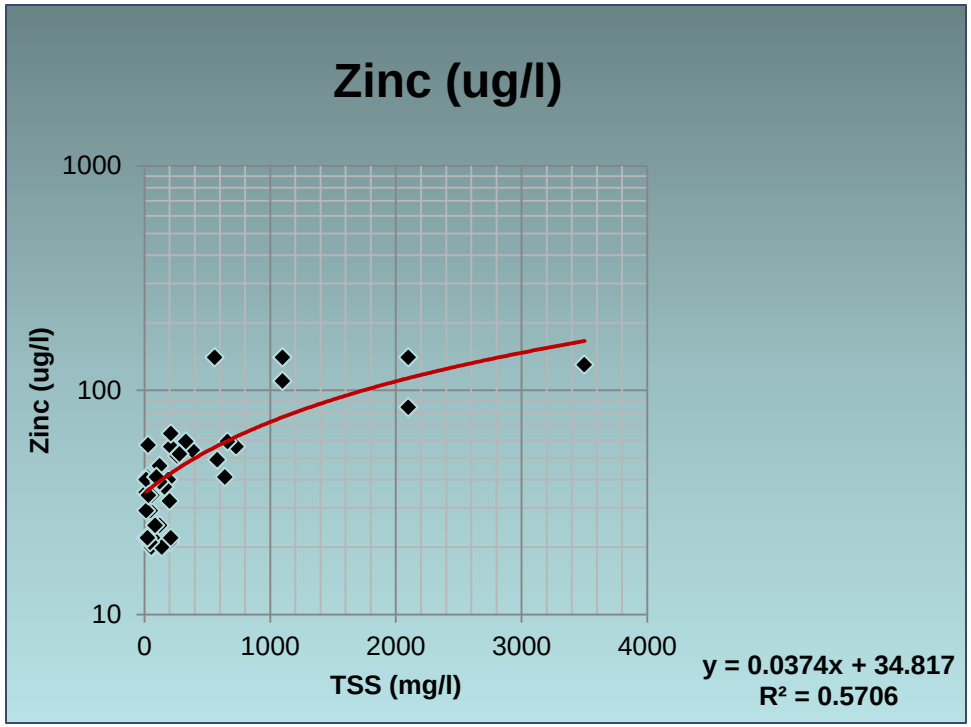
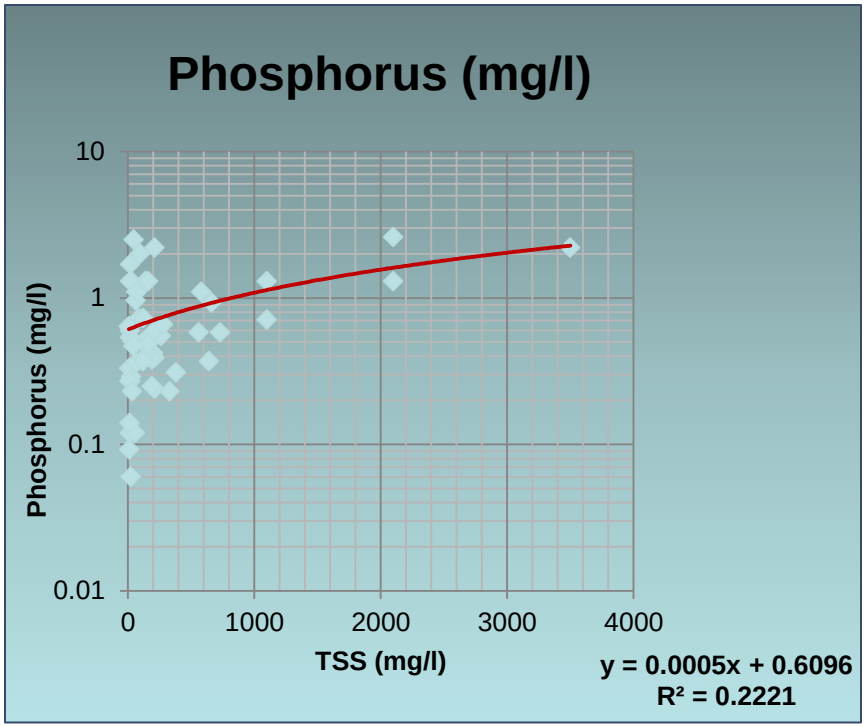
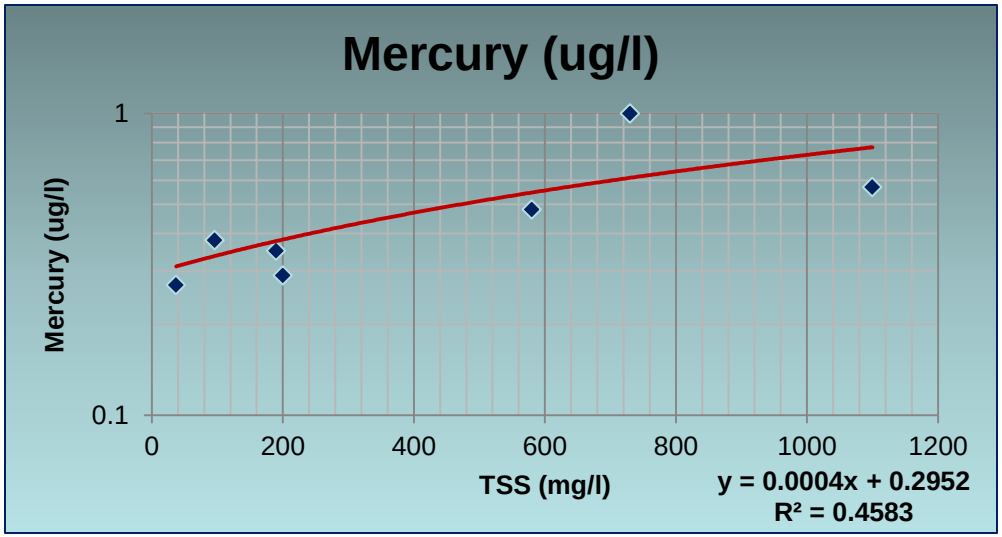
TSS vs. Zinc/Mercury/Phosphorus







Water Quality Criteria:

- **Zinc: 2000 ug/l**
- **Phosphorus: 0.1 mg/l**
- **Mercury: 0.05 ug/l**

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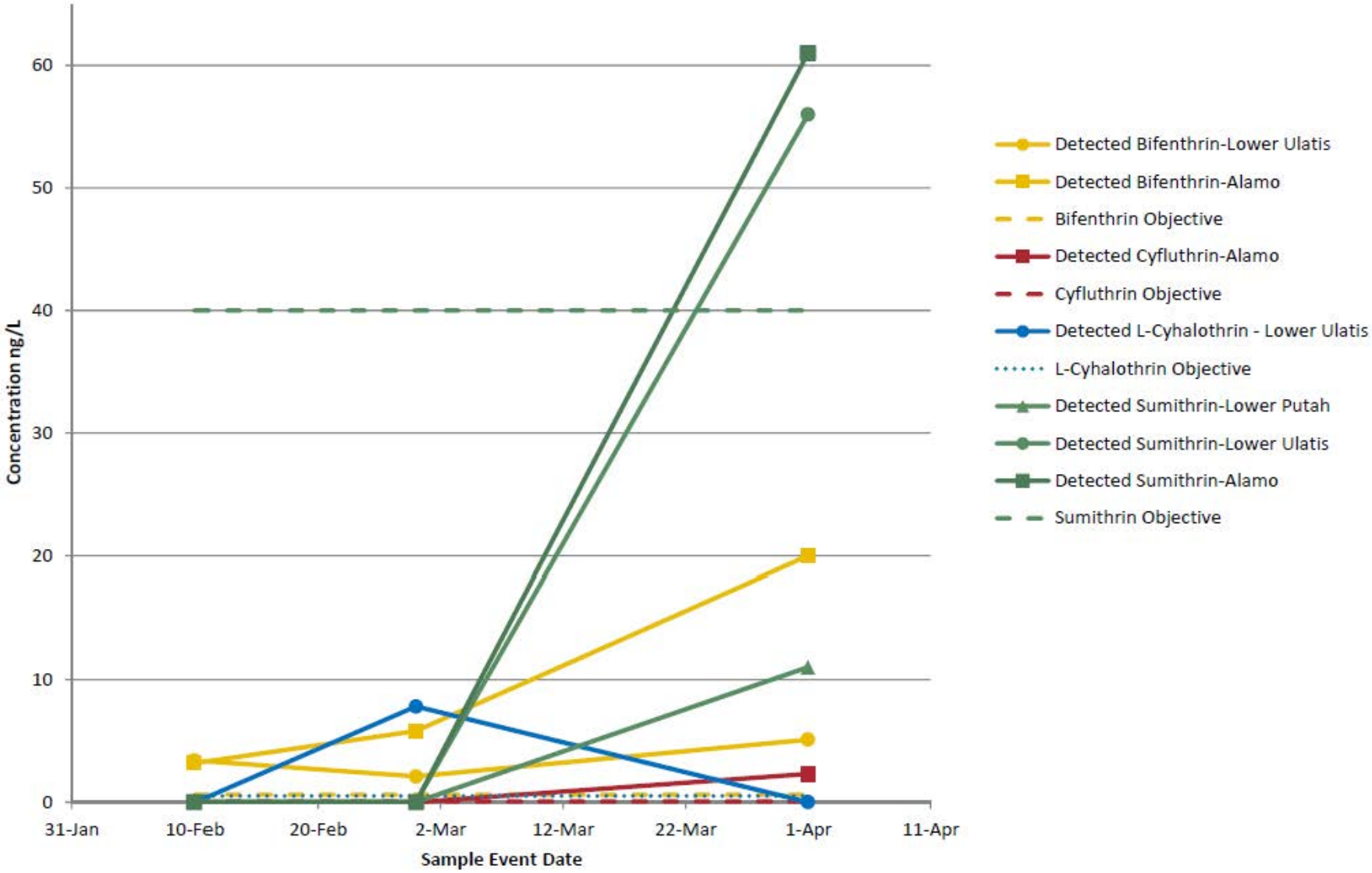
Lower Putah, Lower Ulatis, and Alamo Creeks - Pyrethroid Sample Detections



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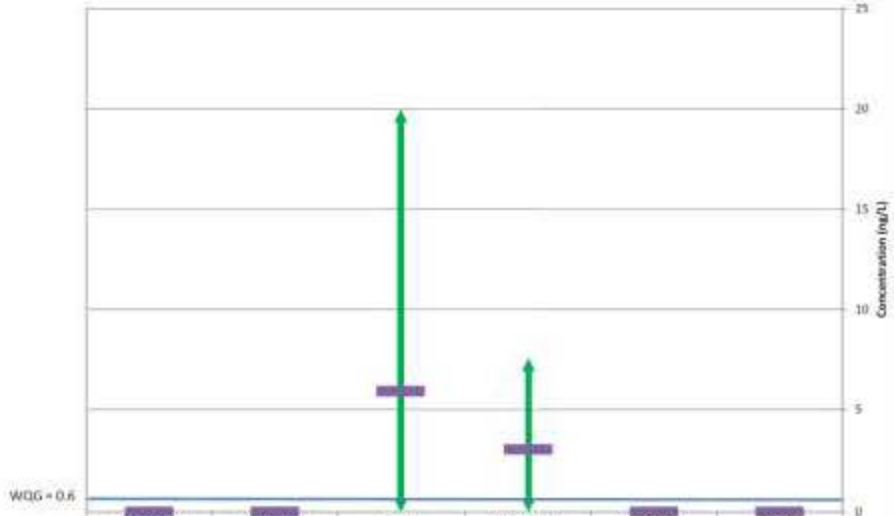
Bifenthrin

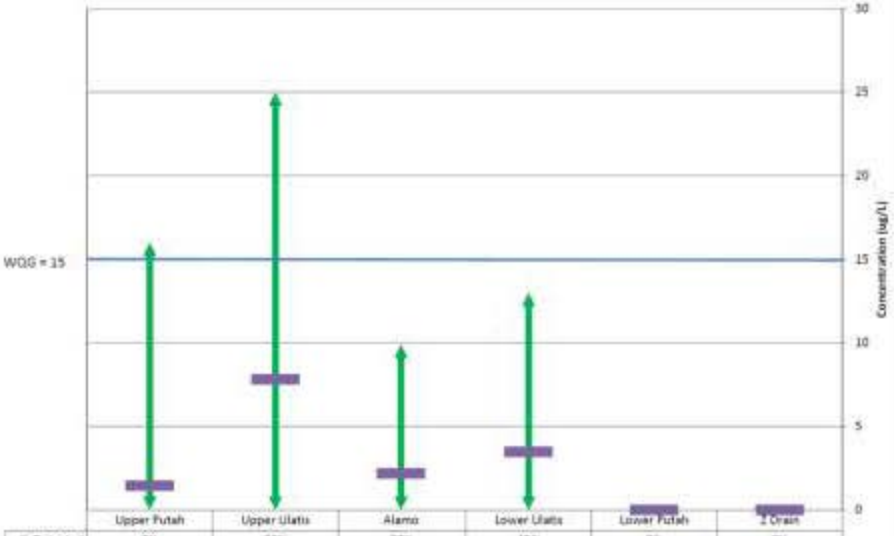


	Upper Putah	Upper Ulatis	Alamo	Lower Ulatis	Lower Putah	Z Drain
% Detected	0%	0%	73%	73%	0%	0%
Max	0	0	20	7.8	0	0
Min	0	0	0	0	0	0
Mean	0	0	5.9	3.0	0	0

Arsenic

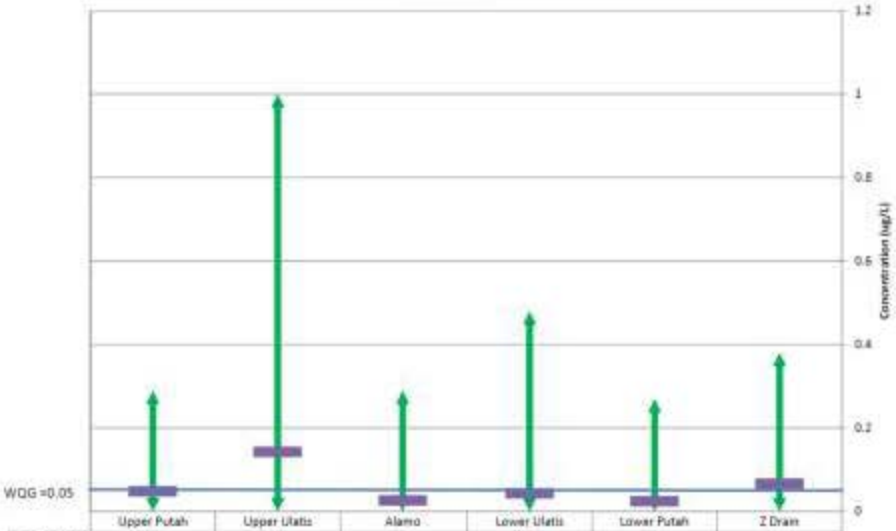
	Upper Putah	Upper Ulatis	Alamo	Lower Ulatis	Lower Putah	Z Drain
% Detected	0%	18%	0%	0%	0%	0%
Max	0	17	0	0	0	0
Min	0	0	0	0	0	0
Mean	0	2.8	0	0	0	0

Lead



	Upper Putah	Upper Ulatis	Alamo	Lower Ulatis	Lower Putah	Z Drain
% Detected	9%	36%	27%	45%	0%	0%
Max	16	25	9.9	13	0	0
Min	0	0	0	0	0	0
Mean	1.5	[illegible]	[illegible]	[illegible]	0	0

Mercury



	Upper Putah	Upper Ulatis	Alamo	Lower Ulatis	Lower Putah	Z Drain
% Detected	18%	18%	9%	9%	9%	18%
Max	0.29	1	0.29	0.48	0.27	0.38
Min	0	0	0	0	0	0
Mean	0.05	0.14	0.03	0.04	0.02	0.07

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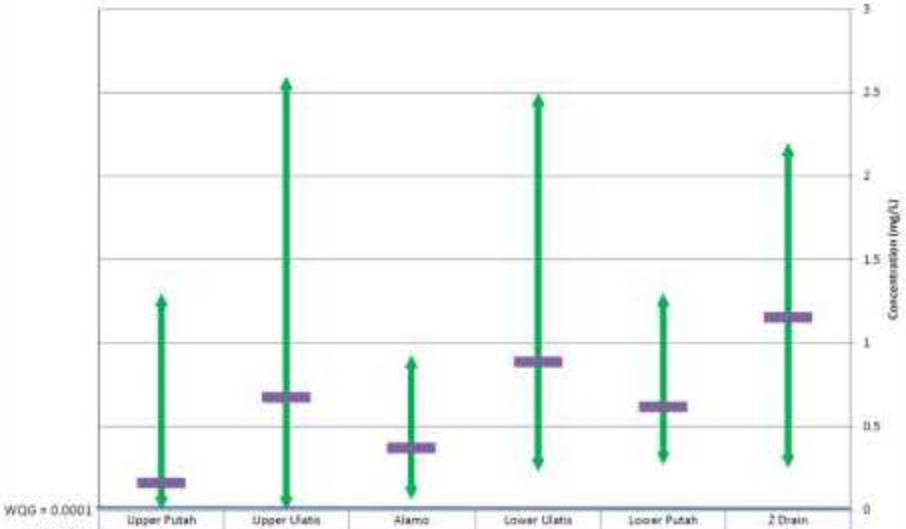
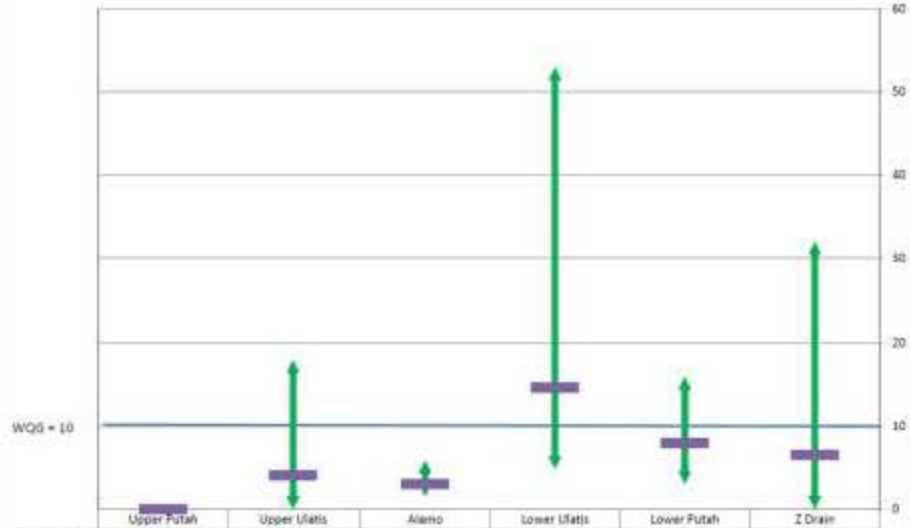
Phosphorus



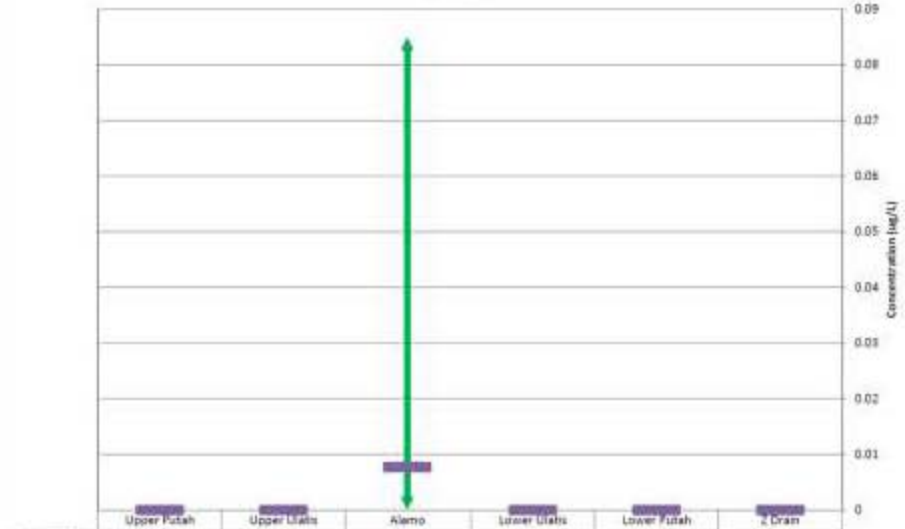
	Upper Putah	Upper Ulatis	Alamo	Lower Ulatis	Lower Putah	Z Drain
% Detected	27%	91%	100%	100%	100%	100%
Max	1.3	2.6	0.93	2.5	1.3	2.2
Min	0	0	0.06	0.23	0.27	0.25
-- Mean	0.16	0.67	0.37	0.89	0.62	1.15

Nitrate



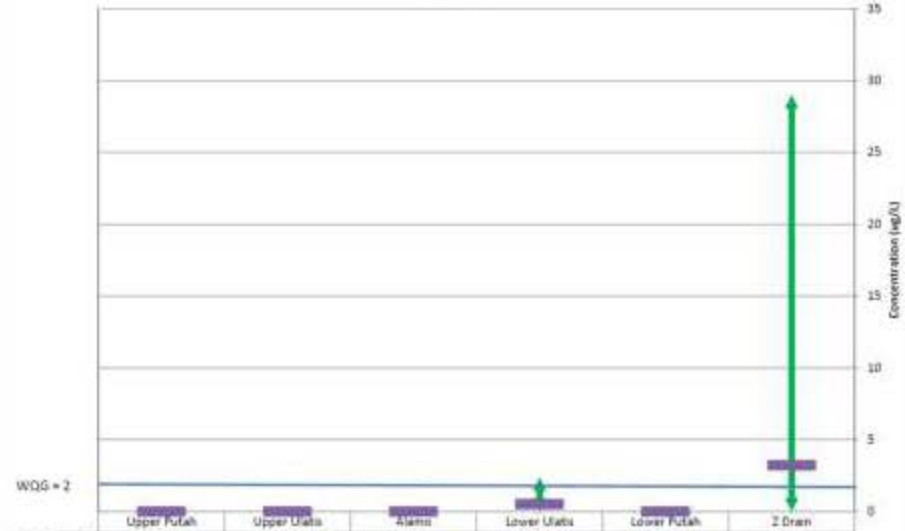
	Upper Putah	Upper Ulatis	Alamo	Lower Ulatis	Lower Putah	Z Drain
% Detected	0%	82%	100%	100%	100%	73%
Max	0	18	5.9	53	16	32
Min	0	0	1.5	4.8	3	0
-- Mean	0	4.1	3.0	14.7	8.0	6.5

4,4'-DDT



	Upper Putah	Upper Ulatis	Alamo	Lower Ulatis	Lower Putah	Z Drain
% Detected	0%	0%	9%	0%	0%	0%
Max	0	0	0.085	0	0	0
Min	0	0	0	0	0	0
-- Mean	0	0	0.0077	0	0	0

Diuron



	Upper Putah	Upper Ulatis	Alamo	Lower Ulatis	Lower Putah	Z Drain
% Detected	0%	0%	0%	27%	0%	36%
Max	0	0	0	2.4	0	29
Min	0	0	0	0	0	0
-- Mean	0	0	0	0.52	0.00	3.2

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Annual Detection Averages - All Sites

	AVERAGES	Sampling Season>	2010/2011 Average	2011/2012 Average	2012/2013 Average	2013/2014 Average	Overall Average
Parameter	Units	Water Quality Goal [source]					
Field Readings							
pH	--	6.5-8.5 [BP]	7.8	7.5	7.1	7.5	7.5
Conductivity	µS	700 [A&W]	334	298	323	415	344
Dissolved Oxygen	mg/L	5 (WARM); 7 (COLD) [BP]	8.4	8.3	7.8	7.8	8.1
Temperature	C	Various	12.3	11.7	12.4	10.9	11.8
Salinity	ppm	--	158	148	95	217	167
Bacteria							
Total Coliform	MPN/100mL	10000 [BP]	37825	83913	96958	67946	72514
Fecal Coliform	MPN/100mL	400 [BP]	9802	30412	40273	27073	27341
E. Coli	MPN/100mL	235 [BP]	9620	24434	36187	22905	23560
OCPs							
4,4'-DDT	ug/L	3.5 [USEPA RfD]	ND	0.005	ND	ND	0.001
Carbamates							
Diuron	ug/L	2 [USEPA HA]	0.13	0.47	0.11	1.61	0.62
Pyrethroids	ng/L						
Allethrin	ng/L	2100 [USEPA RED]	ND	31.72	13.08	ND	11.03
Bifenthrin	ng/L	0.6 [UCD]	0.17	1.92	1.78	2.20	1.49
Cyfluthrin	ng/L	0.05 [UCD]	ND	1.44	ND	0.13	0.43
L-Cyhalothrin	ng/L	0.5 [UCD]	ND	ND	ND	0.43	0.12
Sumithrin	ng/L	40 [USEPA RED]	ND	ND	ND	7.11	1.94
Metals (Total)							
Antimony	ug/L	2.8 [USEPA RfD]	ND	ND	ND	0.6	0.2
Arsenic	ug/L	0.02 [USEPA HA]	ND	0.8	ND	0.9	0.5
Barium	ug/L	700 [USEPA HA]	93.6	109.1	203.3	95.4	118.3
Chromium	ug/L	50 [1° MCL]	5.8	4.8	4.1	5.3	5.1
Cobalt	ug/L	50 [CAG]	2.2	3.6	6.4	2.2	3.3
Copper	ug/L	200 [CAG]	5.9	7.6	13.9	4.9	7.5
Lead	ug/L	15 [1° MCL]	0.7	3.4	5.8	1.2	2.5
Mercury	ug/L	0.05 [CTR]	ND	0.19	ND	0.02	0.06
Molybdenum	ug/L	35 [USEPA RfD]	3.1	2.6	2.0	2.2	2.5
Nickel	ug/L	100 [1° MCL]	10.2	9.9	14.5	9.2	10.6
Vanadium	ug/L	100 [USEPA RfD]	14.6	13.9	18.1	12.2	14.4
Zinc	ug/L	2000 [CAG]	31.6	27.9	41.3	18.6	28.8

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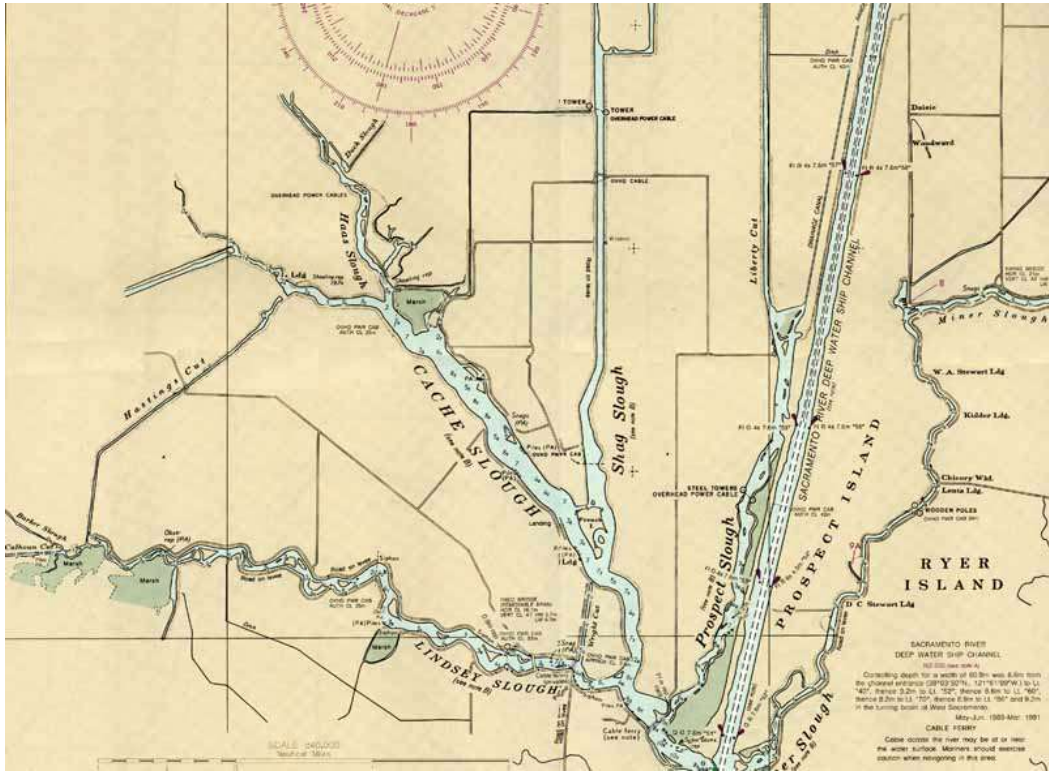
Detections Above Criteria

- Bacteria: consistent exceedances, except Upper Putah Creek (2010-2014)
- Diuron (2013-2014)
- Bifenthrin (2010-2014)
- Cyfluthrin (2011-2014)
- Sumithrin (2013-2014)
- Diuron (2013-2014)
- Arsenic (2011-2014)
- Lead (2012-2014)
- Molybdenum (2010-2011)
- Mercury (2012-2014)
- Nitrate & Phosphorus (2010-2014)
- Conductivity & TSS (2010-2014)



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Other Detections & Non-Detects

- Pendimethalin & Dichloran (herbicides)
- Copper, Barium, Nickel, Vanadium, Cobalt, Chromium, Zinc
- No Organo-phosphate pesticide detections
- Few Organo-chlorine pesticide detections (DDT, Alamo Creek)
- Diuron was the only Carbamate detected (Lower Ulatis & upstream of Shag Slough/Z-drain)

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General Findings/Implications and Potential Future Data Collection

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General Findings

- Upper Putah Creek consistently exhibits significantly improved conditions
  - ✓ no bacteria exceedances; no Pyrethroid detections; no Nitrate detections; low Phosphorus
- Lower Putah Creek
  - ✓ occasional DO deficiency; consistent Phosphorus
- Upper Ulatis Creek
  - ✓ occasional DO deficiency; consistent Phosphorous; notable Mercury, Lead & Arsenic
- Lower Ulatis Creek
  - ✓ consistent Nitrate; consistent Bifenthrin, select peaks in Diuron and Conductivity
- Alamo Creek
  - ✓ highest average DO; consistent Bifenthrin
- Z Drain Area
  - ✓ consistent Nitrate; Diuron; DO deficiencies

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General Findings/Implications

- Locations downstream of urbanized & agricultural areas exhibit lower water quality than those in the upper watershed
- TSS, bacteria, metals, nutrients, and pesticides continue to be the primary constituent groups detected
- Legacy OC pesticide detections decreased in favor of pyrethroids
- Pyrethroid detections not highly correlated with elevated TSS (diluted concentrations associated with higher intensity rain events)
- Consistent Bifenthrin detections indicate ongoing ecological toxicity risk
- Higher-intensity rain events yielded higher TSS and correlated metals concentrations
- High TSS yields sediment associated pollutants but also support turbid conditions favorable to Delta smelt in Cache Slough

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Potential Alternate Analytes

- Bioassessment
- Flow → Mass Loading
- Dry weather flows
- Boron, Aluminum
- Herbicides
- DOC/TOC
- Sediment chemistry
- Water toxicity
- Sediment toxicity
- PCBs
- Methylmercury
- Disinfection by-products
- New and emerging contaminants (CECs)
- Tissue chemistry

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Potential Future Enhancements

- Continuous Monitoring
  - More detailed data to capture temporal/spatial variability
  - Additional targeted locations
  - Analyze data with respect to time
  - "ISCO" - Automated Samplers
    - No mobilization or storm tracking necessary
- Correlated flow measurements
  - Mass loading analysis
  - Support ongoing/future TMDL studies
- Additional data sharing & coordination with Vacaville WWTP
- Formalized coordination/participation with DRMP

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Questions?

People wade through blue-green algae at Qingdao, the host city for
sailing events at the 2008 Olympic Games, in China's Shandong province.

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Additional/Optional Slides

Watershed Stormwater Hotspots:

- Gas/fueling stations
- Roads/transportation infrastructure
- Vehicle maintenance/washing/cleaning areas
- Outdoor material storage areas
- Agricultural areas
- Residential developments
- Loading and transfer areas
- Landfills
- Construction sites
- Industrial sites
- Impervious surfaces

ILRP Exceedance Details (2005-2009)

Summary of Water Quality Exceedances
(sampling period: January 2005 - September 2009)

No. of Exceedances	Analyte	Min.	Location of Minimum Exceedance	Max.	Location of Maximum Exceedance	Mean	Unit	WQO Value	WQO Code
63	Conductivity	715	Tule Canal at I-80	1677	Ulatis Creek at Brown Road	986	uS/cm	700	A&W
14	Dissolved Oxygen	3.50	Cache Creek at Capay Diversion Dam	6.86	Willow Slough Bypass at SP	4.61	mg/L	5 (warm) 7 (cold)	BP
13	pH	8.61	Cache Creek at Capay Diversion Dam	9.38	Ulatis Creek at Brown Road	8.89	-log[H+]	6.5 - 8.5	BP
40	Total Dissolved Solids	460	Willow Slough Bypass at Pole Line	1000	Cache Creek at Capay Diversion Dam	625	mg/L	450	A&W
39	E. coli	240	Z Drain – Dixon RCD	2400	Z-Drain... & Tule @ I-80	1239.23	MPN/100mL	235	BPA
3	Fecal Coliforms	1600	Ulatis Creek at Brown Road	1600	Willow Slough Bypass at SP	1600	MPN/100mL	400	BP
33	Boron	740	Ulatis Creek at Brown Road	3100	Willow Slough Bypass at SP	1367.88	µg/L	700	A&W
3	Selenium	6	Willow Slough Bypass at Pole Line	11	Willow Slough Bypass at Pole Line	8	µg/L	5.0	BP
5	Ceriodaphnia survival	0	Willow Slough Bypass at Pole Line	0.75	Willow Slough Bypass at Pole Line	0.35	% control	narrative	BP
8	Hyalella survival	0.1	Ulatis Creek at Brown Road	10	Cache Creek at Capay Diversion Dam	2.92	% control	narrative	BP
13	Selenastrum growth	0.1109	Willow Slough Bypass at Pole Line	57	Willow Slough Bypass at Pole Line	8.96	% control	narrative	BP
1	Carbofuran	0.72	Z Drain – Dixon RCD	0.72	Z Drain – Dixon RCD	0.72	µg/L	0.4	BP
8	DDE(p,p')	0.0037	Ulatis Creek at Brown Road	0.0115	Z Drain – Dixon RCD	0.0065	µg/L	0.00059	BP
1	DDT(p,p')	0.0033	Tule Canal at I-80	0.0033	Tule Canal at I-80	0.0033	µg/L	0.00059	BP
1	Diazinon	0.154	Tule Canal at I-80	0.154	Tule Canal at I-80	0.154	µg/L	0.1	BP
1	Diuron	9.7	Tule Canal at I-80	9.7	Tule Canal at I-80	9.7	µg/L	2.0	USEPA HA
1	Malathion	0.455	Ulatis Creek at Brown Road	0.455	Ulatis Creek at Brown Road	0.455	µg/L	0.1	BP
2	Simazine	8.608	Ulatis Creek at Brown Road	11.922	Tule Canal at I-80	10.265	µg/L	4.0	BP
4	Chlorpyrifos	0.016	Z Drain – Dixon RCD	0.083	Z Drain – Dixon RCD	0.0358	µg/L	0.015	BP

Imagine the result

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ILRP Pesticide Detections (2013)

SiteID	SampleDate	AnalyteName		Result[1] (µg/L)	Trigger Limit[2]	Basis for Limit[3]
CCCPY	8/21/2013	Bifenthrin	DNQ	0.0003	NA	
LSNKR	9/18/2013	Bifenthrin	DNQ	0.0001	NA	
CCCPY	4/17/2013	Chlorpyrifos	DNQ	0.0002	0.025	BPA (acute)
GIDLR	3/20/2013	Chlorpyrifos[4]	=	0.0063	0.025	BPA (acute)
GIDLR	3/20/2013	Chlorpyrifos	=	0.0059	0.025	BPA (acute)
LSNKR	7/17/2013	Chlorpyrifos	DNQ	0.0018	0.025	BPA (acute)
LSNKR	8/20/2013	Chlorpyrifos	DNQ	0.0019	0.025	BPA (acute)
LSNKR	9/18/2013	Chlorpyrifos	DNQ	0.0007	0.025	BPA (acute)
PNCGR	**5/22/2013**	**Chlorpyrifos[4]**	**=**	**0.0432**	**0.025**	**BPA (acute)**
PNCGR	**5/22/2013**	**Chlorpyrifos**	**=**	**0.0368**	**0.025**	**BPA (acute)**
RARPP	5/21/2013	Chlorpyrifos	=	0.0026	0.025	BPA (acute)
STYHY	3/21/2013	Chlorpyrifos	DNQ	0.0003	0.025	BPA (acute)
UCBRD	3/20/2013	Chlorpyrifos	=	0.0141	0.025	BPA (acute)
UCBRD	4/16/2013	Chlorpyrifos	=	0.0055	0.025	BPA (acute)
UCBRD	5/21/2013	Chlorpyrifos	=	0.0109	0.025	BPA (acute)
GIDLR	**5/21/2013**	**DDD(p,p) [5]**	**DNQ**	**0.0018**	**0.00083**	**CTR**
GIDLR	**8/20/2013**	**DDD(p,p) [5]**	**DNQ**	**0.0016**	**0.00083**	**CTR**
COONH	**5/23/2013**	**DDE(p,p) [5]**	**DNQ**	**0.003**	**0.00059**	**CTR**
COONH	**8/22/2013**	**DDE(p,p) [5]**	**DNQ**	**0.0033**	**0.00059**	**CTR**
GIDLR	**5/21/2013**	**DDE(p,p) [5]**	**DNQ**	**0.0028**	**0.00059**	**CTR**
GIDLR	**8/20/2013**	**DDE(p,p) [5]**	**DNQ**	**0.0015**	**0.00059**	**CTR**
COLDR	2/19/2013	Diazinon[4]	=	0.0195	0.16	BPA (acute)
COLDR	2/19/2013	Diazinon	=	0.0241	0.16	BPA (acute)
UCBRD	7/16/2013	Diazinon	=	0.0061	0.16	BPA (acute)
GIDLR	3/20/2013	Dimethoate[4]	=	0.0133	1.0	CDPH Notification Level
GIDLR	**8/20/2013**	**Dimethoate**	**=**	**1.0067**	**1.0**	**CDPH Notification Level**
UCBRD	12/11/2012	Diuron	DNQ	0.32	2	USEPA Health Advisory
CCCPY	8/21/2013	L-Cyhalothrin	DNQ	0.0003	NA	
COLDR	**3/20/2013**	**Malathion**	**=**	**0.0967**	**ND[6]**	**BP**
WLSPL	**3/20/2013**	**Malathion**	**=**	**0.0583**	**ND[6]**	**BP**

Imagine the result

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LOWER ULATIS											
	Sample Date	24-Oct-10	29-Dec-11	18-Feb-11	23-Jan-12	14-Mar-12	13-Apr-12	18-Nov-12	2-Dec-12	10-Feb-14	28-Feb-14
Pyrethroids	GC/MS NCI-SIM										
Allethrin	ng/L	<0.85	<0.85	<0.85	<0.85	**81**	**53**	**25**	<0.85	<0.85	<0.85
Bifenthrin	ng/L	<0.79	<0.79	**3.0**	**2.7**	**7.6**	**6.5**	**2.8**	<0.79	**3.4**	**2.1**
Cyfluthrin	ng/L	<0.83	<0.83	<0.83	<0.83	<0.83	<0.83	<0.83	<0.83	<0.83	<0.83
Cypermethrin	ng/L	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Deltamethrin/Tralomethrin	ng/L	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9
Dichloran**	ng/L	<0.80	<0.80	<0.80	--	<0.80	**3.5**	<0.80	<0.80	**2.4**	<0.80
Esfenvalerate	ng/L	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98
Fenpropathrin (Danitol)	ng/L	--	--	--	--	--	--	<2.0	<2.0	<2.0	<2.0
Fenvalerate	ng/L	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98	<0.98
L-Cyhalothrin	ng/L	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	**7.8**
Pendimethalin**	ng/L	<0.50	**93**	**77**	--	**190**	**430**	**59**	**33**	**61**	**240**
Permethrin	ng/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Prallethrin	ng/L	<0.92	<0.92	<0.92	<0.92	<0.92	<0.92	<0.92	<0.92	<0.92	<0.92
Sumithrin	ng/L	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4
Tefluthrin	ng/L	<0.93	<0.93	<0.93	<0.93	<0.93	<0.93	<0.93	<0.93	<0.93	<0.93

LOWER ULATIS											
	Sample Date	24-Oct-10	29-Dec-11	18-Feb-11	23-Jan-12	14-Mar-12	13-Apr-12	18-Nov-12	2-Dec-12	10-Feb-14	28-Feb-14
Metals (Total)	EPA 6010B										
Antimony	µg/l	<10.	<10.	<10.	<10.	<10.	<10.	<10.	<10.	<10.	<10.
Arsenic	µg/l	<10.	<10.	<10.	<10.	<10.	<10.	<10.	<10.	<10.	<10.
Barium	µg/l	**74**	**220**	**93**	**118**	**120**	**81**	**94**	**300**	**87**	**150**
Beryllium	µg/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Cadmium	µg/l	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Chromium	µg/l	<10.	**23**	<10.	<10.	**17**	<10.	<10.	<10.	<10.	**20**
Cobalt	µg/l	<2.0	**8.7**	**2.4**	**7.8**	**5.3**	<2.0	**2.4**	**11**	<2.0	**5.5**
Copper	µg/l	<20.	**32**	<20.	**24**	**22**	<20.	<20.	**41**	<20.	**24**
Lead	µg/l	<5.0	**5.8**	<5.0	**8.4**	**6.0**	<5.0	**5.1**	**13**	<5.0	<5.0
Molybdenum	µg/l	<10.	<10.	<10.	<10.	<10.	<10.	<10.	<10.	<10.	<10.
Nickel	µg/l	<10.	**28**	**10**	**18**	**16**	<10.	<10.	**22**	<10.	**21**
Selenium	µg/l	<20.	<20.	<20.	<20.	<20.	<20.	<20.	<20.	<20.	<20.
Silver	µg/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Thallium	µg/l	<10.	<10.	<10.	<10.	<10.	<10.	<10.	<10.	<10.	<10.
Vanadium	µg/l	<10.	**44**	**16**	**20**	**30**	<10.	**17**	**37**	<10.	**33**
Zinc	µg/l	**29**	**140**	**25**	**49**	**59**	<20	**37**	**110**	**20**	**52**
Mercury	µg/l	<0.2	<0.2	<0.2	**0.48**	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2