Sources, Pathways, and Loadings

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2011 Summary at a glance

- **Small Tributaries Loading Strategy**
  - **Regional watershed spreadsheet model (RWSM)**
    - Calibration and verification data
      - Loadings in individual watersheds
    - Input data
      - Event mean concentrations (EMCs)
        - » Literature review
        - » Back-calculations using other local data
        - » Empirical field observations
      - GIS layers
  - **Planning efforts**
    - 16 watershed reconnaissance
    - EMC literature review to provide rationale for RWSM structure
    - Final design of the loadings studies for WY 2012
      - Site selection / reconnaissance / permits
      - Analyte list
      - Field methods / logistics (Jen Junt!) and field manual
      - Equipment prefabrication and installation (Rand Eads!)

2011 Summary at a glance – continued

- **Technical reports**
  - **Mallard Island final report**
  - **Z4LA final report**
- **Linkages**
  - **Dioxins strategy – collected field data and presented congener profiles and loadings** (Sacramento River at Mallard Island; Guadalupe River at Hwy 101; Guadalupe River at Foxworthy (Almaden Expwy); Zone 4 Line at Cabot BLVD)
  - **Emerging contaminants**
    - Erika Houtz, UCB student, PFC loads (PFOA/PFOS)
    - Pyrethriod pesticides, carbaryl and fipronyl
  - **Nutrients**
    - The Y1 results of the hydrology component used for new nutrient loads estimate
- **Other SFEI projects (enhanced by and enhance the RMP)**
  - **LID projects (Daly city, El Cerrito, Fremont)** (analyte list includes PCBs, Hg, others)
  - **Richmond pump station** (analyte list includes PCBs, Hg and dioxins, others)
 - **Alameda geomorphology projects** (support for improvements to regional sediment loads)

Small Tributaries Loading Strategy

- **STLS framework document Multi-year plan (MYP) Version "2011" completed**

  - **Largely lead by Arleen Feng / BASMAA but supported by SFEI/RMP staff**
    - Edited and wrote components of the main text
    - Provided content for appendices
      - Appendix B: RWSM Construction and calibration
      - Appendix C: Optimizing sampling methods for loads/ trends
      - Appendix D: Exploratory watersheds characterization
      - Appendix E: WY 2011 Watershed Characterization Field Study
  - **Submitted to the Water Board in September**

RWSM
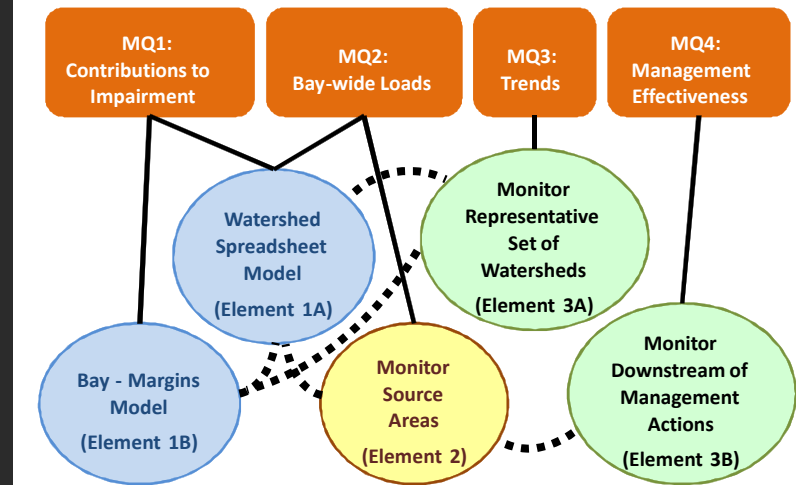
- **Objective**
  - Improve regional average annual estimates of suspended sediment and contaminant loads
    - Support prioritization and management of "high leverage" watersheds in relation to sensitive areas of the Bay margin
    - Provide input into food web models of the Bay

- **Progress**
  - 2010 – base hydrology model and initial contaminant models – Y1 report
  - 2011 – improved hydrology model + model documentation

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Tested two approaches to Rainfall-Runoff Model...

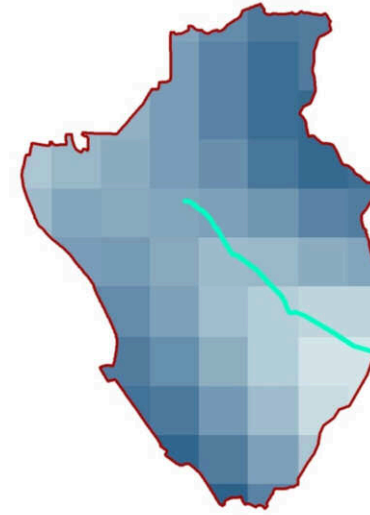| Runoff Coefficient	x	Rainfall	=	Runoff
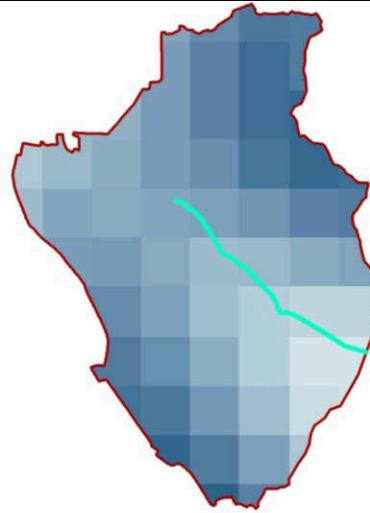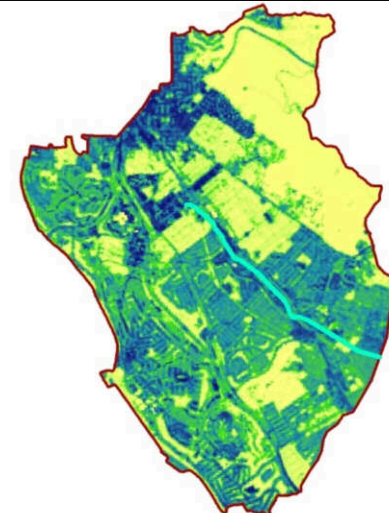
Approach 1
by % impervious
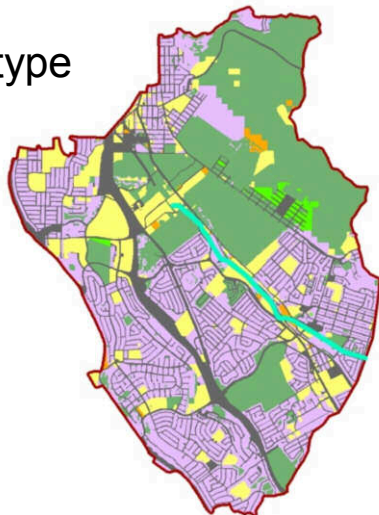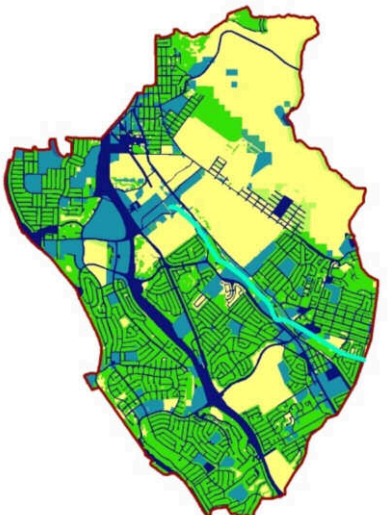
Approach 2
by land use type

x

=

x

=

Hydrologic Results

Range of annual flow volume results shown for 18 watersheds

median   mean

Original ICM (0.9, 0.05)

Calib. ICM (0.45, 0.25) w/ rock   -48%   +66%

Land Use Model (Rantz)

Land Use Model (Browne)

Land Use Model (Calib. Browne w/ rock)   -42%   +46%

New model (ABAG 2005 with LU++)
(consistent resolution refined definitions   -75%   +70%
Improved calibration data)

-100%   0%   100%

% Diff. between Sim. & Obs.
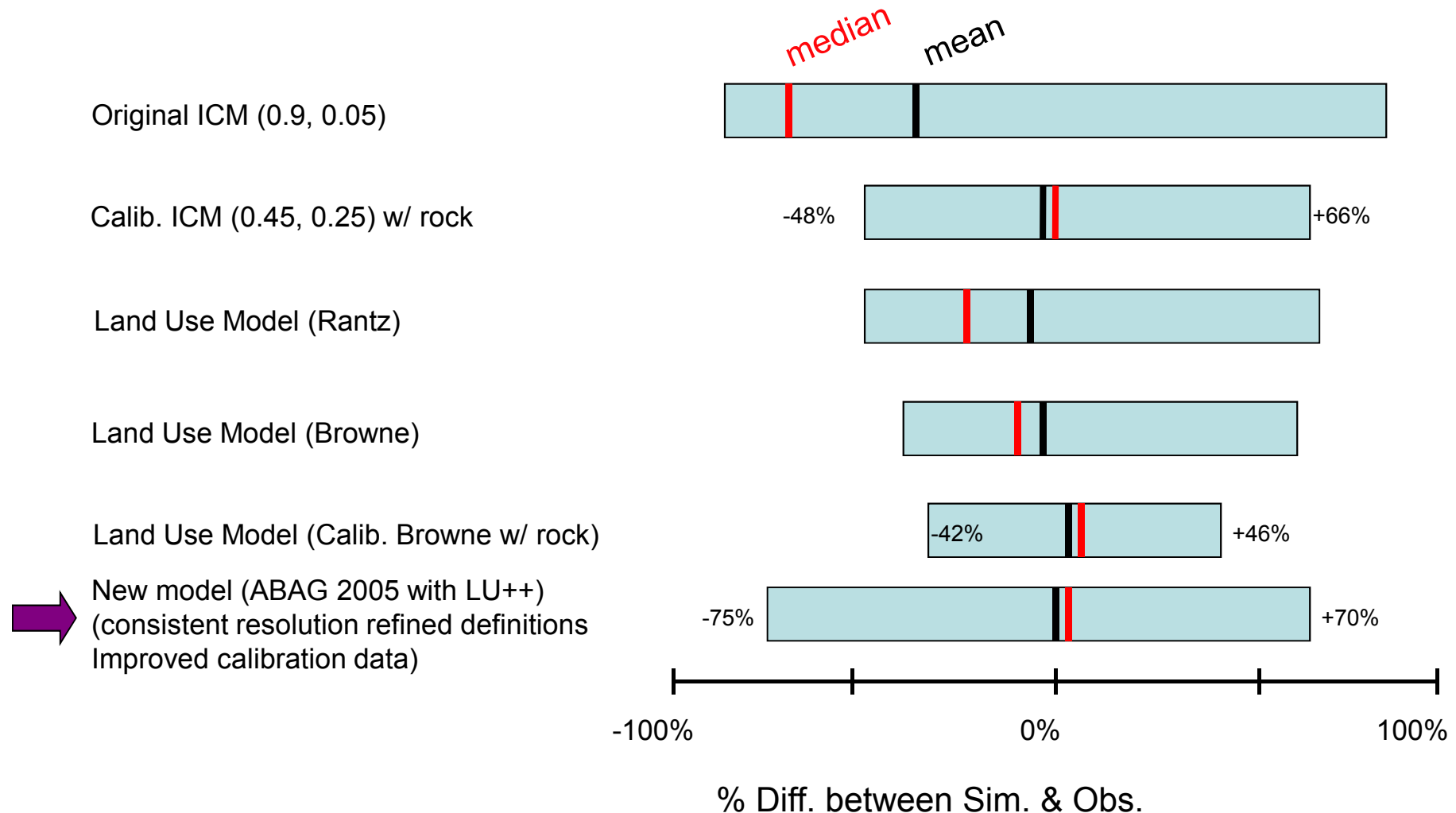
WY 2011 16-watersheds reconnaissance

- 1-2 storms for each site

- 4-7 samples per site (PCBs, HgT, SSC, TOC, PBDEs, PAHs, SeT, SeD)

- Manual turbidity and stage data

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SeT

- **Range 0.2 to 6 ug/L**
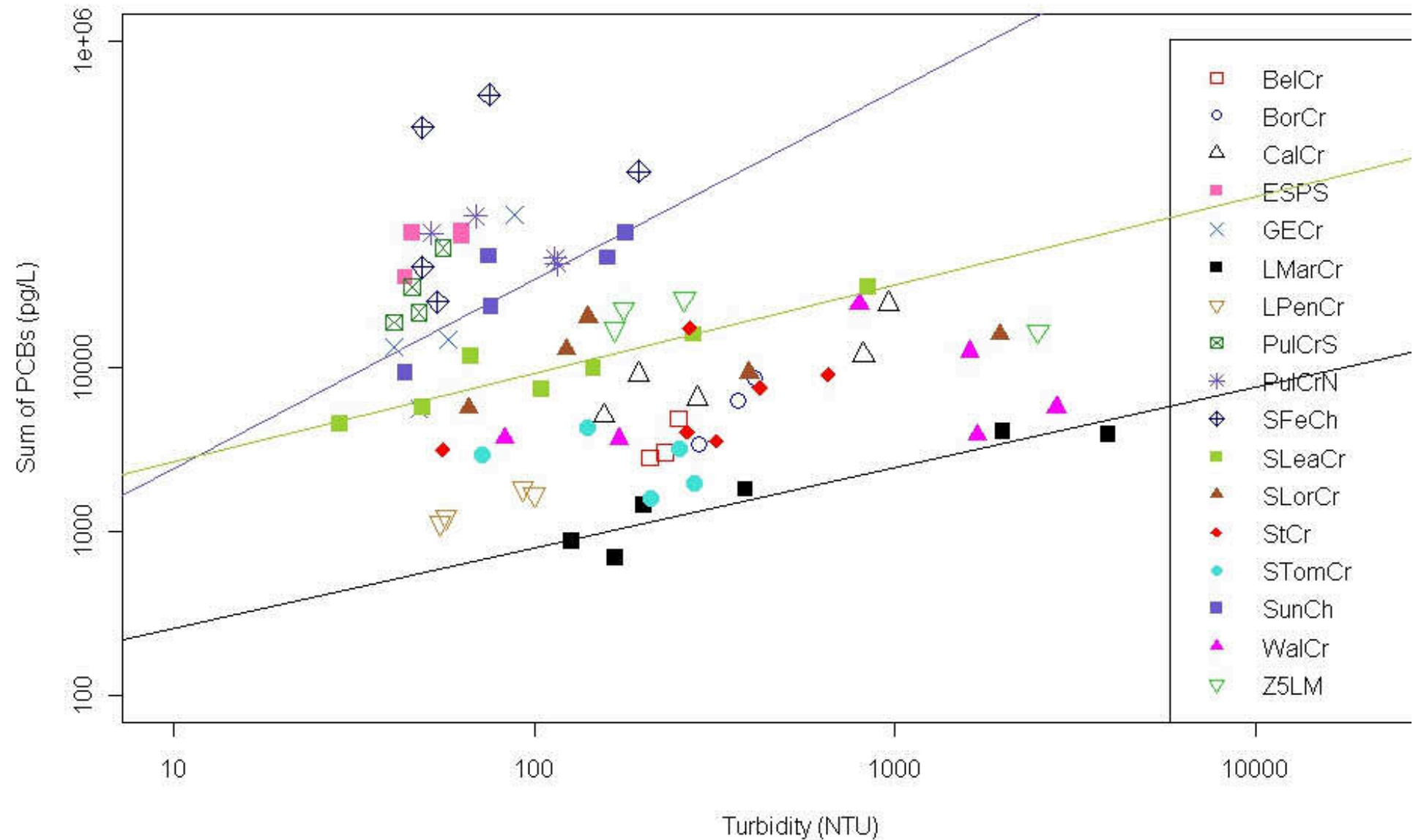- **Surprising tight relationship to turbidity**
- **The very urban Santa Fe Channel had as expected lower concentrations than the other two larger and open-space dominated watersheds by about an order of magnitude.**
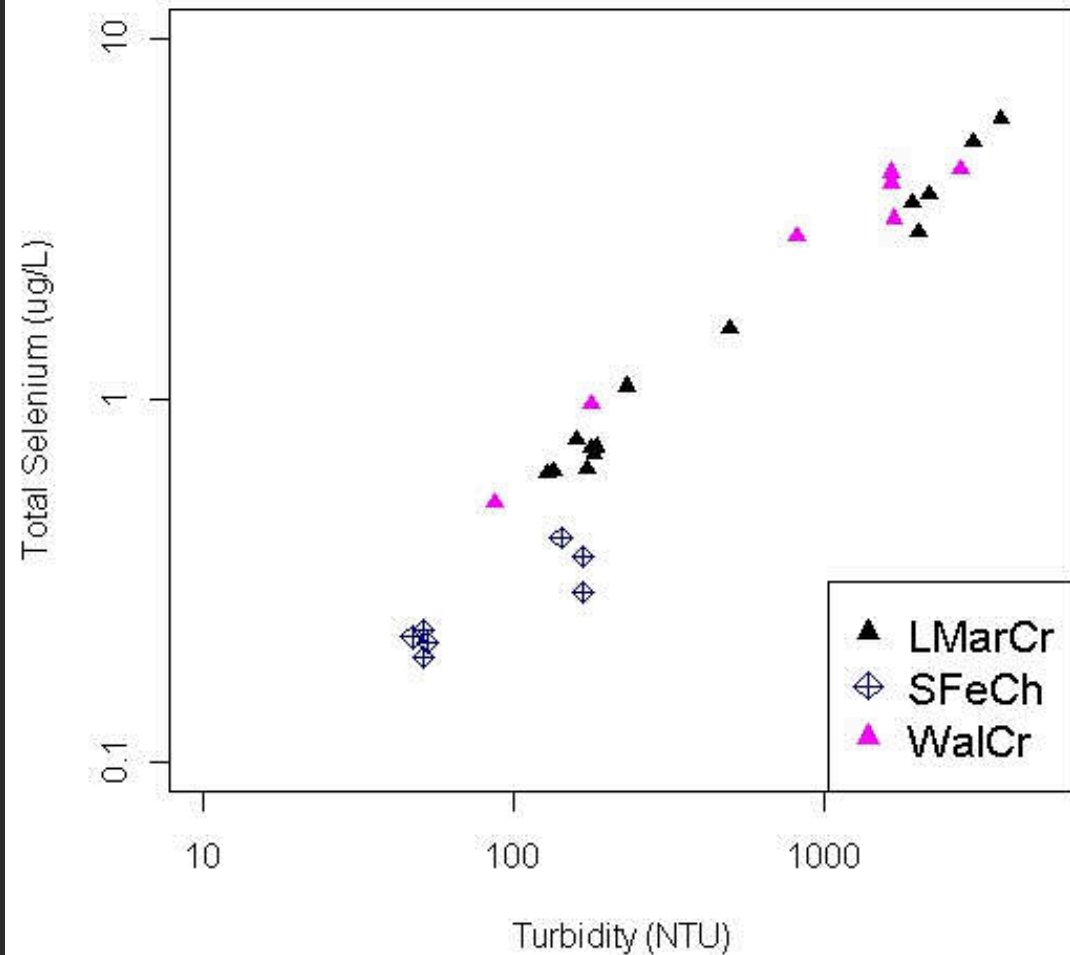
PCB Data (pending final QA)

Results Summary

Watershed	PCB/Turb Avg Ratio (pg/NTU)	HgT/SSC Avg Ratio (ng/mg)	PCB Rank	Hg Rank	Rank Sum
Guadalupe River	1883	4.7	2	1	3
Santa Fe	2882	0.68	1	5	6
Ettie St	1094	0.78	3	4	7
Pulgas South	639	0.83	5	2	7
Pulgas North	822	0.47	4	6	10
San Leandro	98	0.8	8	3	11
Glen Echo	420	0.41	6	7	13
Sunnyvale Channel	369	0.34	7	9	16
Z5LM	85	0.4	9	8	17
San Lorenzo	74	0.28	10	10	20
Stevens	30	0.26	11	12	23
San Tomas	20	0.27	13	11	24
Calabazas	29	0.16	12	16	28
Belmont	15	0.24	17	13	30
Lower Penetencia	20	0.16	14	17	31
Borel	17	0.17	16	15	31
Walnut	18	0.1	15	18	33
Lower Marsh	4	0.2	18	14	34

# Mallard Island / Z4LA FINAL reports

- e.g. the loads table for Z4LA

- Table for Mallard Is. looks similar but fewer analytes

Analyte	Unit	Low Flow (<0.05 CMS) Min	Max	Storm Flow (>= 0.05 CMS) Min	Max	4 Year Average FWMC
SSC	mg/l	1.4	299	8.0	2,744	166
Aluminum	µg/l	66	982	940	11,337	1,840
Arsenic	µg/l	1.0	3.2	0.68	2.8	1.2
Cadmium	µg/l	0.01	0.20	0.11	0.67	0.22
Chromium	µg/l	0.57	3.3	4.0	39.2	5.8
Copper	µg/l	2.3	10.4	6.9	50.0	14.4
Copper - Dissolved	µg/l	5.9	5.9	1.4	10.9	pilot data
Iron	µg/l	27	252	2,415	75,000	7,687
Lead	µg/l	0.18	4.6	4.5	40.1	10.3
Nickel	µg/l	3.3	10.0	5.1	60.0	10.3
Selenium	µg/l	0.11	2.9	0.053	1.2	0.14
Selenium(IV)	µg/l	NS	NS	0.027	0.027	pilot data
Selenium(VI)	µg/l	NS	NS	0.027	0.085	pilot data
Selenium - Dissolved	µg/l	NS	NS	0.041	0.10	pilot data
Silver	µg/l	0.020	0.020	0.020	0.11	0.032
Zinc	µg/l	2.4	62	39	284	91
DOC	µg/l	2.0	7,460	107	12,000	4,423
POC	µg/l	150	1,239	60	16,200	7,004
TOC	µg/l	3,390	9,431	3,950	22,541	11,608
Total Nitrogen - Dissolved	mg/l	NS	NS	0.31	1.3	0.42
Total Phosphorous - Dissolved	mg/l	NS	NS	0.038	0.23	0.069
NO3+NO2 - Dissolved	mg/l	NS	NS	0.012	0.67	0.091
PO4 - Dissolved	mg/l	NS	NS	0.024	0.24	0.063
Ammonium - Dissolved	mg/l	NS	NS	0.056	0.17	0.080
Sum of PCBs	ng/l	0.33	11.0	4.0	109	15.9
Sum of Dioxins and Furans	pg/l	226	226	977	6,254	3,579
Sum of PBDEs	ng/l	0.35	24.9	9.4	425	50.3
BDE 47	ng/l	0.11	2.5	0.75	19.6	3.1
BDE 209	ng/l	0.58	13.6	5.0	241	29.2
Sum of PAHs	ng/l	13.9	1,415	1,395	22,640	6,392
Sum of DDTs	ng/l	0.41	7.4	5.1	59.5	15.4
Sum of Chlordanes	ng/l	0.35	6.4	2.5	16.4	6.7
Sum of HCHs	ng/l	0.087	0.40	0.30	0.89	0.40
Dieldrin	ng/l	0.28	0.85	0.74	4.6	1.4
Bifenthrin	ng/l	0.18	11.8	2.2	46.3	22.0
Delta/Tralomethrin	ng/l	0.64	0.64	0.46	5.5	2.9
Permethrin	ng/l	1.6	25.6	4.6	285	89

2012 loads studies

- 4 watersheds
- 3 years
- 4 storms per year per watershed
- A 1st flush; a large storm, and 2 others
- Hybrid POC sampling approach
  - 6712 ISCO – composite and discrete sample collection
  - D95 – total mercury and total methylmercury
  - DH84 – total methylmercury wading stage
- Continuous turbidity and stage measurements
- Manual discharge measurements
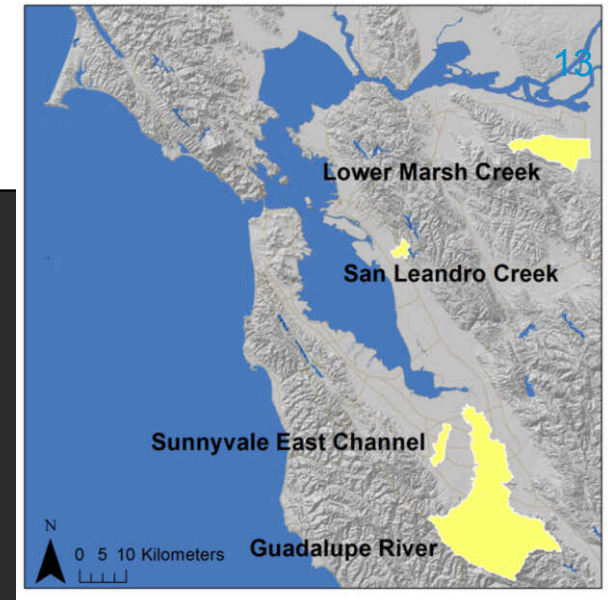
Analytes and collection method

Sample Method	Discrete or Composite	Analysis	Sample Number
Manual ISCO	Discrete	PCBs (40)	18
Manual ISCO	Discrete	PAH	4
Manual ISCO	Discrete	PBDE	4
Manual ISCO	Discrete	SSC (GMA)	17
Manual ISCO	Discrete	TOC	18
Manual ISCO	Discrete	Total Phosphorous	18
Manual ISCO	Discrete	Dissolved phosphorus and Nitrate as N	18
Manual ISCO	Discrete	SSC (GMA)	17
Automated ISCO	Composite	Toxicity – water column	4
Automated ISCO	Composite	Pyrethoids**	6
Automated ISCO	Composite	Carbaryl	6
Automated ISCO	Composite	Fipronil	6
Automated ISCO	Composite	Total Cu and Total Se and Hardness	6
Automated ISCO	Composite	Dissolved Cu and Dissolved Se	6
Automated ISCO	Composite	SSC	6
Manual Grab	Discrete	Total methylmercury	10
Manual Grab	Discrete	Total Mercury	18
Manual Grab	Discrete	SSC	19

- **Note – Guadalupe will be all manual this year due to permit delays**
  - Turbidity surrogate / USGS flow
  - D95 / composites completed by staff also (with great effort)

2012 Spreadsheet model / EMC development

$80 (2011 funding for EMC development); $20k + support from BASMAA

- **Likely products:**
  - GIS layer development based on EMC recommendations
  - PCB model v2?; Copper model v1?
  - Lewicki and McKee SS update (BASMAA funding)
  - PDBE/OC Pest contaminant "fact sheets"

- **December / January:**
  - Draft work plans developed / refined
  - STLS / SPLWG review

Open

PG&E substation

Area assigned source EMC
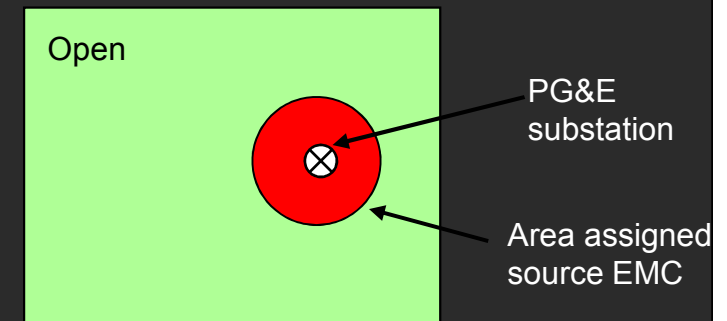
- **February – June:** Complete work / inclusion as appendices in STLS v 2012a (March) and 2012b (September)

- **July - September:** Planning for WY 2013 wet season

2013 possibilities / options

- EMC development depending on 2012 results
    - Field studies to fill data gaps ($~40k 2011 budget; further TRC approved budget $100k?)
    - Further desktop work (e.g. back calculations from regional/ world data)
    - Combination?

- Municipal Regional Permit (MRP) calls for 2 more loadings studies (or equivalent effort)
    - Implement in two more selected watersheds
        - Existing reconnaissance data
        - Sediment / soil results from CW4CB project
        - Targeted towards addressing source areas identified through the EMC lit.rev. contaminants "fact sheets"
    - One loads study / more reconnaissance or EMC field study