



**P4** INFRASTRUCTURE

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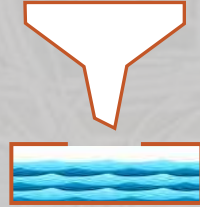
## How to Implement Resiliency in Green Infrastructure Design

February 22, 2021

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How fast does my storage  
gallery discharge?



Do I have excess pollutant removal  
to allow Water Quality Trading?

Wet Ponds



Permeable  
Pavement



Does my subgrade  
infiltration rate change  
over time?

Detention  
Cisterns



Can I increase the efficiency of  
my existing and new BMPs  
using technology?

Biofiltration



How much stormwater  
am I capturing?

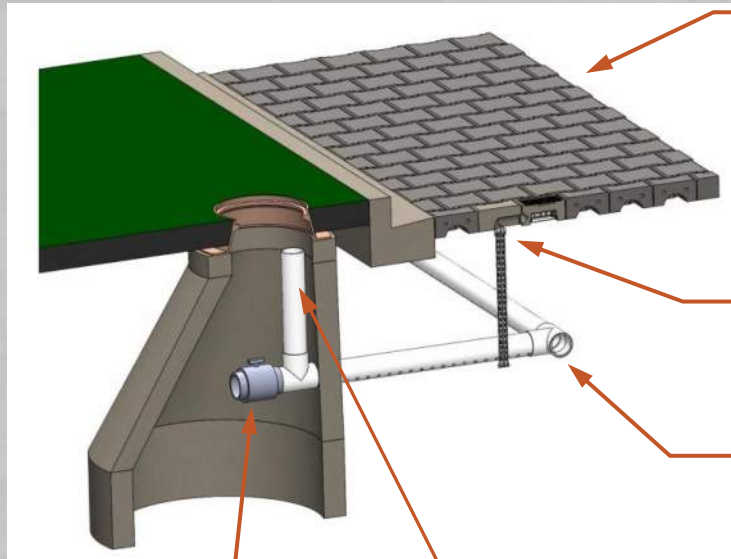
When should I perform  
maintenance?

Which type of BMP  
do I build?

How effective is my BMP  
in removing pollutants?



# INFIL-Tracker & Flow-RTC



Permeable Pavement  
(Stormwater BMP)

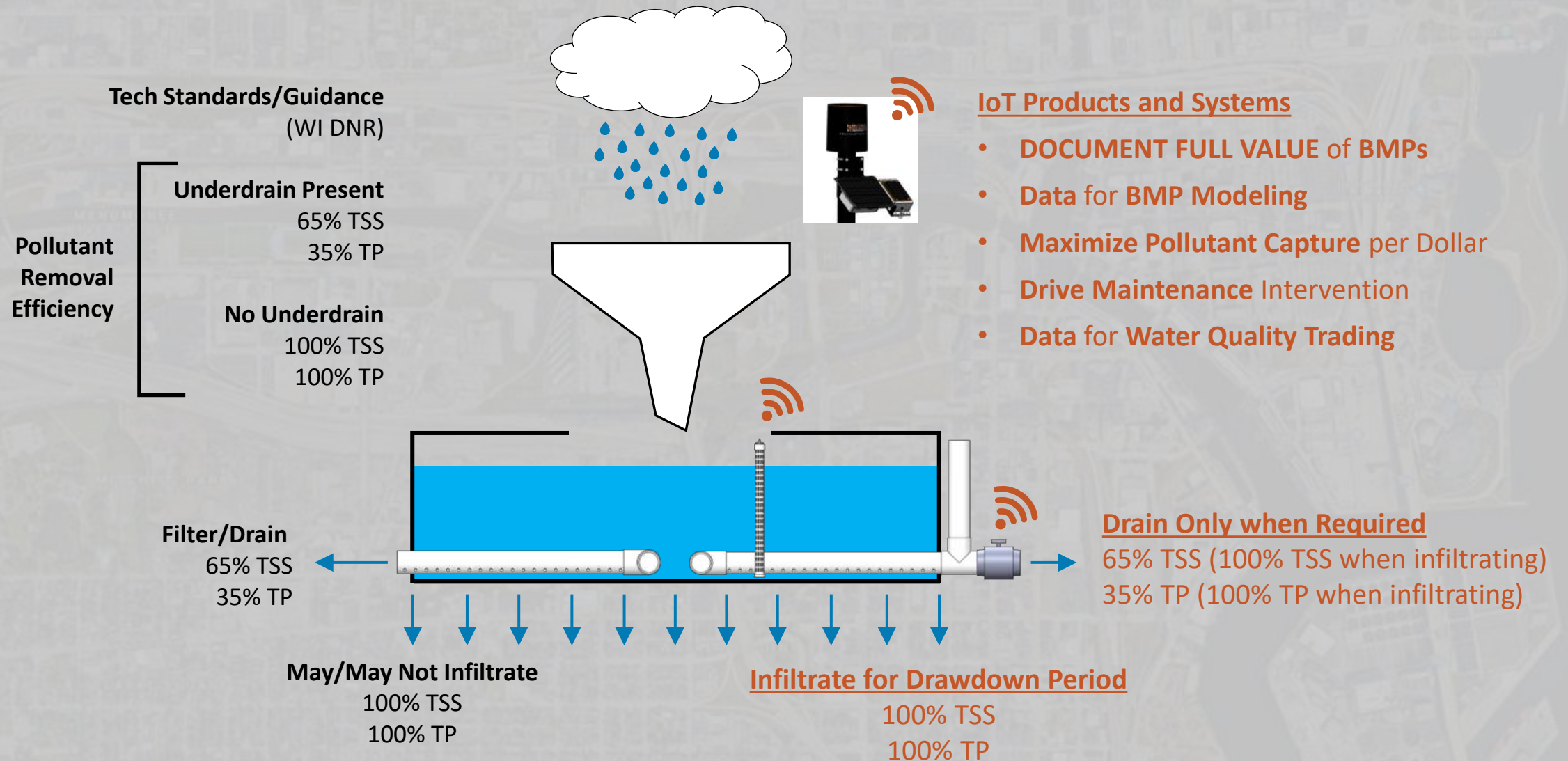
INFIL-Tracker Device

Underdrain  
(typical)

Real-Time Control (valve)  
Flow-RTC

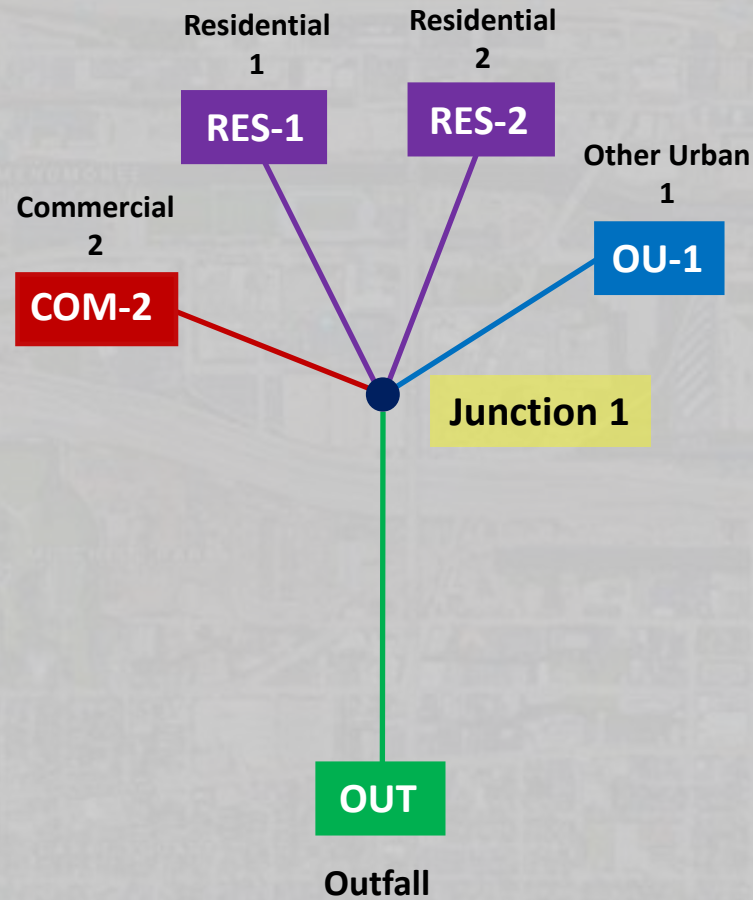
Vertical Overflow  
Standpipe (optional)







# Source Load and Management Model



## Land Use

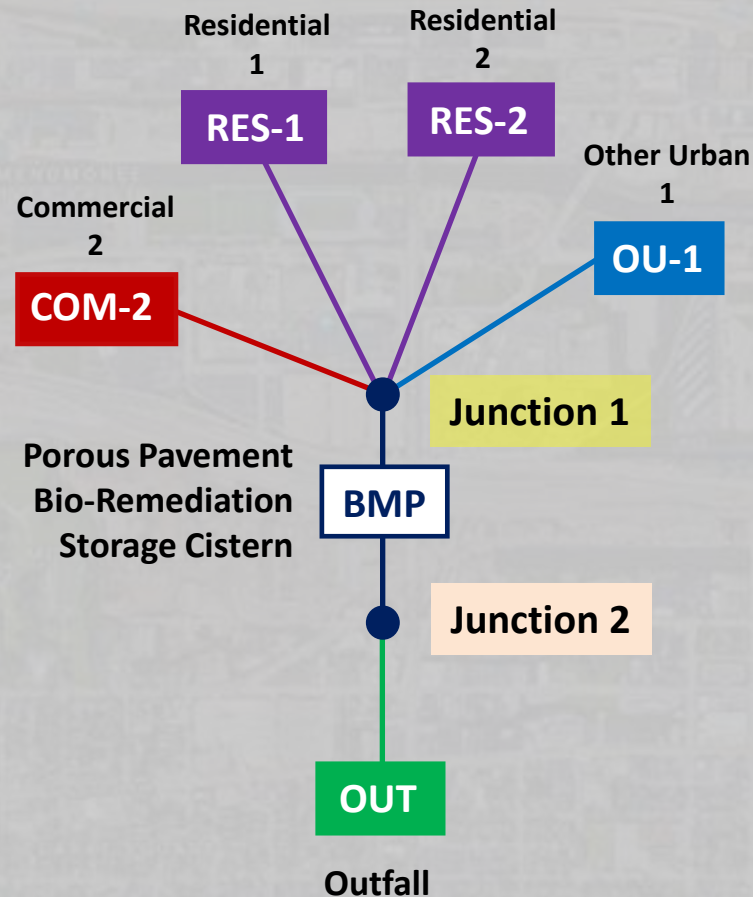
- Pollutant Source
- Pollutant Load (lbs/cf)

## Stormwater and Pollutant Quantity

- Rainfall Volume
- Runoff Coefficient
- **Stormwater Runoff Volume (cf)**
- Pollutant Load (lbs)

**Baseline  
Pollutant  
Concentration  
(lbs/cf)**

# Source Load and Management Model



## Land Use

- Pollutant Source
- Pollutant Load (lbs/cf)

## Stormwater and Pollutant Quantity

- Rainfall Volume
- Runoff Coefficient
- **Stormwater Runoff Volume (cf)**
- Pollutant Load (lbs)

**Baseline  
Pollutant  
Concentration  
(lbs/cf)**

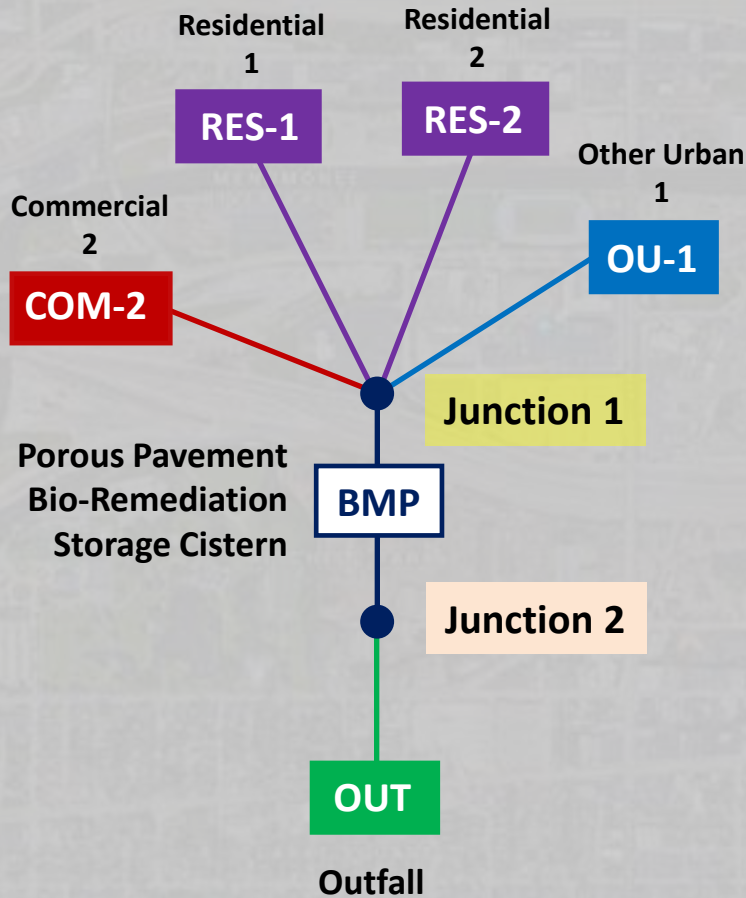
## Pollutant Treatment

- Gallery Media
- Underdrain
- Infiltration (cf)
- **Stormwater Pass-Through Volume (cf)**
- Pollutant Load (lbs) at Outfall



# Source Load and Management Model

Permeable Pavement | UD@Bottom | Subgrade Seepage = 0.04 in/hr



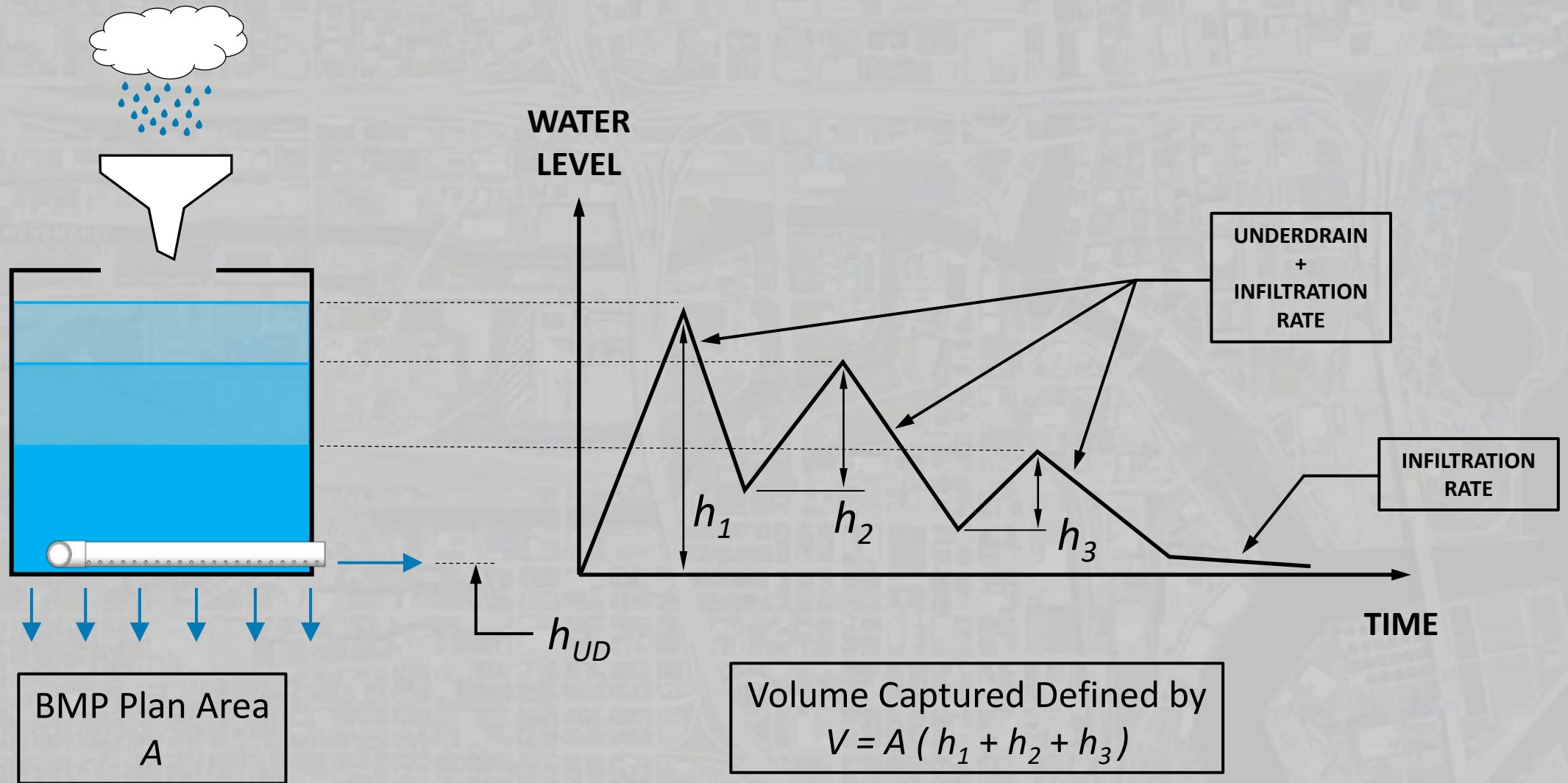
## WinSLAMM Output Summary

	Runoff Volume (cu ft)	Percent Runoff Volume Reduction	Particulate Solids Conc. (mg/L)	Particulate Solids Yield (lbs)	Percent Particulate Solids Reduction			
Total of all Land Uses without Controls:	113630	-	106.4	754.8	-			
Outfall Total with Controls:	107304	5.57%	31.44	210.6	72.10%			
Annualized Total After Outfall Controls:	110952			217.8				
Pollutant	Concentration - No Controls	Concentration - With Controls	Conc. Units	Pollutant Yield No Controls	Pollutant Yield With Controls	Pol. Yield Units	Yield	Percent Reduction
Particulate Solids	106.4	31.44	mg/L	754.8	210.6	lbs	72.10 %	
Filterable Solids	64.24	64.24	mg/L	455.7	430.3	lbs	5.57 %	
Total Solids	170.6	95.68	mg/L	1210	640.9	lbs	47.05 %	
Particulate Phosphorus	0.3019	0.09285	mg/L	2.141	0.6220	lbs	70.95 %	
Filterable Phosphorus	0.1219	0.1219	mg/L	0.8650	0.8163	lbs	5.63 %	
Total Phosphorus	0.4238	0.2147	mg/L	3.006	1.438	lbs	52.16 %	

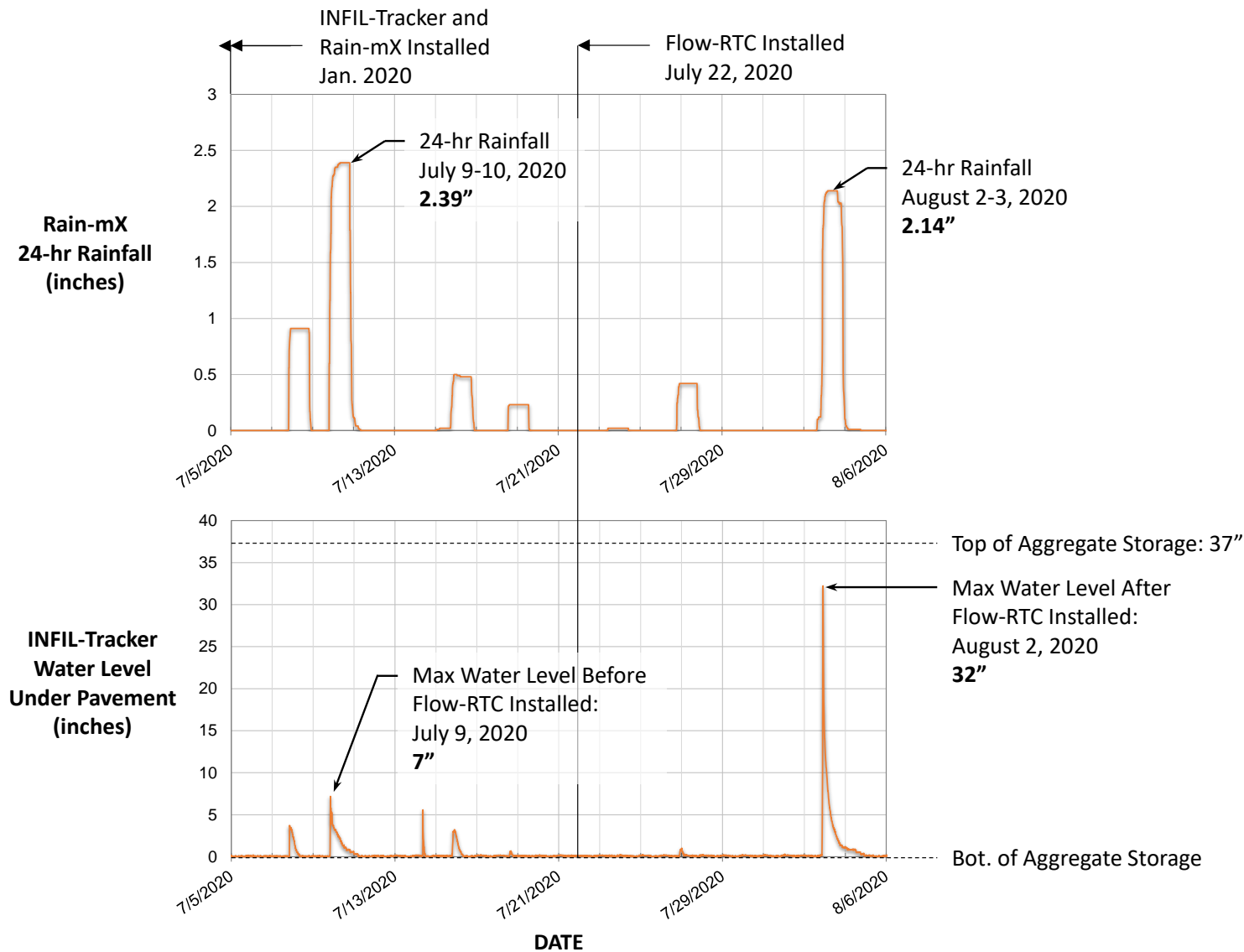
Permeable Pavement | UD@Bottom | Subgrade Seepage = 2.5 in/hr

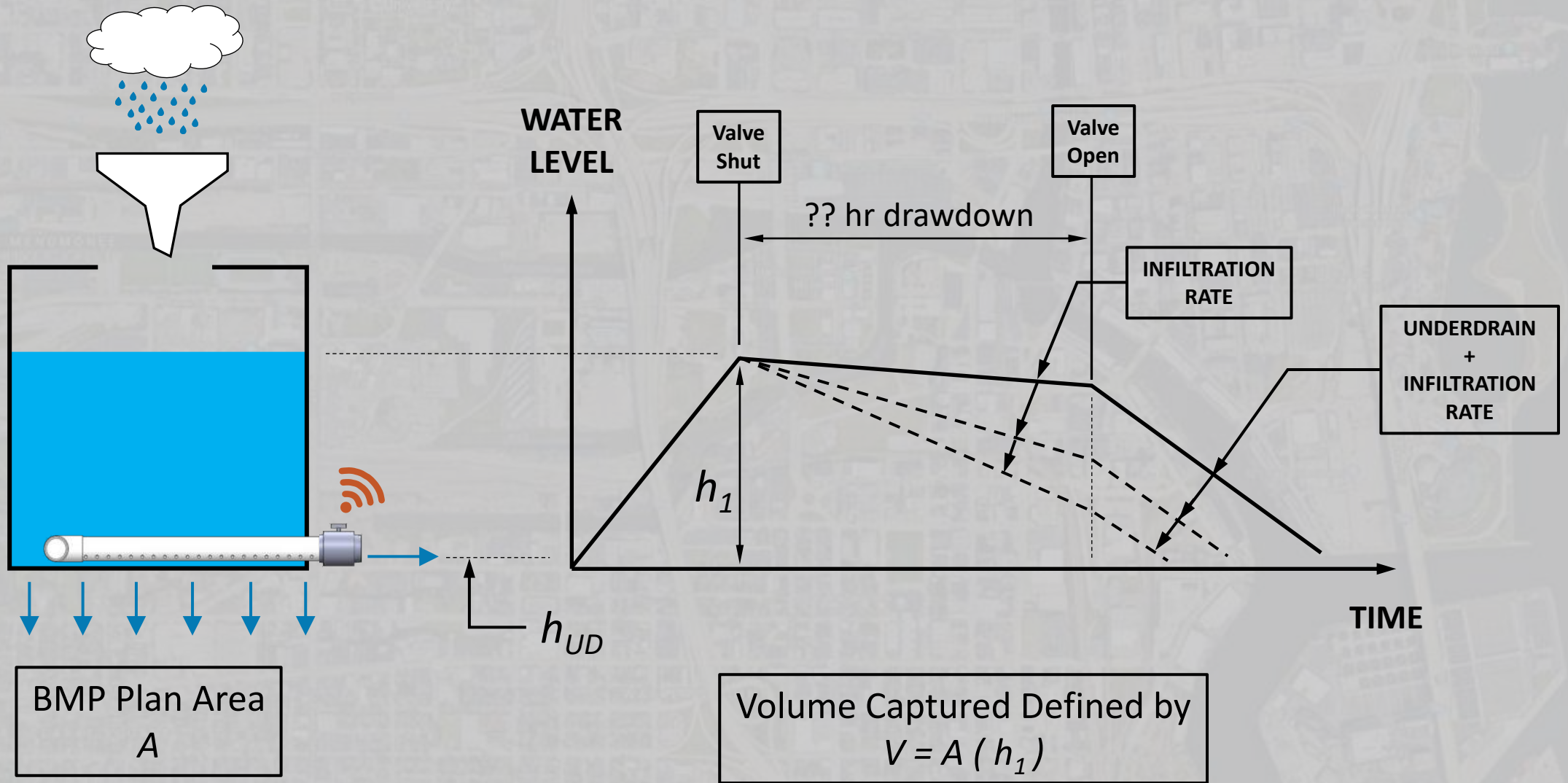
## WinSLAMM Output Summary

	Runoff Volume (cu ft)	Percent Runoff Volume Reduction	Particulate Solids Conc. (mg/L)	Particulate Solids Yield (lbs)	Percent Particulate Solids Reduction			
Total of all Land Uses without Controls:	113630	-	106.4	754.8	-			
Outfall Total with Controls:	27878	75.47%	32.26	56.14	92.56%			
Annualized Total After Outfall Controls:	28825			58.05				
Pollutant	Concentration - No Controls	Concentration - With Controls	Conc. Units	Pollutant Yield No Controls	Pollutant Yield With Controls	Pol. Yield Unit	Yield	Percent Reduction
Particulate Solids	106.4	32.26	mg/L	754.8	56.14	lbs	92.56 %	
Filterable Solids	64.24	65.07	mg/L	455.7	113.3	lbs	75.15 %	
Total Solids	170.6	97.33	mg/L	1210	169.4	lbs	86.01 %	
Particulate Phosphorus	0.3019	0.09589	mg/L	2.141	0.1669	lbs	92.21 %	
Filterable Phosphorus	0.1219	0.1256	mg/L	0.8650	0.2185	lbs	74.74 %	
Total Phosphorus	0.4238	0.2214	mg/L	3.006	0.3854	lbs	87.18 %	



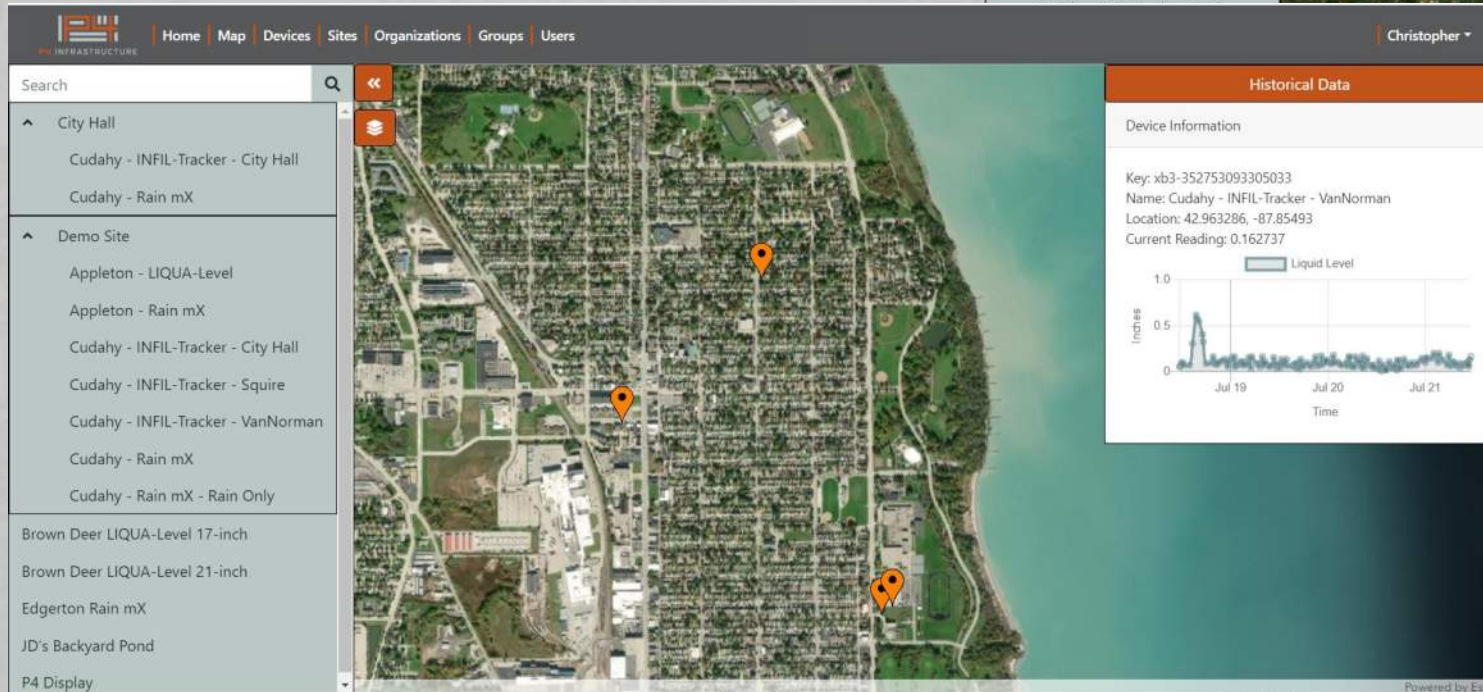
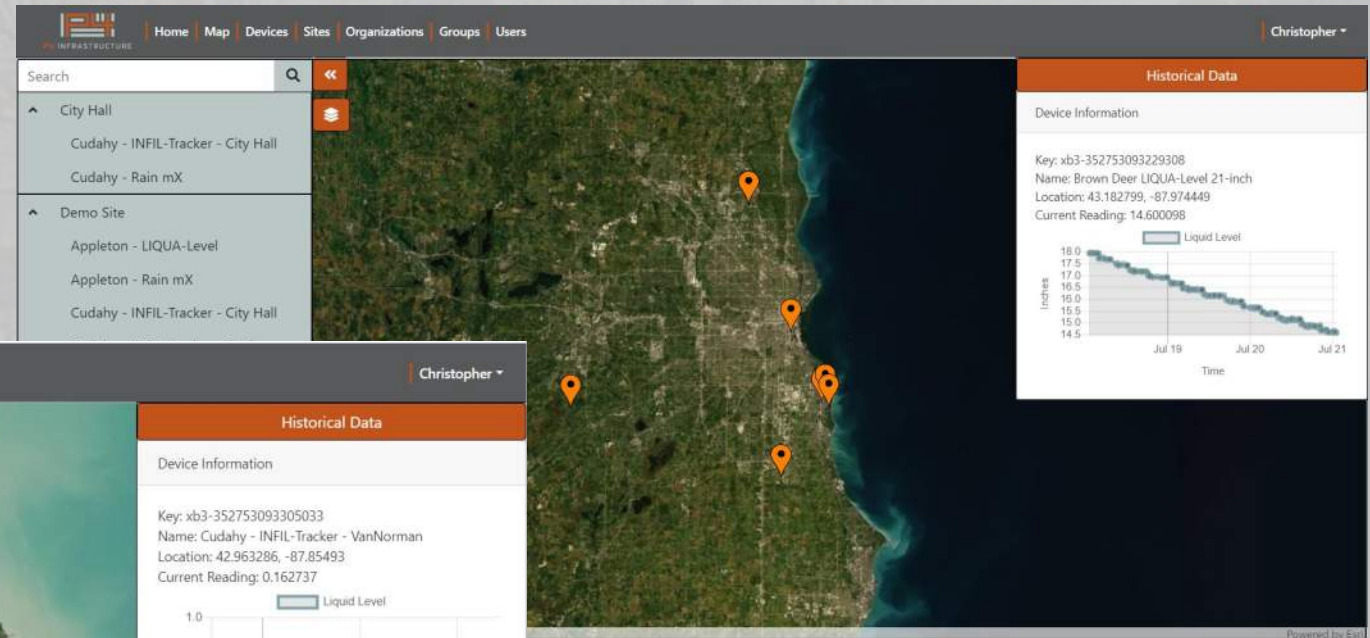






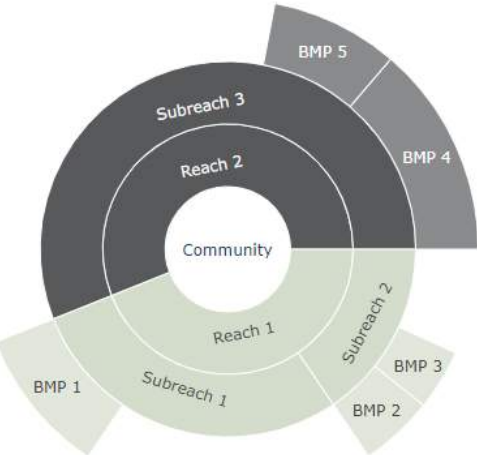


# Dashboard ERSI/ArcGIS

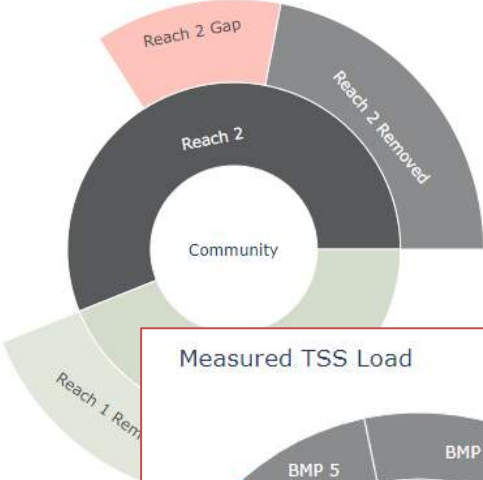


# BMP Management

Measured TSS Load



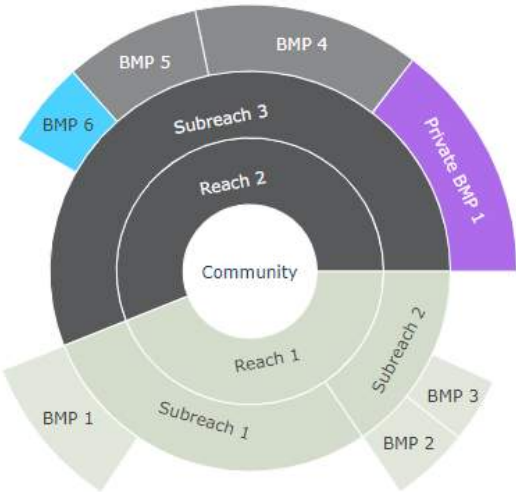
Measured TSS Gap



Measured TSS Cost Summary

TOGGLE COLUMNS			
Label	Type		Effective Cost
Reach 1 Gap	Gap		\$8,788
Reach 1 Removed	Value		\$24,220
Reach 2 Gap	Gap		\$16,087
Reach 2 Removed	Value		\$29,229

Measured TSS Load



Measured TSS Gap



Measured TSS Cost Summary

TOGGLE COLUMNS			
Label	Type		Effective Cost
Reach 1 Gap	Gap		\$8,788
Reach 1 Removed	Value		\$24,220
Reach 2 Credit	Credit		\$10,218
Reach 2 Removed	Value		\$45,316





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*Revolutionizing  
the way we address  
civil infrastructure*