



# Development of an Integrated Watershed-wide Monitoring Program for the San Gabriel River (CA)

Karin Wisenbaker – Aquatic Bioassay & Consulting  
Scott Johnson – Aquatic Bioassay & Consulting

# Acknowledgements

- Los Angeles Regional Water Quality Control Board
- The majority of the SGRRMP monitoring funding was provided by Los Angeles County Sanitation District
- Los Angeles Department of Public Works
- Orange County Public Works
- Aquatic Bioassay Field Crew
- Wendy Willis, Aquatic Bioassay



# Presentation Objectives

- **San Gabriel River Regional Monitoring Program (SGRRMP) Development & Project Implementation**
- **Current Watershed Monitoring & Results**
  - Adaptive Monitoring
  - Special Studies
- **Project Re-design**

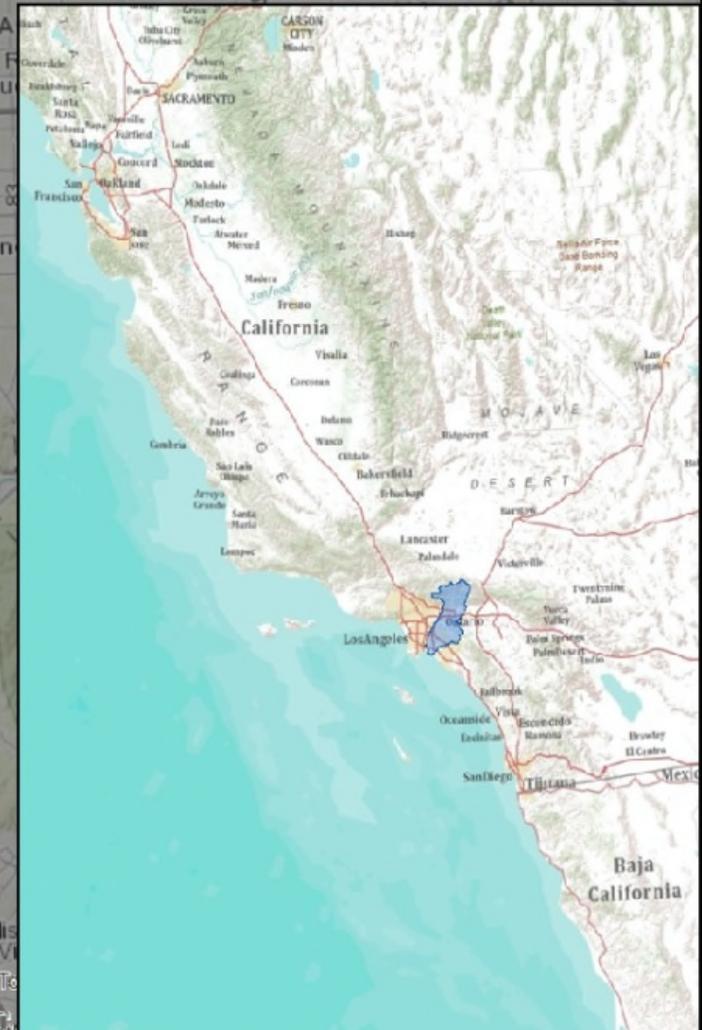
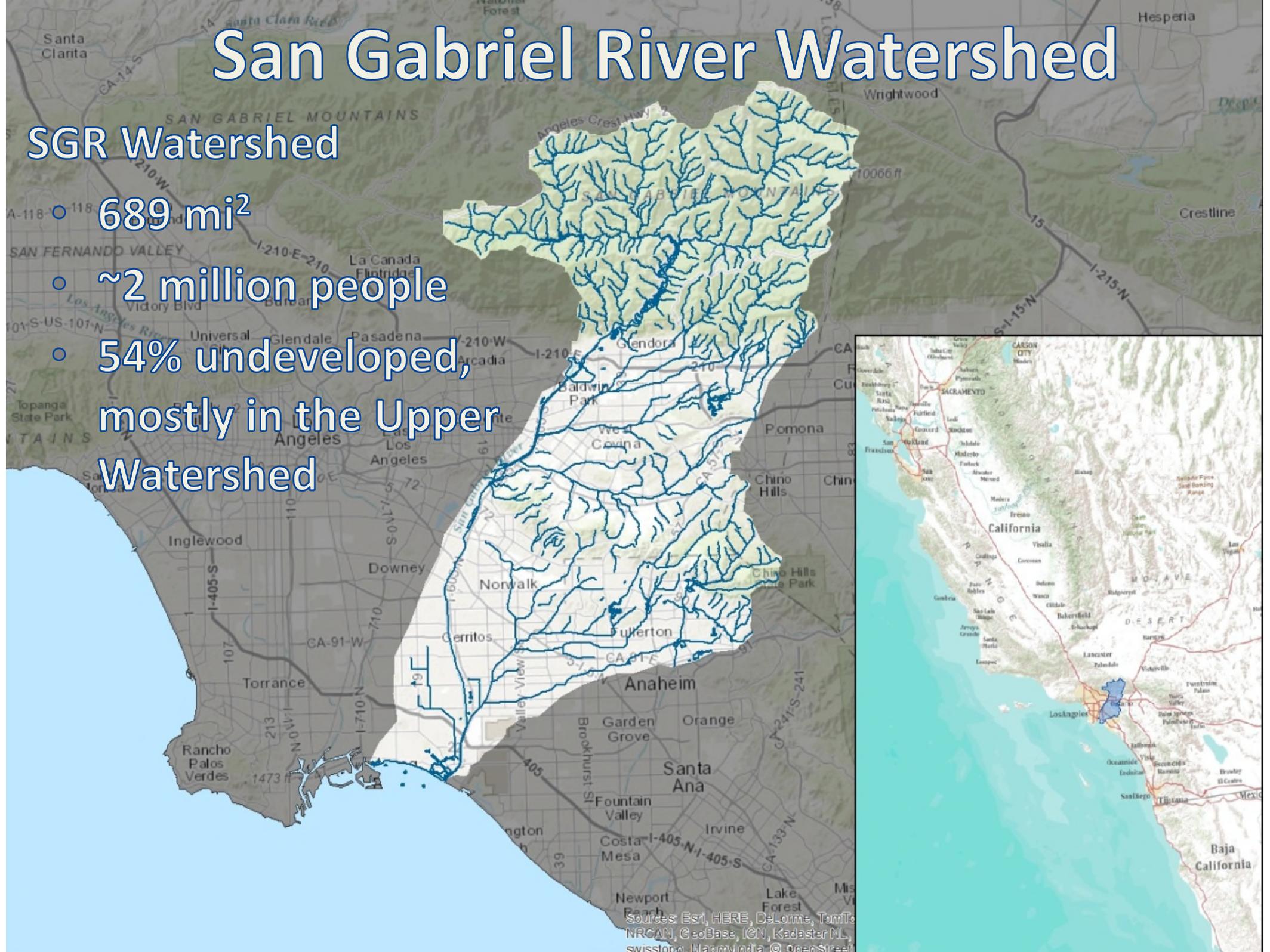


# San Gabriel River Watershed

SGR Watershed

689 mi<sup>2</sup>

- ~2 million people
- 54% undeveloped, mostly in the Upper Watershed



Sources: Esri, HERE, DeLorme, TomTom, NRCAN, GeoBase, IGN, Kadaster NL, swisstopo, Mapbox, © OpenStreetMap contributors, and the GIS User Community

# San Gabriel River (SGR) Watershed

Upper Watershed



Lower Watershed  
Tributary



**SGR Mainstem**



# San Gabriel River Regional Monitoring Program (SGRRMP)

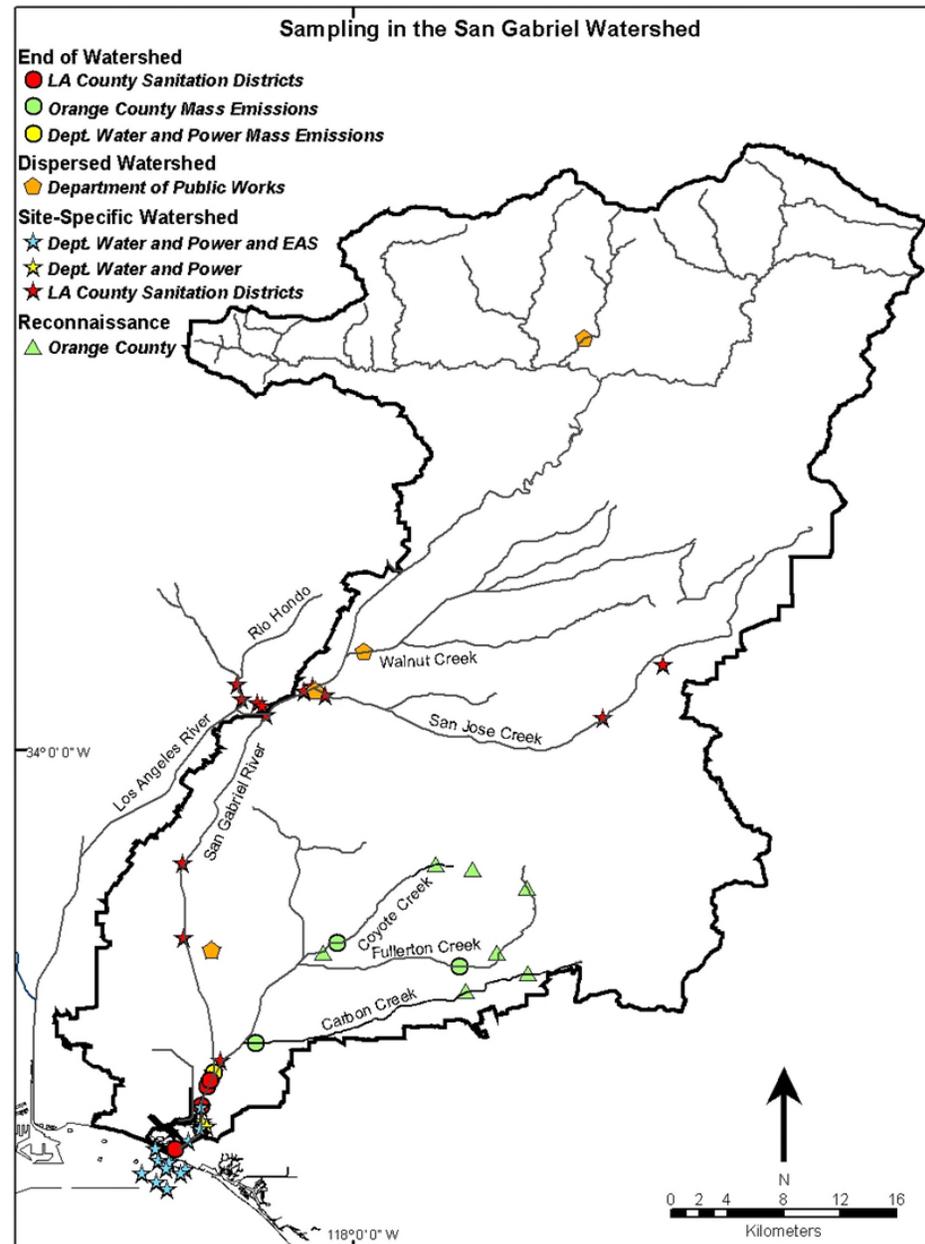
## Before the Development of the Program:

- Watershed monitoring conducted by numerous agencies
- Programs were not coordinated on a local, regional or State level
- Inefficiencies
- No way to assess watershed as a whole



# San Gabriel Watershed

## Sampling Locations Prior to Program Implementation

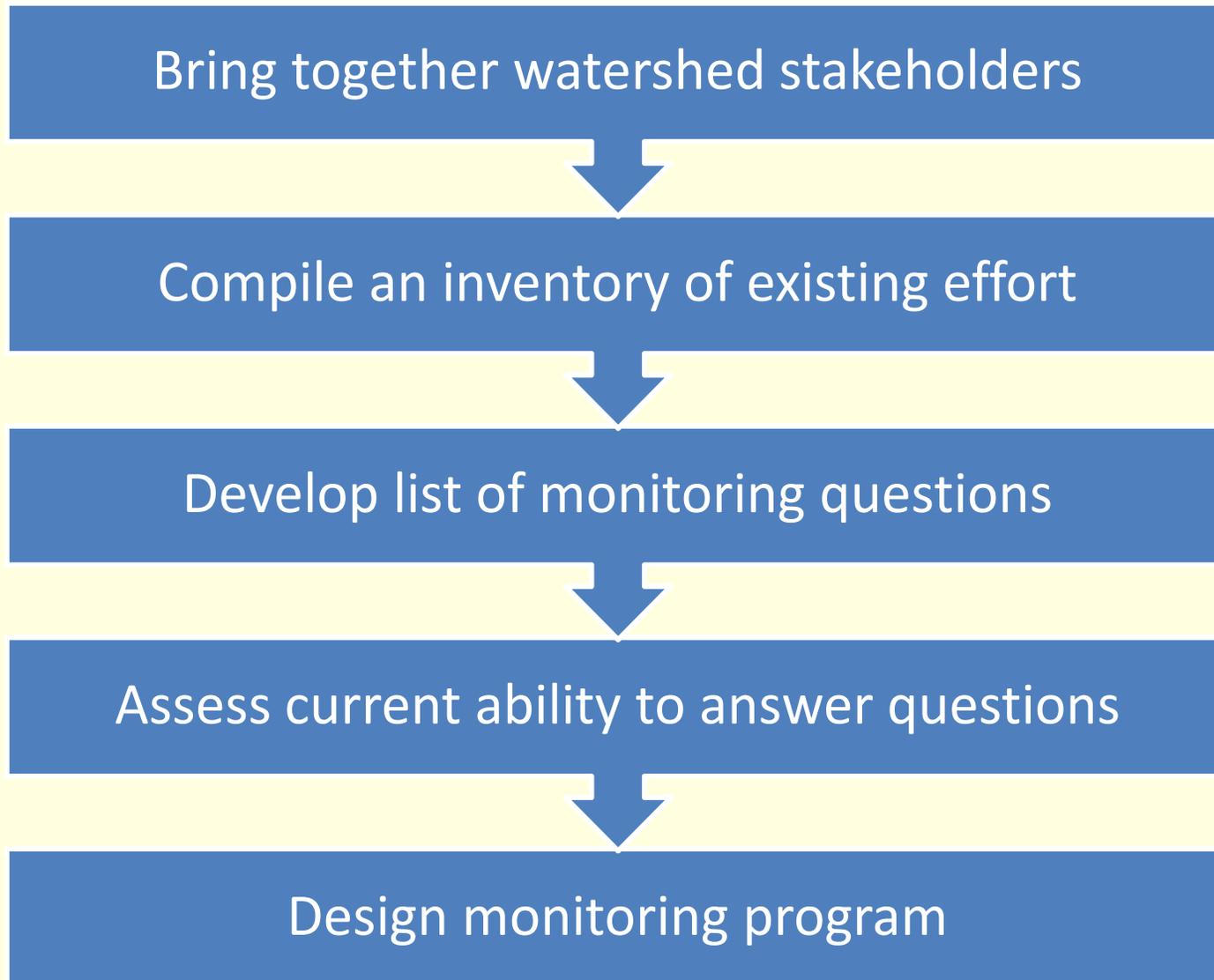


# San Gabriel River Regional Monitoring Program (SGRRMP)

## Program Development Began in 2004

- Program was a direct response to LACSD, LADPW and OCPW NPDES Permit requirements
  - LARWQCB desired more integrated information about the watershed as a whole

# Integrated Regional Monitoring Approach



# **San Gabriel River Regional Monitoring Program**

## **Program Development Stakeholders**

- Los Angeles Regional Water Quality Control Board**
- Los Angeles County Sanitation District**
- Los Angeles Department of Public Works**
- Los Angeles Department of Water and Power**
- Santa Ana Regional Water Quality Control Board**
- Orange County Public Works**
- Southern California Coastal Water Research Project**
- USFS**
- EPA**
- U.S. Army Corps of Engineers**
- Rivers and Mountains Conservancy**
- San Gabriel Mountains Regional Conservancy**
- AES Corporation**
- City of Downey**

# Monitoring Questions



1.

What is the health of streams ?



2.

Conditions at areas of unique importance ?



3.

Are regulated discharges meeting WQ objectives ?



4.

Is it safe to swim ?



5.

Is it safe to eat fish ?

State of the Watershed

# Special Studies

- An adaptive element within the program
- Short term projects
- Intended to extend or provide more insight into the core monitoring program



Post Fire Study

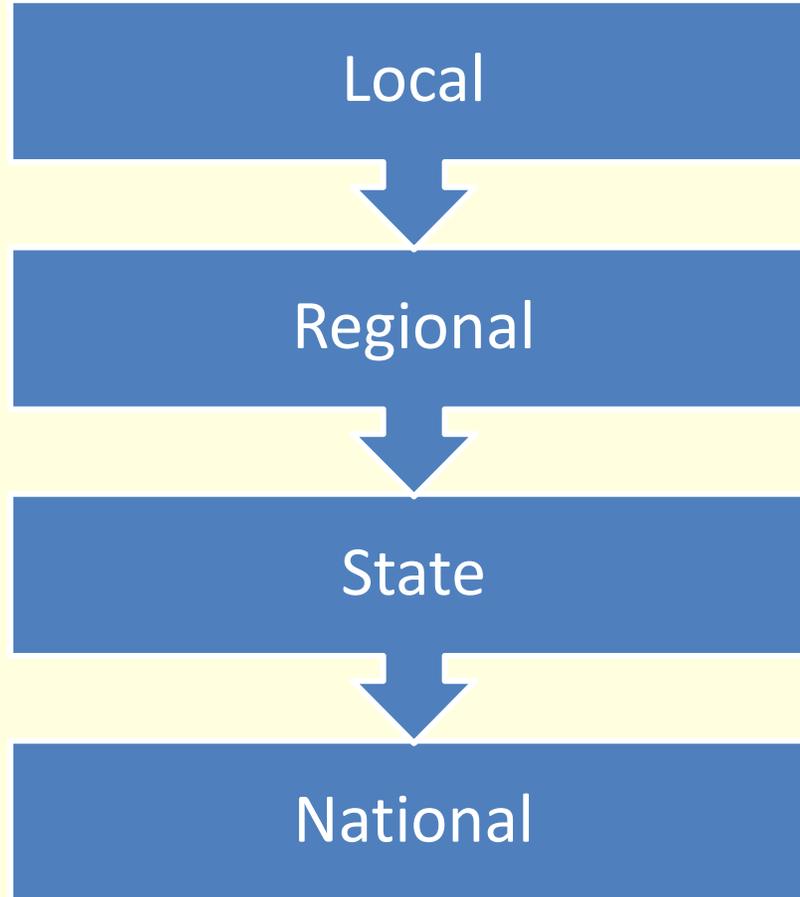


Proteomics



Methyl Mercury

# Nested Program



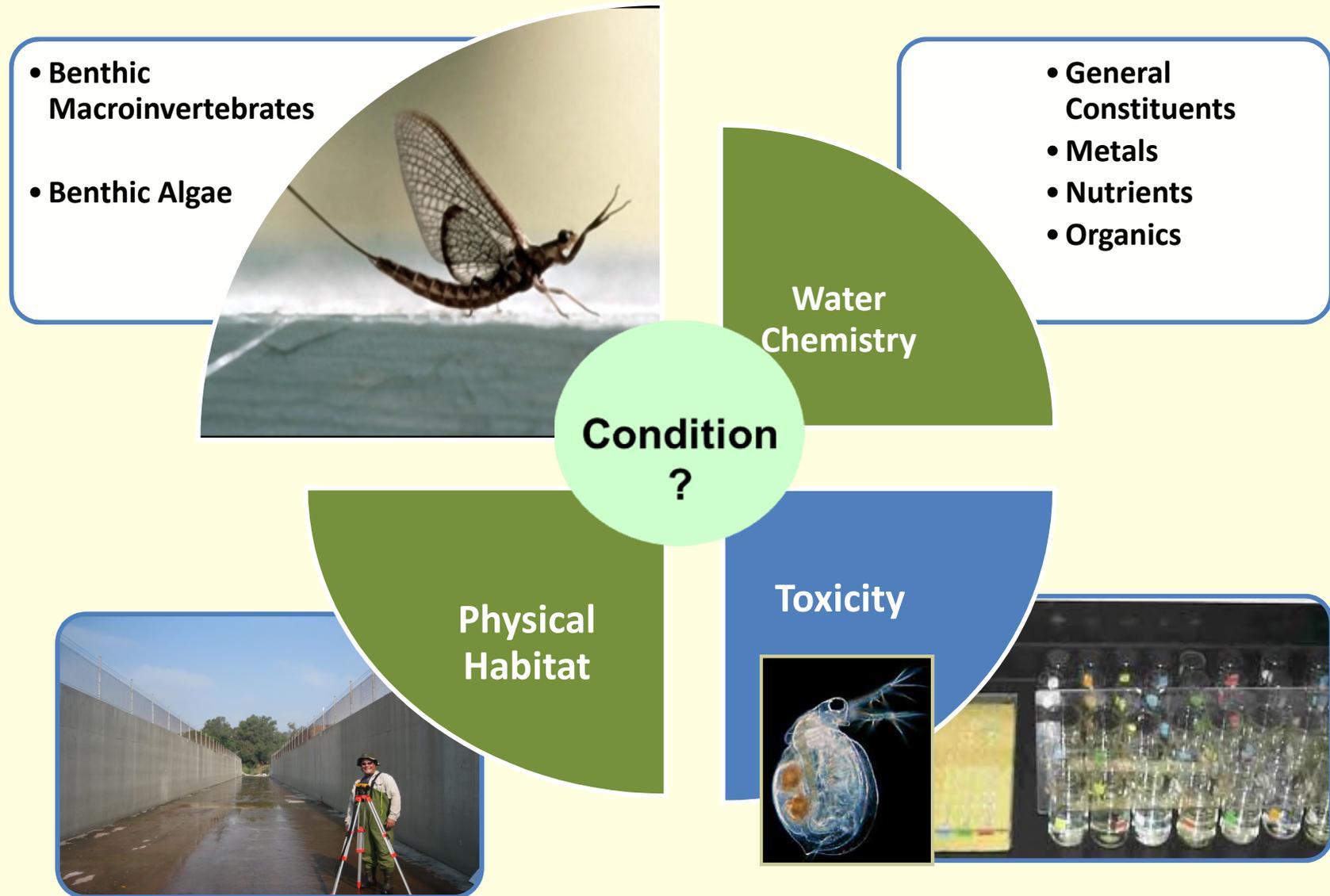
**Sampling was designed to be comparable to other monitoring programs**

A scenic view of a river flowing through a valley. The river is the central focus, with water splashing over numerous dark, rounded rocks. The banks are lined with green vegetation, including tall grasses and shrubs. In the background, there are rolling mountains under a clear blue sky. The overall atmosphere is bright and natural.

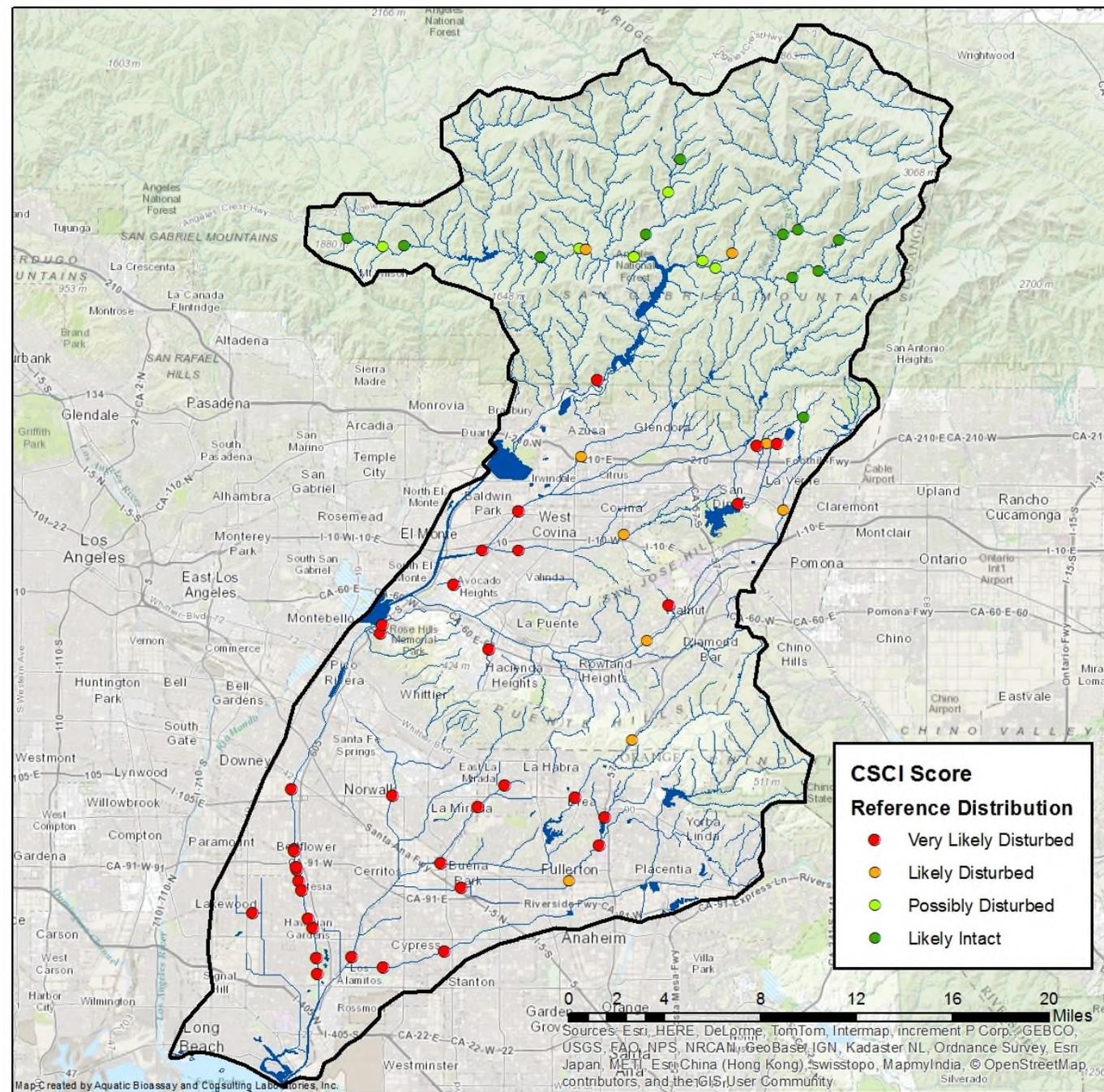
# San Gabriel River Watershed Monitoring Results, Adaptive Monitoring & Special Studies

# Health of Streams - Ambient Condition

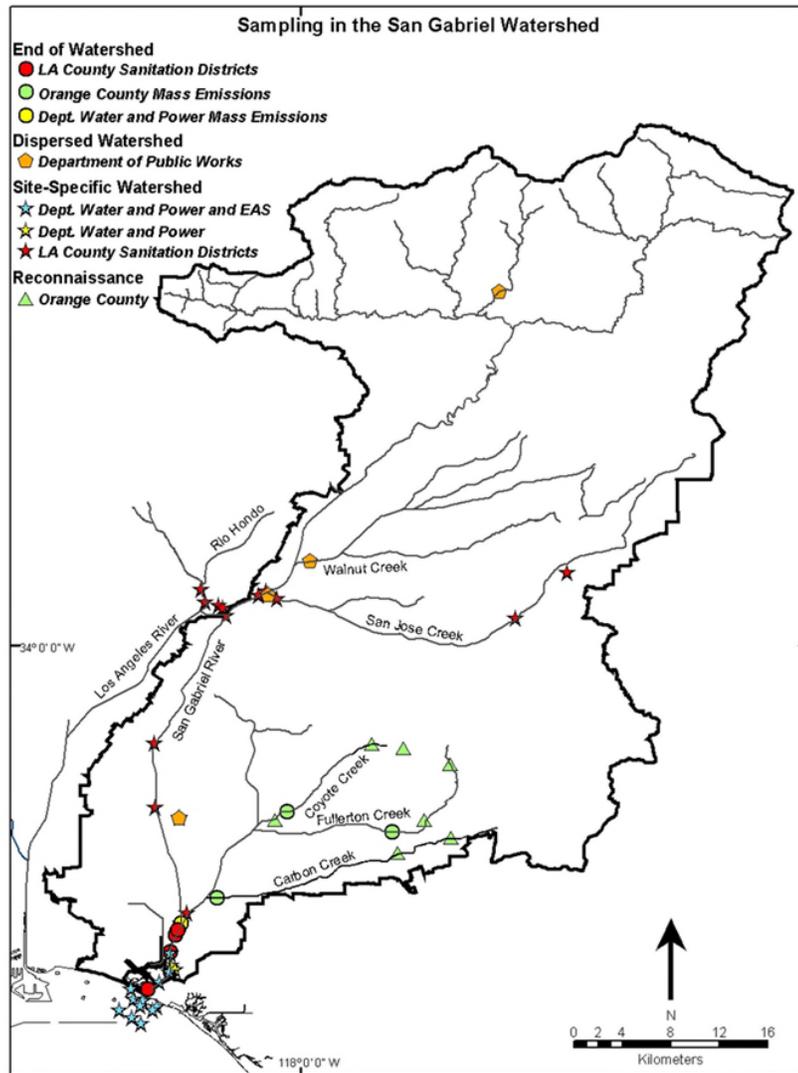
## Multiple Lines of Evidence (MOLE)



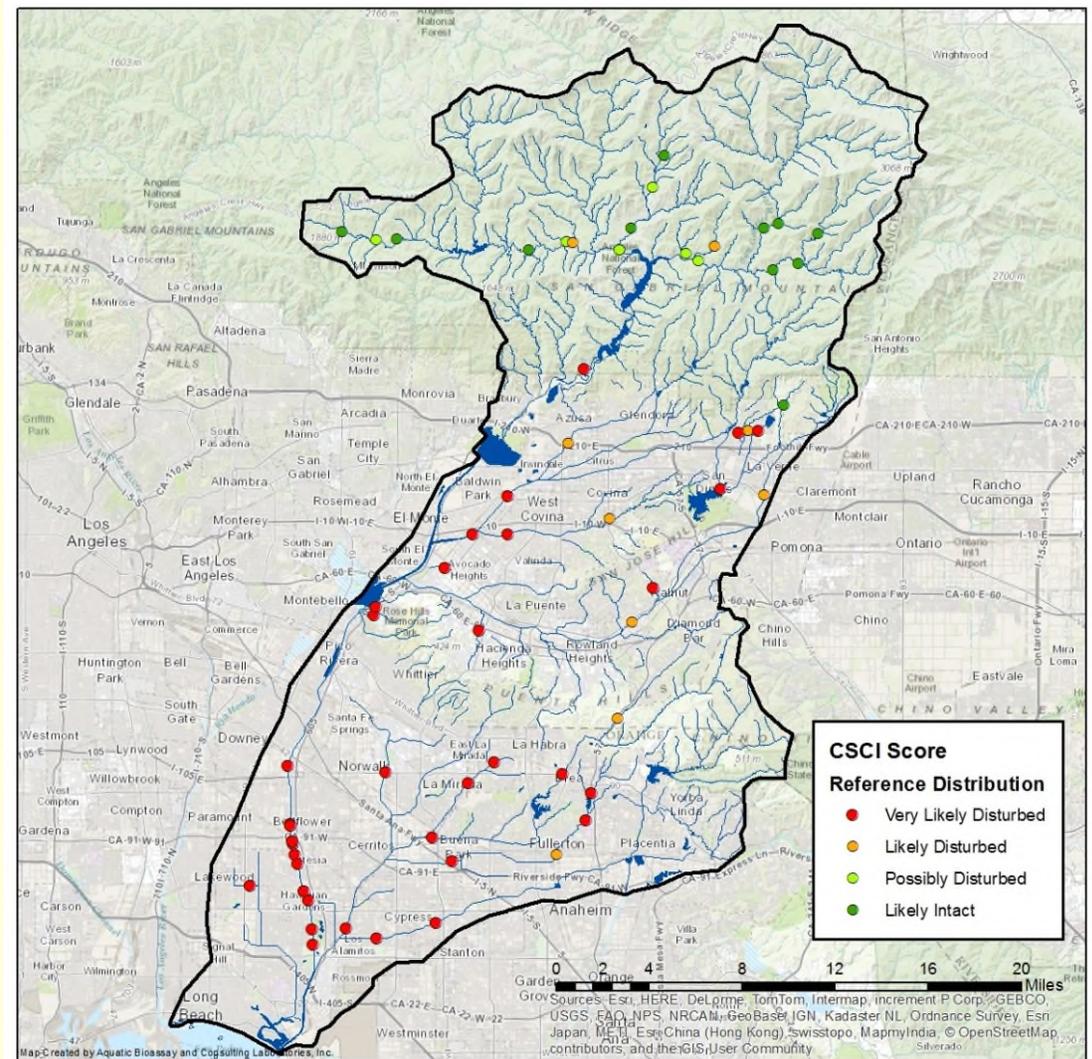
# Ambient Biotic Condition (2008 to 2014)



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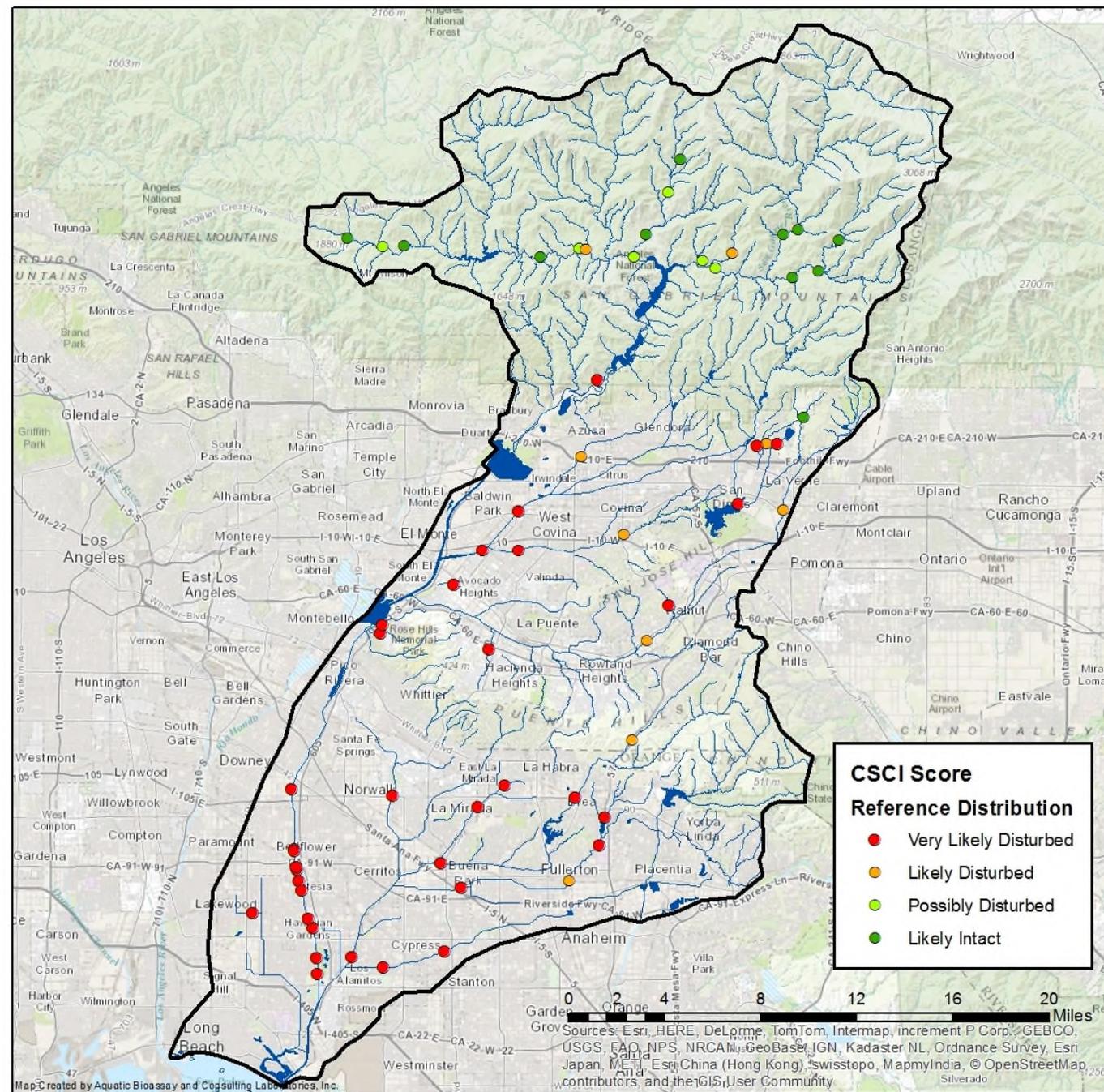


Station Locations Prior to Program Implementation

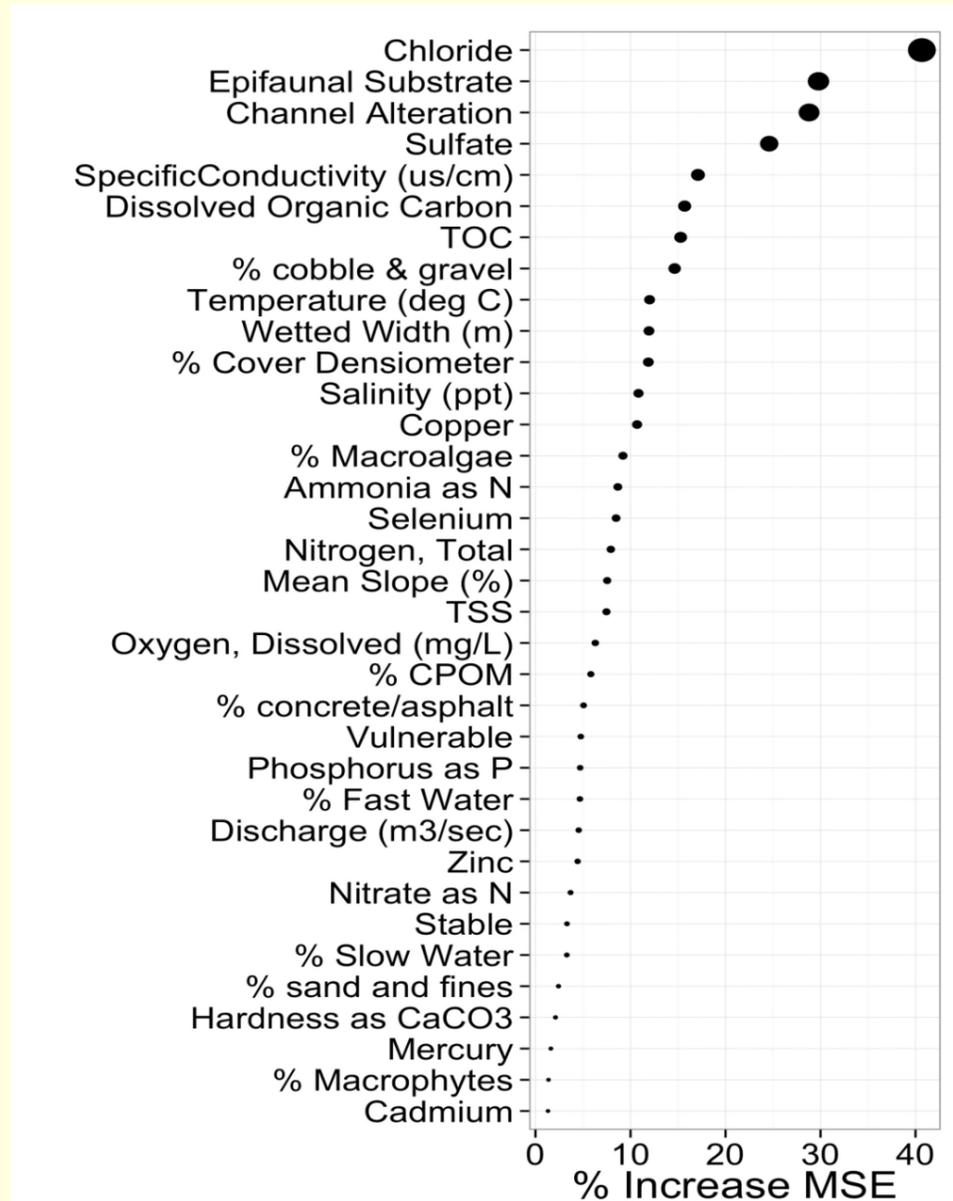


2008-2014 Station Locations

# Ambient Biotic Condition (2008 to 2014)



# Ranking Impacts of Stress on Biological Condition (2008 to 2014)

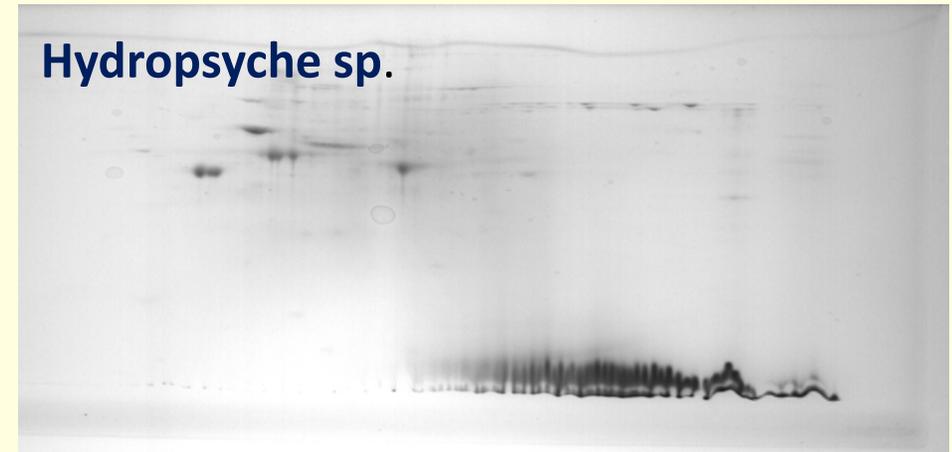


Variable importance plot showing an evaluation of the strength of association of the environmental variables to the biological condition using a random forest model (RF) which was created using imputed PHAB data (from years  $\geq 2008$ ,  $n = 55$ ) to predict CSCI scores.

# Ambient Condition Special Study

## Proteomics

- Can proteomics be used to map protein expression in aquatic insects?
- Can differences in protein expression be detected in the same species collected at reference and non-reference stream reaches?



Protein Identification



Hydropsyche sp.



Baetis adonis

# Ambient Condition Adaptive Monitoring

**New Parameters were added to bioassessment monitoring including:**

- Benthic algae collection and identification
- Hydromodification assessment
- Channel engineering assessment
- Hydrologic state assessment
- Vertebrate Checklist
- Non-perennial stream bioassessments
- Water level loggers



# Safe to Swim (2014)

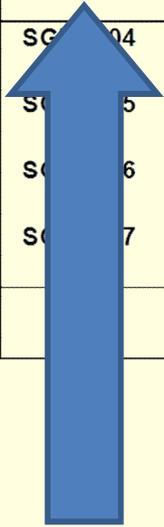
Swim Sites	Geometric Mean						Single Sample Exceedances		
	May	June	July	Aug.	Sept.	n =	#	%	
SGUT200	29	9	40	20	52	19	2	11%	
SGUT201	412	174	287	106	165	19	10	53%	
SGUT202	102	32	19	43	63	19	2	11%	
SGUT203	46	48	82	102	141	19	5	26%	
SGUT210	NS	286	196	134	190	14	6	43%	
SGUT204	14	37	13	59	46	19	1	5%	
SGUT205	41	9	8	21	14	19	0	0%	
SGUT206	35	14	32	43	91	19	0	0%	
SGUT207	58	11	20	160	121	19	2	11%	
						Totals	166	28	17%

Exceedances of the 30 day geometric mean REC 1 standard for *E. coli* (126/ MPN/100 mL) and single sample exceedances (235 MPN/100 mL)



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**New Site in 2014**



# Safe to Swim (2014)

New safe to swim location added in 2014 on the SGR



- Single sample *E. coli* results ranged from 41 to 3873
- Single samples exceeded REC1 standards (235 MPN/100 ml) 43 % of the time

# Safe to Swim – Other Changes

## Site changes

- Puddingstone Lake and Santa Fe Dam sites (lower watershed) dropped after 2007 sampling
- 2008 – Swim sites are all focused on the upper watershed
  - 4 Upper watershed sites added
  - 2008 – Swim sites are all focused on the upper watershed
- 2014 - Heavily used and impacted swim site added



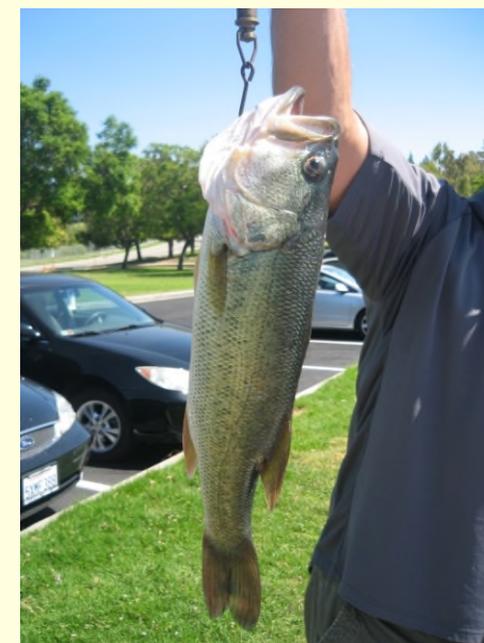
Puddingstone Lake – Cl Bubbler

# Safe to Eat Fish

Station Description	Year	Common Name	Comp. #	Mercury (ppb)	Selenium (ppb)	DDTs (ppb)	PCBs (ppb)
Puddingstone Lake SGLT307	2006	largemouth bass	1	328	174	25.6	3.3
	2007	largemouth bass	1	224	350	30.8	18.7
	2008	largemouth bass	1	160	139	306.2	ND
		redeer sunfish	1	10	283	ND	ND
	2009	bluegill	1	20	136	5.0	7.2
		common carp	1	20	112	15.4	8.4
		largemouth bass	1	290	151	37.4	32.7
			2	210	126	38.7	44.9
			3	40	138	7.0	7.4
		redeer sunfish	1	40	281	6.8	6.5
		white catfish	1	40	82	8.0	7.7
	2014	bluegill	1	30	200	1.8	ND
		common carp	1	20	200	20.4	3.1
		largemouth bass	1	100	100	5.8	ND
			2	90	100	4.7	ND
		redeer sunfish	1	10	100	1.1	ND

## Advisory Tissue Levels (ATL)

=Exceeds three 8-oz servings a week ATL
=Exceeds two 8-oz servings a week ATL
=Exceeds one 8-oz servings a week ATL
= Exceeds no consumption ATL.



# Safe to Eat Fish Special Study

- **Development of Methyl Mercury Analysis**
  - Methyl Mercury is now part of our bioaccumulation analyte list

Common Name	Comp #	Mercury (ppb ww)	Methyl Mercury (ppb ww)	% Methyl Mercury
Bluegill	1	30	20	67
Common Carp	1	20	20	100
Largemouth Bass	1	100	85	85
Redear Sunfish	1	90	80	90
Redear Sunfish	2	10	ND	NA



**Concentration of mercury in fish tissue at Puddingstone Lake in 2014**

A scenic landscape photograph of a river flowing through a valley. The river is filled with numerous dark, smooth rocks of various sizes, creating a shallow, fast-moving stream. The water is clear and reflects the surrounding environment. On either side of the river, there are lush green trees and vegetation. In the background, rolling mountains rise, covered in dense forests. The sky is bright and clear, suggesting a sunny day. The overall scene is peaceful and natural.

# Program Re-design

# SGRRMP Program Re-design

Over ten years since this project began

- Samples collected at over 150 targeted and probabilistic (random) sites

## SGRRMP knowledge gaps

- How do stream condition change over time?
  - Do not want to lose ambient condition info
- How do management practices or natural phenomena affect stream condition overtime?
- How do we determine the health of non-perennial streams?

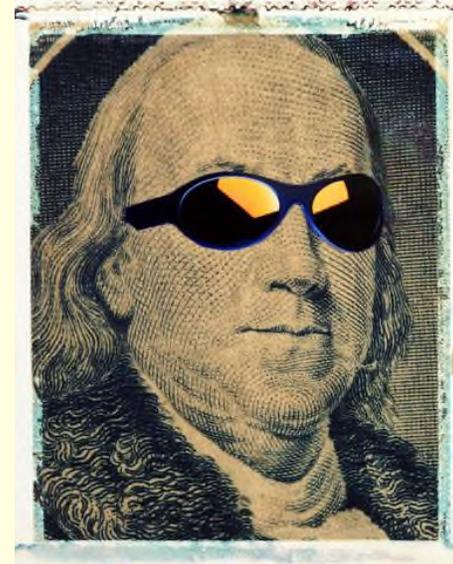


# **SGRRMP Re-design Proposed Plan**

- 1. Begin revisiting 10 to 20 *standard random* sites per year; working down list since 2008 (= 65 sites)**
- 2. Review and select up to 5 *special random* sites on list (same as above) to revisit each year for 5 to 10 years**
- 3. Revisit up to 5 sites per year previously deemed *non-perennial* and not sampled, working down list since 2008**

# Budgets and Resources

**In the end, it's all about the  
Benjamins!**



- **The plan, if fully implemented, would exceed entire budget of SGRRMP**
- **We want to ensure there is money for special studies**

# SGRRMP Re-design

## Next Steps

**The Technical Stakeholder Group (TSG) will determine**

- 1. Re-design constraints and how many special random sites might be included**
- 2. Budgets and workplans**

**Field work will begin with the new design in 2017!**



# SGRRMP Technical Stakeholder Group



# Summary of Findings

## Ambient Condition (2008 to 2014)

- Ambient condition of perennial streams in watershed well understood
- Some idea regarding key stressors to system (at least in an associative sense)
- Less clear regarding trends in ambient condition or at fixed trend sites



# Summary

- **Program development was a collaboration between regulatory agencies and NPDES permit holders**
  - **Permit language allows for adaptive monitoring**
  - **Sampling was designed to be nested into other regional, State, and Federal programs**
- **Adaptive Monitoring Program**
- **Special Studies**
  - **Some special studies have been integrated into the program**
- **SGRRMP monitoring plan is being redesigned to address knowledge gaps**

- **Program Development**

- **Approach**

- **Bring together watershed stakeholders**
      - vested in water quality and ecosystem health
      - formed SGRRMP Workgroup
    - **Compile an inventory of existing effort**
    - **Develop list of monitoring questions**
    - **Assess current ability to answer questions**
    - **Modify or create monitoring designs to effectively and efficiently answer questions**

# **Summary of Findings**

## **Ambient Condition (2008 to 2014)**

**Ambient condition of perennial streams in watershed well understood**

- Ten years of data suggest upper vs. lower watershed differences (urban vs. open)**
- No big differences between mainstem and tribs**
- No change in ambient condition detected**

**Some idea regarding key stressors to system (at least in an associative sense)**

- Physical habitat, nutrients, ions**

# **Summary of Findings**

## **Trends in Condition (2005 to 2014)**

**Less clear regarding trends in ambient condition or at fixed trend sites**

- Ambient program not designed to detect change within a reasonable time frame (5 to 10 years)**
- Trend sites: either highly variable or no change over the time period**
- Sites originally chosen to detect trends in stream condition over time not linked to management or policy practices**

# **Summary of Findings**

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**Less clear regarding trends in ambient condition or at fixed trend sites**

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