

WQ Explorer

Aggregating Municipal and State Open Data for
Water Quality Investigations

2016 SARC Data Innovation Challenge

presented by...

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Background

The mission of the California State Water Resources Control Board (SWRCB) and the nine California regional water boards is to achieve the desired outcome of the State Porter Cologne Act and the federal Clean Water Act:

“protect and restore the chemical, physical, and biological integrity of waters”

Measuring effectiveness in carrying out this mission requires understanding conditions of water bodies and how they relate to beneficial uses which may apply.

Background

Water quality monitoring and assessment programs are most effective when they are designed to answer specific questions related to those beneficial uses, such as:

1. Is our water safe to drink?
2. Is it safe to swim in our waters?
3. Is it safe to eat shellfish from our waters?



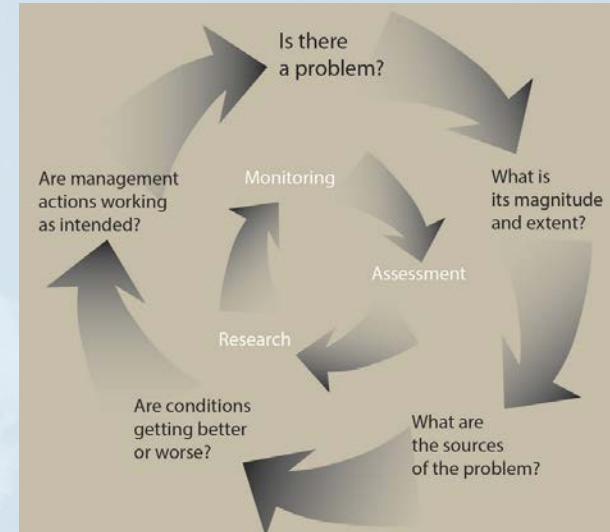
Answering Questions 2 and 4 drives most municipal stormwater monitoring and assessment programs.

4. Are our aquatic ecosystems healthy?

Background

Orange County Stormwater Program Question-Driven Water Quality Monitoring and Assessment Approach:

1. Is there a problem?
2. If so, what is its magnitude and extent?
3. What are the sources of the problem?
4. Are the conditions getting better or worse?
5. Are management actions working as intended?



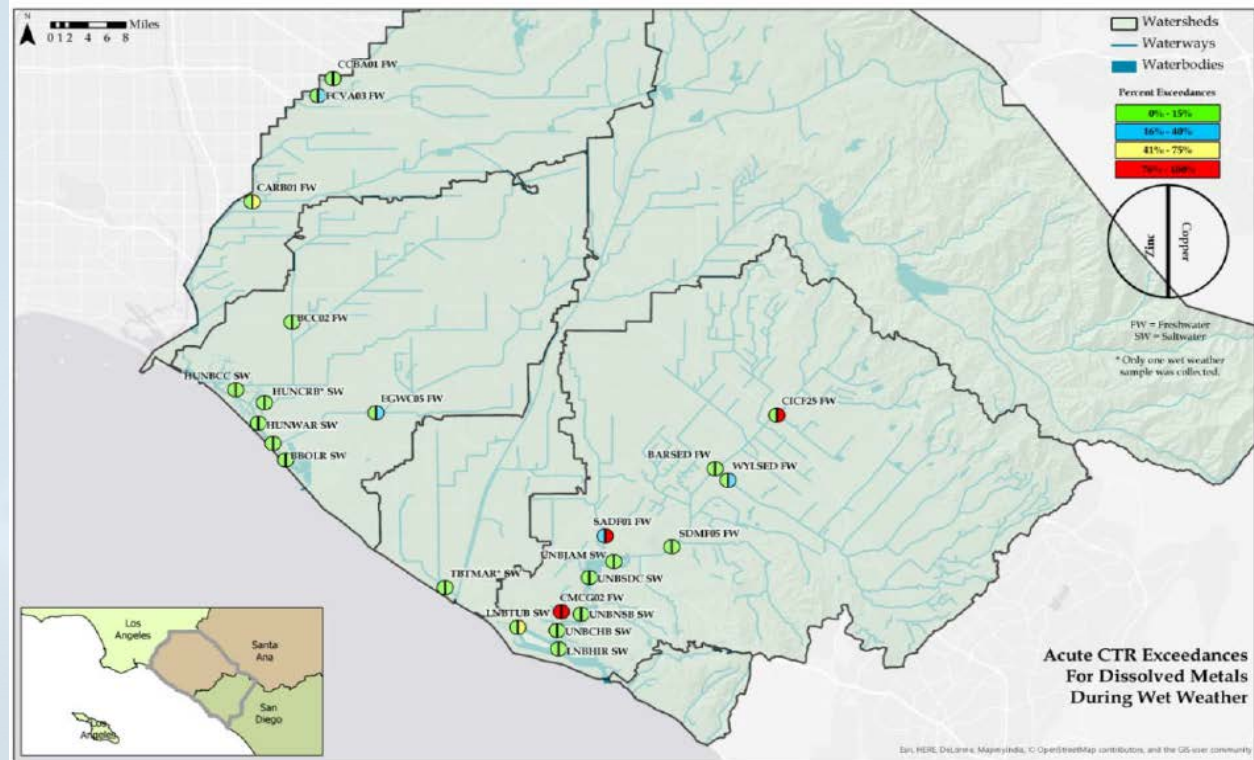
Background

Orange County Stormwater Program Monitoring Assessment Themes:

1. Focus on priority areas and constituents rather than trying to monitor all constituents, potential issues, and locations.
2. Increase the integration of data from a wider range of sources in order to leverage the value and impact of the program's efforts to address the five assessment questions.
3. Continue evolving from a strictly discharge specific approach to a risk prioritization approach that can highlight problem areas and support more flexible monitoring designs that include data driven adaptive triggers.

Mass Emission Wet Weather Data 2014-15

Attachment C-11-III from the 2014-15 Orange County Stormwater Program Effectiveness Assessment



Open Collaboration

Public-private partnership

Orange County Public Works (OCPW)

CloudCompli, Inc.

CA Water Board Office of Information Management and Analysis (OIMA)

Outcomes

Paper

<http://wqexplorer.cloudcompli.com/paper>

Software

<http://wqexplorer.cloudcompli.com/ctr>

Code

CLOUDCOMPLI

OC Public Works

Two-Phase Approach

Issue Identification & Prioritization

Answering **Monitoring & Assessment Questions 1 & 2**

Is there a problem?

If so, what is its magnitude and extent?

Using **Orange County Monitoring Data**

Mass Emissions Program & Estuary/Wetlands Program

Source Investigation

Answering **Monitoring & Assessment Question 3**

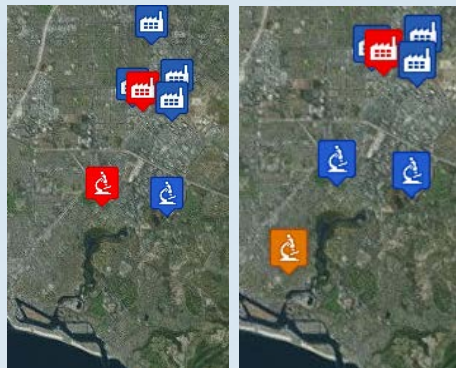
What are the sources of the problem?

Using **State Regulatory Data from Related Entities**

SMARTS Industrial Raw Parameter Results & Stormwater Violations



Results Exceedances, Deviations & Correlations

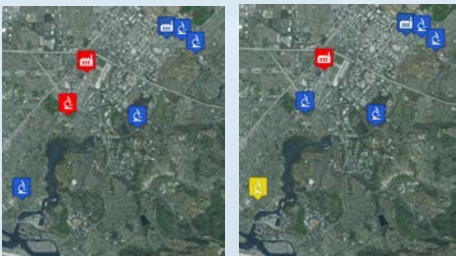


CTR Acute/Chronic Criteria and Industrial NAL Exceedances

Date	CICF28			SDMF05			CMC002			SADF01										
	Result	Acute	Chronic	Result	Acute	Chronic	Result	Acute	Chronic	Result	Acute	Chronic								
2015-10-28	12	23.72	51%	15.05	80%	11	73.35	15%	41.9	26%	32	26.9	119%	16.87	190%	17	87.57	19%	43.2	35%
2015-10-06																				
2015-10-05				8.8	79.29	11%	44.96	19%								56	25.93	230%	15.14	96%
2015-09-03																				

Localized event

Industrial facility exceeding proposed Newport Bay Toxics TMDL-specific Industrial NALs



CTR Acute/Chronic Criteria and Industrial Deviations from Norm

Date	CMC002			SDMF05			WVLEB			SADF01			BANS02			CICF28				
	Result	Acute	Chronic	Result	Acute	Chronic	Result	Acute	Chronic	Result	Acute	Chronic	Result	Acute	Chronic	Result	Acute	Chronic		
2014-10-23	23	286.67	1%	16.67	2%	12	286.17	0%	16.67	2%										
2014-10-01				1.4	110.87	0%	4.21	8%												
2014-10-01	381	29.23	4%	9.76	103%	328	14	1%	2.1	13%	12	82.12	0%	3.2	8%	1.67	81.1	2%	1.17	87%
2014-10-01	117	38.1	4%	1.13	94%	127	319.18	0%	12.31	2%	124	99.83	0%	3.86	8%	4.57	27.68	1%	1.83	23%
2014-10-02																2.4	30.1	8%	1.17	280%

No facility exceeding proposed Toxics TMDL-specific Industrial NALs

Industrial facility 2.24 deviations out of norm



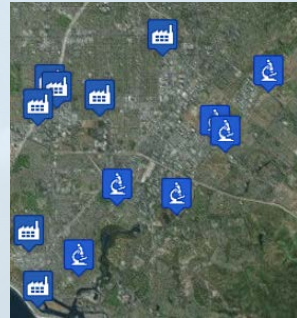
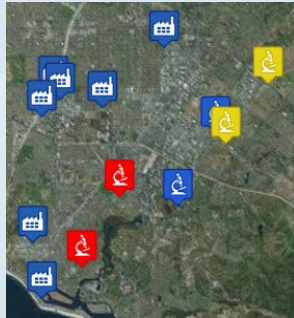
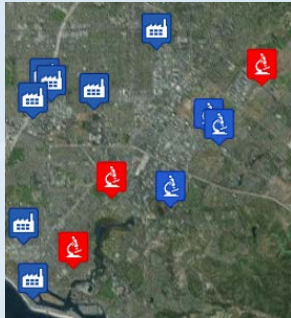
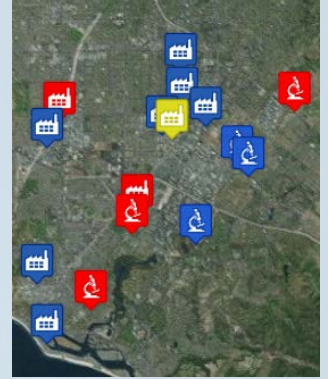
Results *Aggregate Effects & Uncaptured Factors*

Aggregate Effects

Exceedances of acute CTR criteria at multiple mass emissions stations

Smaller discharges may contribute to cumulative build up

Three facilities outside historic mean - if their pollution footprints were reduced, could result in a positive trend on the loading stations



Uncaptured Factors

Non-stormwater contributions (geology, atmospheric deposition)

Discharges from unregulated facilities

Limitations

Data Availability

Only **three historical datasets** considered

Ongoing work to **make all datasets API-ready**

More datasets would **reduce uncaptured factors**

Real-time data would **improve response times**

Correlation versus Causation

Provides a **starting point for an investigation**

Should not be used in exclusivity of other investigative procedures

Results should always **keep aggregate effects in mind**

Need methodology to **account for unseen factors**

Methodology Improvements

Analytical Methods

Our **CTR Limit approach** is specific to Orange County's use case

Many regional boards & municipalities **use different assessment approaches**

Implement other analytical methods to support other regions

Mashup uniquely assessed regions into a single visualization

Statistical Methods

Our **deviation-based approach** is not well-suited to non-normal, multi-factor data

Multivariate statistical models to better isolate issues and possible causes

Descriptive statistical models to improve the way we interpret parameters

Closing the Loop

Study effectiveness over time to answer **Monitoring & Assessment Questions 4 & 5**

Data Improvements

Granularity

Tighter isolation through **more stations and higher sampling frequency**

Should seek to **improve statistical soundness of times, places and parameters**

Statistical methods can help balance cost versus accuracy

Sources

Reduction of uncaptured factors if we **incorporate more datasets**

Tighter isolation through **subwatersheds, channels and flow**

Latency

Use real-time data instead of historical data

Go beyond **retrospectively assessing water quality**

Move towards **“smart stormwater”**

Questions?

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