Constituents of Emerging Concern (CECs) and the Water Boards

An Update on CEC Monitoring and Regulatory Strategies

February 22, 2017

Greg Gearheart, Director

Office of Information Management and Analysis

Contaminants of Emerging Concern

PFOA/
PFOS

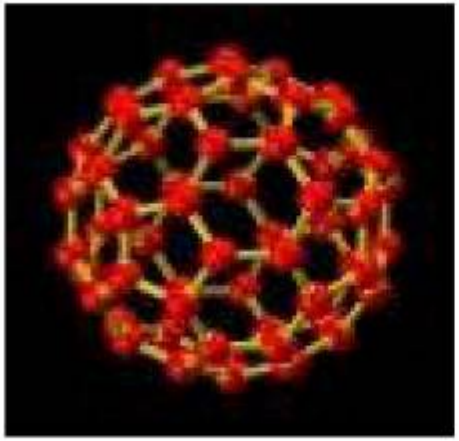
Pharmaceuticals
and Personal Care
Products

Flame
Retardants

Endocrine
Disrupting
Compounds

Pesticides

Microplastics



PBDEs

What do we mean by CEC?

- Constituent (or chemicals) of Emerging Concern (CECs) – vast number of chemicals that are generally unregulated in the U.S. or have limited regulation in environmental media
- CECs may include –pharmaceuticals, flame retardants, newly registered contemporary use pesticides, newly developed commercial products, including nanomaterials.
- Generally CECs have likely been present in water bodies, sediments and tissues but at concentrations that were not detectable by commonly used analytical methods

Water Board Functions re: CECs

- Monitoring (direct, indirect)
- Special studies (direct, coordinate)
  - Linkages to thresholds
  - Development of monitoring methods
  - Treatability
- Regulatory interventions
  - Permit requirements
  - New “standards”

Office of Information Management and Analysis (OIMA) Role re: CECs

- With DWQ, coordinate CEC Initiative activities
- Direct pilot monitoring in ambient recommended by expert panel
- Work with DWQ, DDW and Regions to direct special studies
- Track and help evaluate effectiveness of regulatory interventions

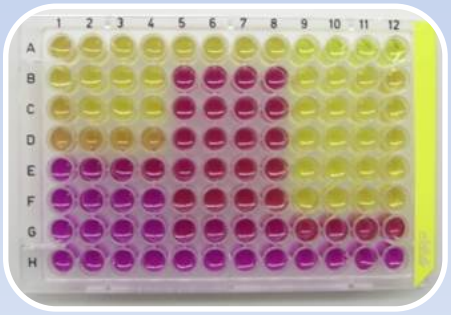
CEC Ambient Monitoring Pilot Framework

Biological

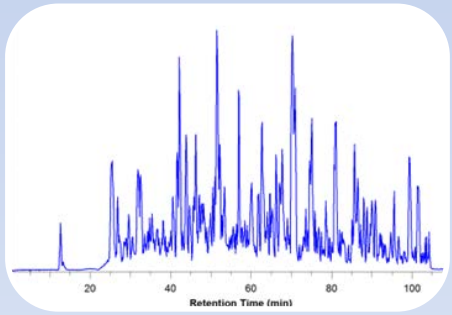
Bioassessment

Targeted

Chemical

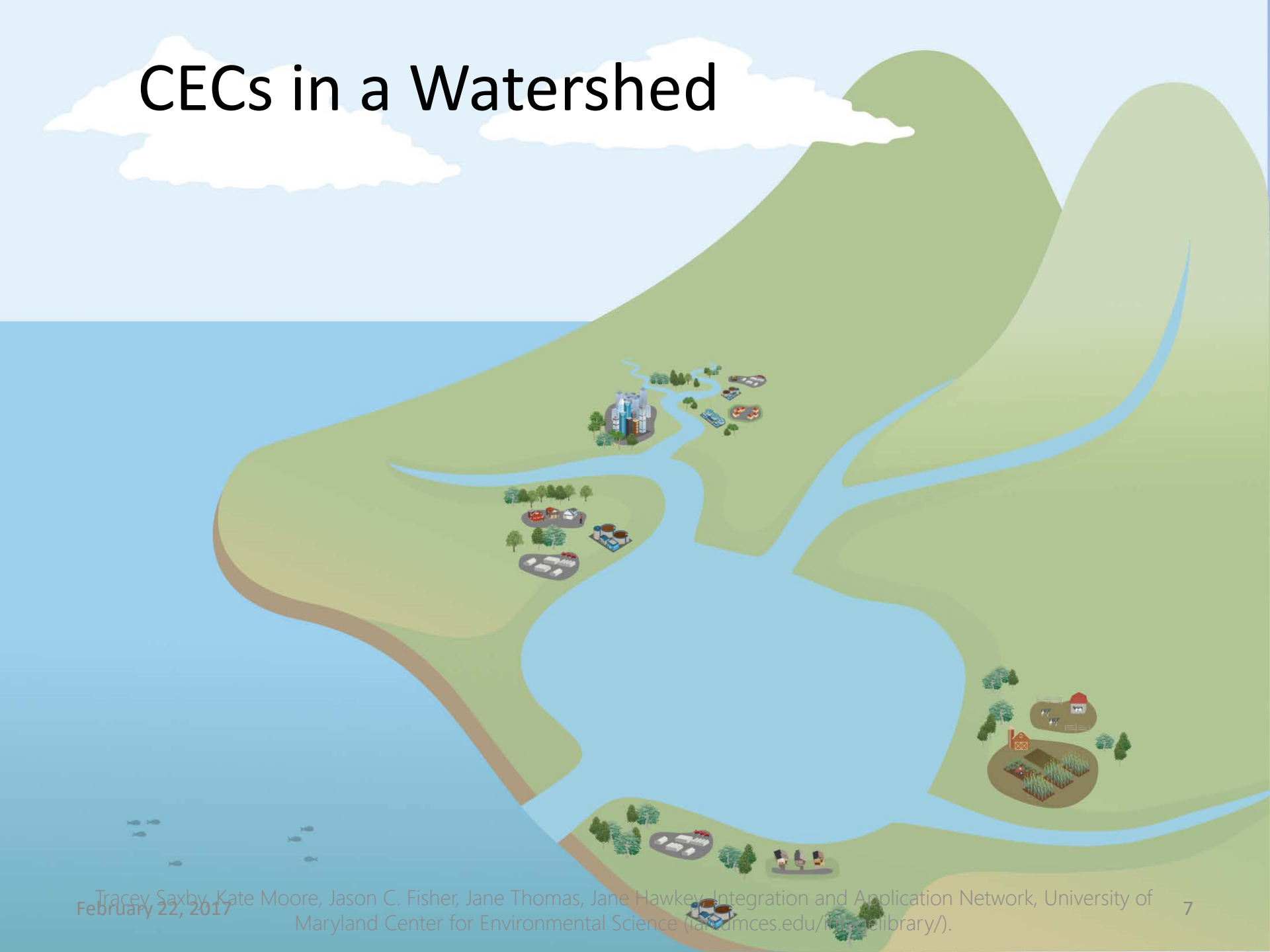


Bioanalytical



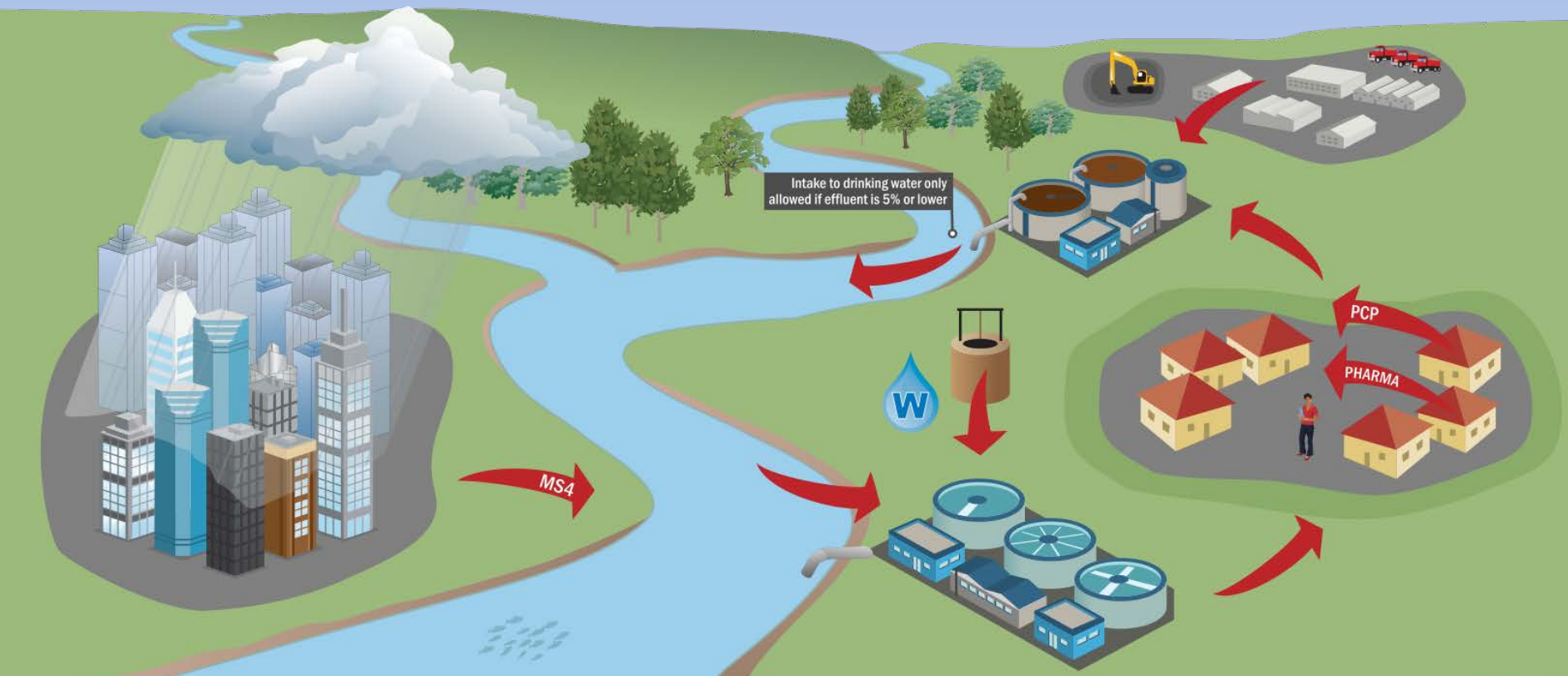
Non-targeted

CECs in a Watershed



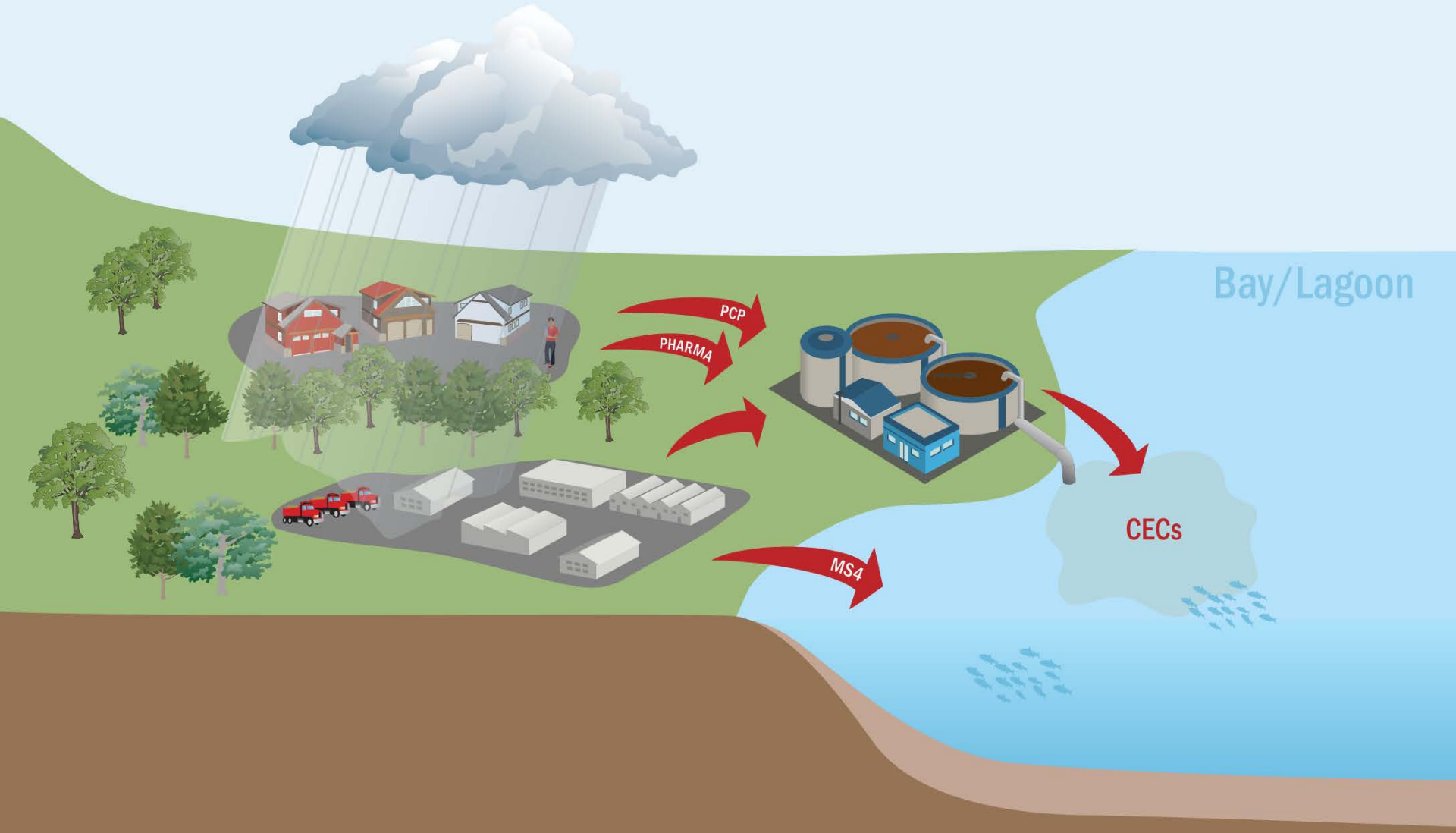
Tracey Saxby, Kate Moore, Jason C. Fisher, Jane Thomas, Jane Hawkey, Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/imagelibrary/).

Scenario 1 – Inland Freshwater/Effluent Dominated Waters



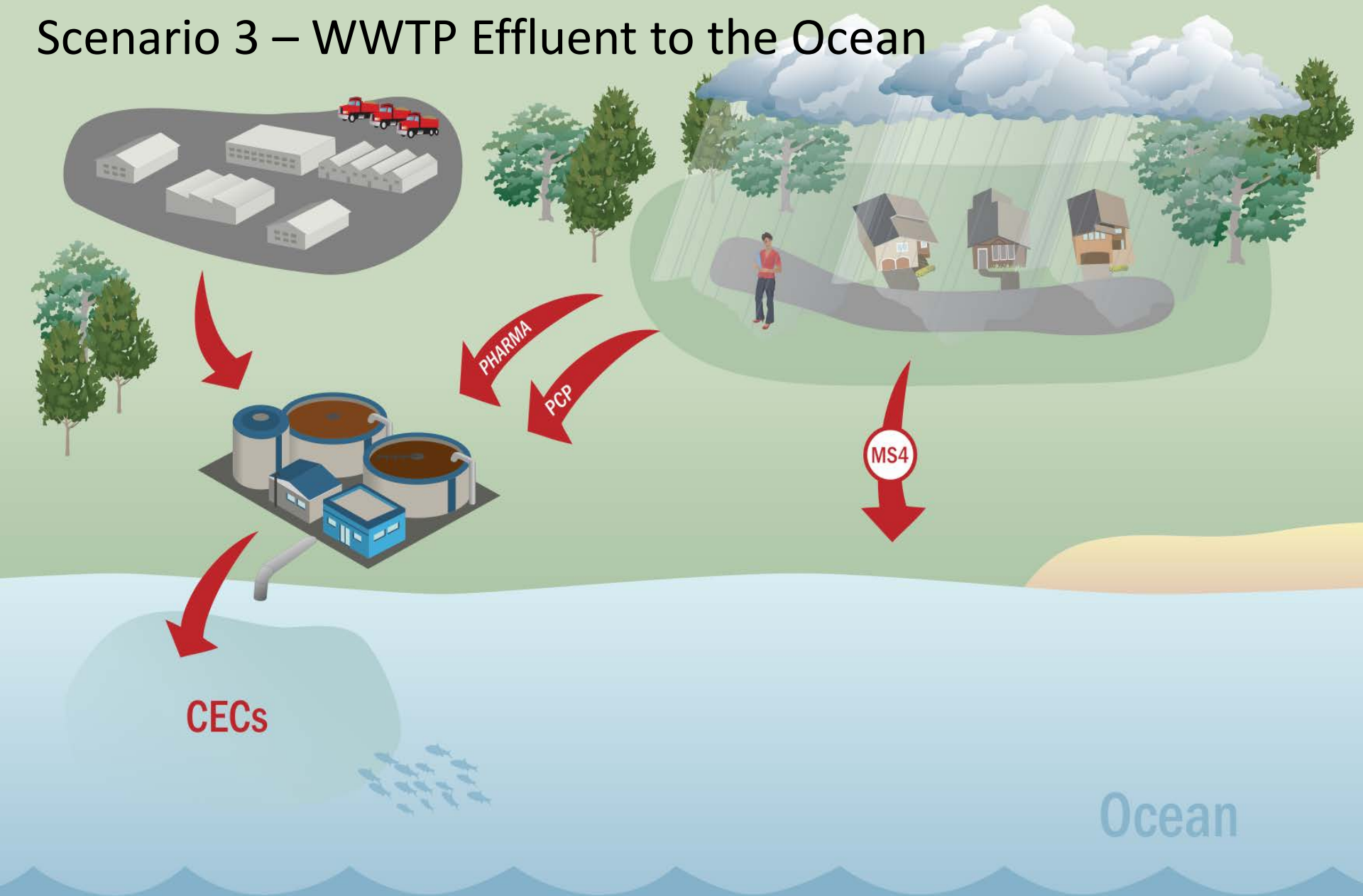
Tracey Saxby, Kate Moore, Jason C. Fisher, Jane Thomas, Jane Hawkey, Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/imagelibrary/).

Scenario 2 – Coastal Embayment



Tracey Saxby, Kate Moore, Jason C. Fisher, Jane Thomas, Jane Hawkey, Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/imagelibrary/).

Scenario 3 – WWTP Effluent to the Ocean



Tracey Saxby, Kate Moore, Jason C. Fisher, Jane Thomas, Jane Hawkey, Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/imagelibrary/).

Timeline for CECs

- **2009** – SWRCB convened two panels on CECs, one for recycled water driven human health risks (Science Advisory Panel) and one for ecosystem health risks, funded by the Packard Foundation (Aquatic Ecosystem CEC Panel)
- **2010** – Science Advisory Panel made recommendations for monitoring using a risk-based approach in their final report, SWRCB staff wrote a staff report supporting their recommendation to develop bioanalytical approaches
- **2011** – SWRCB contracted with SCCWRP to convene experts at bioanalytical cellular methods to explore further and they developed a framework still in play today (though only truly piloted by North Coast Region for Russian River)

Timeline for CECs (cont.)

- **2012** – Aquatic Ecosystem CEC Panel released a report summarizing their findings and discussing this framework in more detail; SWRCB contracted with SCCWRP to develop Monitoring Guidance for CECs in Aquatic Ecosystems
- **2013** – SWRCB adopted Recycled Water Policy with monitoring requirements for priority pollutants and CECs for groundwater recharge by surface and subsurface application methods based on the Science Advisory Panel report; SWRCB defers on bioanalytical and ecosystem requirements to pursue "pilot study"
- **2014** – SCCWRP "bioanalytical" team released report; SCCWRP developed Monitoring Guidance for CECs in Aquatic Ecosystems
- **2015** – OIMA begins implementing "pilot study" approach

Order of CEC Stories Today

Division of Drinking Water	CECs and Drinking Water
Division of Water Quality	CECs and Recycled Water
North Coast Region	CECs in the Russian River
San Francisco Bay Region	Ten Years of Monitoring and Intervening on CECs in the San Francisco Bay
Los Angeles Region	CECs in the Los Angeles Region
Santa Ana Region	CECs in the Santa Ana River and Orange County Coast
Office of Information Management and Analysis	Data Visualization of CECs

Division of Drinking Water

Update on Constituents of Emerging Concern

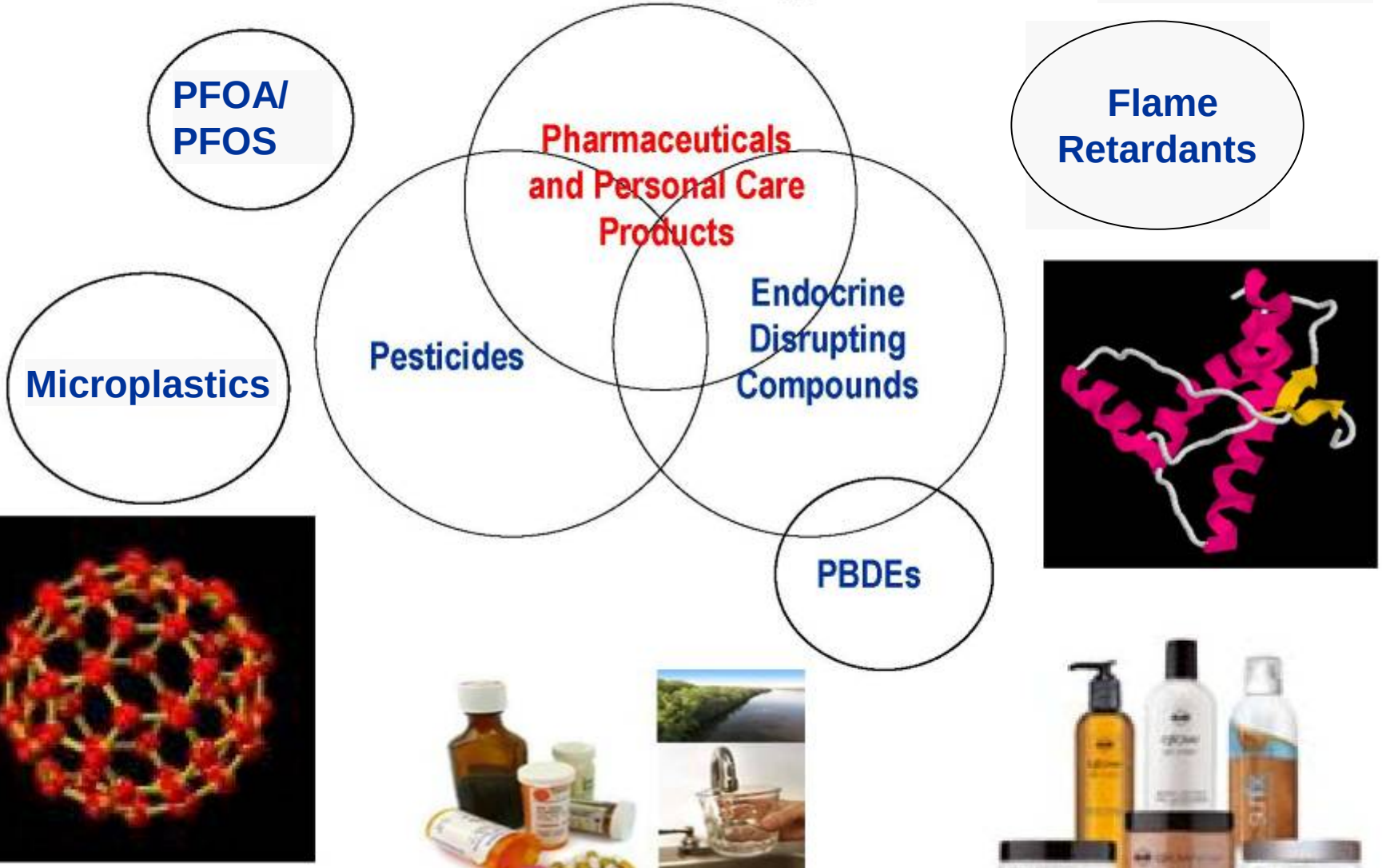
Mark Bartson, P.E., Chief,

Technical Operations Section

CECs and Drinking Water

- What are CECs?
- U.S. EPA Drinking Water Initiatives to Address CECs
- CECs in Recycled Water for Potable Reuse
- Suggested Approaches toward the CEC issue

Contaminants of Emerging Concern



CECs in Drinking Water

- CECs in Drinking Water - Issues
  - ✓What CECs are in the source water?
  - ✓*What CECs may be present in the treated water?*
  - ✓Disinfection By-Products
- CECs in Recycled Water for Potable Reuse
  - ✓Groundwater Recharge,
  - ✓Surface Water Augmentation
  - ✓Direct Potable Reuse (potentially)

CECs, Maximum Contaminant Levels (MCLs)

- To develop a Maximum Contaminant Level we need to have:
  - Occurrence data (results of monitoring)
  - Health impacts information (Public Health Goals)
- Many chemicals that were originally CECs now have Maximum Contaminant Levels (MCLs)
- Examples: MTBE, perchlorate, hexavalent chromium, 1,2,3-TCP (MCL now being proposed)

1996 Safe Drinking Water Act Initiative
(Unregulated Contaminant Monitoring Rule)

- Collect data for contaminants suspected to be present in drinking water, but that do not have health-based standards set under the Safe Drinking Water Act (SDWA).
- Provides national data on the occurrence of contaminants in drinking water, the population exposed, and levels of that exposure.
- This data can support future regulatory determinations and other actions to protect public health.

Unregulated Contaminant Monitoring Rule (UCMR)

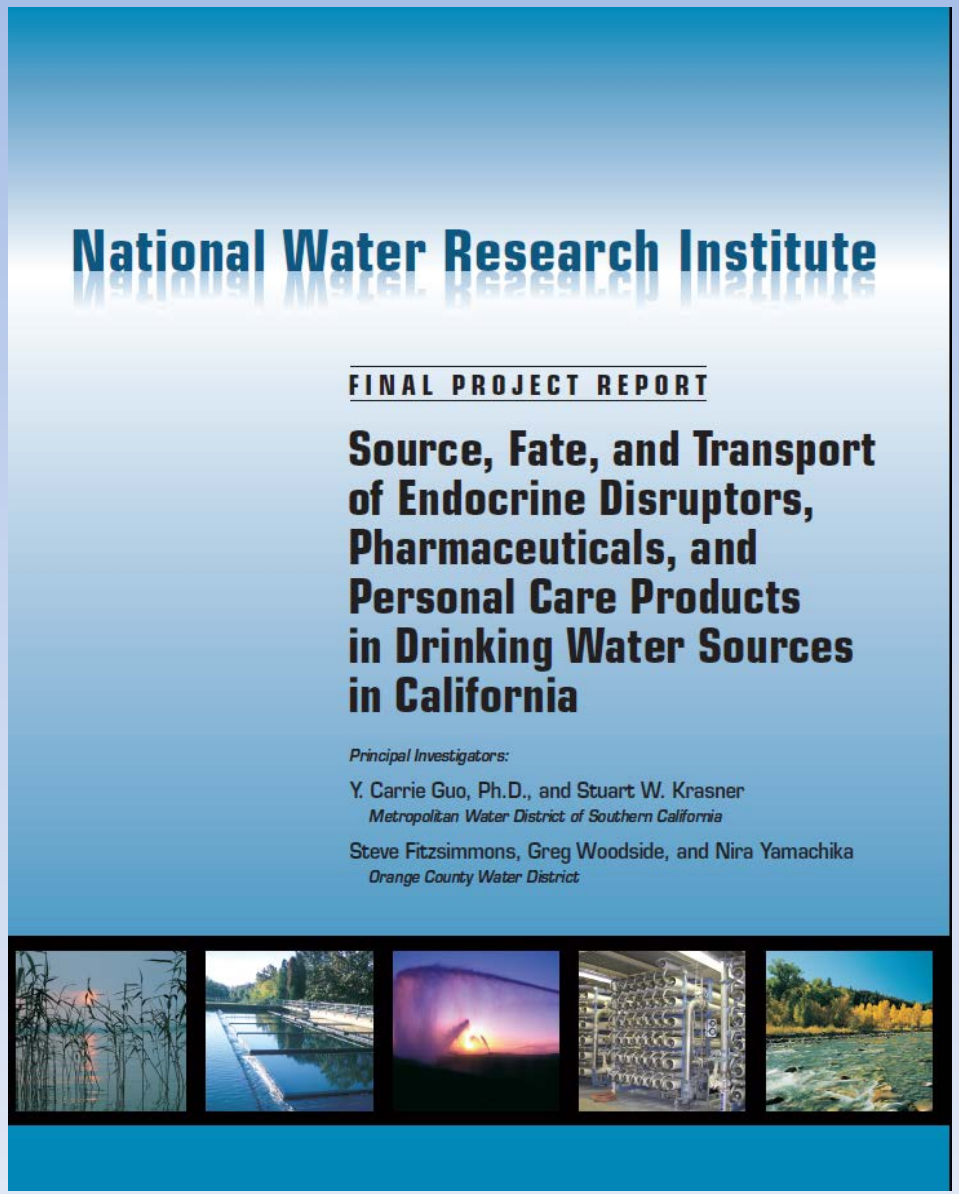
The UCMR was established by US EPA under the Safe Drinking Water Act of 1996 .

UCMR #	**Year**	**Number of Contaminants**
1	2001-2005	26 contaminants
2	2007-2011	25 contaminants
3	2012-2016	30 contaminants (and two viruses)
4	**2017-2021**	**30 contaminants**

2017 Federal UCMR Contaminant Groups

- Ten Cyanotoxin Chemical Contaminants
- Two Metals
- Eight Pesticides and One Pesticide Manufacturing Byproduct
- Three Brominated Haloacetic Acid (HAA) Groups
- Three Alcohols
- Three Other Semi-volatile Chemicals

Public Water Systems Research initiatives



2010 NWRI Study

Source, Fate, and Transport of Endocrine Disruptors, Pharmaceuticals, and Personal Care Products in Drinking Water Sources in California

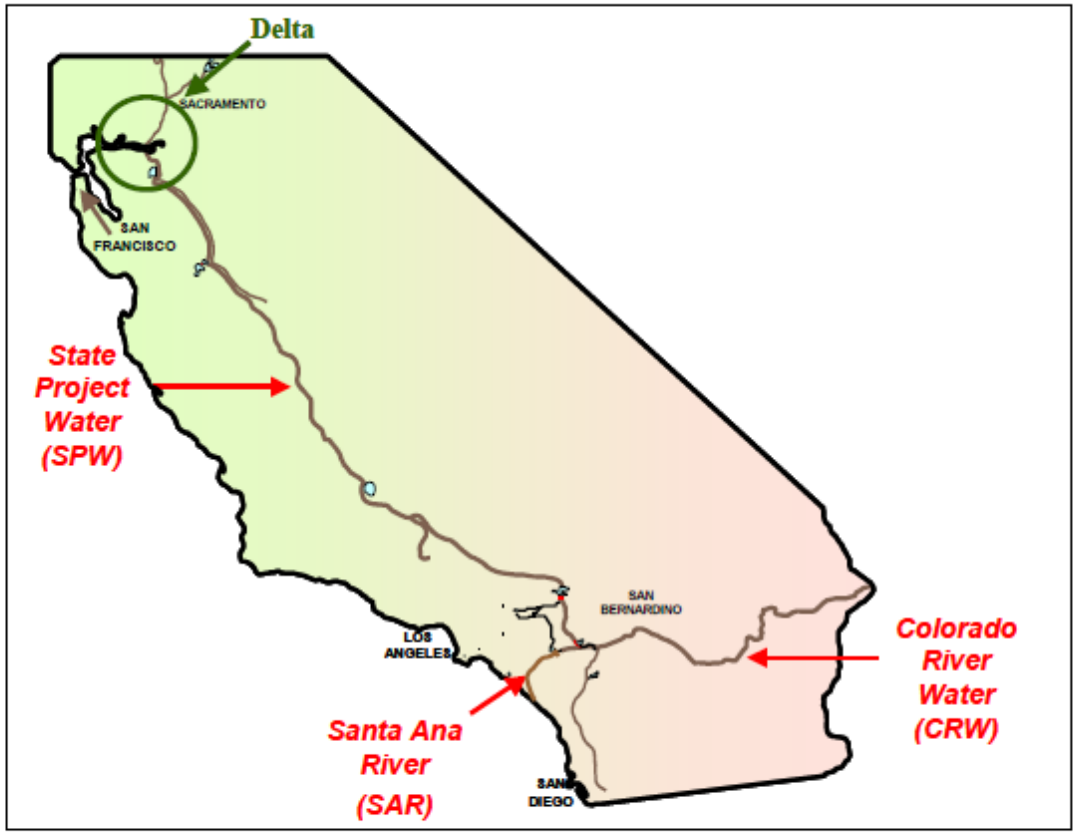


Figure ES-1. Map of central and southern California depicting the three watersheds studied for the project.

CECs & Potable Reuse of Recycled Water

1. Development of CEC indicators and surrogates

2. Recommendations on CECs from Direct Potable Reuse Expert Panel :

   - Advanced Source Control to address CECs
   - Research to Assess potential health risks from short-term exposures
   - Research to Identify options for final treatment processes that can reduce potential chemical peaks
   - Research to Develop and Use non-targeted analysis, especially for low molecular weight compounds

Suggested Approach to CECs

Key Points from Recycled Water Policy

1. The state of knowledge regarding CECs is incomplete.

2. There needs to be additional research and development of analytical methods and surrogates to determine potential environmental and public health impacts.

Approach to CECs – Key Points (continued)

3. **Agencies should minimize the likelihood of CECs impacting human health and the environment by means of source control and/or pollution prevention programs.**

4. Regulating most CECs will require significant work to develop test methods and more specific determinations as to how and at what level CECs impact public health or our environment.

Order of CEC Stories Today

Division of Drinking Water	CECs and Drinking Water
Division of Water Quality	CECs and Recycled Water
North Coast Region	CECs in the Russian River
San Francisco Bay Region	Ten Years of Monitoring and Intervening on CECs in the San Francisco Bay
Los Angeles Region	CECs in the Los Angeles Region
Santa Ana Region	CECs in the Santa Ana River and Orange County Coast
Office of Information Management and Analysis	Data Visualization of CECs

Division of Water Quality

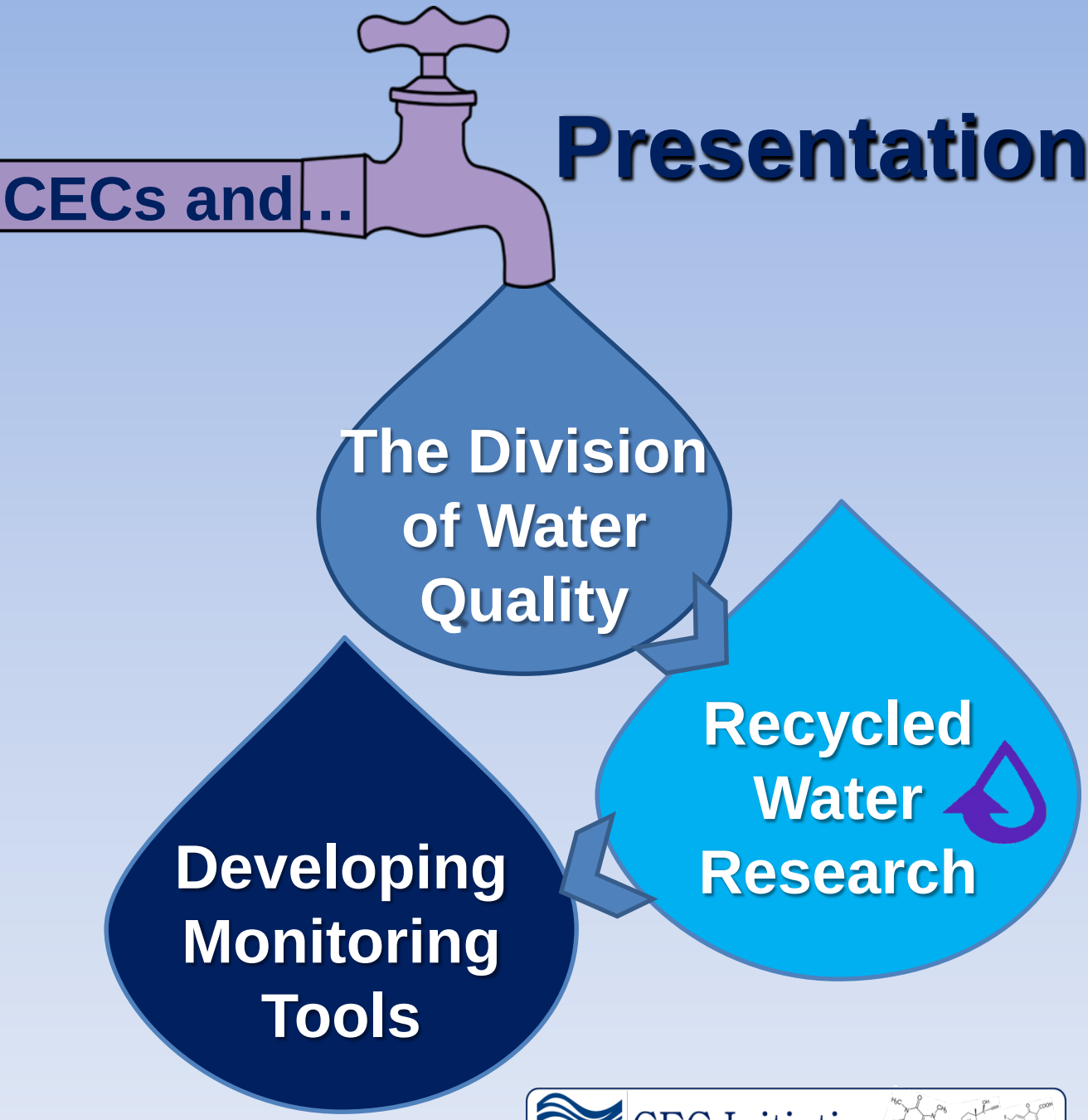
Update on Efforts Related to Constituents of Emerging Concern

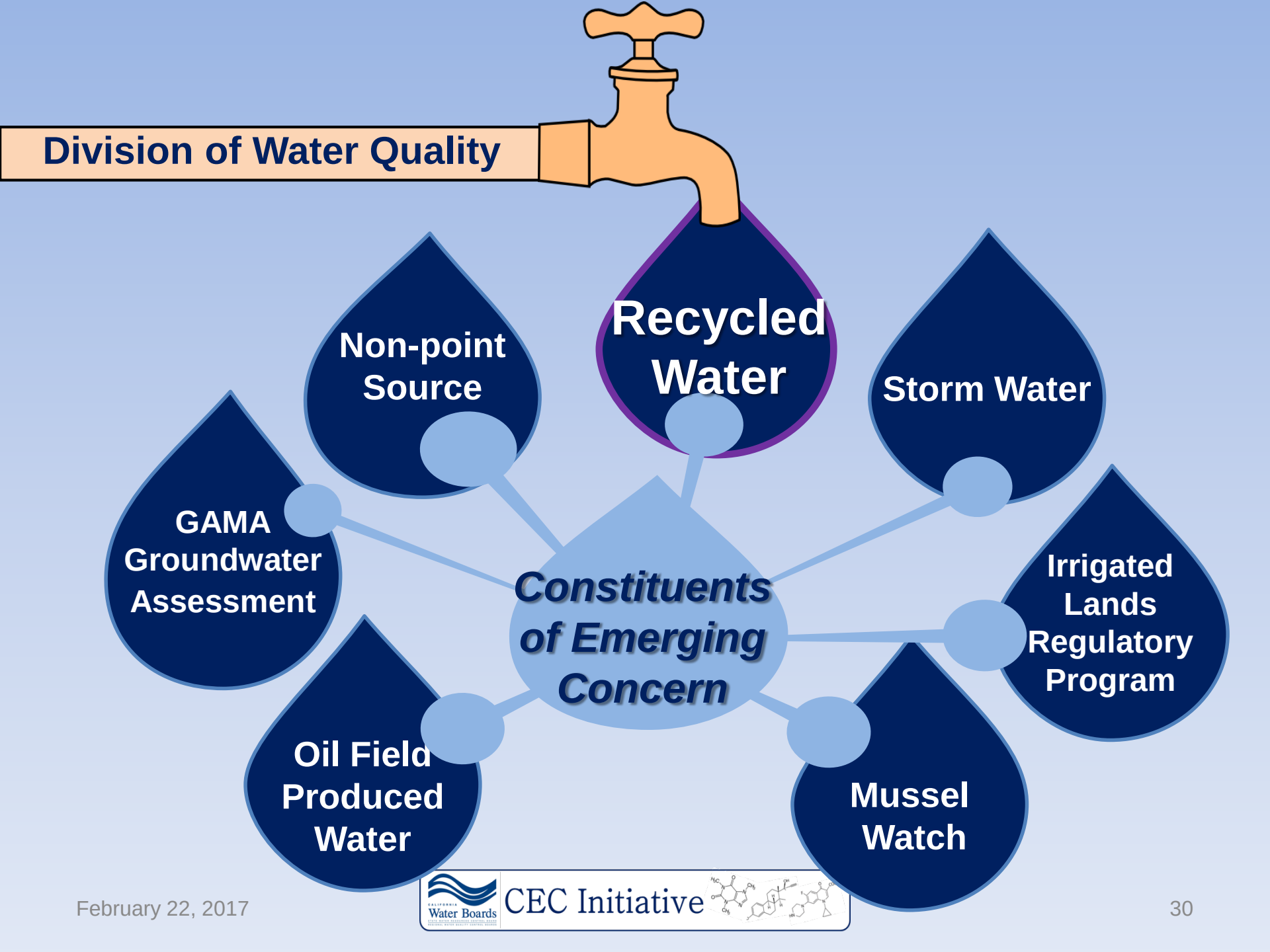
Claire Waggoner

Statewide Policies and Planning Unit

Groundwater Protection Section

Presentation Summary



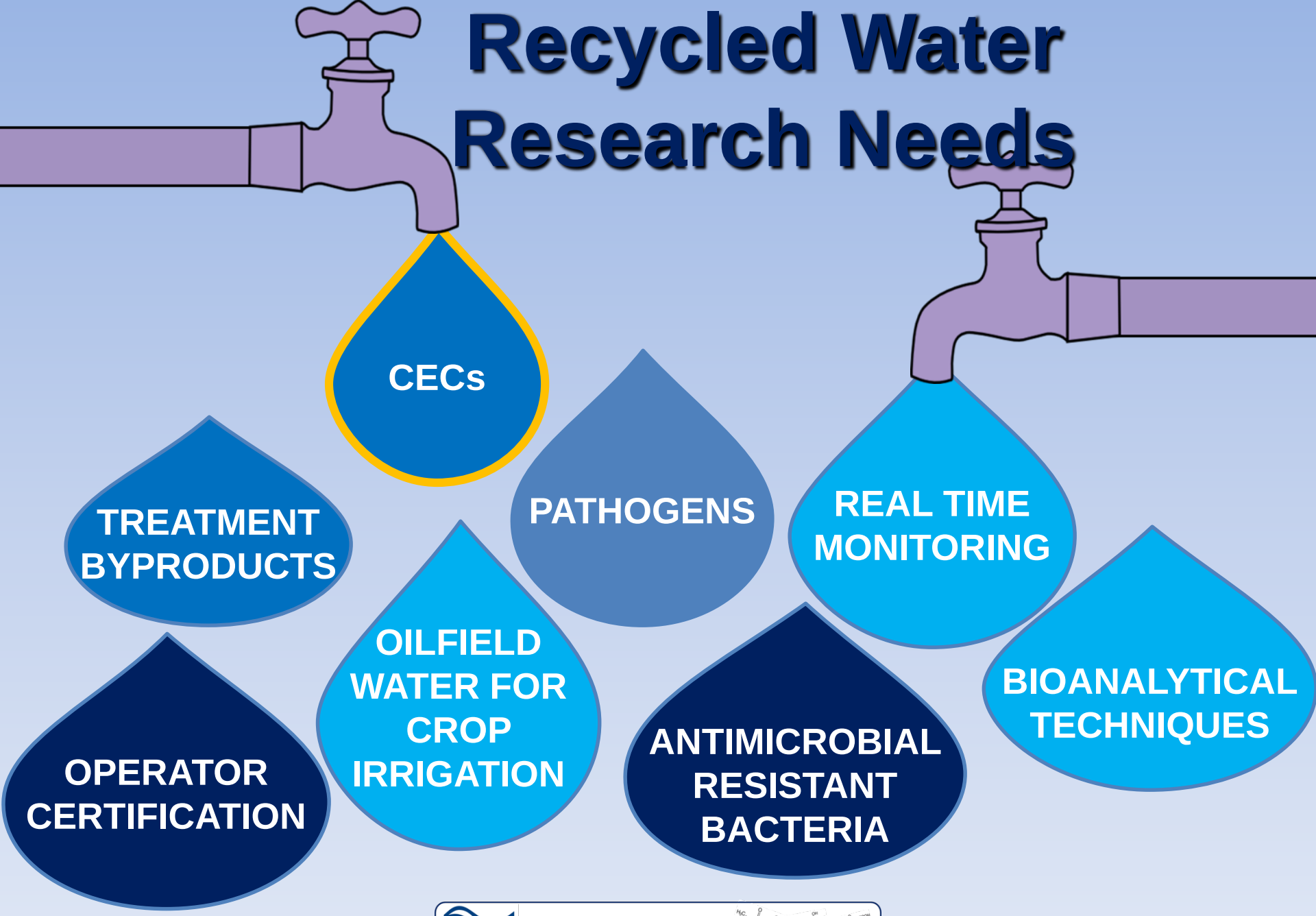

Division of Water Quality
Recycled Water
Non-point Source
Storm Water
GAMA Groundwater Assessment
Constituents of Emerging Concern
Irrigated Lands Regulatory Program
Oil Field Produced Water
Mussel Watch
CEC Initiative

Recycled Water

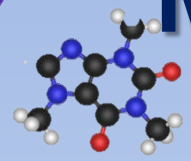
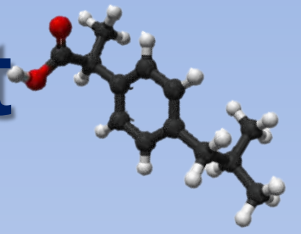
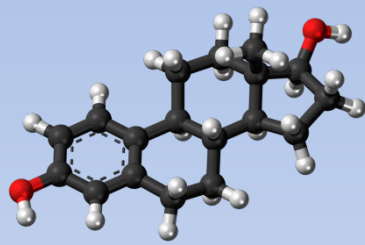
December 6, 2016 Resolution

- The State Water Board directed staff to:
  - Reconvene CEC Science Advisory Panel
  - Update the Recycled Water Policy
- Acknowledged the need to fund research projects to fill critical knowledge gaps

Recycled Water Research Needs



Recycled Water Research Needs: Monitoring and Treatment Performance for CECs

- October 2015 Workshop
- Research themes:
  - performance of treatment technologies
  - chemical testing, bioanalytical screening, and non-targeted analyses

CALIFORNIA Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

NWRI National Water Research Institute

SCCWRP Established 1969

WATEREUSE

WATER ENVIRONMENT & REUSE FOUNDATION WE&RF

CEC Initiative

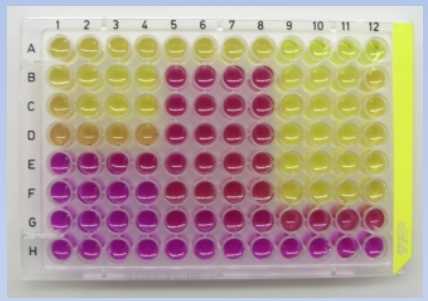
Detecting and Measuring CECs in Recycled Water and the Environment

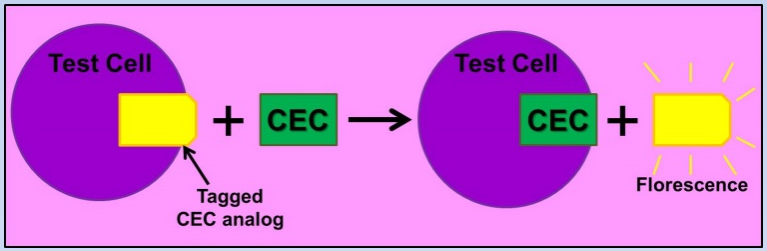
Tracey Saxby, Kate Moore, Jason C. Fisher, Jane Thomas, Jane Hawkey, Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/imagelibrary/).

Tools for CEC Monitoring

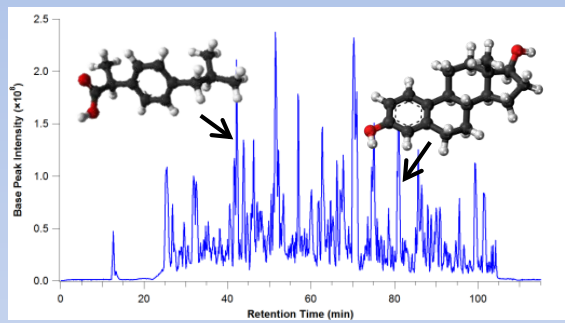
Targeted Chemistry

Bioanalytical





Non-targeted Analytical (NTA)



Known Knowns

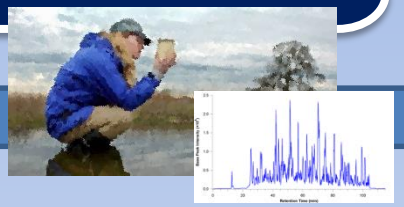
Known Unknowns

Unknown Unknowns

Tools for CEC Monitoring

Targeted Chemistry + **Bioanalytical** + **Non-targeted Analytical**

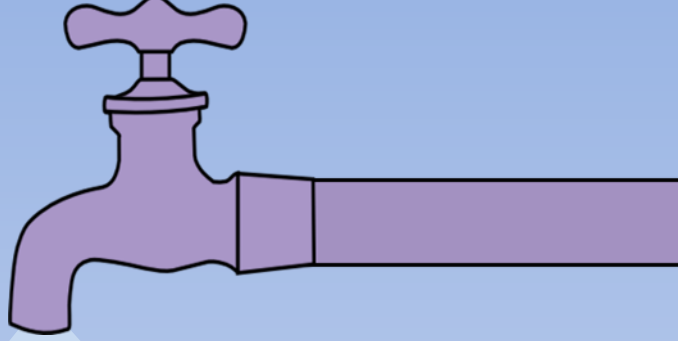




- Some analytical methods are well established
- Some methods need to be developed further (e.g., for “new” CECs)
- We plan on using a portion of research funds to further develop and optimize CEC monitoring tools

PROP 1
GOVERNOR EDMUND G. BROWN, JR.
WATER BOND 2014
RELIABILITY | RESTORATION | RESILIENCE

- Regional Water Boards are piloting these CEC monitoring techniques
- Pilot results will inform future CEC monitoring programs



- ***Let's continue to coordinate and collaborate***

Order of CEC Stories Today

Division of Drinking Water	CECs and Drinking Water
Division of Water Quality	CECs and Recycled Water
North Coast Region	CECs in the Russian River
San Francisco Bay Region	Ten Years of Monitoring and Intervening on CECs in the San Francisco Bay
Central Coast Region	CECs in the Central Coast
Los Angeles Region	CECs in the Los Angeles Region
Santa Ana Region	CECs in the Santa Ana River and Orange County Coast
Office of Information Management and Analysis	Data Visualization of CECs

Russian River CECs Monitoring

Shin-Roei Lee

North Coast Regional Water Board

INITIAL FINDINGS

- **Preliminary results for water and fish tissue suggest minimal concern for impact due to CECs**
  - Fish tissue concentrations well below available human consumption thresholds

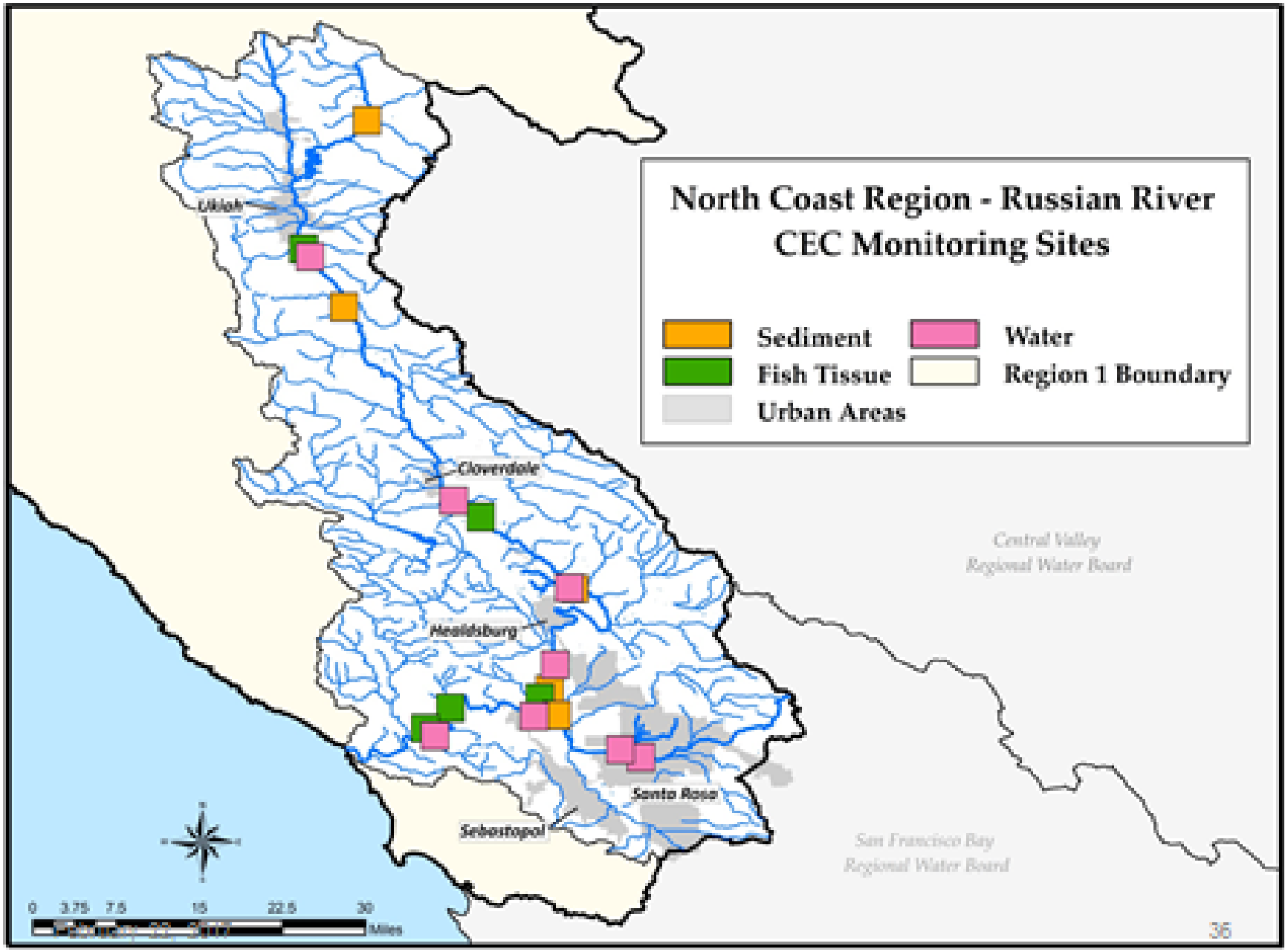
- **Bioscreening of endocrine disrupting CECs agrees with conventional monitoring results in effluent and river water samples**

RATIONALE & OBJECTIVES

- **OBJECTIVE**
  - *Are CECs impacting beneficial uses in the Russian River watershed?*

- **STUDY QUESTIONS**
  - *What is the occurrence of CECs in water, sediment and fish tissue?*
  - *Can bioanalytical tools effectively screen for CECs?*
  - *What pesticides deserve monitoring?*

- **TASKS**
  - *Measure CECs in water, sediment and fish tissue*
  - *Compare bioanalytical results to chemical results of targeted CECs*
  - *Prioritize pesticides monitoring based on usage, toxicity and persistence*


North Coast Region - Russian River
CEC Monitoring Sites
Sediment
Water
Fish Tissue
Region 1 Boundary
Urban Areas
Ukiah
Cloverdale
Healdsburg
Santa Rosa
Sebastopol
Central Valley
Regional Water Board
San Francisco Bay
Regional Water Board
0 3.75 7.5 15 22.5 30
Miles
36

TASK 1 – OCCURRENCE

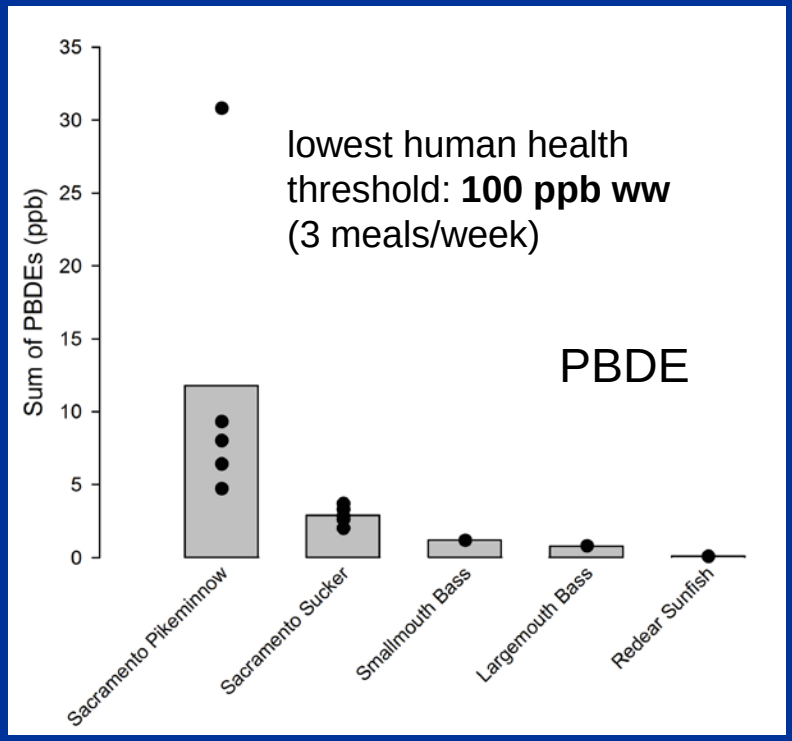
- **CECs in water**
  - Samples collected in March 2016
  - Most targeted CECs were detectable in effluent at ng/L concentrations
  - Fewer CECs detected in river water, levels 1-100X lower than effluent
  - *Preliminary comparison to monitoring trigger levels show minimal concern*

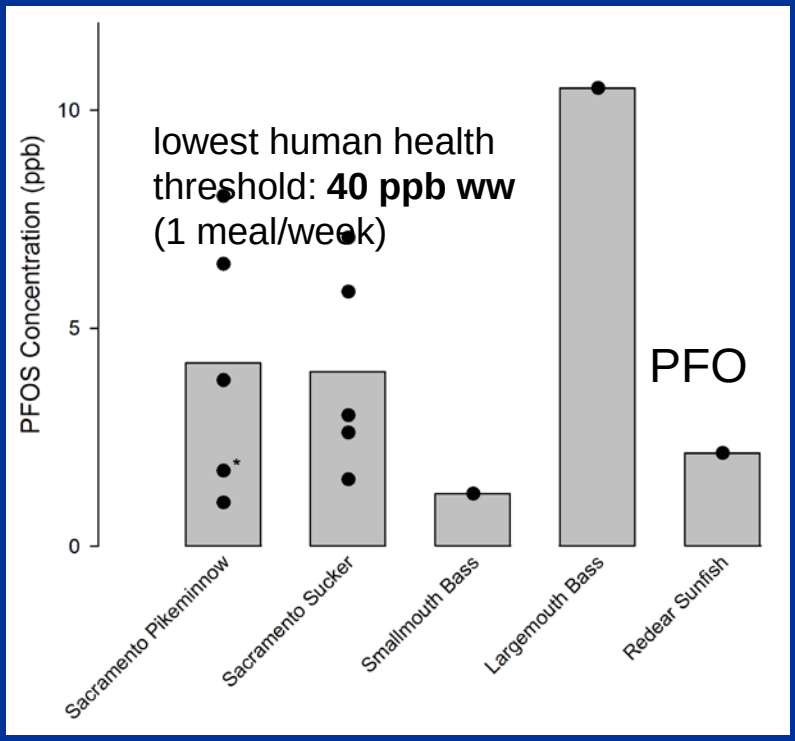
- **CECs in fish tissue**
  - Samples collected in Summer 2015
  - *Polybrominated diphenyl ether flame retardants (PBDEs) and perfluorochemicals (PFOs) were detected but at levels below available thresholds of concern for human consumption*

- **CECs in sediment**
  - Samples collected in Sept/October 2016
  - *Results should be available in April 2017*

TASK 1 – OCCURRENCE (supplemental)

- **CECs in fish tissue**
  - Fish collected in August 2015 in 5 sections of the River
  - Tissue composited by species and location analyzed for PBDEs, PFOs
  - PBDEs, PFOs levels were < available human health thresholds





TASK 2 – BIOANALYTICAL TOOLS

- **River water, WWTP effluent samples were screened for endocrine disrupting chemicals (EDCs):**
  - estrogens
  - glucocorticoid steroids (a.k.a. GCS, anti-inflammatory drugs)

- **EDCs were detected at low levels in one WWTP effluent and not detected in the other WWTP effluent and river water samples**

- **Bioanalytical results are in agreement with the targeted chemistry results**

- **Bioscreening results for sediment expected in April 2017**

TASK 3 – PESTICIDE USAGE & OCCURRENCE

- **Used DPR Tool to prioritize pesticides for monitoring**
  - Pesticides prioritized based on likelihood of impact (e.g., use volume, toxicity, use trend, application timing and method)
  - 153 pesticides analyzed based on method availability and prioritization results
  - Analysis by USGS Sacramento

- **River water and sediment collected**
  - September - October 2016
  - 5 sites along the Russian River and its tributaries draining lands with expected pesticide application
  - Results are expected in April 2017

Summary

- **Outstanding tasks scheduled for completion by April 2017**
  - bioscreening of sediment samples will target different CECs
- **All results and interpretations finalized by June 30, 2017**
  - which CECs, if any, should be monitored in the future
- **Reduced role for non-targeted analysis if samples continue to show little potential for impact**
  - dry weather levels of non-pesticide CECs are still a data gap

PILOT MONITORING OF CECS IN RUSSIAN RIVER WATERSHED

- **Project Lead: Keith Maruya, SCCWRP**

- **Project Team:**
  - Rich Fadness (North Coast Water Board)
  - Alvine Mehinto, Wayne Lao (SCCWRP)
  - Rebecca Sutton, Jennifer Sun, Thomas Jabusch (SFEI)

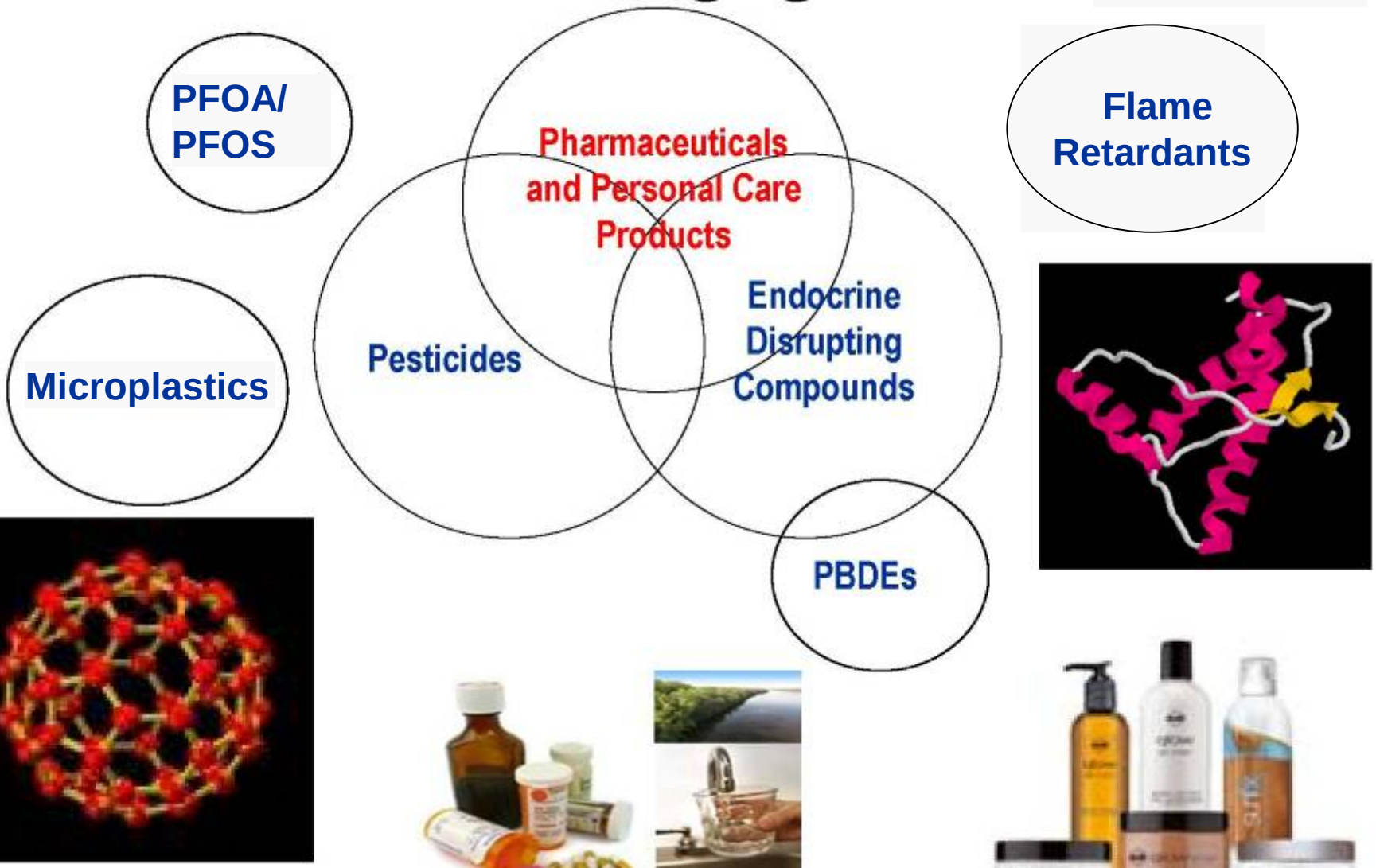
Order of CEC Stories Today

Division of Drinking Water	CECs and Drinking Water
Division of Water Quality	CECs and Recycled Water
North Coast Region	CECs in the Russian River
San Francisco Bay Region	Ten Years of Monitoring and Intervening on CECs in the San Francisco Bay
Los Angeles Region	CECs in the Los Angeles Region
Santa Ana Region	CECs in the Santa Ana River and Orange County Coast
Office of Information Management and Analysis	Data Visualization of CECs

San Francisco Bay CEC Program

Naomi Feger
Planning Division Chief
San Francisco Bay Regional Water Board

Contaminants of Emerging Concern



SF Bay Regional Monitoring Program
Emerging Contaminants

- Over 10 years of monitoring and studies
  - Primarily ambient water, sediment, and biota
  - Some wastewater and stormwater
- 2013 data synthesis and strategy document
  - Added non-targeted monitoring and development of bioanalytical tools
- 2017 update of synthesis and strategy

SF Bay Regional Monitoring Program
CECs Strategy

- Tiered risk and management action framework
- Recurring review scientific literature and other CECs monitoring programs
- Emerging Contaminants Workgroup
  - Stakeholders and scientific advisors

SF Bay Regional Monitoring Program
Science Advisors

Bill Arnold	**Univ. of Minnesota**
Lee Ferguson	**Duke University**
Phil Gschwend	**MIT**
Kelly Moran	**TDC Environmental**
Derek Muir	**Environment Canada**
Daniel Schlenk	**UC Riverside**
Heather Stapleton	**Duke University**

Risk Tiers

High probability of moderate or high level effect on Bay wildlife

High probability of low level effect on Bay wildlife

High probability of no effect on Bay wildlife

Uncertainty in Bay levels or toxic thresholds

Monitoring Strategy

Studies to support Total Maximum Daily Load (TMDL) or alternatives

---

Trends monitoring and/or fate, effects, and sources and loadings studies

---

Periodic ambient and/or source trend screening

Ambient and source screening

Management Strategy

303(d) list → TMDL or alternative(s)

Action plan or strategy

- Aggressive pollution prevention
- Seek product or chemical alternatives

Track product use and market trends

Easy, low-cost source identification and pollution prevention actions

---

Identify and prioritize potential CECs

Develop bio and chemistry methods

Chemicals

None currently in Bay

PFOS (stain repellant)

Fipronil (insecticide)

Nonylphenol (surfactant)

PBDEs (flame retardants)

HBCD (flame retardant)

Pyrethroids (insecticides)

Pharmaceuticals

Personal Care Product Ingredients

Polybrominated Dioxins and Furans

Alternative Flame Retardants

Perfluorinated Chemicals

Pesticides

Plastic Additives (Bisphenol A, Phthalates)

Many, many others

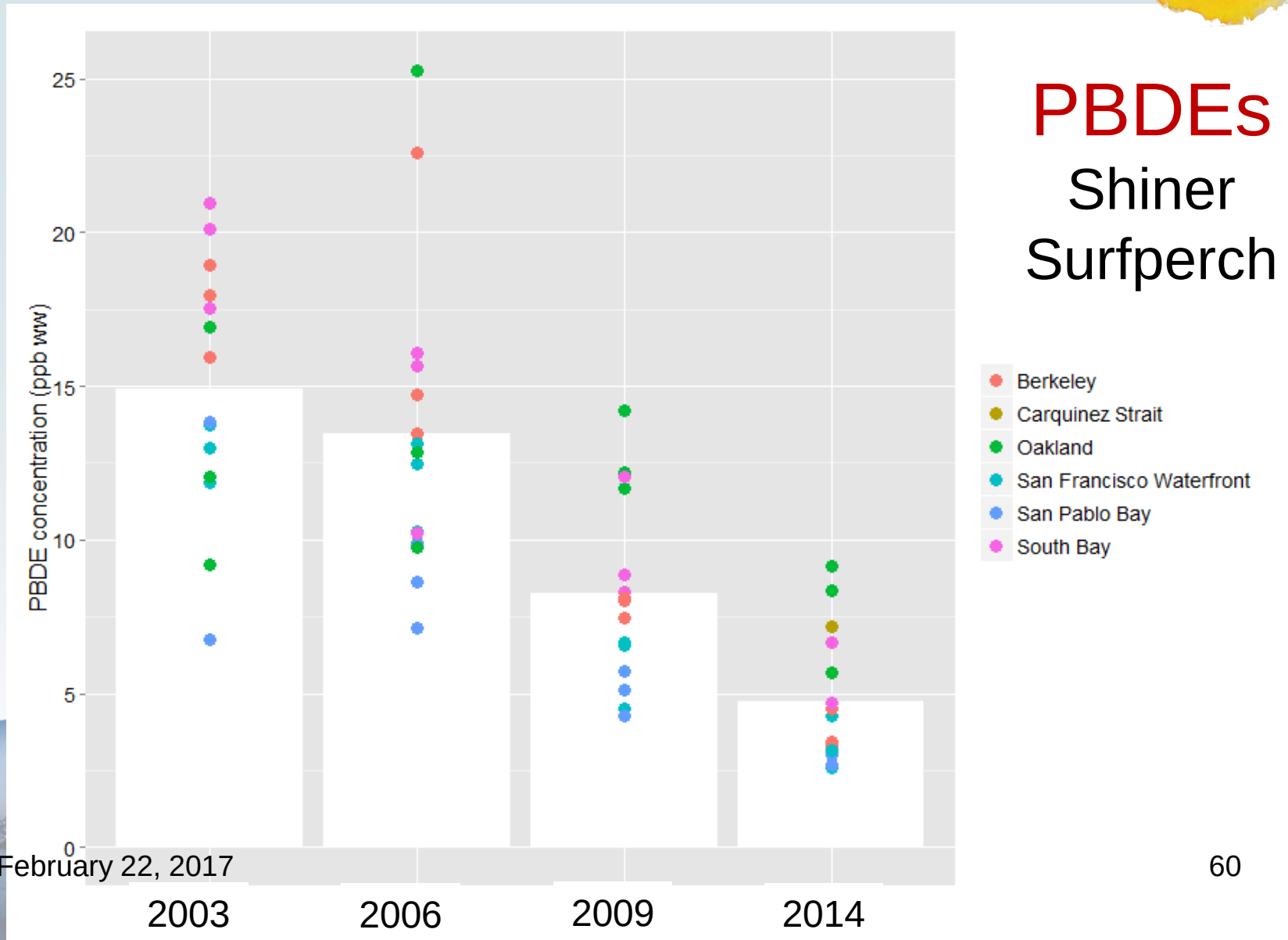
TIER 3
MODERATE CONCERN

Candidate Actions

- Source identification
- Source control identification and evaluation
- Referral to other regulatory authority(s)
- Track product use and market trends
- Communication and outreach
- Monitoring/study strategy

Flame Retardants

TIER 3
MODERATE CONCERN



PBDEs

Shiner Surfperch

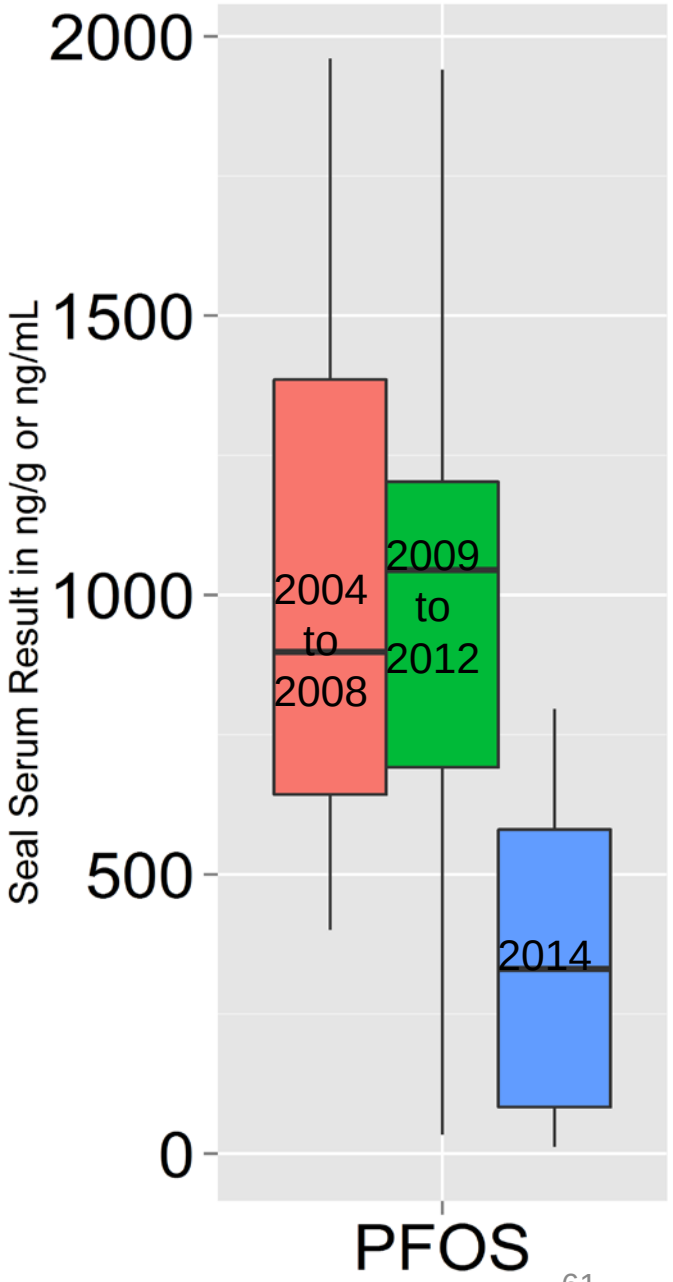
TIER 3
MODERATE CONCERN

PFOS in the Bay

South Bay

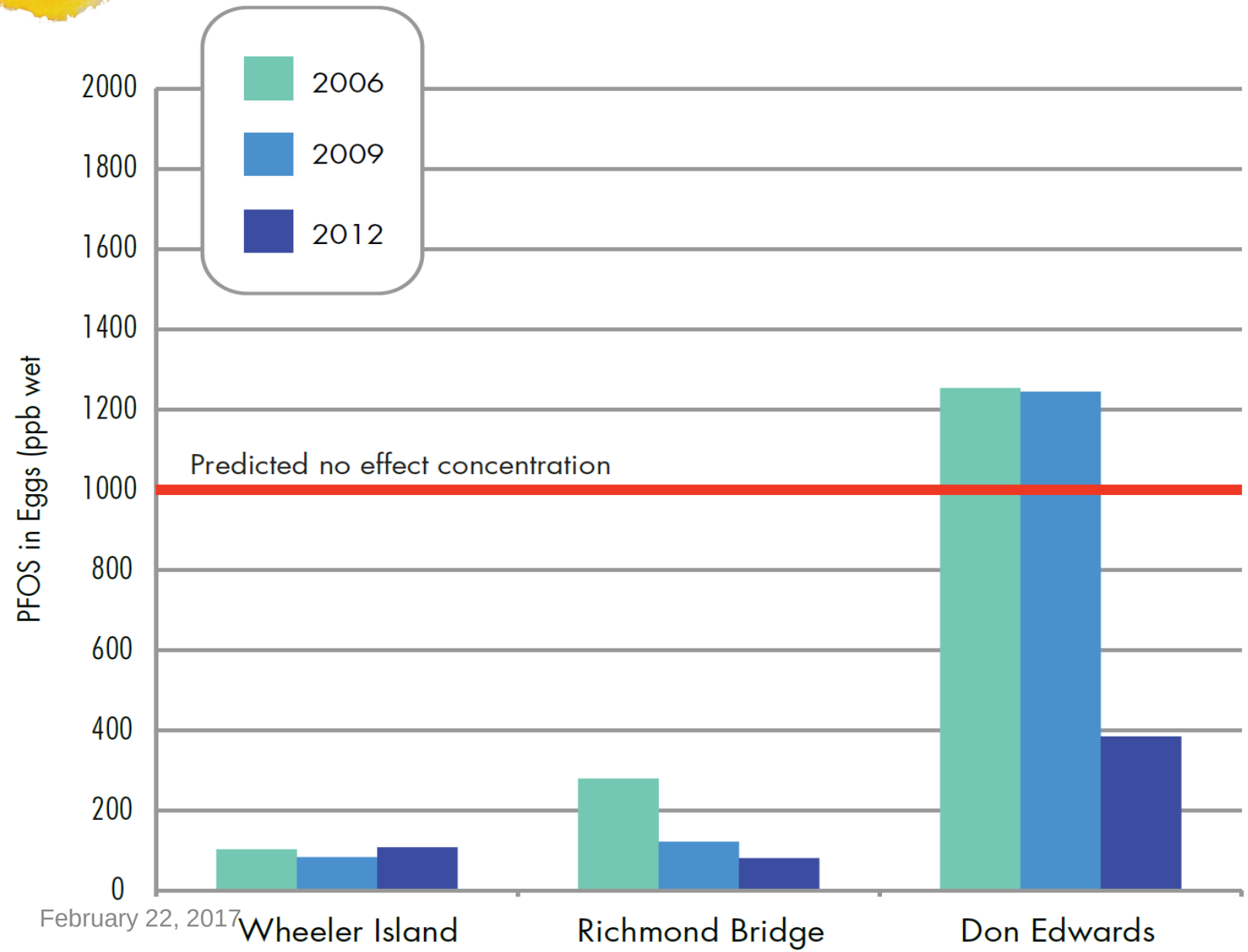
Harbor seals

PFOS in Serum



TIER 3
MODERATE CONCERN

PFOS in the Bay



TIER 3
MODERATE CONCERN

Fipronil

Concern

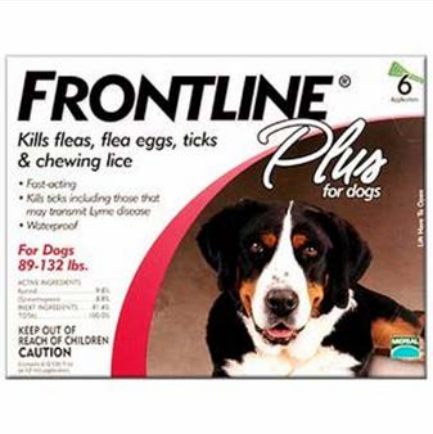
- Aquatic toxicity

Uses

- Flea, tick, lice control
- Structural pest control (ants,termites)
- No ag uses

Actions

- SF Bay Region Urban Creeks Pesticides Toxicity TMDL (2005)
- US EPA registration review (2011)
- Develop action plan with CA DPR (2014)
- Wastewater study (2015)



Next Steps: Additional Special Studies

- Microplastics in the Bay and sources
- PFOS/PFAS synthesis and strategy
- Additional monitoring
  - ✓ Bisphenols in Bay waters
  - ✓ Triclosan and methyl triclosan in small fish
  - ✓ Alt. flame retardants in Bay and sources
  - ✓ Imidacloprid, degradates, other neonicotinoids in Bay and sources
- Non-targeted analysis of water-soluble compounds
- Test developed bioanalytical tool and use of passive sampler(s)

Order of CEC Stories Today

Division of Drinking Water	CECs and Drinking Water
Division of Water Quality	CECs and Recycled Water
North Coast Region	CECs in the Russian River
San Francisco Bay Region	Ten Years of Monitoring and Intervening on CECs in the San Francisco Bay
Los Angeles Region	CECs in the Los Angeles Region
Santa Ana Region	CECs in the Santa Ana River and Orange County Coast
Office of Information Management and Analysis	Data Visualization of CECs

CEC Initiative
Los Angeles Region

Deb Smith
Chief Deputy Executive Officer
Los Angeles Regional Water Quality Control Board

Types of CEC Monitoring

1. Wastewater Effluents
2. Freshwater Streams and Estuaries
   - Water column
   - Sediment
   - Fish tissue
3. Bioanalytical Screening and Non-targeted Analyses
   - Water column
   - Sediment
4. Biological Responses

Wastewater Effluents

CEC Effluent Monitoring

Waterbody	POTWs
Ocean	Hyperion, JWPCP, Oxnard, Avalon, San Clemente
Los Angeles Harbor	Terminal Island
Santa Clara River Estuary	Ventura
Santa Clara River	Saugus, Valencia, Camarillo, Camrosa, Simi Valley, Thousand Oaks
San Gabriel River	San Jose Creek, Long Beach, Pomona, Los Coyotes, Whittier Narrows
Los Angeles River	Tillman, LA-Glendale, Burbank
Ventura River	Ojai
Malibu Creek	Tapia

Assessment Thresholds

State Board's CEC Expert Panel

- "Monitoring Trigger Levels" (MTLs) for some CECs
  - Effluent dominated freshwater systems – 11 MTLs for water, 1 MTL for sediment, 3 MTLs for fish tissue
  - Coastal embayments – 8 MTLs for water, 5 MTLs for sediment, 3 MTLs for fish tissue
  - Ocean waters – 5 MTLs for sediment, 3 MTLs for fish tissue

Exceedances of MTLs

Compound	MTL (ng/L)	# POTWs exceeding MTL	Concentration range (ng/L)
Galaxolide (fragrance)	700 (Freshwater) 70 (Embayments)	14/15 (93 %)	<20 – 10,000
Fipronil (pesticide)	42 (Freshwater) 5 (Embayments)	9/15 (60 %)	<2 – 190
Diclofenac (anti-inflammatory)	100 (Freshwater)	5/15 (33%)	<5-331
Estrone (hormone)	6 (Freshwater) 0.6 (Embayments)	3/14 (21 %)	<0.2 – 8.3
Chlorpyrifos (pesticide)	5 (Freshwater) 1 (Embayment)	2/14 (14 %)	<1 – 10
Bisphenol A (plasticizer)	60 (Freshwater) 6 (Embayments)	2/16 (12.5 %)	<10 – 87
17-Beta Estradiol (hormone)	2 (Freshwater) 0.2 (Embayments)	1/16 (6 %)	<0.31 – 1.2

No Exceedances of MTLs

Compound	MTL (ng/L)	# POTWs exceeding MTL	Concentration range (ng/L)
Ibuprofen (anti-inflammatory)	100 (Freshwater)	0/14 (0%)	<10 – 56.5
Triclosan (anti-bacterial)	250 (Freshwater)	0/14 (0%)	<10 - 64

Uncertainty About Exceedances of MTLs

Compound	MTL (ng/L)	# POTWs exceeding MTL	Concentration range (ng/L)
Bifenthrin (pesticide)	0.4 (Freshwater) 0.04 (Embayments)	2/2 (100 %)	<2 – 5.2
Permethrin (pesticide)	1 (Freshwater)	1/2 (50%)	<5 – 16

Note: Detection Limits > MTLs for Most Facilities
(Unable to Determine # Exceedances)

Freshwater Streams & Estuaries

Los Angeles/San Gabriel River CEC Study

2011 LA Regional Board Study

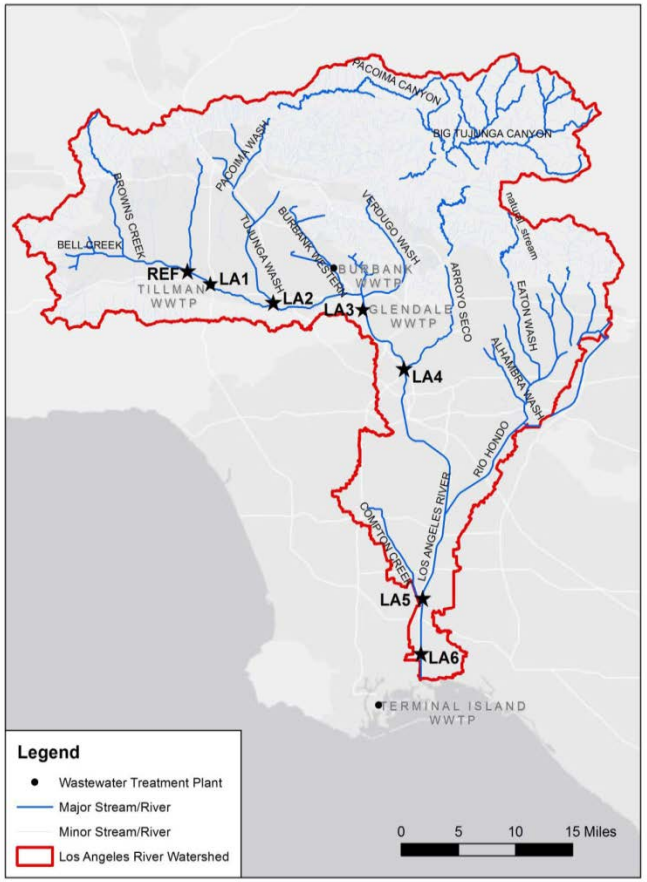
- Quantify occurrence of CECs above and below POTW discharges
- Characterize in-stream fate and transport
- Water samples at 7-9 stations

(upper watershed to mouth of river)

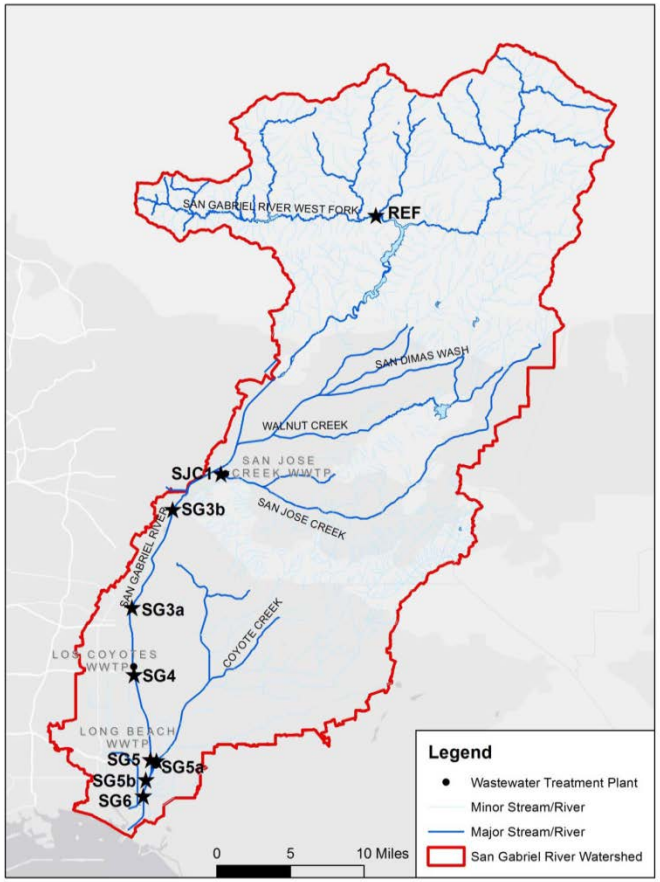
- @ 60-70 CECs analyzed

Los Angeles/San Gabriel River CEC Study

Los Angeles River Watershed



San Gabriel River Watershed



Los Angeles/San Gabriel River CEC Study

CECs in waters of LA and San Gabriel Rivers

- 52% of targeted CECs were detectable at stations downstream of wastewater discharges
- Natural and synthetic hormones not detectable
- Chlorinated flame retardants averaged 2.4 – 3.4 µg/L (no MTL available)
- Galaxolide & bisphenol A averaged 2.4 and 0.28 µg/L (exceeds MTLs)
- Fipronil and degradates up to 29 ng/L

  (less than MTL of 42, but literature suggests possible toxicity to estuarine invertebrates)

Los Angeles/San Gabriel River CEC Study

- Fate and Transport in Los Angeles River
  - Primary input of targeted CECs occurred between Tillman and LA-Glendale wastewater discharges (river mile 45 to 31)
- Attenuation of target CECs not observed downstream of POTW discharges
  - Short residence time in river (1-2 days) compared to time required for many CECs to degrade in sunlit waters (weeks to months)

Los Angeles/San Gabriel River CEC Study

- Fate and Transport in San Gabriel River
  - Primary loading of CECs originated from Los Coyotes and Long Beach wastewater discharges in lower river (river mile 10 to 5)
  - Comparatively short window of time (@ 1 day or less) for in-stream attenuation of CECs
  - Mass loading estimates to estuary for highest occurring CECs are @ 100 kilograms per year

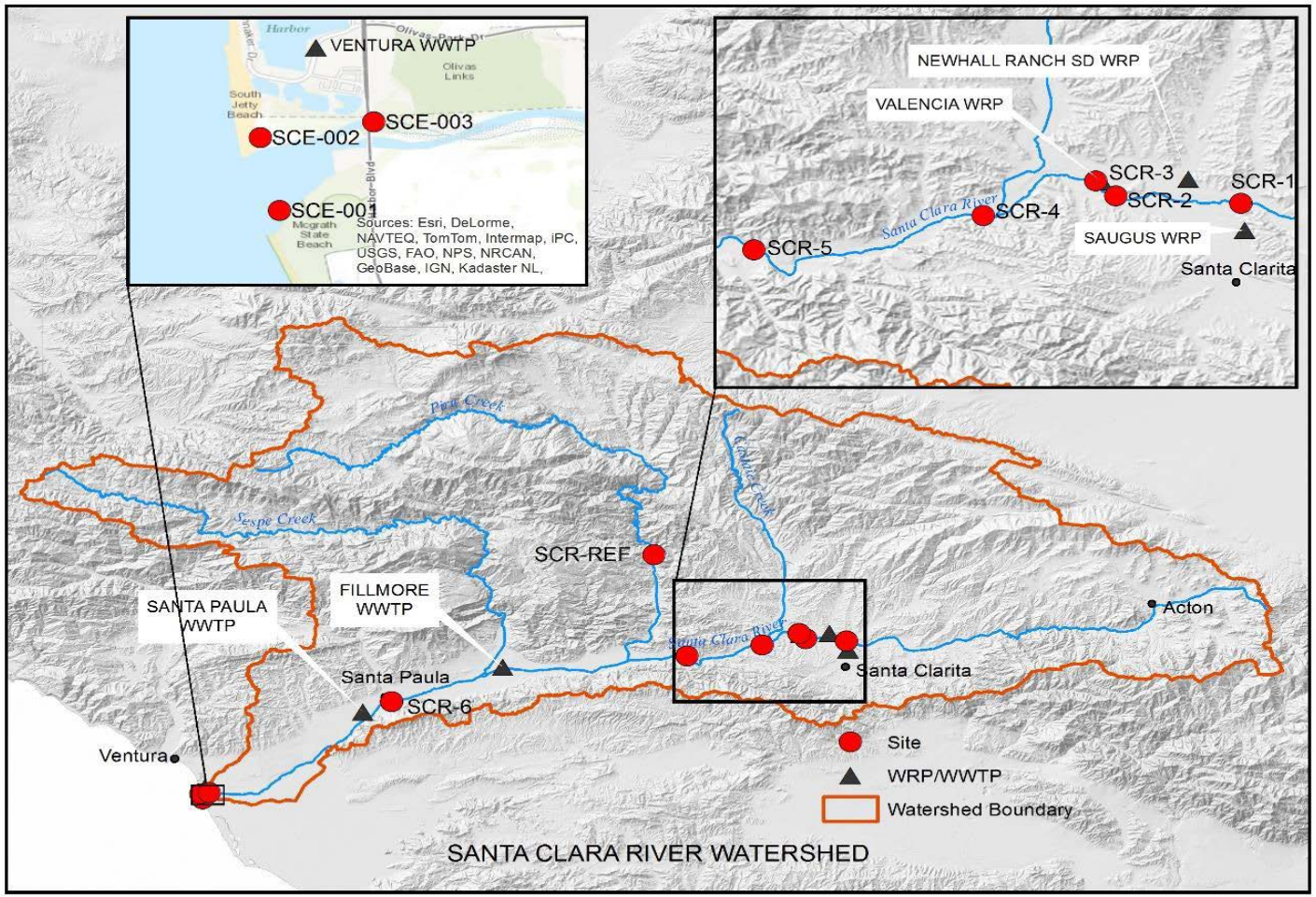
Santa Clara River CEC Study

- 2013 LA Regional Board Study
  - Quantify occurrence of CECs above and below POTW discharges
  - Characterize in-stream fate and transport
  - Water samples at 10 stations

  (upper watershed to mouth of river)
  - @ 60 CECs analyzed

Santa Clara River CEC Study

Santa Clara River Watershed



Santa Clara River CEC Study

- CECs in waters of Santa Clara River
  - Several targeted CECs were detectable at stations downstream of wastewater discharges
  - Natural and synthetic hormones not detectable
  - Chlorinated flame retardants found in low parts per billion range
  - Pharmaceuticals (eg. Meprobamate) found in high parts per trillion range

Santa Clara River CEC Study

- Fate and transport in Santa Clara River
  - Highest concentrations measured in proximity of wastewater discharges in upper watershed and in the estuary
  - Concentrations in upper watershed were rapidly diluted (probably due to rising groundwater, sorption to natural sediments/riparian vegetation and degradation)

Sediment Studies

- Sediment collected from Santa Clara River and Estuary (LA Regional Board study)
- Sediment collected from 21 coastal embayments and marinas in Southern California (Bight'13 Study)

Sediment Studies

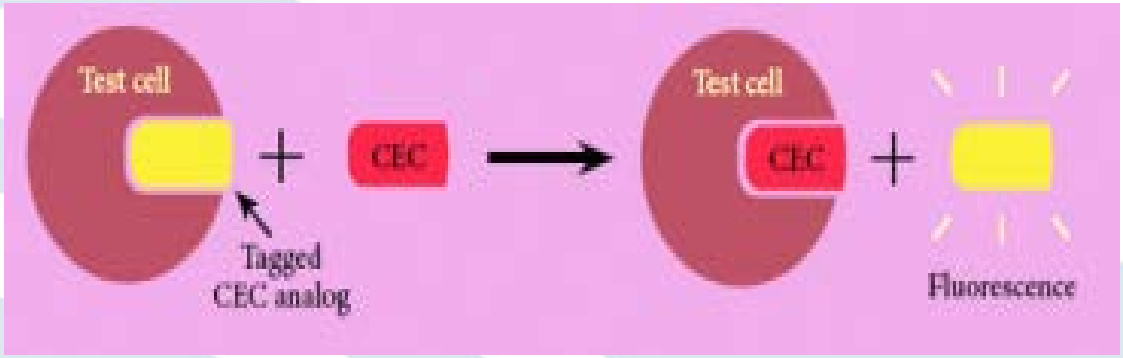
Coastal embayments/marinas in SoCal

- high parts per billion concentrations of nonylphenol, bisphenol A, pyrethroid pesticides, chlorinated flame retardants and triclocarban
- highest in more highly urbanized coastal systems (eg., LA River estuary, Ballona Creek estuary, Marina del Rey)
- lower in Santa Clara River estuary
  - Sediment exceeded MTLs for bifenthrin, permethrin, PBDE-47, PBDE-99, and fipronil
  - Chlorinated flame retardants and perfluorinated compounds seemed low (no MTLs available)

Fish Tissue Studies

- Fish collected in Santa Clara River and Estuary (LA Regional Board study)
- Fish collected in southern California embayments (Bight'13)
- Fish tissue concentrations in both studies:
  - Exceeded MTLs for PBDE-47 and PBDE-99
  - Pyrethroid pesticides and fipronil seemed high (no MTLs available)
  - Chlorinated flame retardants and perfluorinated compounds seemed low (no MTLs available)

Bioanalytical Screening and Non-Targeted Analyses for CECs



Bioanalytical Screening and Non-Targeted Analyses for CECs

- Ongoing study in Los Angeles and San Gabriel Rivers
  - Screening tool for biological impacts of CECs
  - Water and sediment samples
  - 3 sites per river x 2 sampling events

    (all samples were collected in August and October 2016)
  - 4 or 5 in-vitro bioassays per sample (water and sediment assay results should be available by mid-2017)

Biological Responses to CECs

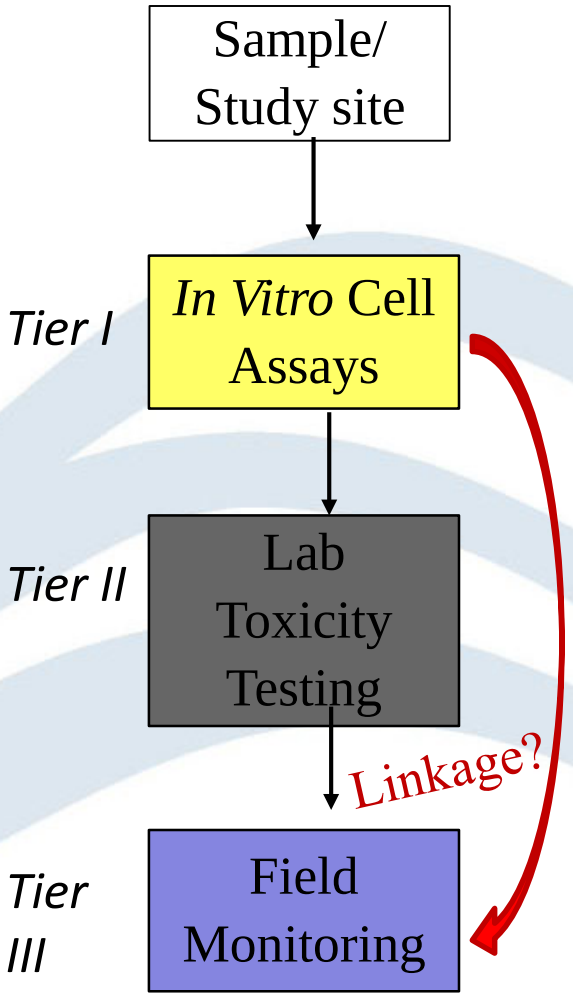
Field Fish Toxicity Study in Los Angeles River

Overall goal: Conduct field-based fathead minnow exposures to assess the water quality of urban-impacted waters

- Two sites with different sources of contamination
  - Urban runoff (Sepulveda Basin above Tillman WRP)
  - Treated wastewater effluent discharges (below LA-Glendale WRP)
- Fathead minnows will be held in mobile exposure units under real-time flow-through conditions while maintaining other parameters under control (e.g. flow rate, oxygen…)
- Linkage between chemical occurrence (targeted chemicals), bioanalytical tests, and fish biological changes will be investigated

Self-contained battery-operated exposure unit placed on the bank of the river for field exposure of adult fathead minnows.

Linkage Between Laboratory Studies and Field Testing



Objective is to improve our ability to interpret bioanalytical screening results and develop response thresholds of concern

Approach:

- Bioscreening of water samples from study sites using endocrine related endpoints
- Analysis of endocrine related changes in fish (incl. plasma hormone levels, male sex characteristics)
- Comparisons between bioactivity measured in water samples and the number/severity of biological changes observed in fish

For more information: Dr. Alvina Mehinto and Steve Bay @ SCCWRP

Research to Date

- Occurrence of CECs in wastewater effluents
- Degree of attenuation
- Accumulation in coastal sediments
- Accumulation in fish tissue

Ongoing Studies/Next Steps

- Complete study for bioanalytical screening and non-targeted analysis of CECs
- Complete study on biological response to CECs
- Integrate results and determine objectives for future studies

Order of CEC Stories Today

Division of Drinking Water	CECs and Drinking Water
Division of Water Quality	CECs and Recycled Water
North Coast Region	CECs in the Russian River
San Francisco Bay Region	Ten Years of Monitoring and Intervening on CECs in the San Francisco Bay
Los Angeles Region	CECs in the Los Angeles Region
Santa Ana Region	CECs in the Santa Ana River and Orange County Coast
Office of Information Management and Analysis	Data Visualization of CECs

Overview of Santa Ana Watershed Project Authority (SAWPA)

Emerging Constituents Program Task Force

Hope Smythe
Assistant Executive Officer
February 22, 2017

Emerging Constituents Task Force

- **Convened by Santa Ana Watershed Project Authority (SAWPA) in 2008; participation voluntary**
- **Task Force deliberate identification of "Emerging Constituents" (ECs) and not "Constituents of Emerging Concern" (CEC)**
- **Task Force Goals:**
  - To undertake a proactive approach to investigating "emerging constituents"
  - Evaluate potential human health EC effects from **all water sources** in the watershed
  - To determine which emerging constituents may be important in the Santa Ana River Watershed
  - To inform SWRCB's Recycled Water Policy development/Science Advisory Panel Efforts

Emerging Constituents Task Force (cont.)

Task Force Administrator: Mark Norton, SAWPA

Task Force Consultant: Tim Moore, Risk Sciences

Water Supply Agencies	Water Supply AND Wastewater Agencies	Wastewater Agencies	Advisory Agencies/ Organizations
Orange County Water District	Eastern MWD	City of Beaumont	Regional Board
San Bernardino Valley MWD	Inland Empire Utilities Agency	City of Redlands	CA Dept. of Health
Chino Basin Watermaster	Irvine Ranch Water District	City of Corona	US Geological Survey
Western MWD	Elsinore Valley MWD	City of Rialto	Analytical Labs
Metropolitan Water District of So. Calif.	Yucaipa Valley Water District	City of Riverside	National Water Resource Institute
San Gorgonio Pass Water Agency		Lee Lake Water District	Environmental NGOs
		Jurupa CSD	Jörg Drewes (Co. School of Mines)
		Colton/San Bernardino RIX	David Sedlack (UC Berkeley)
		Western Riverside County Regional Wastewater Authority	Shane Snyder (So. NV Water Authority)

Emerging Constituents Task Force (cont.)

Task Force Sub-committees

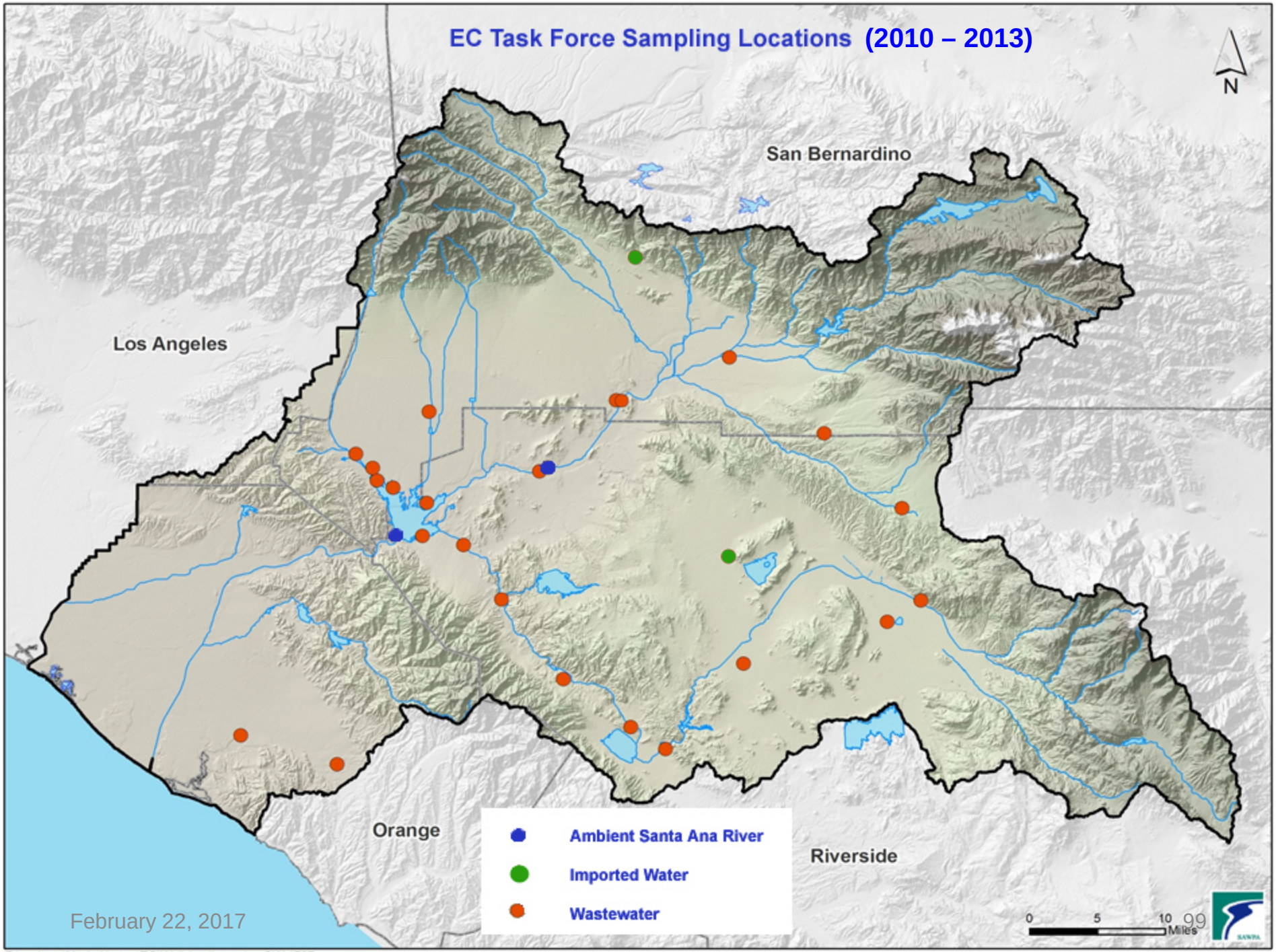
1. Public Relations Sub-committee

- Developed Communication Plan
- Created to focus on unified messaging to the public to address water quality concerns
- Coordinates with media outlets
- Maintains water blog, Facebook, Twitter accounts

  https://yoursocaltapwater.org/

2. Laboratory Sub-committee

- Provided QA/QC protocols and analytical methods standardization expertise


EC Task Force Sampling Locations (2010 – 2013)
N
San Bernardino
Los Angeles
Orange
Riverside
Ambient Santa Ana River
Imported Water
Wastewater
0
5
10
Miles
February 22, 2017
99
P:\projects\Mark_Norton\EC\Wells\wells.mxd SW-1797

EC Task Force Sampling Program (cont.)

- **Analytes (from among the following list)**

Caffeine	Ibuprofen
DEET	Carbamazepine
Gemfibrozil	Acetaminophen
Iopromide	Bisphenol A (BPA)
Triclosan	Naproxen
NDMA	Sulfamethoxazole
Sucralose	TCEP
17β Estradiol	Diuron
17α Ethinyl Estradiol	

Summary of Results

- QA/QC results: variability b/t labs
- ECs detected at many sites → low concentrations
- EC concentrations below Blue Ribbon Panel identified thresholds
- 100+ samples → no hormones detected
- Over 4 year sampling period – no increasing or decreasing EC trends
- Subsurface recharge effective in transforming EC concentrations
- Wastewater treatment process affected EC concentrations

2012 Summary of Results (all sites)

Compound	Primary Use	Frequency of Detection	Reported Range	Common Dose
Acetaminophen (Tylenol)	Analgesic	12% (3 of 26)	ND – 0.000030 mg/L	500 mg
Bisphenol A (BPA)	Plastic Coating	12% (3 of 26)	ND – 0.000045 mg/L	n/a
Caffeine	Food Additive	73% (19 of 26)	ND – 0.000210 mg/L	100 mg
Carbamazepine	Anti-Convulsant	88% (23 of 26)	ND – 0.000390 mg/L	200 mg
DEET	Insecticide	92% (24 of 26)	ND – 0.001300 mg/L	270 mg
Diuron	Herbicide	81% (21 of 26)	ND – 0.000220 mg/L	n/a
17α Ethinyl Estradiol	Synthetic Hormone	0% (0 of 26)	Never Detected	1 mg
17β Estradiol	Natural Hormone	0% (0 of 26)	Never Detected	1 mg
Gemfibrozil	Anti-cholesterol	77% (20 of 26)	ND – 0.000970 mg/L	600 mg
Ibuprofen (Advil)	Analgesic	46% (12 of 26)	ND – 0.000110 mg/L	300 mg
Iopromide	X-ray Contrast Agent	65% (17 of 26)	ND – 0.000860 mg/L	500 mg
Naproxen (Aleve)	Analgesic	23% (6 of 26)	ND – 0.000140 mg/L	200 mg
Sulfamethoxazole	Antibiotic	69% (18 of 26)	ND – 0.002900 mg/L	800 mg
TCEP	Flame Retardant	92% (24 of 26)	ND – 0.000930 mg/L	n/a
Triclosan	Antiseptic	58% (15 of 26)	ND – 0.001000 mg/L	1 mg

Source: SAWPA, 2013

Ongoing Stakeholder/Regional Board Activities and Next Steps

- EC sampling incorporated into recycled water recharge projects - waste discharge requirements
  - Surface spreading and injection projects (*e.g.*, seawater intrusion)
- EC sampling not (yet) required for
  - Incidental recharge discharges
  - Stormwater discharges
  - Aquatic life protection ECs (note: EC TF sampling included analytes relevant to aquatic life)
- EC Task Force status
  - Continue to meet annually (or as needed)
  - Track SWRCB recycled water policy updates
  - Individual TF agencies continue EC sampling

Order of CEC Stories Today

Division of Drinking Water	CECs and Drinking Water
Division of Water Quality	CECs and Recycled Water
North Coast Region	CECs in the Russian River
San Francisco Bay Region	Ten Years of Monitoring and Intervening on CECs in the San Francisco Bay
Los Angeles Region	CECs in the Los Angeles Region
Santa Ana Region	CECs in the Santa Ana River and Orange County Coast
Office of Information Management and Analysis	Data Visualization of CECs

Additional CEC Stories

- Other Regional Boards (Central Coast, Central Valley, and San Diego)
- Statewide datasets / stories
  - CECs being monitored, driven by permits
    - https://rpubs.com/daltare/cec_npdes
  - CECs being monitored and reported in ambient datasets (SWAMP / CEDEN and GAMA / GeoTracker)
    - https://daltare.shinyapps.io/CECapp/

Office of Information Management and Analysis

Division of Drinking Water

Division of Water Quality

North Coast

San Francisco Bay

Central Valley

Central Coast

Los Angeles

Santa Ana

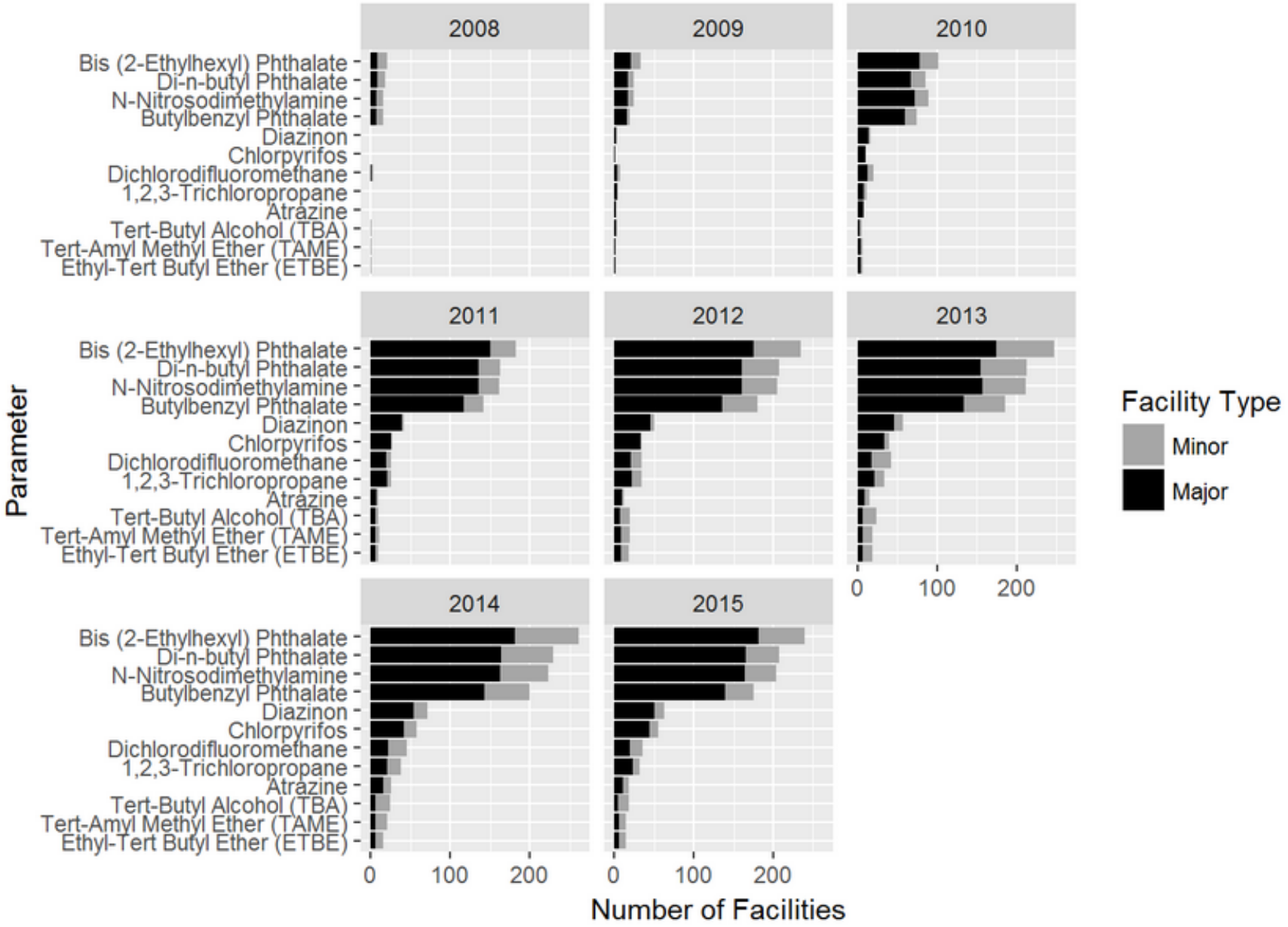
San Diego

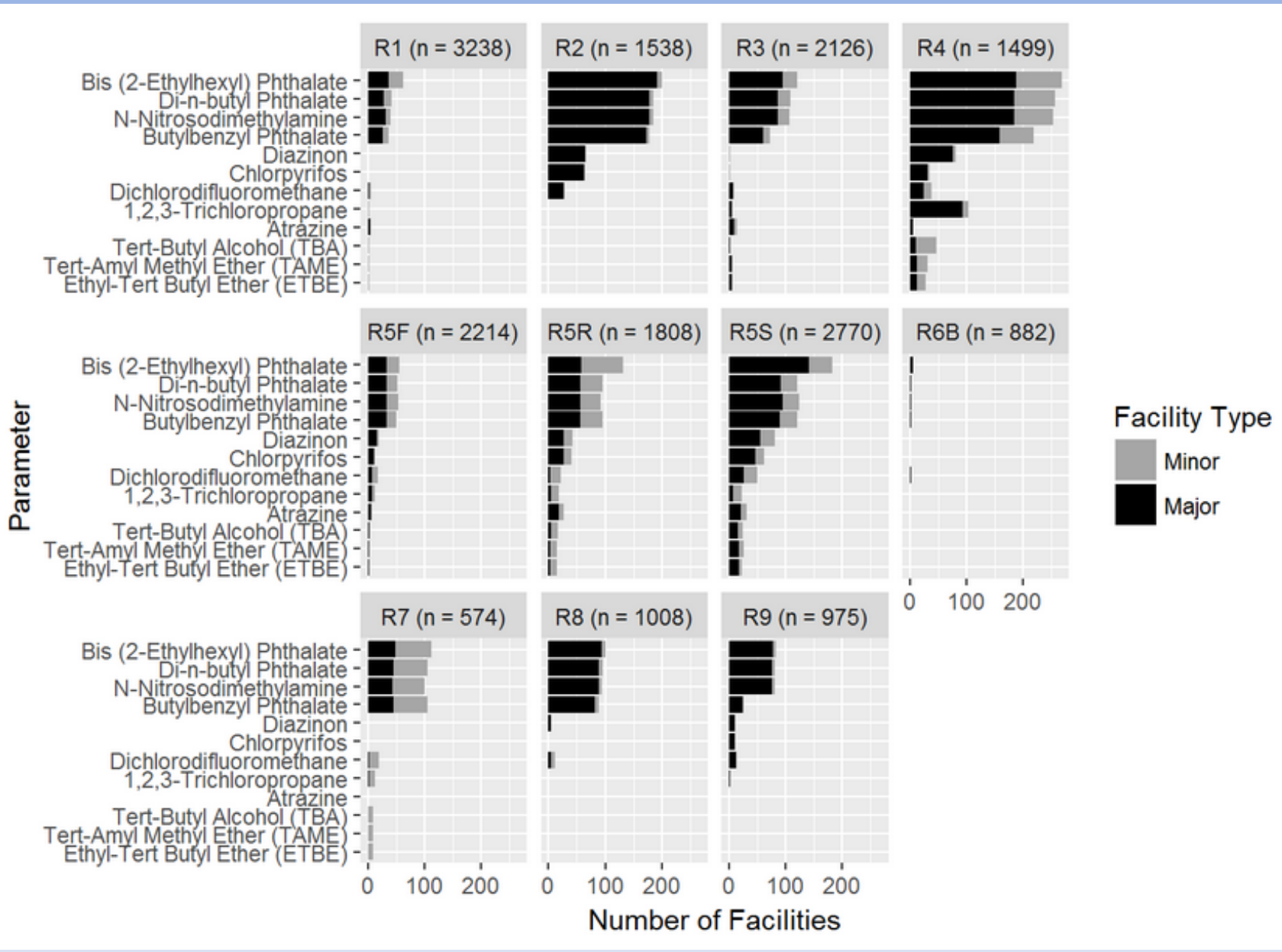
CECs in NPDES Permits

- CEC data is present in the California Integrated Water Quality System (CIWQS) due to permittees submitting the data.
- We analyzed this dataset to see what type and frequency of CEC data is present
- The dataset summarized here was filtered to include monitoring data from 2008 through 2015.
- In the eSMR data, there were:
  - **12** unique CECs
  - **344** facilities associated with CEC monitoring data

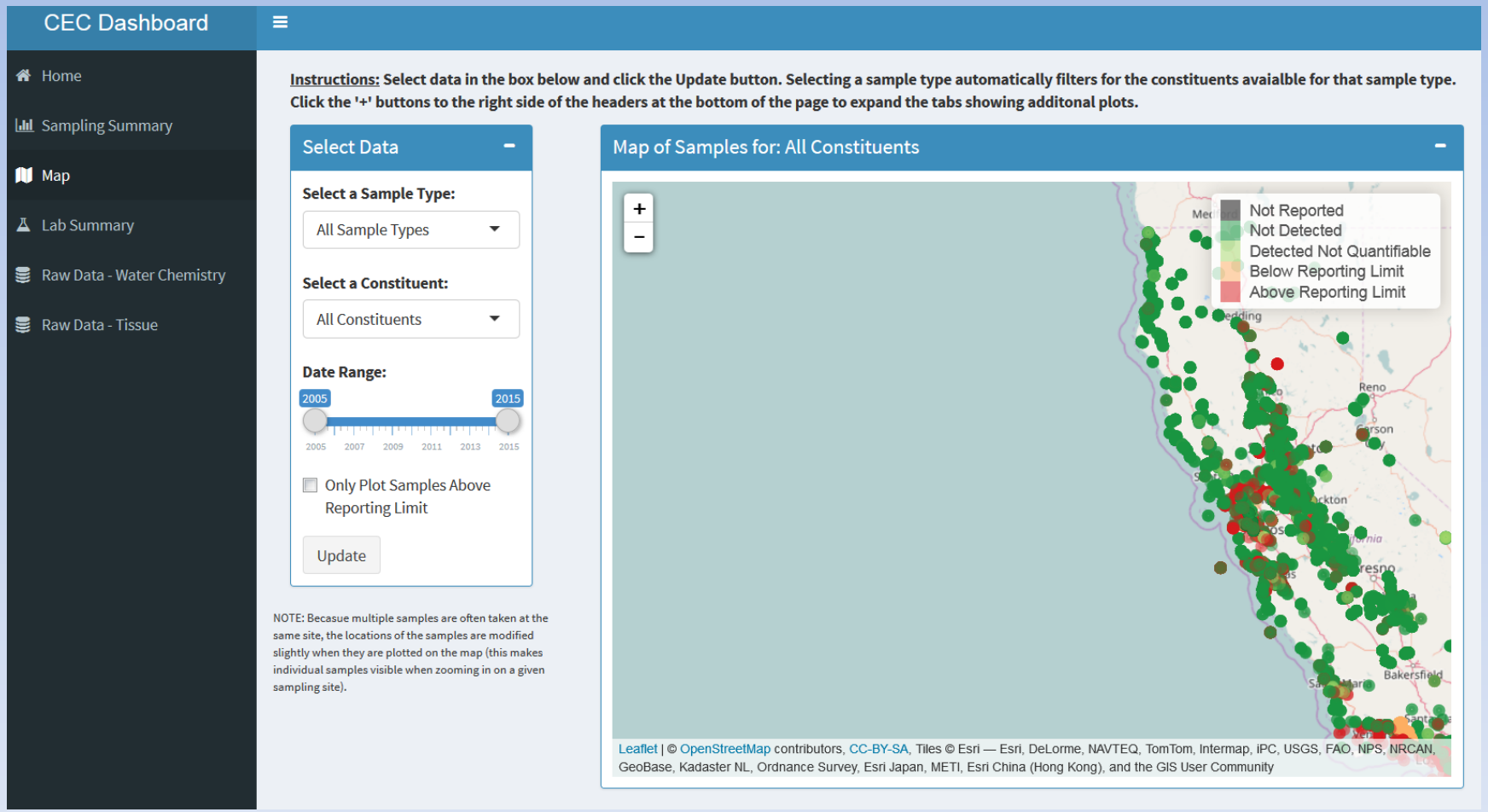
Table 1. Number of facilities that sampled for each constituent and total number of samples across the entire dataset

Parameter	Number of Facilities	Total Number of Samples
Bis (2-Ethylhexyl) Phthalate	333	14,731
Di-n-butyl Phthalate	305	6,013
N-Nitrosodimethylamine	302	9,098
Butylbenzyl Phthalate	266	4,631
Diazinon	96	2,423
Chlorpyrifos	81	1,109
Dichlorodifluoromethane	79	2,491
1,2,3-Trichloropropane	57	937
Atrazine	43	266
Tert-Butyl Alcohol (TBA)	39	637
Tert-Amyl Methyl Ether (TAME)	35	449
Ethyl-Tert Butyl Ether (ETBE)	34	329


2008
2009
2010
2011
2012
2013
2014
2015
Bis (2-Ethylhexyl) Phthalate
Di-n-butyl Phthalate
N-Nitrosodimethylamine
Butylbenzyl Phthalate
Diazinon
Chlorpyrifos
Dichlorodifluoromethane
1,2,3-Trichloropropane
Atrazine
Tert-Butyl Alcohol (TBA)
Tert-Amyl Methyl Ether (TAME)
Ethyl-Tert Butyl Ether (ETBE)
Parameter
0
100
200
Number of Facilities
Facility Type
Minor
Major


R1 (n = 3238)
R2 (n = 1538)
R3 (n = 2126)
R4 (n = 1499)
R5F (n = 2214)
R5R (n = 1808)
R5S (n = 2770)
R6B (n = 882)
R7 (n = 574)
R8 (n = 1008)
R9 (n = 975)
Bis (2-Ethylhexyl) Phthalate
Di-n-butyl Phthalate
N-Nitrosodimethylamine
Butylbenzyl Phthalate
Diazinon
Chlorpyrifos
Dichlorodifluoromethane
1,2,3-Trichloropropane
Atrazine
Tert-Butyl Alcohol (TBA)
Tert-Amyl Methyl Ether (TAME)
Ethyl-Tert Butyl Ether (ETBE)
Parameter
0
100
200
Number of Facilities
Facility Type
Minor
Major

Ambient Surface Water CEC Data



CEC Initiative – Next Steps

- OIMA, DWQ, DDW and RBs will:
  - continue to coordinate the studies, monitoring, management interventions and science regarding CECs for all Water Board elements
  - build more data science and information sharing tools to better inform management decisions
  - identify and coordinate internal resources, partnerships (e.g., SWAMP CEC advisory team), and external experts (e.g., expert panels, academic partnerships, conferences, etc.)

Thank you for your time