WQExplorer
Aggregating Municipal and State Open Data for Water Quality Investigations
2016 SWRCB 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?
4. Are our aquatic ecosystems healthy?

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

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

CTR Acute/Chronic Criteria and Industrial Deviations from Norm

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
Tight 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**
Tight 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?

http://wqexplorer.cloudcompli.com/paper

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