NETWORKED APPROACH TO REAL-TIME MONITORING

Predictive Analytics in Stormwater

Step 1: Build the Knowledge Base

Augment the guy in the office & in the field who knows a thing or two about the stormwater system

Real-Time Monitoring data network that knows EVERYTHING about the stormwater system
NETWORKED APPROACH TO REAL-TIME MONITORING
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Predictive Analytics in Stormwater
(what we are building in 2019)

Step 2:
Build & Train the Predictive Algorithms

- Real-Time Pattern Recognition (time series)
  + Weather Data

- Real-Time Pattern Recognition (spatial series)
  + Weather and Historical System Data
By implementing just real-time monitoring, the EPA estimates that the costs paid by communities from flooding and sewage overflows can be reduced dramatically.

**$88.5B**
Total

**$7.5B – 50%**
of estimated O&M, annual

**ELIMINATE SANITARY SEWER OVERFLOWS**
by tracking and identifying undersized pipes and rainfall-derived I/I (inflow & infiltration), sediment & debris buildup, pipe breaks and leaks, offset joints

**$7.5B – 50%**
of estimated O&M, annual

**MINIMIZE OPERATING COSTS**
by reducing high electricity costs for pump & gate ops

**$6B**
Fines, fixes, and litigation, annual

**MINIMIZE MAINTENANCE COSTS**
by tracking and identifying equipment failure rates and sedimentation issues

**$270B**
Flood damages in 2017

**MINIMIZE CSOs**
by tracking and identifying rainfall-derived I/I and undersized facilities

**REDUCE FLOODING RISKS**
by tracking and identifying rainfall-derived I/I and undersized facilities
BUT WE STILL HAVE SOME LIMITATIONS: RTC REQUIRES DATA BUT DATA ARE EXPENSIVE
So I asked myself: how do we get AS MUCH DATA as possible from AS LARGE AN AREA as possible... underground?

...and how do we make it actionable?
NETWORKED APPROACH TO REAL-TIME MONITORING

DATA: Advanced Infrastructure Analytics and Mapping

VIA

Patented design for low-cost, high-reliability sensors (Scutes™)

Cloud-connected via IoT
NETWORKED APPROACH TO REAL-TIME MONITORING

FLOW
LEVEL
+ TEMPERATURE!

VELOCITY

10X COST REDUCTION
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Predictive Analytics in Stormwater
(what we are building in 2019)

Step 2: Build & Train the Predictive Algorithms

Real-Time Pattern Recognition (time series) + Weather Data

Real-Time Pattern Recognition (spatial series) + Weather and Historical System Data
(MY PIPE DREAM)
NETWORKED APPROACH TO REAL-TIME MONITORING

CSOs
IDDE
FLOODING & COASTAL MANAGEMENT
GREEN INFRASTRUCTURE ASSESSMENT
NETWORKED APPROACH TO REAL-TIME MONITORING: BMPs

Assess effectiveness of BMPs, e.g., Green Infrastructure

CURRENT | EFFECTIVENESS

FUTURE | BASELINE

REFERENCE | COMPARISON
USE CASE: GREEN STORMWATER INFRASTRUCTURE ASSESSMENT

Current Situation: Many green infrastructure (GI) projects are disconnected and small in scale, making their impacts on the larger system difficult and costly to evaluate. Using a networked approach to real-time monitoring, you can evaluate the cumulative impacts GI projects are having on your urban watershed.

For GI projects, we suggest that you employ a paired-watershed monitoring approach using test and reference sub-watersheds. Insights gathered while monitoring GI with a StormSensor network can be used to evaluate changes in infiltration, bulk flow, and thermal pollution within your watershed.

THE VALUE OF NETWORKED MONITORING:

- Know the “who, what, and where” in real-time: spatially track and quantify volume reductions across project and reference sites.
- Quantify your savings: comparisons on a long-term basis allow you to evaluate project effectiveness over time which can aid in cost-effective maintenance, and long-term planning, and project funding.
- Move Forward: comparisons between project types help determine operational efficiencies under varying conditions so you can empirically determine the best fit for a given land use.
- Get Smarter: keeping an eye on parameters upstream and downstream of GI projects help evaluate local effects of projects. Further comparisons to values at outfalls help evaluate the spatial extent of project benefits within the test region.

ONE CITY

INCREASED RECREATION ($520M)
HIGHER PROPERTY VALUES ($1.1B)
LOWER DEATH RATE AND IMPROVED HEALTH ($1.2B)
15,000 NEW JOBS ($125M)
Continuous, networked monitoring means you do not have to reinvent the wheel every time you want to monitor something new.

Once your monitoring network is in place, you can use the data and insights generated for much more than monitoring green infrastructure. Quantify storm flows to local waters as you work to comply with TMDLs. Track potential illicit discharges throughout your system.

Use Data to improve the aesthetics of your community and the health of your human and aquatic ecosystems.
REFERENCES

1 million miles of sewer pipes
$1.4 trillion required for sewer and wastewater infrastructure upgrades
$400/year in average sewer/wastewater fees per household per year in 2015
$48 billion required to address combined sewer overflows

https://www.weather.gov/safety/flood-hazards
75% of declared disasters in the U.S. are from flooding

Axios. 2018. Sea level rise already causing billions in home value to disappear.

First Street Foundation. 2018. As the Seas Have Been Rising, Tri-State Home Values Have Been Sinking.
https://assets.floodiq.com/2018/08/17ae7b7dfe217ed3176e3663a07c24ae20-as-the-seas-have-been-rising-tri-state-home-values-have-been-sinking.pdf
$14.1 billion drop in property values along the east coast between 2005 and 2017 due to flooding and sea level rise

Axios. 2018. Rising Sea Levels Could Cost the U.S. Trillions
$3.6 trillion through 2100 if there are no actions taken to protect coastal infrastructure and property from rising seas. The cost could be reduced to $820 billion under the same scenario if those measures are implemented.