

STORMWATER SAMPLING AND WATER QUALITY MODEL VALIDATION PROJECT

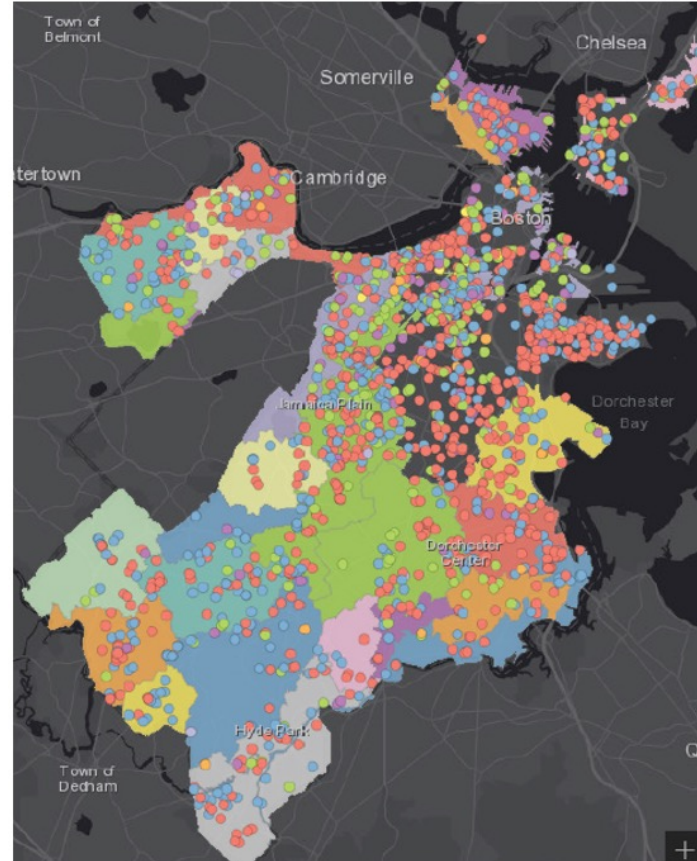
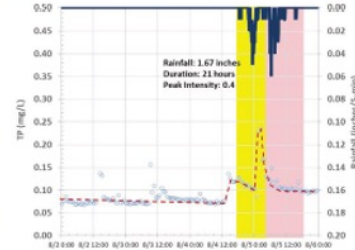
NEWEA ANNUAL CONFERENCE

SESSION 17
JANUARY 23, 2024

 **Boston Water and
Sewer Commission**

 **KLEINFELDER**
Bright People. Right Solutions.

Bright People. Right Solutions. | © 2018 Kleinfelder. All rights reserved.



Outline

- Background/Timeline
- Expected Outcomes
- Field Program
- Stormwater Model Updates
- Stormwater Model Validation
- Findings Summary
- Recommendations

Background Timeline

2007 – Lower Charles River TMDL for Phosphorous

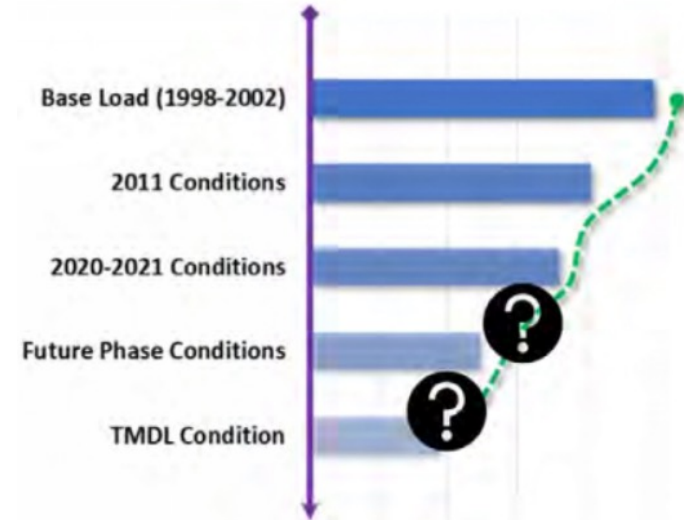
2012 – Commission Consent Decree

2015 – EPA Approved Stormwater Report

2018 – EPA Approved Stormwater BMP Plan *

2020-2022 – Sampling and WQ Model Validation

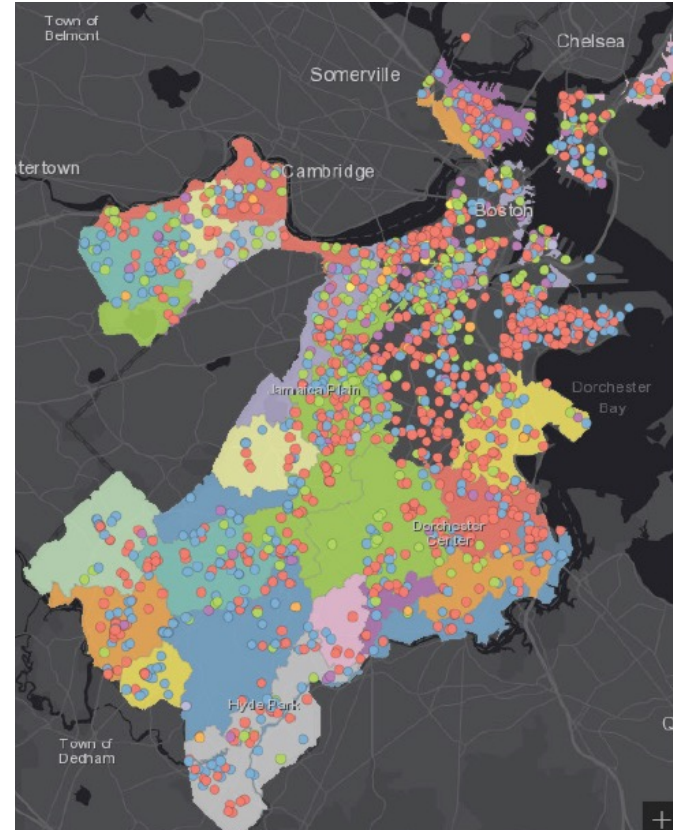
Current – Recalibration of SW Model



** Key Event – EPA Approved use of Commission’s SW Model to account for TP loading*

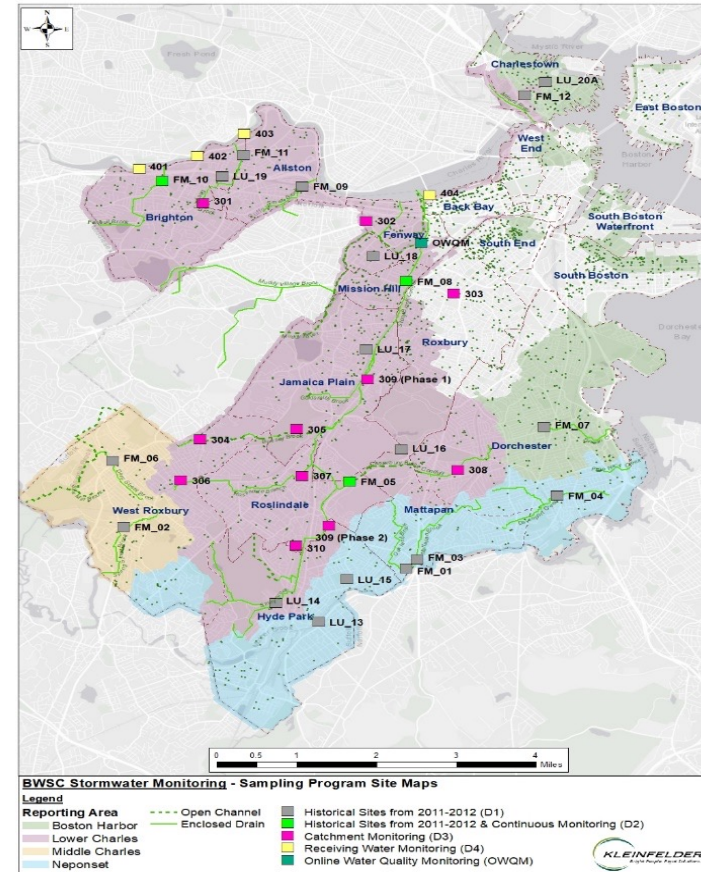
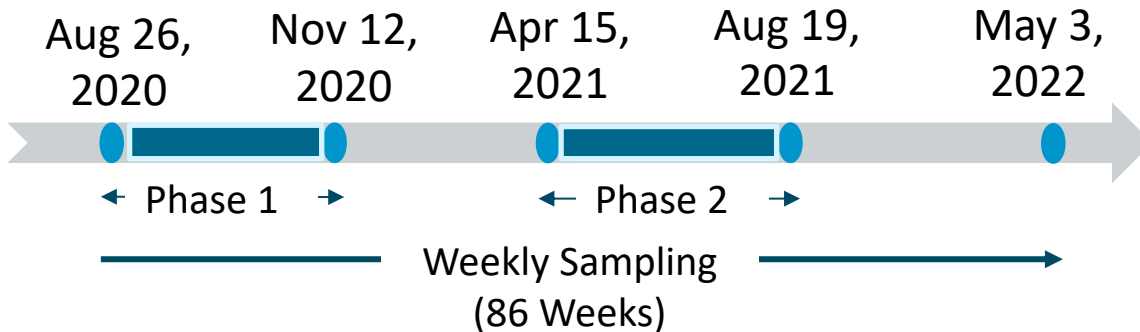
Expected Outcomes

1. Update understanding of water quality loading (from 2011/2012 sample data)
2. Update Stormwater Model to December 2022 conditions to account for
 - Illicit sanitary source (IDDE) elimination
 - Construction of GI/BMPs
3. Estimate event mean concentrations and pollutant loadings within Reporting Areas
4. Evaluate validity of 2012 Stormwater Model



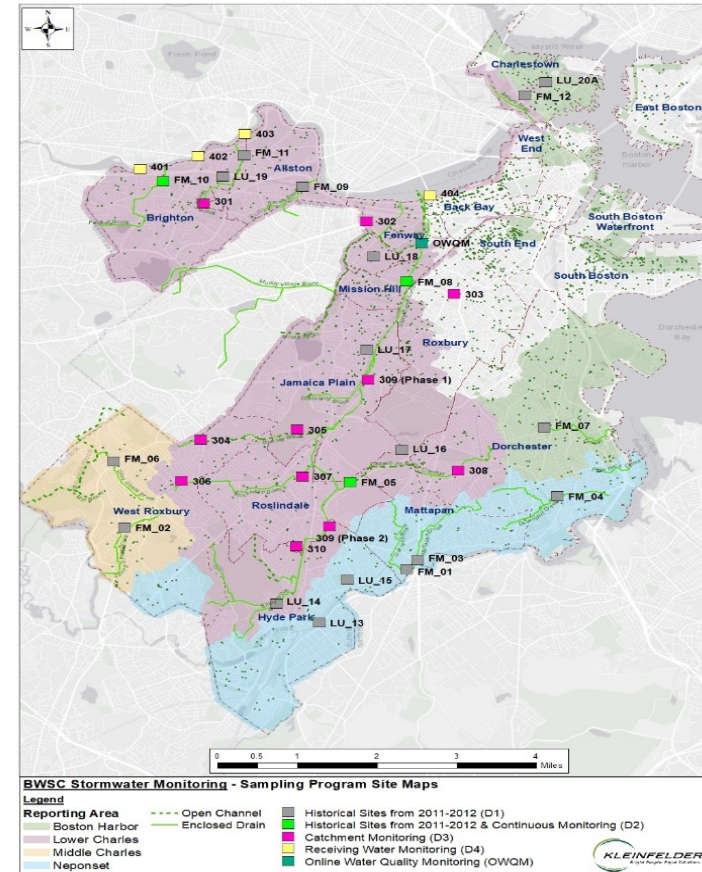
Field Program

- Sampled 34 locations for water quality
- Measured stormwater flow rates at 30 locations
- Sampling Timeline:



Field Program

- **Targeted Dry Weather/Wet Weather Sampling:**
 - 27 sites (17 repeated from 2011/2012 and 10 new sites)
- **Weekly Sampling:**
 - 86 consecutive weeks
 - 3 sites repeated from 2011/2012
- **Receiving Water Sampling:**
 - 4 locations along the Lower Charles River
- **High Temporal Resolution Sampling:**
 - 1 online water quality monitoring (OWQM) station along Stony Brook Conduit at Fens Gatehouse #1



Field Program Observations

- The total phosphorus concentration in the Lower Charles River is routinely < 0.1 mg/L
- Water quality in Lower Charles River rebounds to pre-storm conditions generally within 48 hours
- Dry weather pathogens and ammonia concentrations are lower in 2020/2021 sampling
- The OWQM station high temporal sampling method illustrates the first flush response more clearly than autosamplers

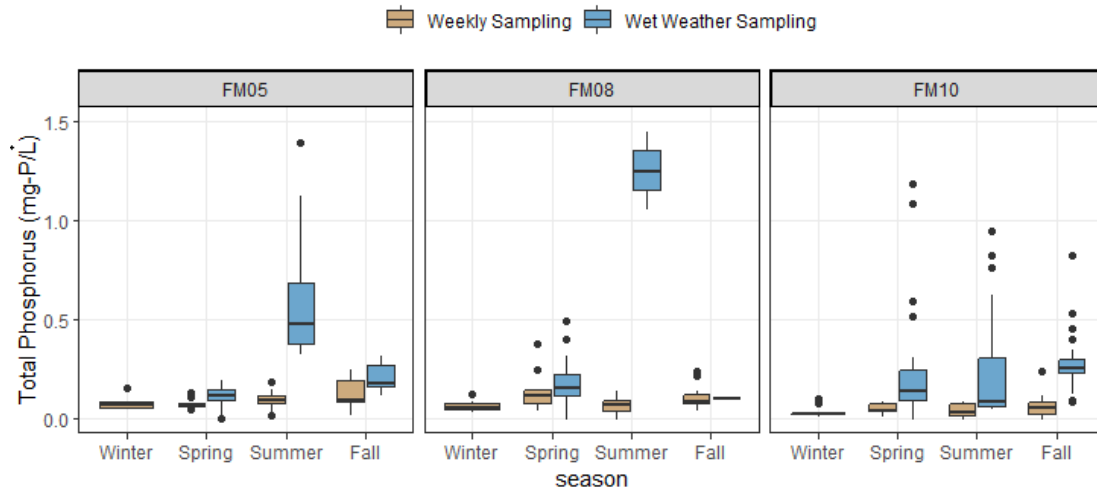
	2011/2012	2020/2021
Fecal Coliform (MPN/100mL):	5,600	2,450
Enterococci (MPN/100mL):	1,300	430
E. coli (MPN/100mL):	5,200	1,542
Ammonia (mg/L):	0.48	0.17

Median dry weather pathogens and ammonia findings across samples

Field Program Observations

- Seasonal Variability in TP (Weekly Sampling):

- Median total phosphorus at FM-05 and FM-08 is higher in Summer
- All the sites showed lower concentrations in Winter



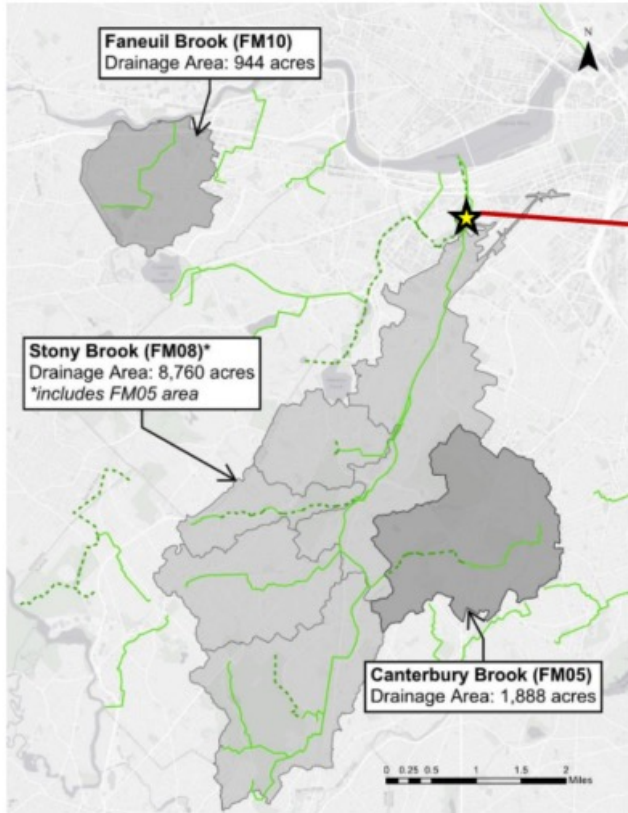
Canterbury Brook
Tributary Area: 1,888 ac

Stony Brook
Tributary Area: 8,760 ac
(Includes FM05 area)

Faneuil Brook
Tributary Area: 944 ac

Online Water Quality Monitoring Station

Gatehouse



Online Water Quality Monitoring Station

Gravity Feed of Pumped Stormwater

Endress-Hauser Liquiline
CA80-TP (total phosphorous)

Southwest Sensor
Nitrate/Nitrate Autoanalyzer

In Situ AquaTroll 500

Hach EZ1032
(Orthophosphate)

Data Logging (to Cloud)

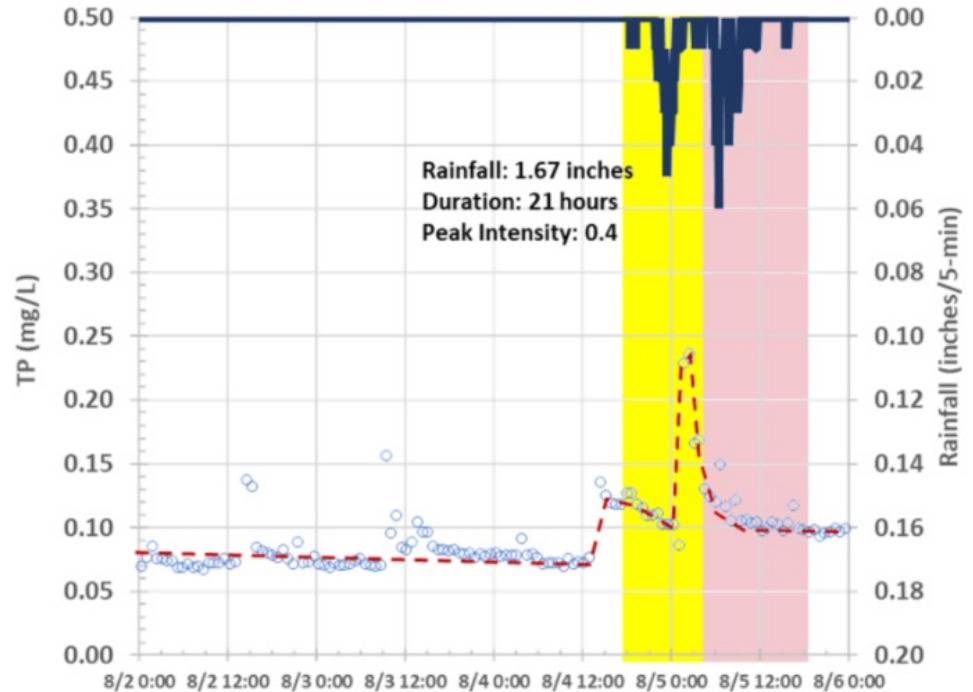
UPS (Backup Power)

ISCO Autosamplers
(24 Bottles x 2)



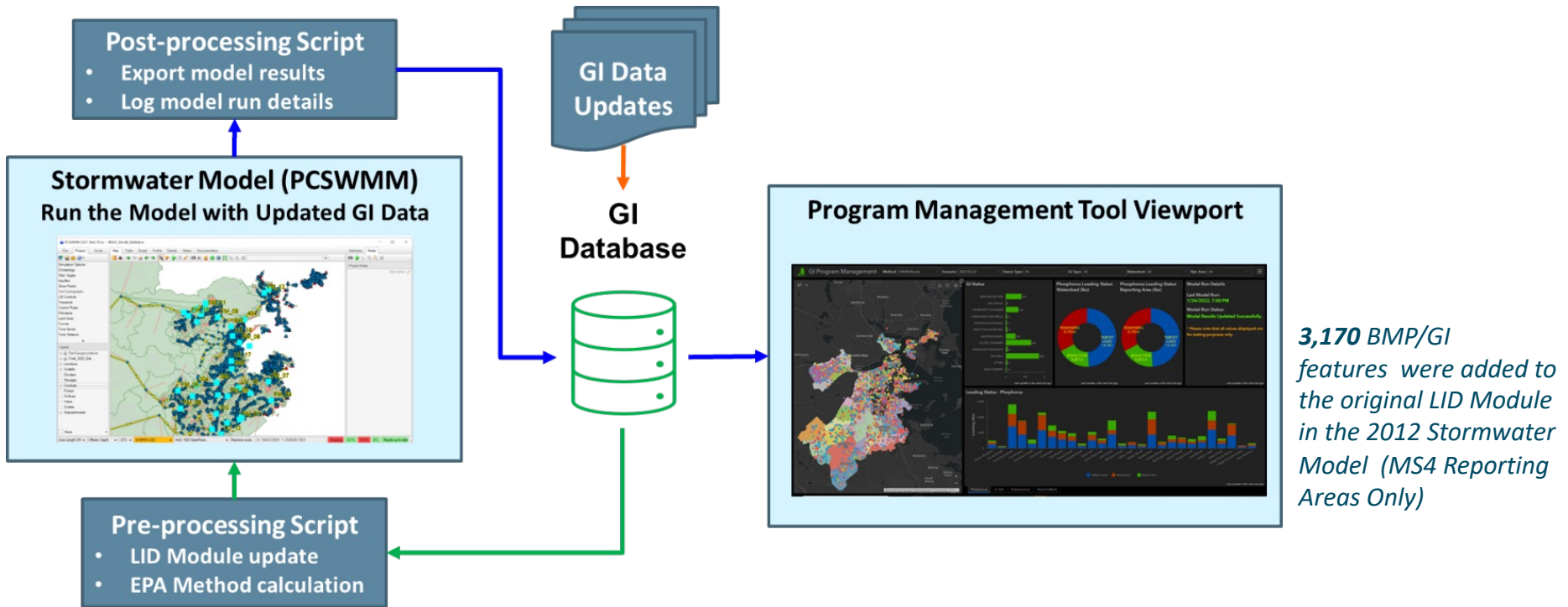
Online Water Quality Monitoring Station

OWQM allowed for data gathering over short durations of time to see first flush phenomenon better than weekly grab samples

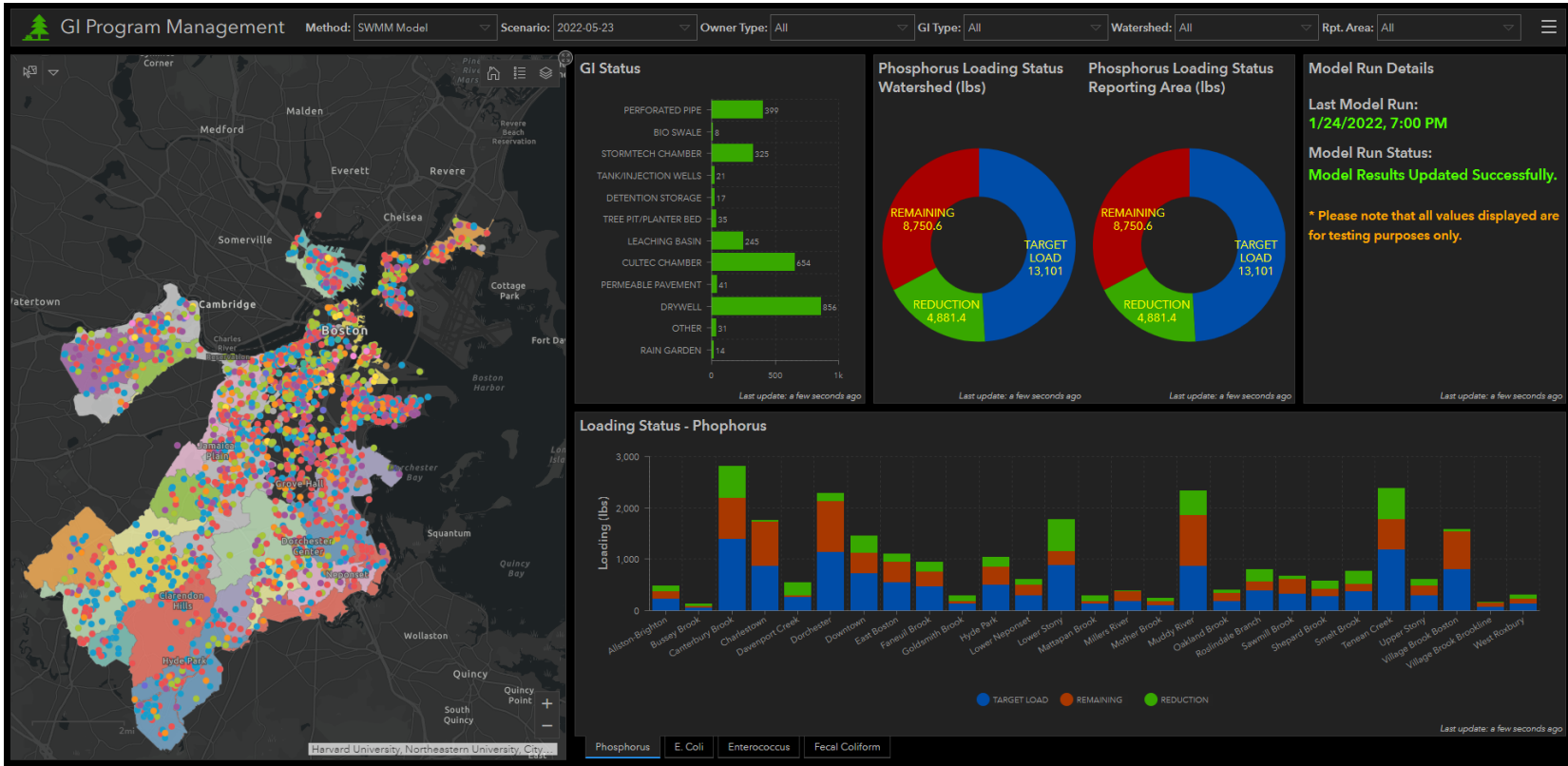


OWQM Results from August 5, 2021 Storm

Stormwater Model Updates



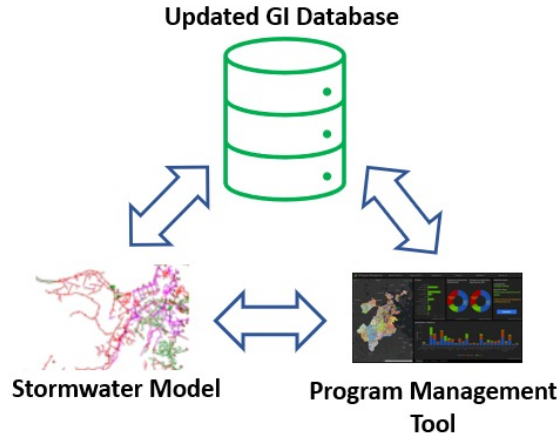
Stormwater Model Updates



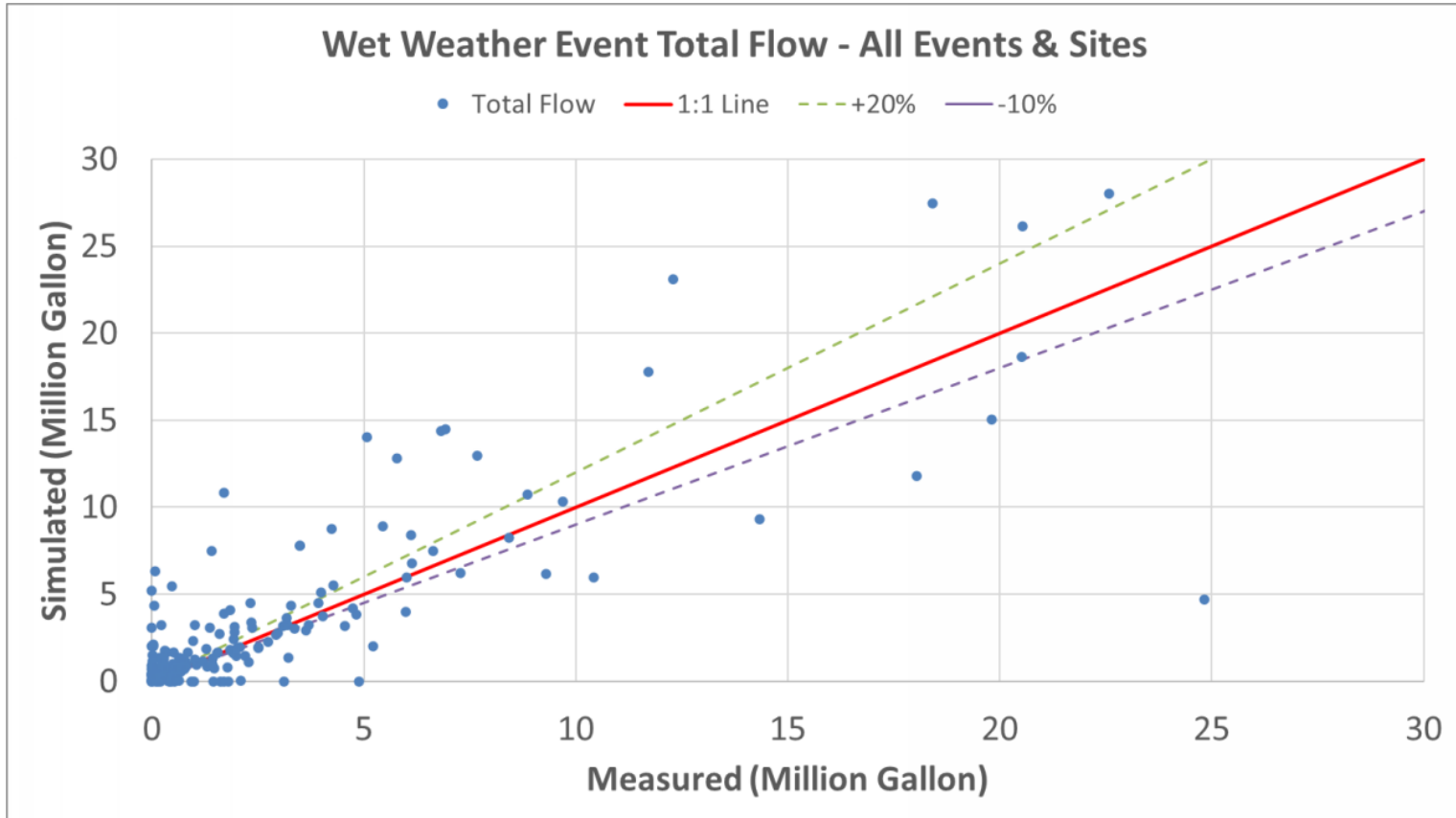
A GI Program Management Tool was built based on ArcGIS Online Operational Dashboard

Commission Workflow Improvements

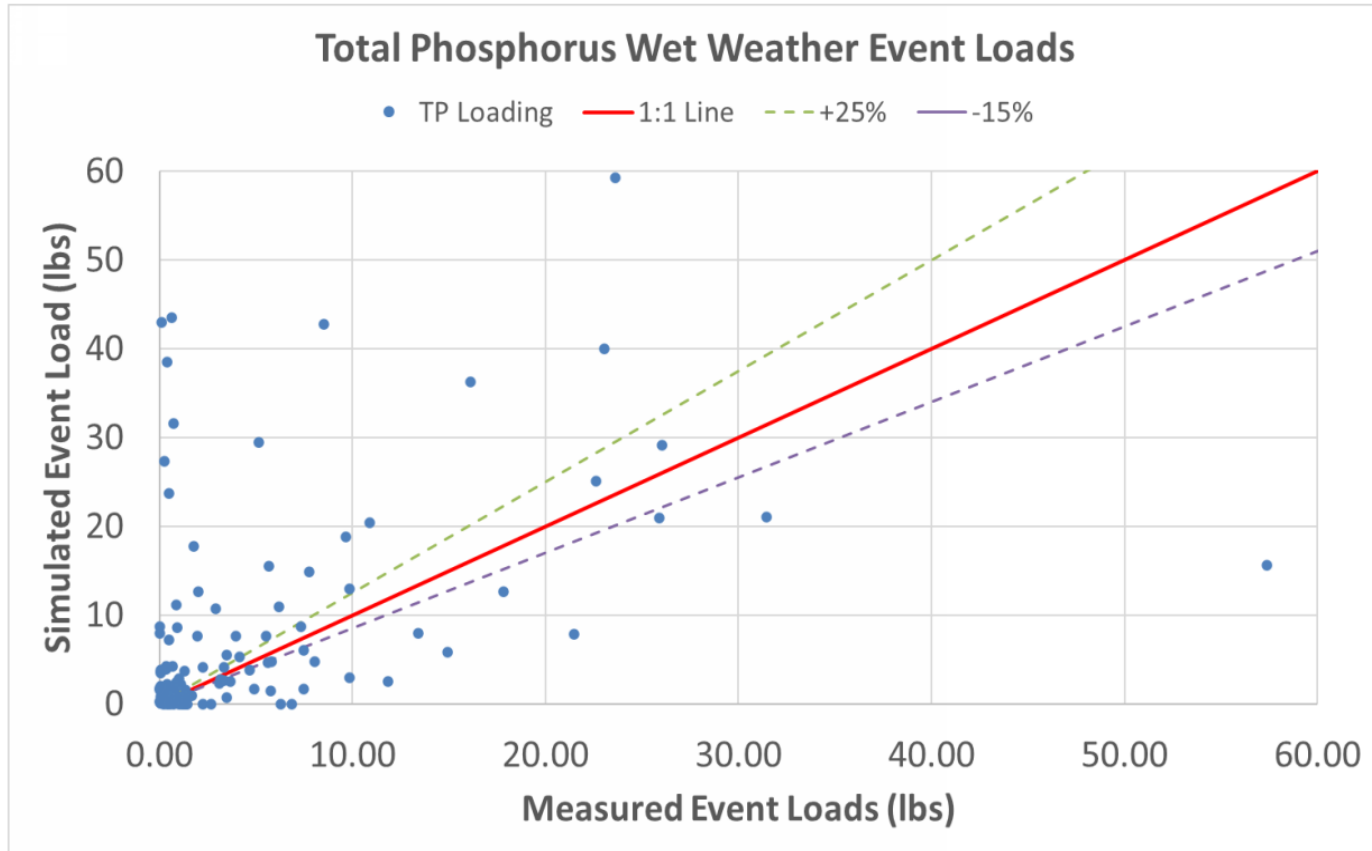
- Improve internal workflow to close data gap between Site Plan Review process and data that Planners need to meet Stormwater Quality Goals



Stormwater Model Validation – Wet Weather Flows



Stormwater Model Validation – Total Phosphorous

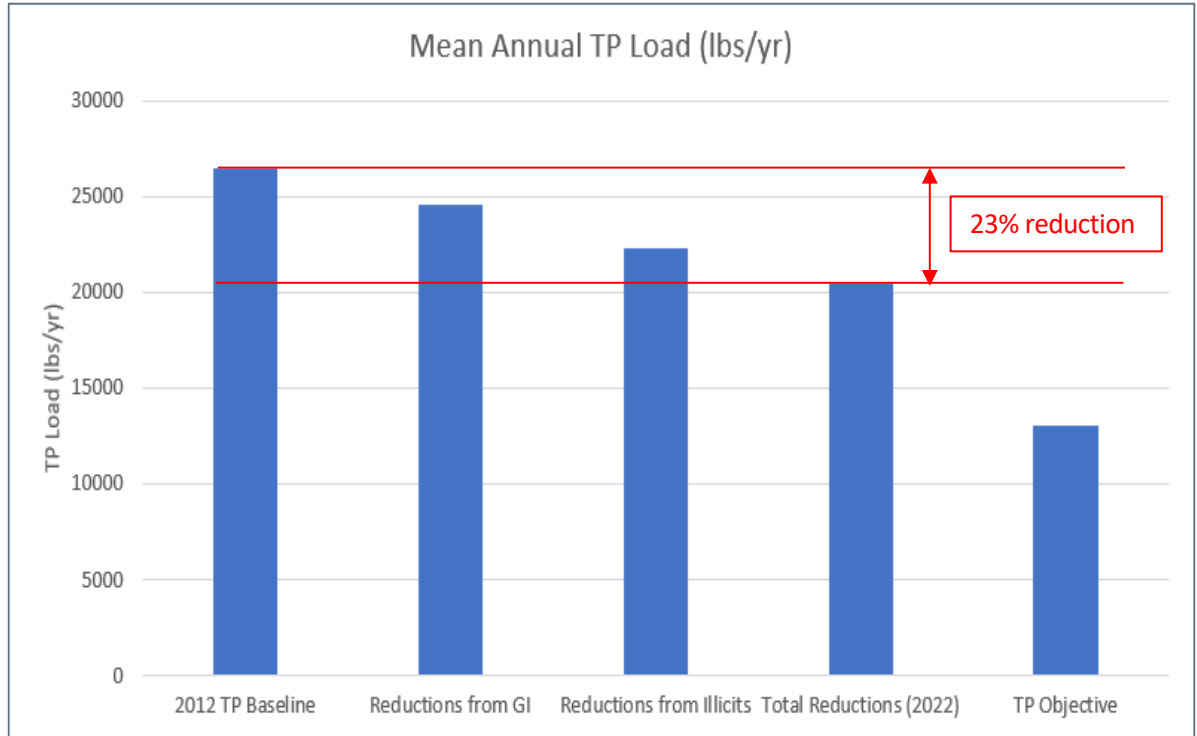


Stormwater Model Validation Findings

- Model has limited accuracy in its predictability under current conditions
- Model overpredicts wet weather event flow volumes and pollutant loads
- Recalibration of 2022 Stormwater Model is recommended for both flow and pollutant loadings
- Model upgrade required to the current version of the SWMM computing engines

TP Loadings Summary (as of 2022)

- 23% reduction since 2012 baseline established
- 51% progress towards TP TMDL objective
- Illicit Connections have accounted for 69% of the TP reductions to date



Recommendations to Commission

- Continue to adopt green infrastructure
- Continue to eliminate illicit sanitary sewer sources (IDDE program)
- Calibrate stormwater model and reassess TP reduction
- Conduct comprehensive sampling every 10 years
- Adopt internal workflow improvements to link GI/BMP data and the Stormwater Model

Acknowledgements



Field Program

- Flow Assessment Services
- CrewTwo
- SDE Civil & Environmental Engineering
- PEER Consultants

OWQM

- Northeastern University
- UNH

Laboratories

- G&L Laboratories
- Alpha Analytical

Questions?

Thank You!

Contact Us!

Charlie Jewell – jewellc@bwsc.org

John Rahill – jrahill@kleinfelder.com

David Peterson – dtpeterson@kleinfelder.com