

Local Urban Stormwater Monitoring: Results and Implications for Future Management



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Topics

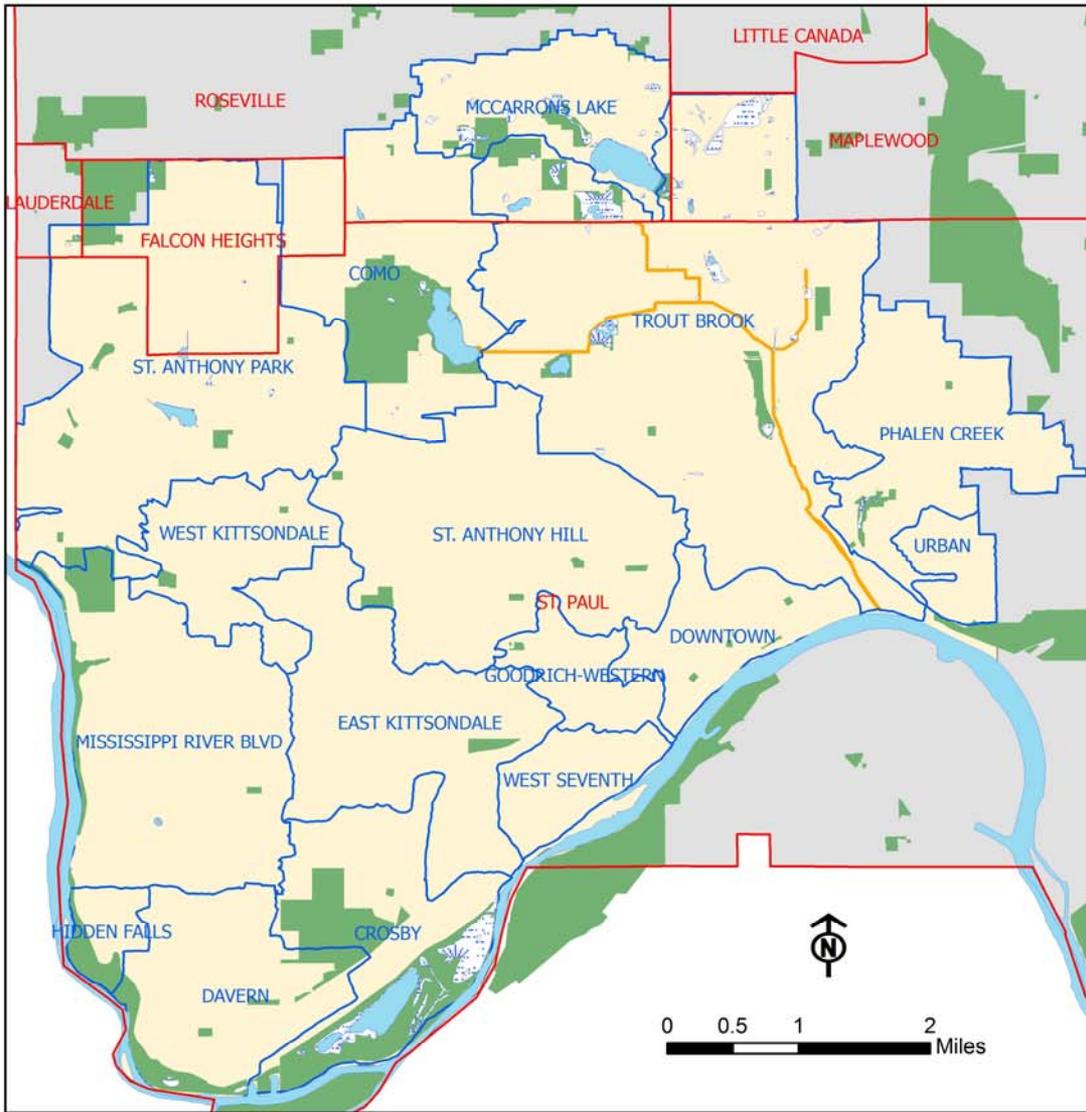
- CRWD Background
- Stormwater Monitoring Methods
- Data Analysis
- Baseline Stormwater Monitoring Results
 - Water Quantity
 - Nutrients and Solids
 - Metals
- Comparison to standards, receiving waters and National averages
- Conclusions

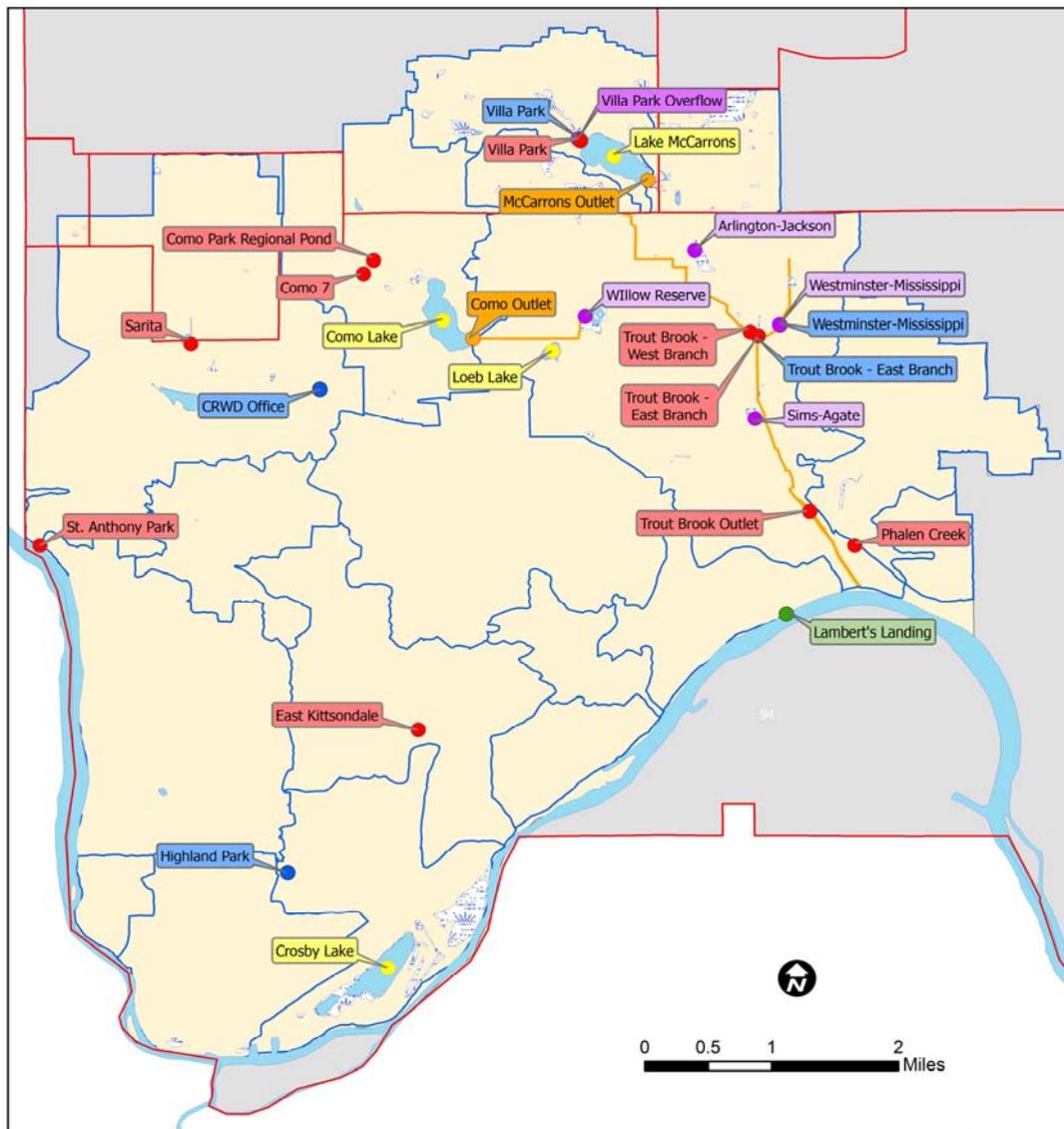


Background

- CRWD is entirely urbanized – 42% impervious surface
- All surface streams have been diverted to underground storm pipes
- Pipes ultimately empty into Mississippi River







Legend

- Capitol Region Watershed District
- Cities
- Subwatershed Boundary
- Water
- Wetlands

- Trout Brook Storm Sewer
- Mississippi River Reference Site

Monitoring Site Type

- Full Water Quality
- Lake
- Flow Only
- Level Only
- Precipitation

Baseline Stormwater Monitoring

To characterize the water resources of the District:

Need to collect baseline data on stormwater across the district

- CRWD monitoring program began in 2005
- Major subwatersheds monitored at outlets to the Mississippi River
- Monitoring coverage ~60% of District



Data Collection

- Continuous level, velocity and discharge
 - Measurements recorded every 10 minutes
- Water quality samples collected for storms (about 18 events/year)
- At least 10 base composite water quality samples/year
- Determine pollutant loads for major sub-watersheds & BMPs



Data Analysis

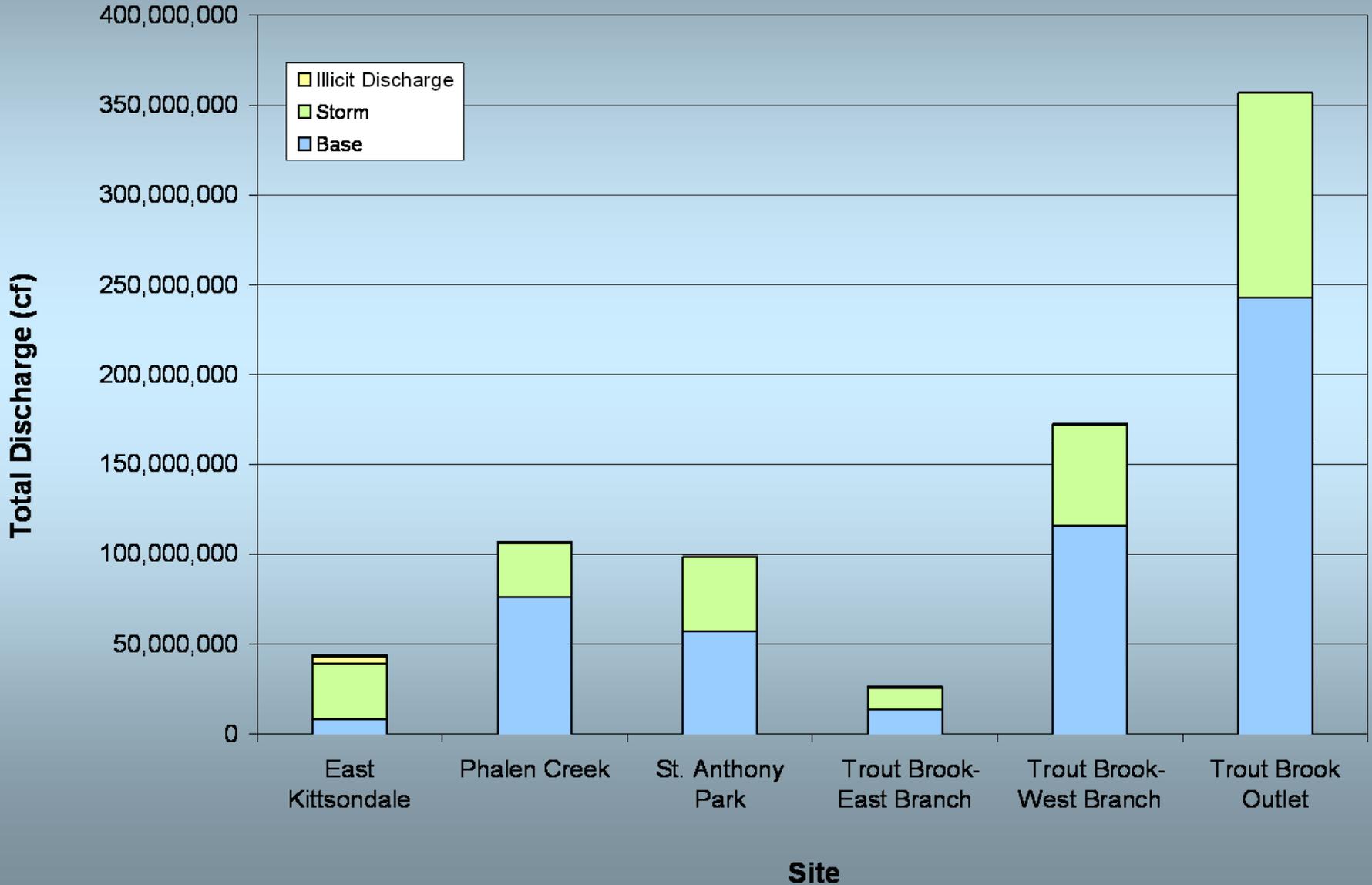
- Determined base, storm, and total **flow**
- Calculated total phosphorus (TP) and total suspended solids (TSS) **loads** (lbs)
- Calculated **yields**: TP and TSS (lbs/acre) per inch runoff
- Calculated metals toxicity (a function of hardness)
- Calculated flow-weighted concentrations of TP, TSS (mg/L)



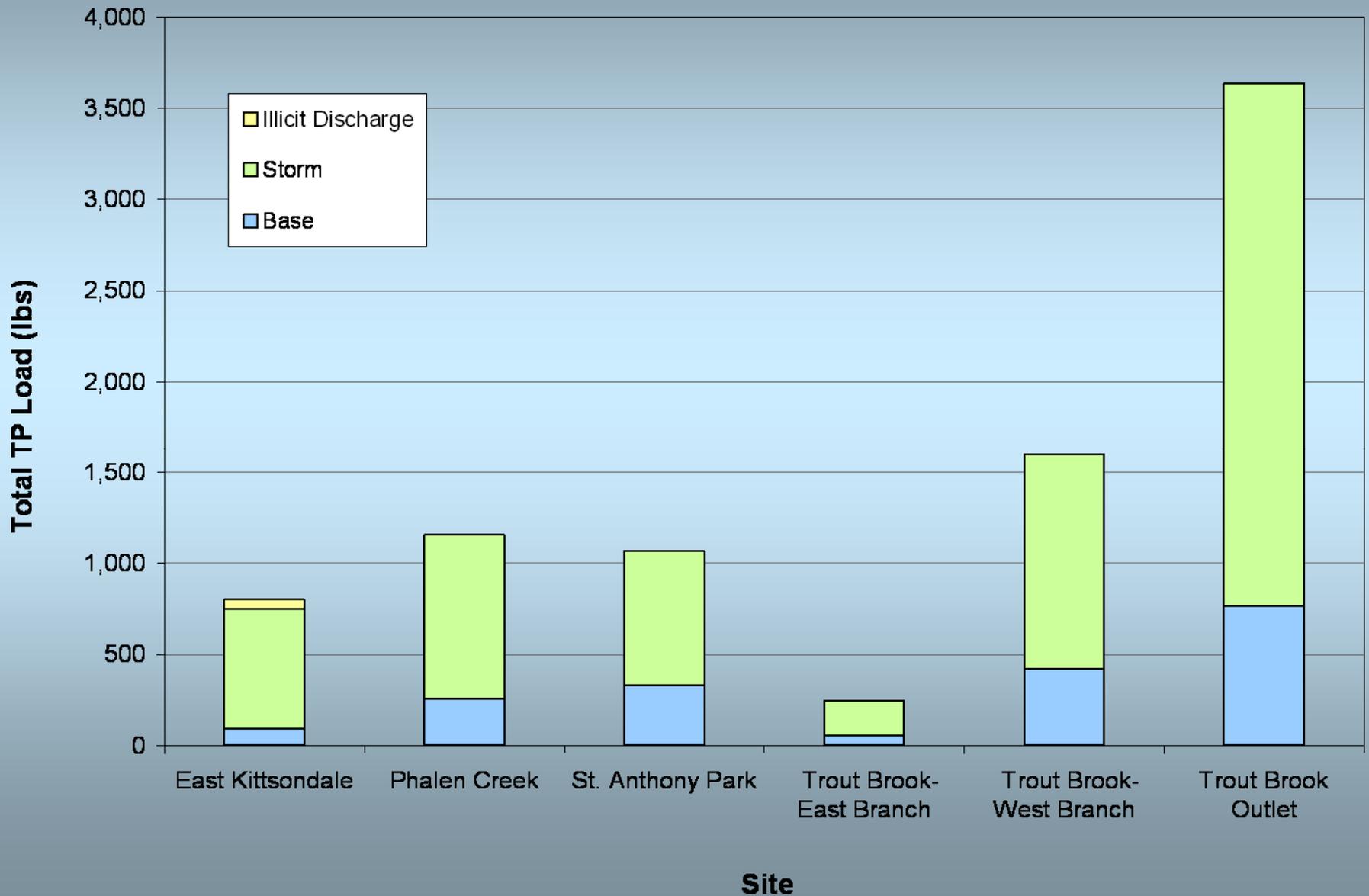
Results: Baseline Site Monitoring



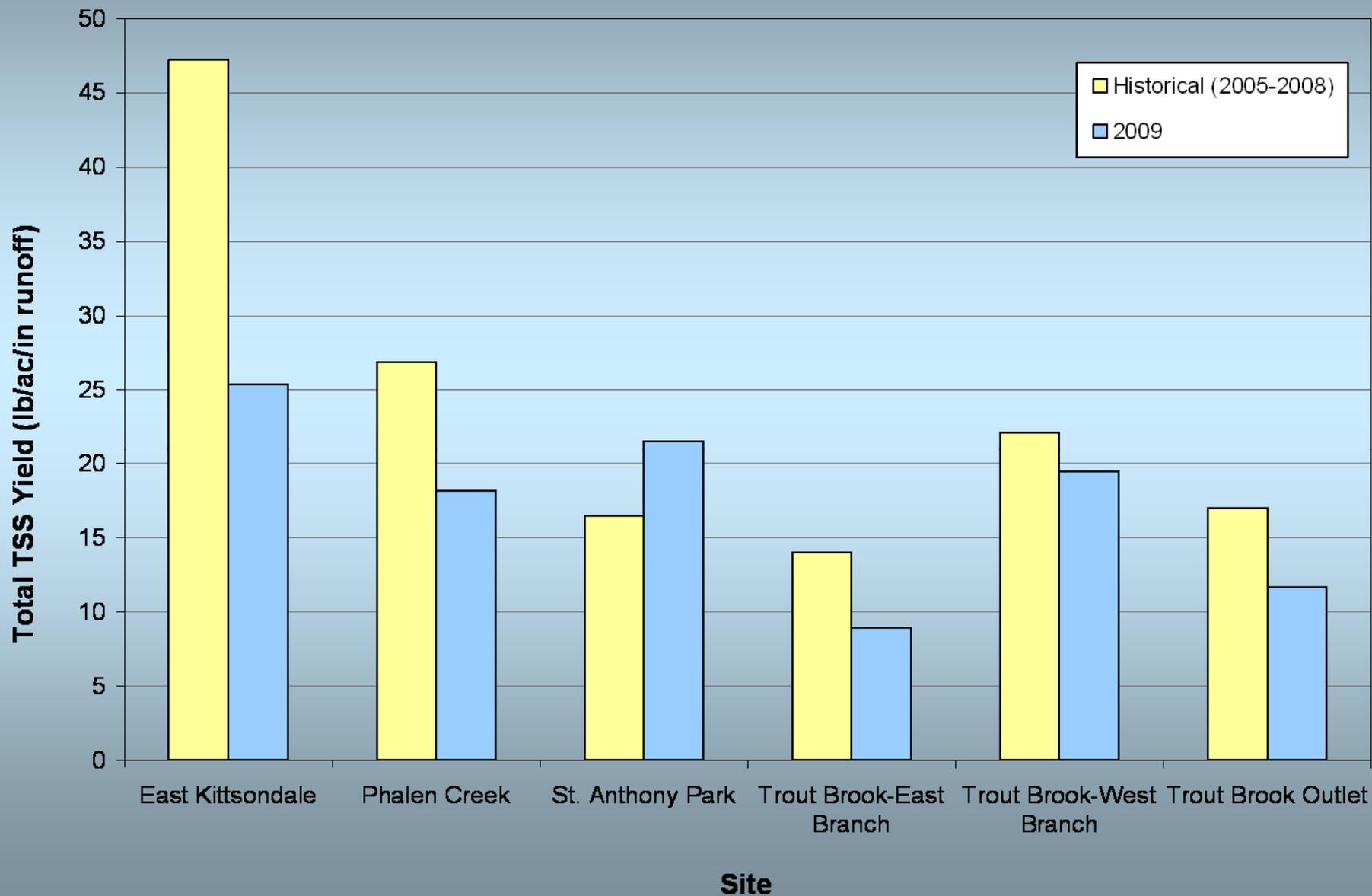
Total Recorded Discharge, 2009.



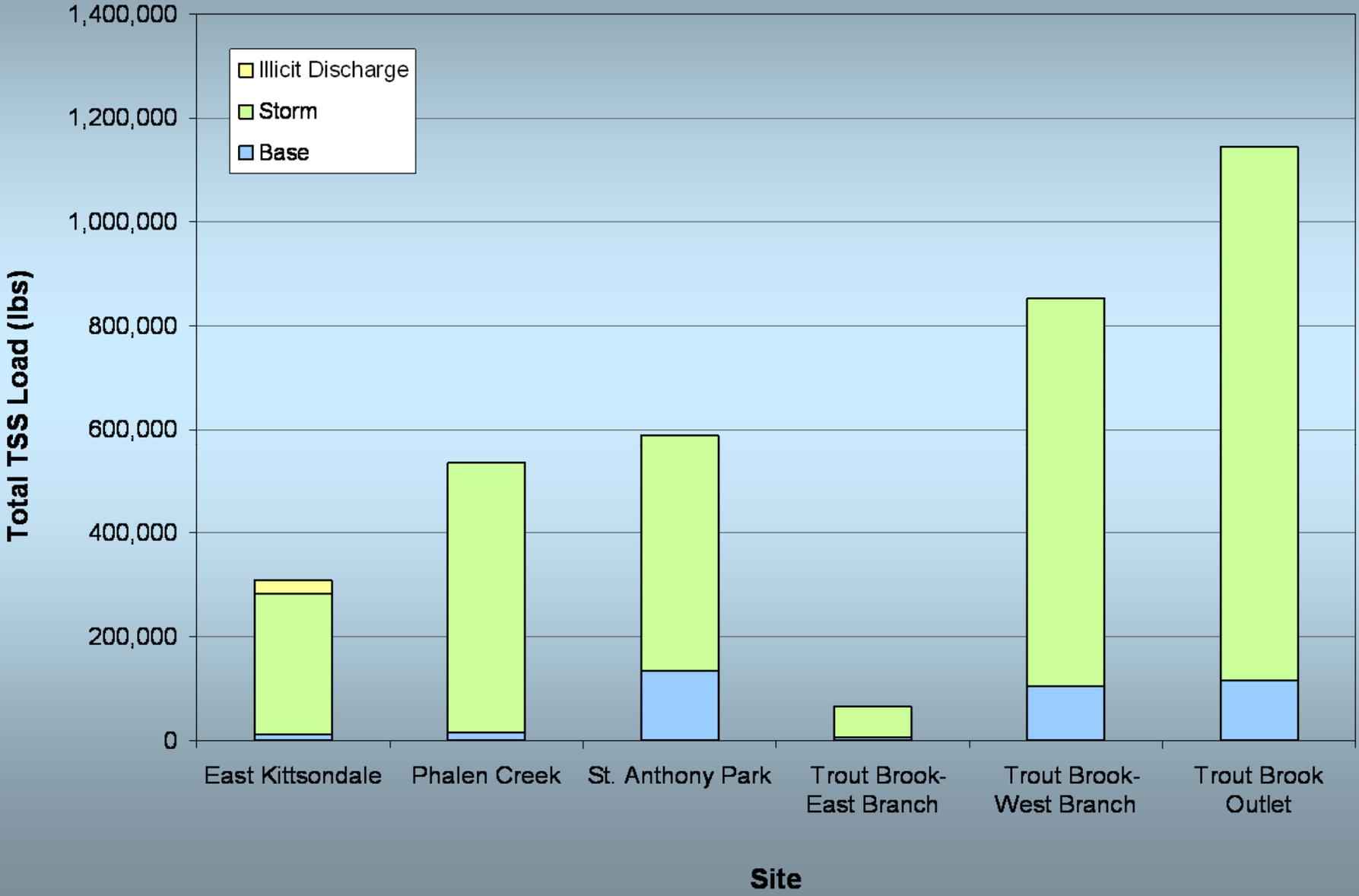
Total TP Loading, 2009.



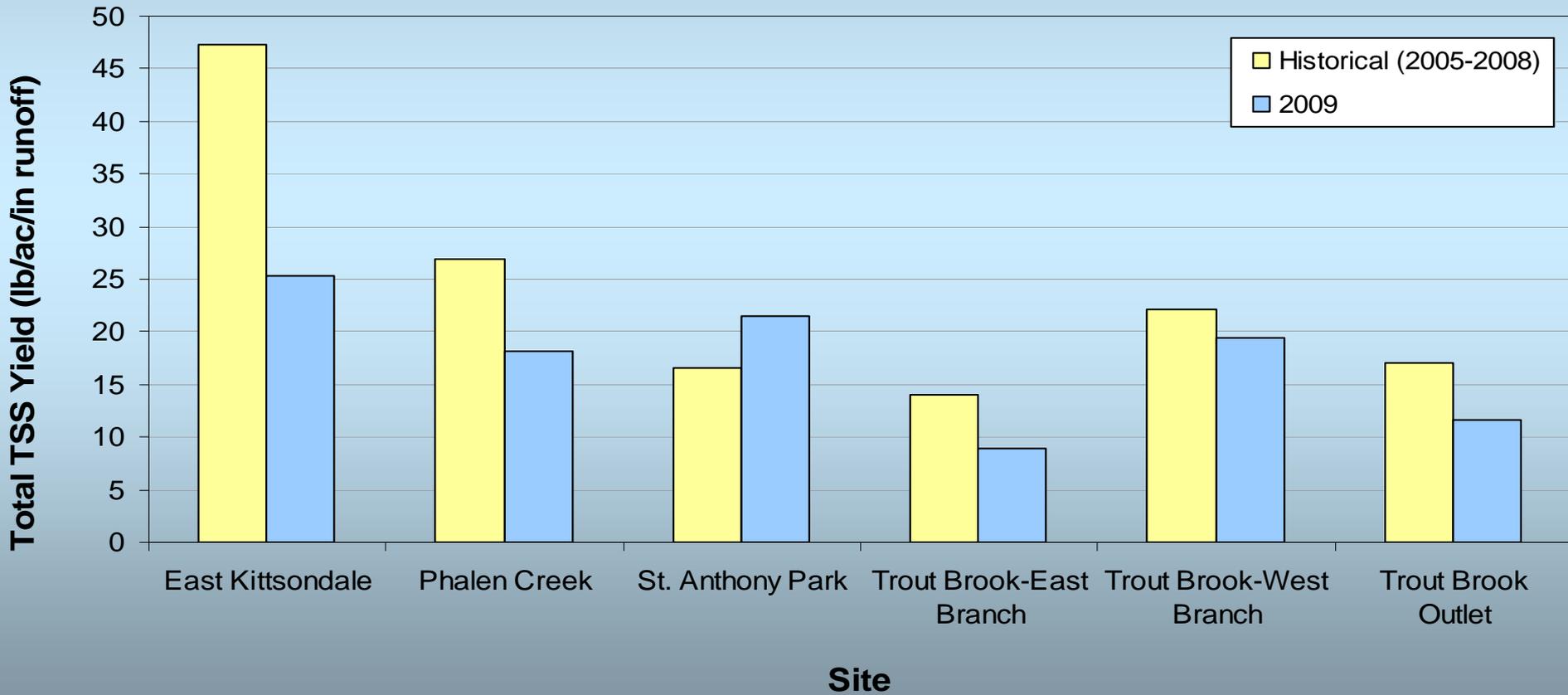
Normalized TP Yield, 2005-2009.



Total TSS Loading, 2009.



Normalized TSS Yield, 2005-2009.



Results Compared to:

- Agency standards & guidelines for **surface water**
 - MPCA, EPA
- Average value for minimally impacted streams in the North Central Hardwood Forests ecoregion
 - **For TP and TSS** only
- Mississippi River concentrations
 - Lamberts Landing – downstream
- National averages for stormwater



	Standard (mg/L)	Metropolitan Council Site	2009 CRWD Monitoring Sites			
		Lamberts Landing	East Kittsondale	Phalen Creek	St. Anthony Park	Trout Brook Outlet
TP ^a	0.13	0.09	0.29	0.30	0.27	0.28
TSS ^a	14	25	100	186	138	104
Ammonia ^b	0.04	0.05	0.21	0.06	0.18	0.14
TKN ^c	0.65	0.96	2.59	1.91	1.42	1.71
Nitrate ^c	NA	1.30	0.51	0.91	0.35	0.49
Nitrite ^c	1.00	0.03	0.05	0.04	0.03	0.04
Cadmium ^e		0.0005	0.0005	0.0005	0.0007	0.0006
Chromium ^e		0.0050	0.0083	0.0078	0.0077	0.0066
Lead ^e		0.0006	0.0204	0.0252	0.0171	0.0145
Zinc ^e		0.0056	0.0884	0.0861	0.0941	0.0537
Nickel ^e		0.0033	0.0061	0.0056	0.0101	0.0046
Copper ^e		0.0018	0.0217	0.0168	0.0183	0.0127
Chloride ^b	230	28	227	66	57	67

All units in mg/L

Yellow = exceeds the standard

Red = exceeds Lambert's Landing and the standard

Metals

Parameter	Average	Lambert's Landing	East Kittsondale	Phalen Creek	St. Anthony Park	Trout Brook - East Branch	Trout Brook - West Branch	Trout Brook Outlet
Cadmium	Base		0.0005	0.0005	0.0009	0.0005	0.0005	0.0005
	Illicit Discharge		0.0005	NA	NA	NA	NA	NA
	Storm		0.0006	0.0005	0.0006	0.0005	0.0005	0.0006
	Yearly	0.0002	0.0005	0.0005	0.0007	0.0005	0.0005	0.0006
Chromium	Base		0.0052	0.0053	0.0053	0.0053	0.0057	0.0053
	Illicit Discharge		0.0075	NA	NA	NA	NA	NA
	Storm		0.0116	0.0100	0.0093	0.0061	0.0073	0.0076
	Yearly	0.0015	0.0083	0.0078	0.0077	0.0057	0.0065	0.0066
Copper	Base		0.0060	0.0017	0.0036	0.0034	0.0037	0.0026
	Illicit Discharge		0.0187	NA	NA	NA	NA	NA
	Storm		0.0383	0.0301	0.0278	0.0114	0.0196	0.0197
	Yearly	0.0025	0.0217	0.0168	0.0183	0.0072	0.0125	0.0127
Lead	Base		0.0014	0.0007	0.0013	0.0012	0.0023	0.0009
	Illicit Discharge		0.0165	NA	NA	NA	NA	NA
	Storm		0.0405	0.0470	0.0272	0.0074	0.0232	0.0240
	Yearly	0.0011	0.0204	0.0252	0.0171	0.0042	0.0139	0.0145
Nickel	Base		0.0055	0.0037	0.0075	0.0057	0.0027	0.0034
	Illicit Discharge		0.0058	NA	NA	NA	NA	NA
	Storm		0.0067	0.0072	0.0119	0.0033	0.0054	0.0053
	Yearly	0.0037	0.0061	0.0056	0.0101	0.0046	0.0042	0.0046
Zinc	Base		0.0134	0.0108	0.0131	0.0113	0.0112	0.0104
	Illicit Discharge		0.0790	NA	NA	NA	NA	NA
	Storm		0.1661	0.1531	0.1459	0.0400	0.0818	0.0839
	Yearly	0.0095	0.0884	0.0861	0.0941	0.0249	0.0504	0.0537

Comparison to NSQD Median Stormwater Concentrations

Parameters	NSQD - Mixed Residential	East Kittsondale	Phalen Creek	St. Anthony Park	Trout Brook - East Branch	Trout Brook - West Branch	Trout Brook Outlet
Area (acre)	151	1,116	1,433	3,418	932	2,379	5,028
% Impervious	45	46	50	48			37
<i>Escherichia coli</i> (mpn/100mL)	1,050	14,500	12,000	12,100	18,650	16,050	17,100
Total Suspended Solids (mg/L)	66	121	135	148	38	194	142
Total Phosphorous (mg/L)	0.28	0.32	0.42	0.29	0.24	0.36	0.32
Ammonia (mg/L)	0.39	0.02	0.02	0.03	0.06	0.06	0.04
Nitrate+Nitrite (mg/L)	0.57	0.18	0.14	0.27	0.28	0.29	0.31
Total Kjeldahl Nitrogen (mg/L)	1.40	2.20	2.50	1.70	1.20	1.75	1.65
Cadmium (mg/L)	0.0009	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Chromium (mg/L)	0.0070	0.0088	0.0080	0.0092	0.0050	0.0058	0.0065
Copper (mg/L)	0.0160	0.0297	0.0239	0.0264	0.0098	0.0153	0.0159
Lead (mg/L)	0.0160	0.0323	0.0303	0.0229	0.0047	0.0164	0.0162
Nickel (mg/L)	0.0078	0.0052	0.0056	0.0104	0.0028	0.0044	0.0048
Zinc (mg/L)	0.0950	0.1360	0.1305	0.1340	0.0303	0.0662	0.0769

All units in mg/L

Red = greater than NSQD value

Data Summary

- In 2009, Normalized TP and TSS yields were generally lower than previous years
- CRWD sites are generally more concentrated than the Mississippi River in nutrients, solids, and metals
- Sites with highest flows have highest loads, even if water relatively clean

Data Summary, cont.

- Lead and copper concentrations high in CRWD storm water
- TP concentrations comparable or lower than national average, TSS higher than national average





The Importance of Volume Reduction

- Pollutant loading is directly related to amount of flow
- Example: Trout Brook Outlet
 - Lower pollutant concentrations but high flow, so **total loading is high.**
- Reducing the volume of stormwater, even if not highly concentrated, will reduce the total amount of pollutants entering water bodies

Conclusions

- Comparison to NSQD data helps us to **focus** on reduction of pollutants that are higher in concentration than average for other urban watersheds.
- The history of baseline data will help us to understand trends within the watershed and how to best implement water resource improvements.



Questions?



Contact us:

<http://www.capitolregionwd.org>



Capitol Region Watershed District