

# Storm Drain and Combined Sewer Overflow Source Evaluations in the Duwamish Waterway Drainage Basin

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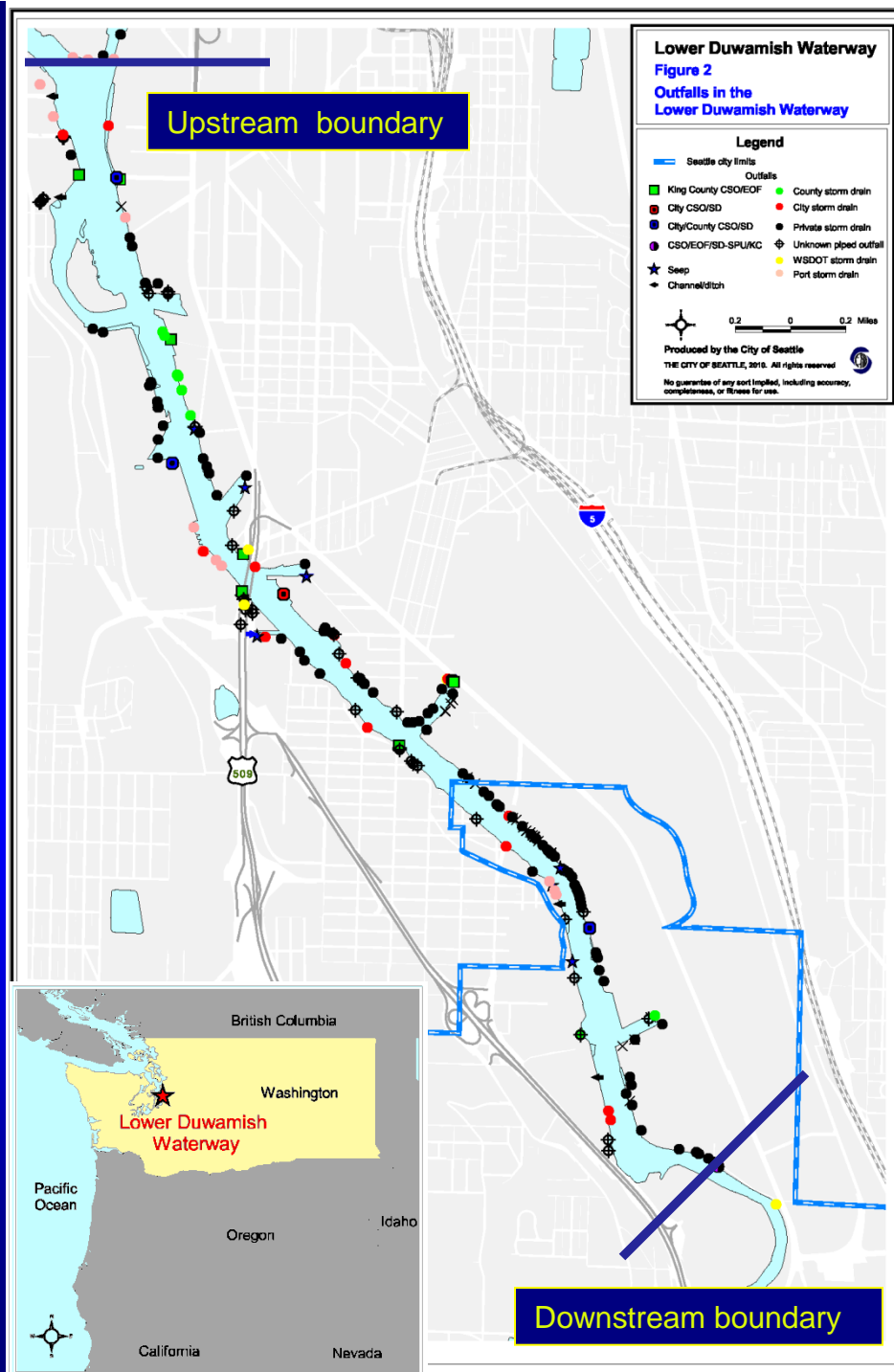
# Introduction

- KC and City of Seattle members of Source Control Work Group for LDW Superfund Site
- KC, Seattle, and others collecting data on source inputs to the LDW to aid in cleanup of the LDW
- This presentation focuses on CSO effluent and storm drain solids data



# General Waterway Characteristics

Length of waterway (miles)	5
Receiving water	Stratified salt wedge, tidal estuary
Annual mean flow (cfs)	2,000
Upstream basin (sq. miles)	450
Contaminants of concern	PCBs, Arsenic, PAHs, dioxins, phthalates, other metals
Outfalls	212



# Contributing Areas

## Drainage Basin

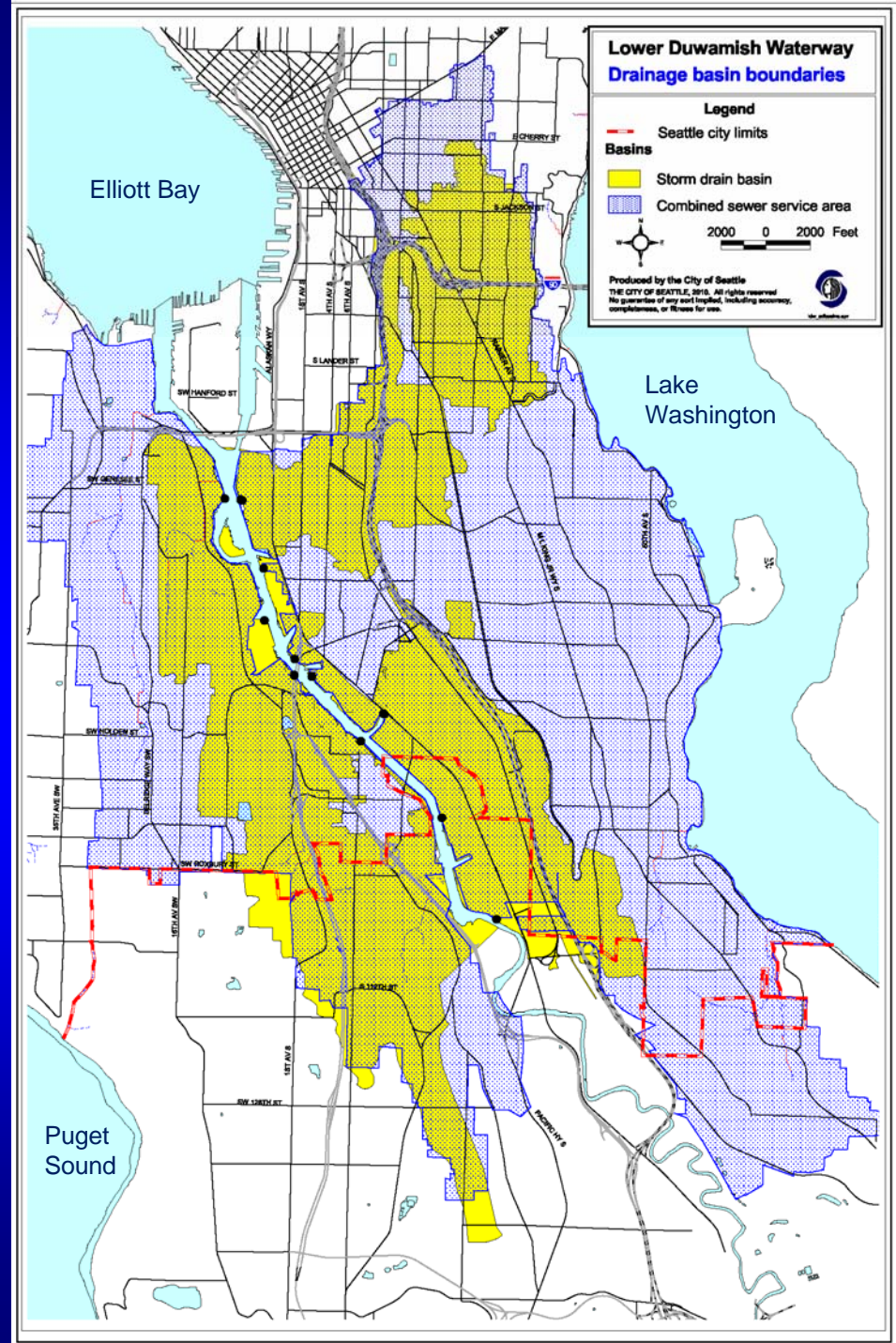
- 8,900 acres (14 sq. mi.)
- 199 outfalls
  - 49 Public storm drains
  - 111 Private storm drains
  - 39 Unknown
- ~ 4,000 mgy; 1,150 MT/yr solids

## Combined Sewer Service Area

- 20,000 acres (31 sq. mi.)
- 9 CSOs
- 4 Emergency overflows (pump stations)
- ~ 75 mgy; 35 MT/yr solids

## Upstream Basin

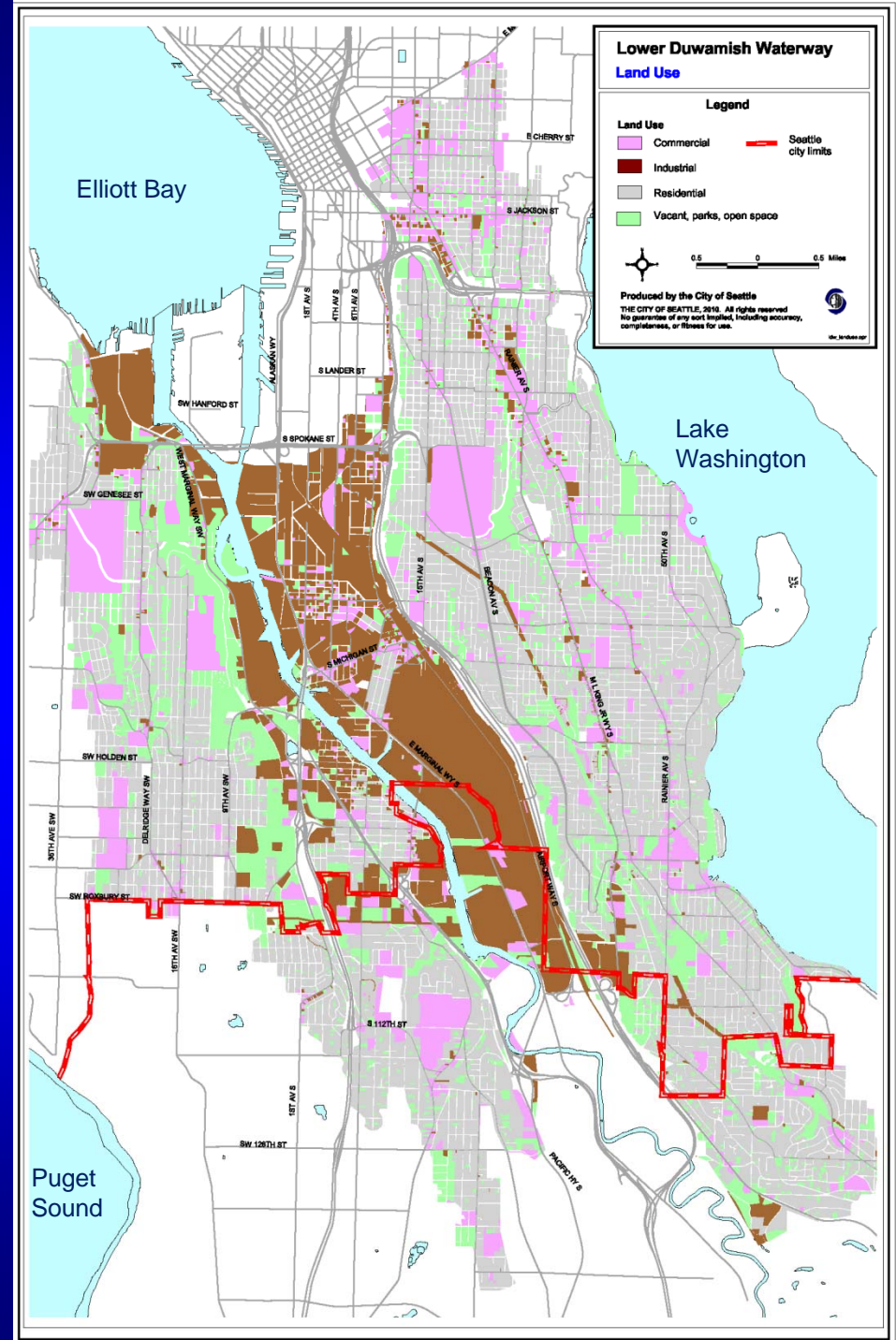
- 207,000 MT/yr solids



# Lower Duwamish Source Area: Land Use

## Land Use (%)

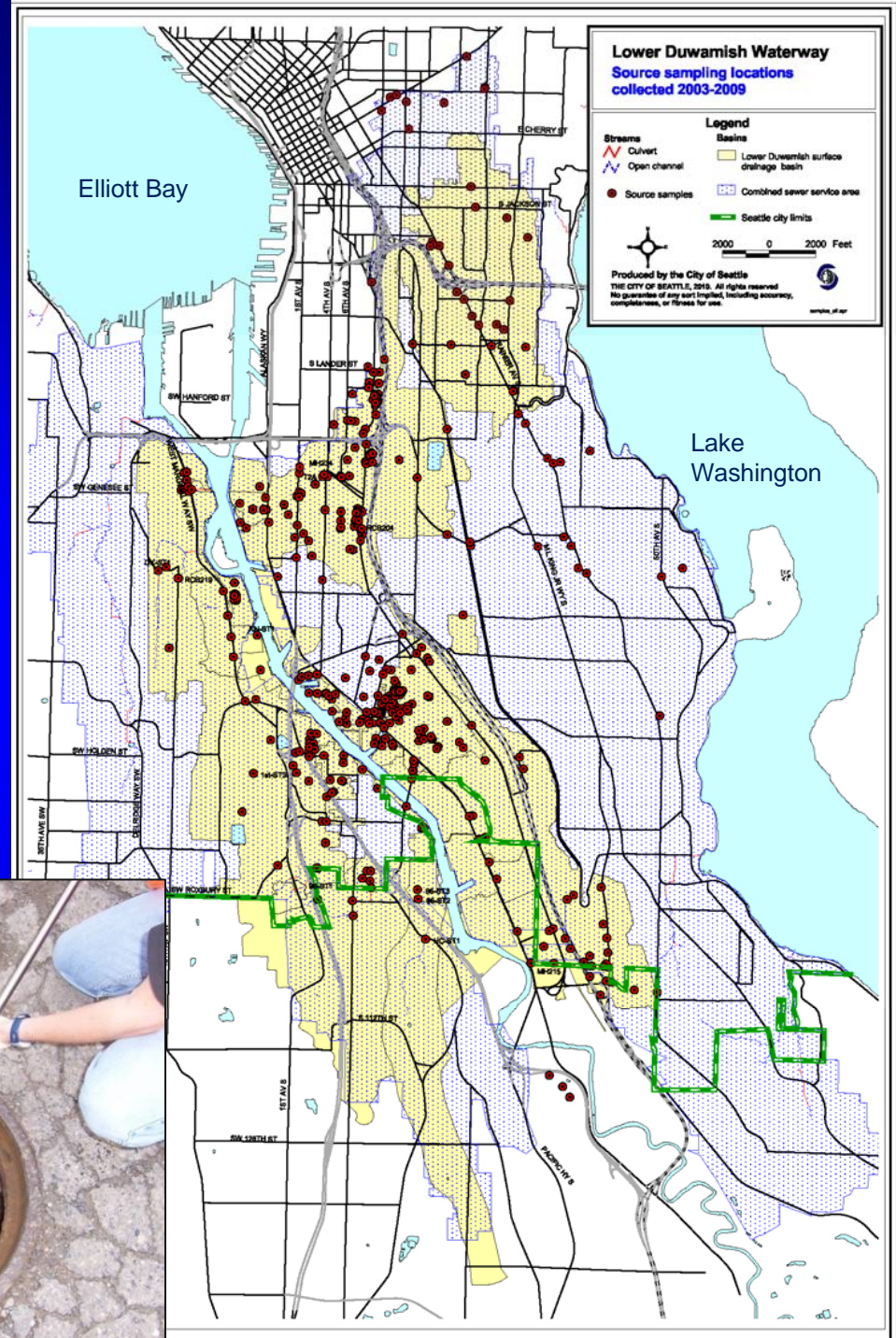
Industrial	18
Commercial	11
Residential	36
Right-of-way (road, RR, Hwy)	18
Open, park, undeveloped	17



# Source Control Efforts: Storm Drain Solids

Collected throughout Duwamish basin

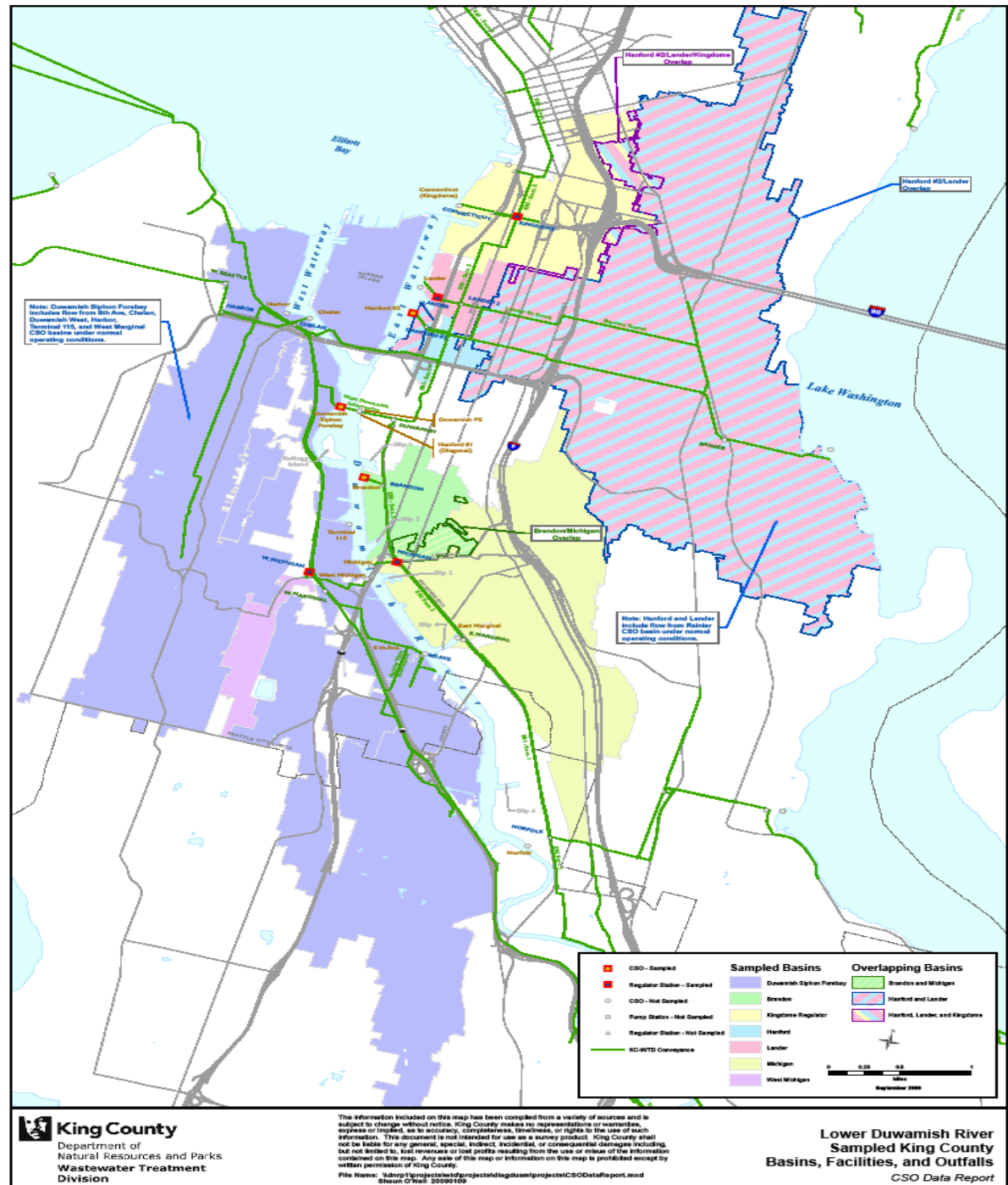
- Catch basin sediment grabs (on-site and right-of-way)
- In-line sediment grabs
- In-line sediment traps



# Source Control Efforts: CSO Samples

## Duwamish Basin

- Michigan Street Regulator
- Brandon CSO
- West Michigan Regulator
- Duwamish Siphon, Forbay
- Hanford #2 CSO
- Lander II Regulator
- Kingdome Regulator



# CSO and Storm Drain Solid Samples

Analyzed for

- PCBs
- SVOCs including PAHs and phthalates
- Metals (As, Cu, Pb, Hg, Zn)
- Organic carbon
- Total solids and grain size (storm drains only)
- Total suspended solids/nutrients (CSO only)



# CSO and Storm Drain Solid Samples

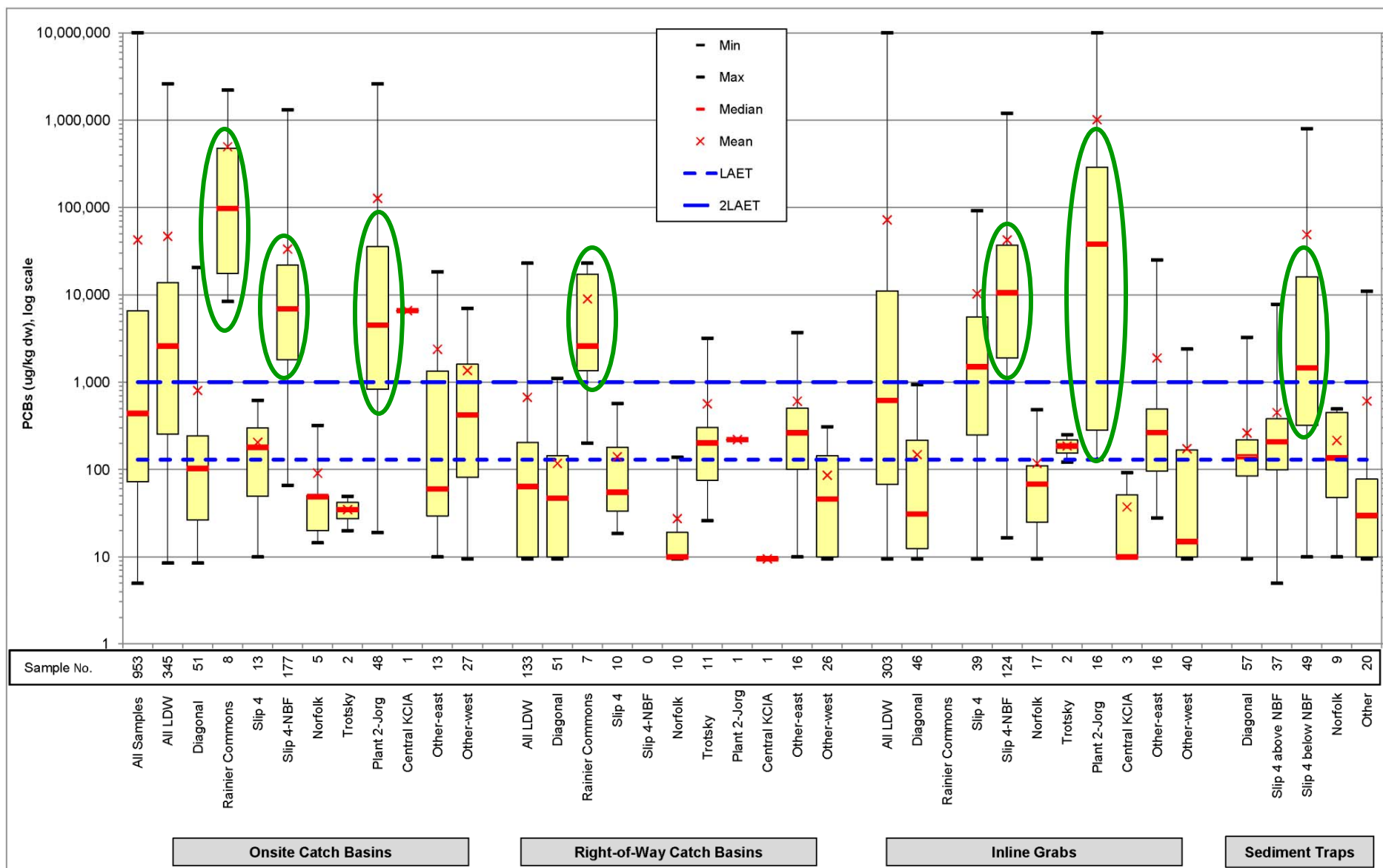
- CSO Samples Collected
  - Sept 2007 through January 2010
  - 42 whole water samples
- Storm Drain Samples Collected
  - March 2003 through June 2009
  - ~ 950 solid samples for PCBs
  - ~ 540 solid samples for SVOCs, metals and mercury

# Storm Drain Solid Samples

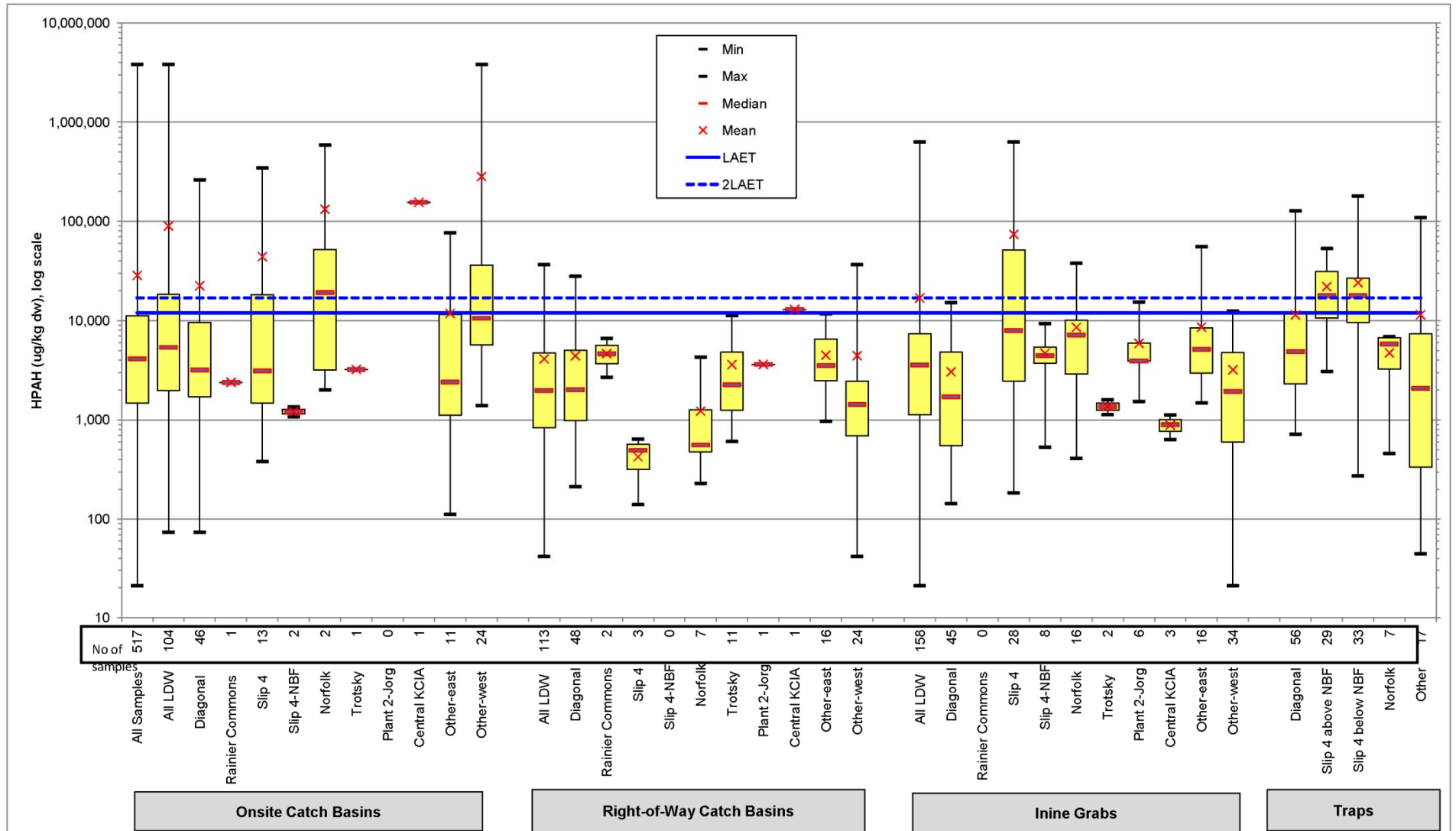
Numbers and types of storm drain samples

	Total PCBs	Arsenic	PAHs
Onsite catch basins	345	137	114
Right-of-way catch basins	133	123	121
Inline grab samples	303	175	166
Sediment trap samples	172	141	142
Total	953	576	543

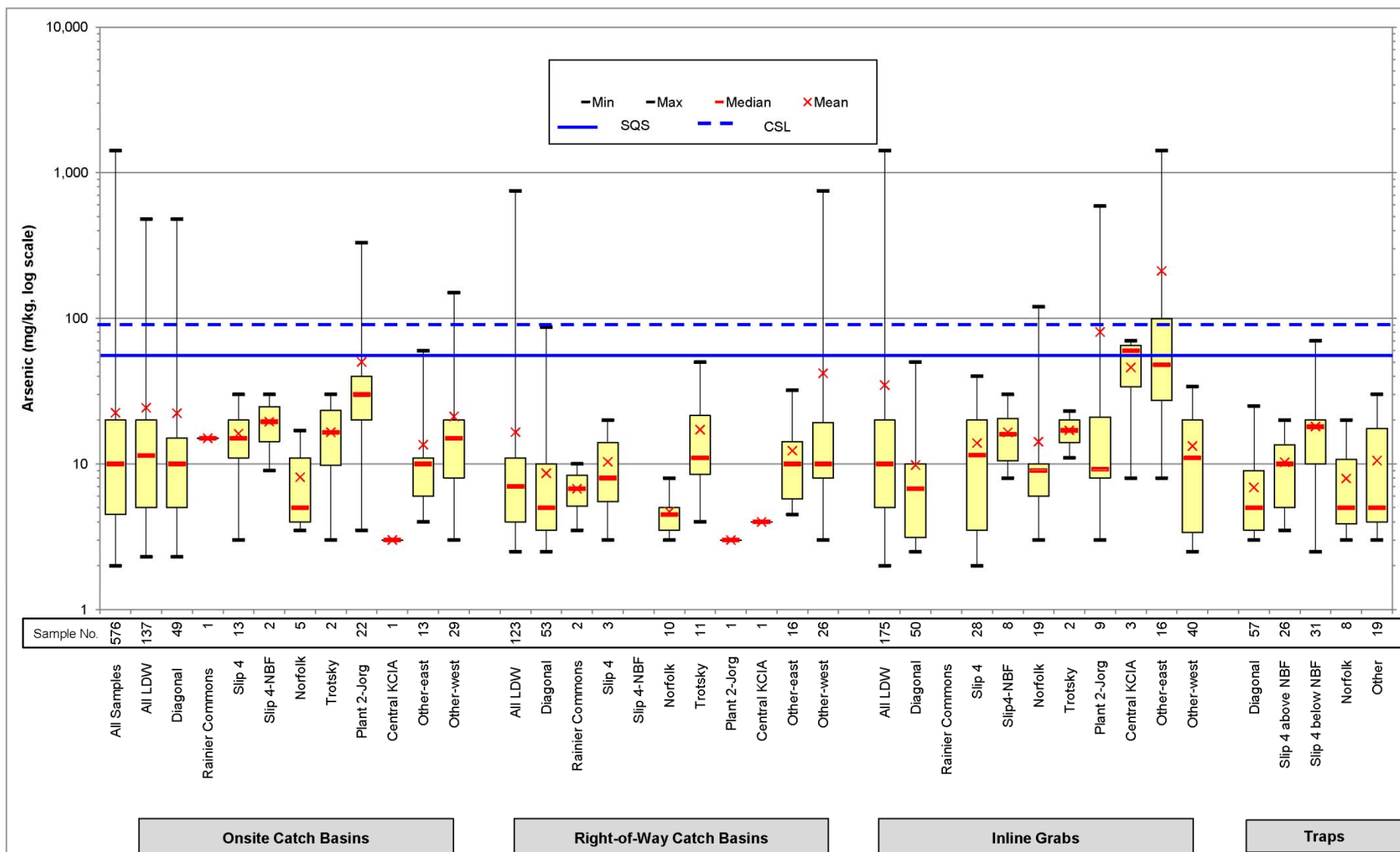
# PCBs



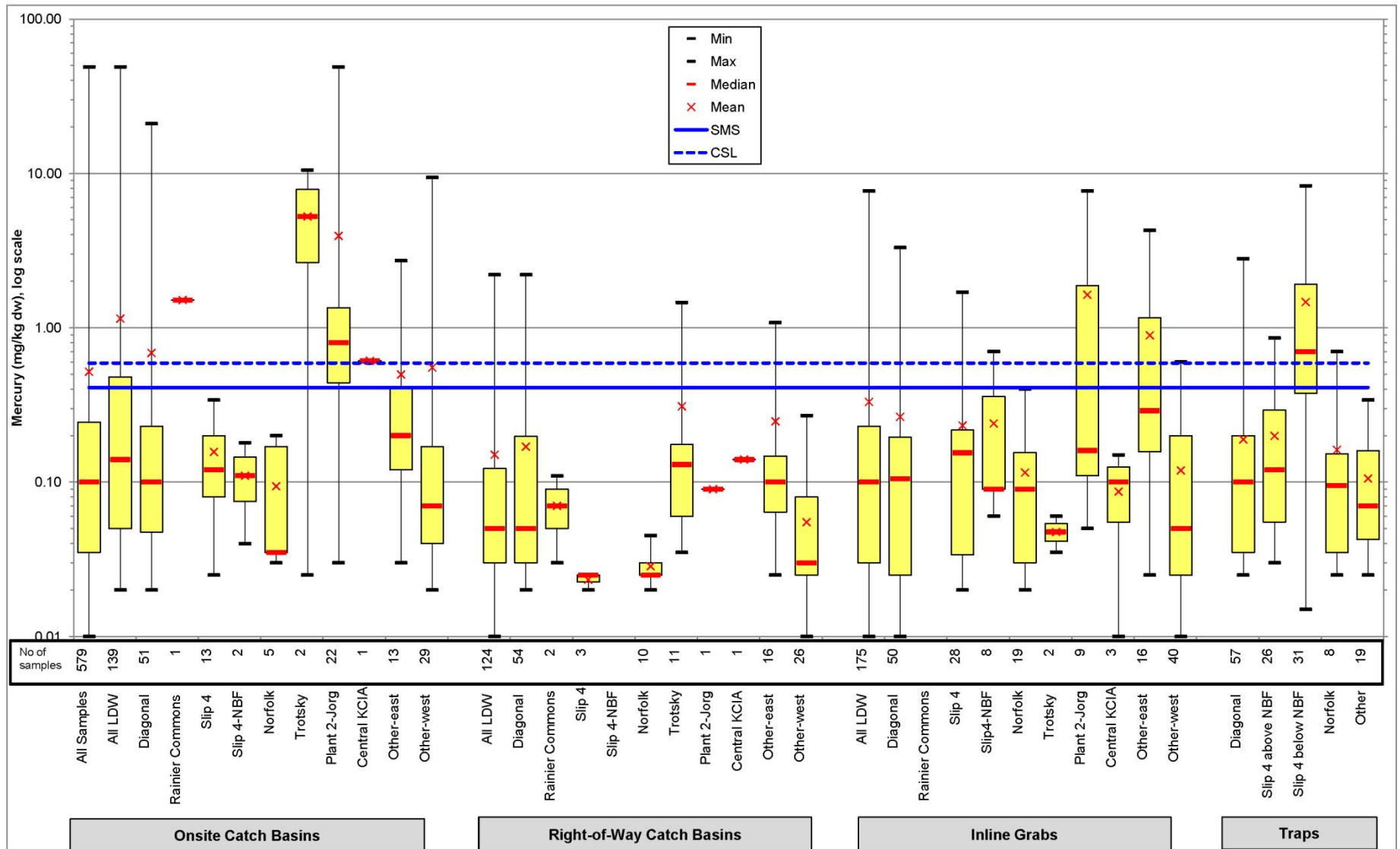
# HPAHs



# Arsenic



# Mercury



# CSO Data Summary

(Sept 2007-April 2009)

Conventional (mg/L)	FOD	<u>Detected</u>		
		Min	Max	Mean
Total Suspended Solids	28/28	34	640	127.7
Dissolved Organic Carbon	28/28	5.06	610	40.7
Total Organic Carbon	28/28	18.8	625	64.1
Total Nitrogen	26/26	2.7	23.4	8.5
Total Phosphorus	26/26	0.392	4.75	1.6

# CSO Data Summary

(Sept 2007-April 2009)

Inroganics (µg/L)	FOD	Detected		Mean <sup>1</sup>
		Min	Max	
Arsenic, Dissolved	21/21	0.656	3.02	1.45
Arsenic, Total	27/27	1.34	8.06	2.59
Copper, Dissolved	21/21	2	14.7	4.87
Copper, Total	27/27	14.6	279	46.52
Lead, Dissolved	21/21	0.36	1.93	0.71
Lead, Total	27/27	4.34	157	29.30
Zinc, Dissolved	21/21	5.77	80.3	28.78
Zinc, Total	27/27	66.2	753	163.13
Mercury, Dissolved	4/15	0.0066	0.0435	0.009
Mercury, Total	19/27	0.015	0.43	0.082

<sup>1</sup> Mean calculated using 1/2 MDL when analyte <MDL.

# CSO Data Summary

(Sept 2007-April 2009)

Organics	FOD	Detected		Mean <sup>1</sup>
		Min	Max	
<u>Phthalates (µg/L)</u>				
Benzyl Butyl Phthalate	23/26	0.257	4.89	0.859
Bis(2-Ethylhexyl)Phthalate	7/25	1.51	45	5.242
<u>PAHs (µg/L)</u>				
Benzo(a)pyrene	14/26	0.0363	0.37	0.096
Naphthalene	23/26	0.0281	1.29	0.218
Total LPAH	24/26	<MDL	4.666	0.842
Total HPAH	23/26	<MDL	4.1095	0.799
<u>PCBs (ng/L)</u>				
Total PCBs	28/28	13.2	455	76.6

<sup>1</sup> Mean calculated using 1/2 MDL when analyte <MDL.

# Storm Drain Solids and CSO Data

	n	25th percentile	75th percentile	Min	Max	Median	Mean
<b><u>Arsenic (mg/kg dw)</u></b>							
All Storm Drain Solids	576	5	20	2	1,420	10	22
CSO TSS normalized	21	6	12	1	16	10.6	9
<b><u>cPAHs (µg TEQ/kg dw)</u></b>							
All Storm Drain Solids	543	195	1,392	17	492,000	520	3,230
Storm Drain Solids Minus samples >50,000	537	194	1,273	17	45,990	501	1,648
CSO TSS normalized	26	134	1,627	29	4,136	714	1,051

# Storm Drain Solids and CSO Data

	n	25th percentile	75th percentile	Min	Max	Median	Mean
<b>Total PCBs (µg/kg dw)</b>							
<b>All Storm Drain Solids</b>	<b>953</b>	<b>73</b>	<b>6,600</b>	<b>5</b>	<b>10,000,000</b>	<b>440</b>	<b>42,512</b>
<b>Storm Drain Solids Minus samples &gt;10,000</b>	<b>755</b>	<b>47</b>	<b>1,021</b>	<b>5</b>	<b>9,300</b>	<b>206</b>	<b>1,166</b>
<b>Storm Drain Solids Minus samples &gt;5,000</b>	<b>692</b>	<b>38</b>	<b>580</b>	<b>5</b>	<b>4,900</b>	<b>161</b>	<b>613</b>
<b>CSO TSS normalized</b>	<b>28</b>	<b>441</b>	<b>724</b>	<b>89</b>	<b>1,627</b>	<b>580</b>	<b>638</b>

## Conclusions

- CSOs have tighter distribution than storm drain solids
- CSOs are within range of storm drain solids
- Chemical concentrations in on-site catch basins typically higher than other source samples
- Geographic hot spots of PCBs
- Elevated PAHs from multiple areas/businesses

# Acknowledgements

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