Monitoring Stormwater Quality in Five Mercer Island Drainage Basins

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Department of Natural Resources and Parks
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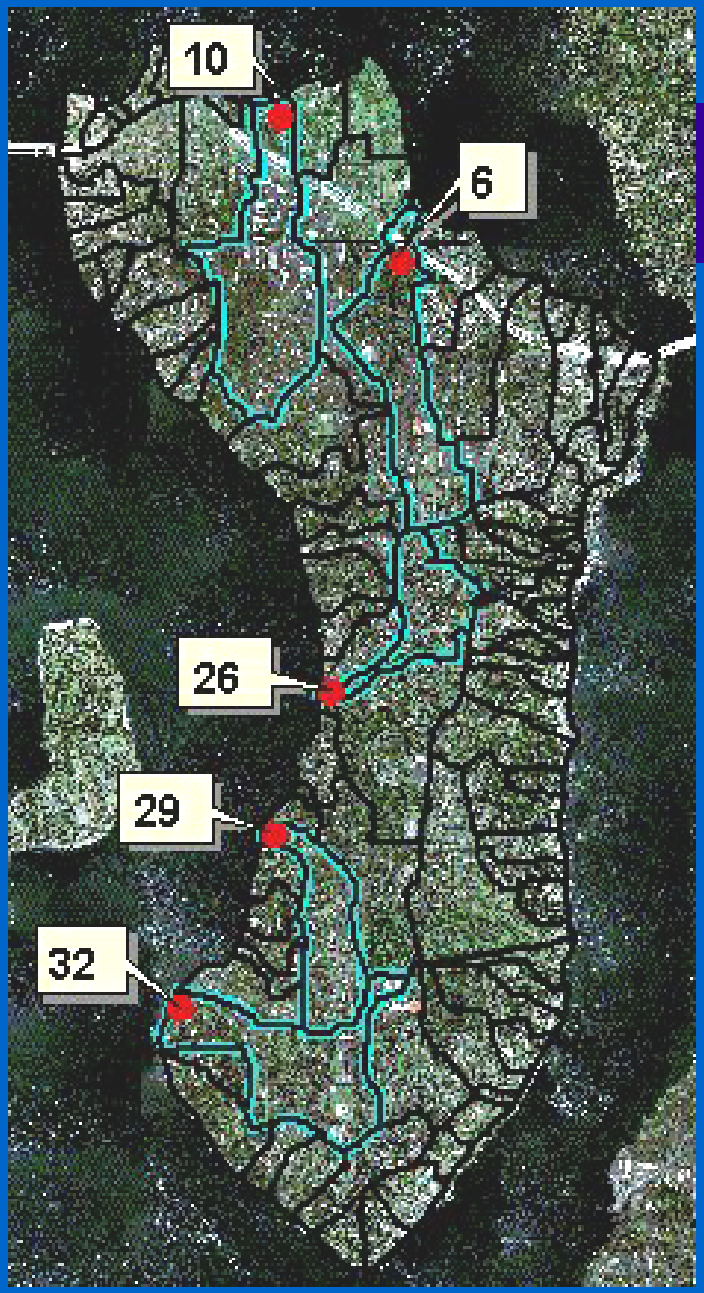
Overview

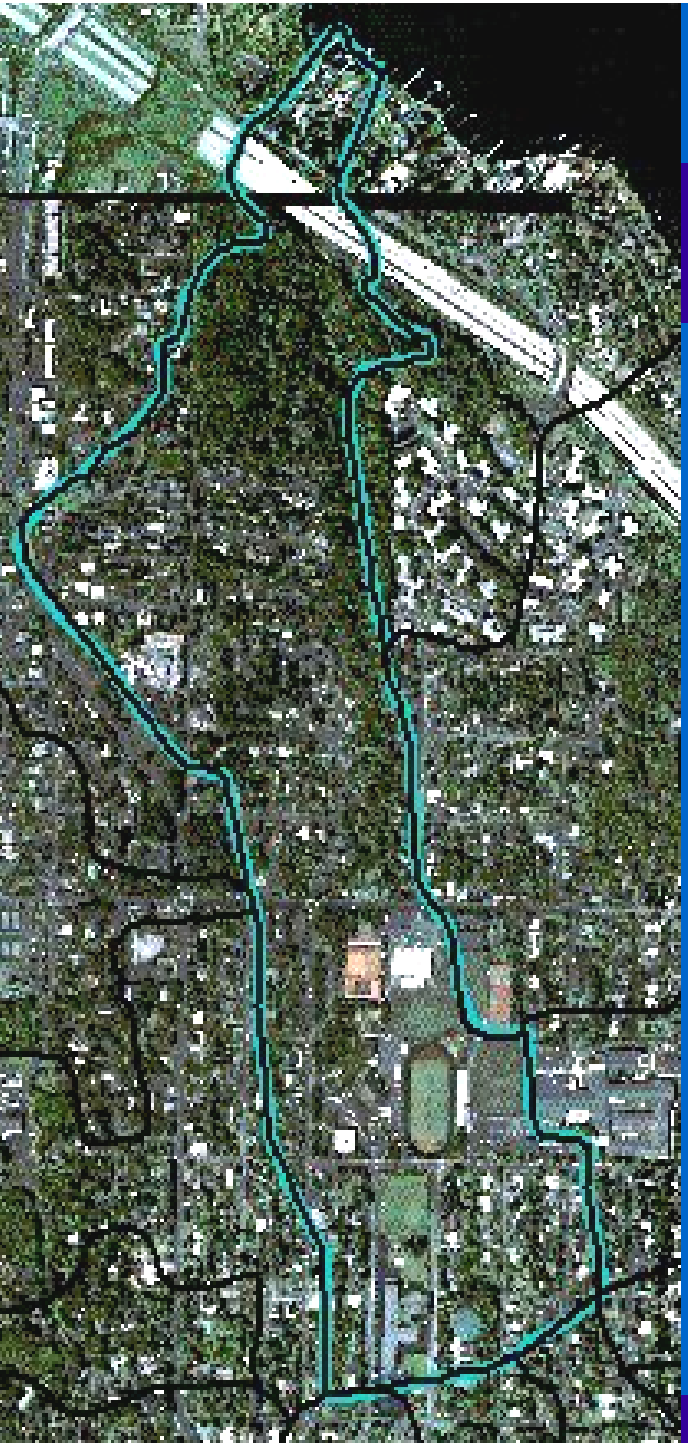
Mercer Island is an urban island surrounded by Lake Washington.

It has 54 distinct drainage basins flowing into the lake.

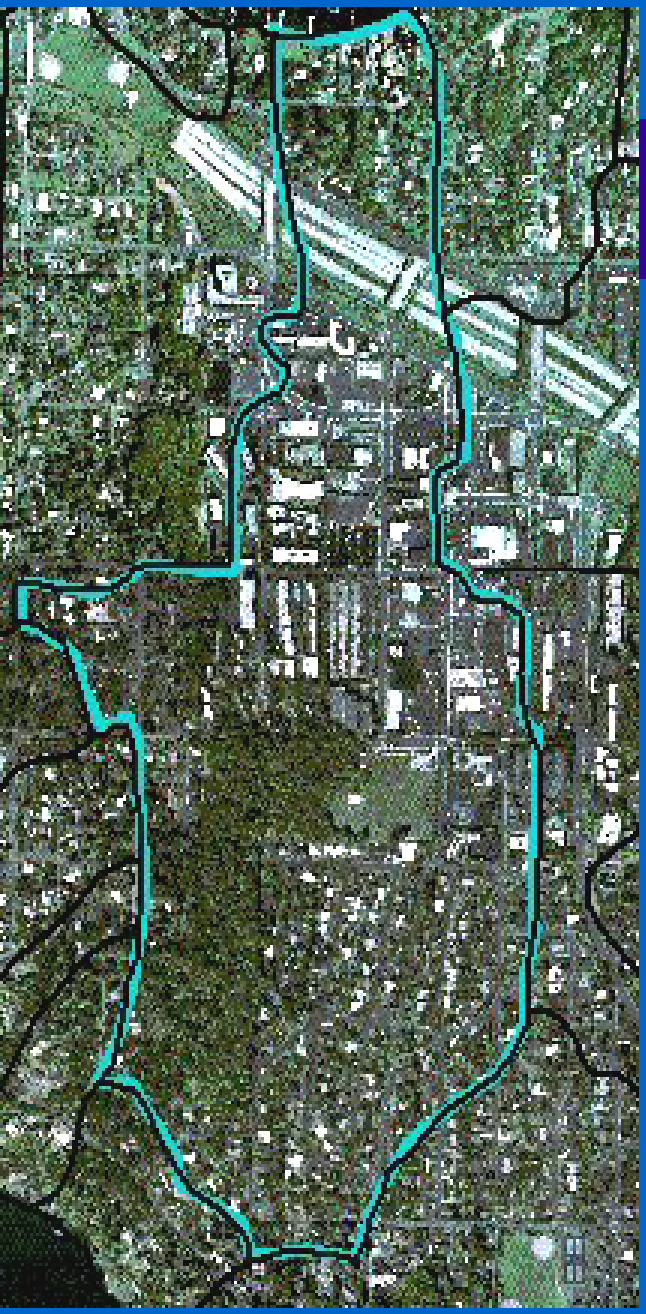


A Closer Look

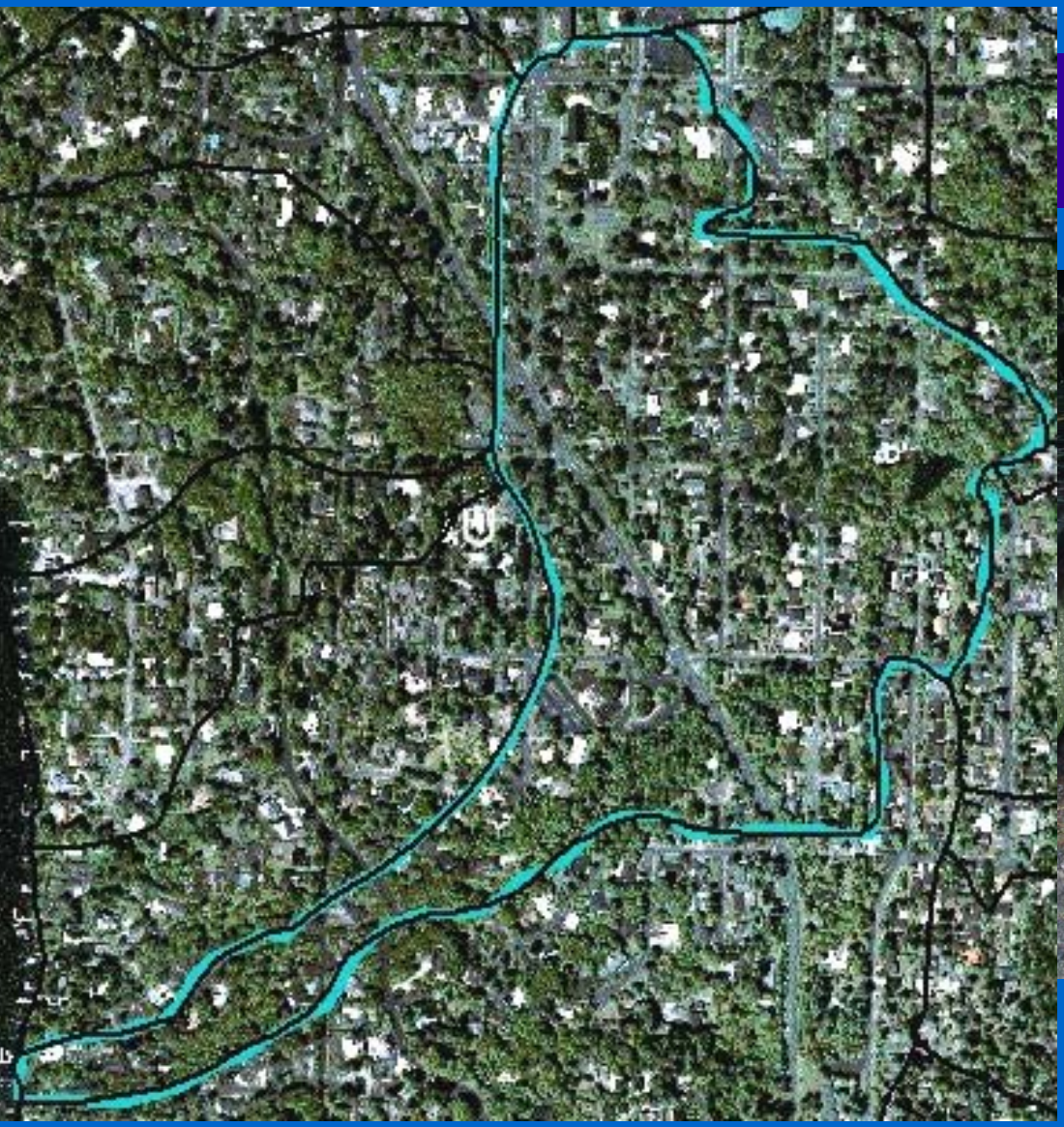
- Monitoring was originally intended to track Capital Improvement Projects in 3 drainages (1999-2000 ILA)
- Program expanded in 2001 to better respond to state and federal agencies, especially regarding the City's NPDES stormwater permit
- Currently provide insights about impacts of urbanization on water and sediment quality in five distinct drainage basins (2001-2004 ILAs)



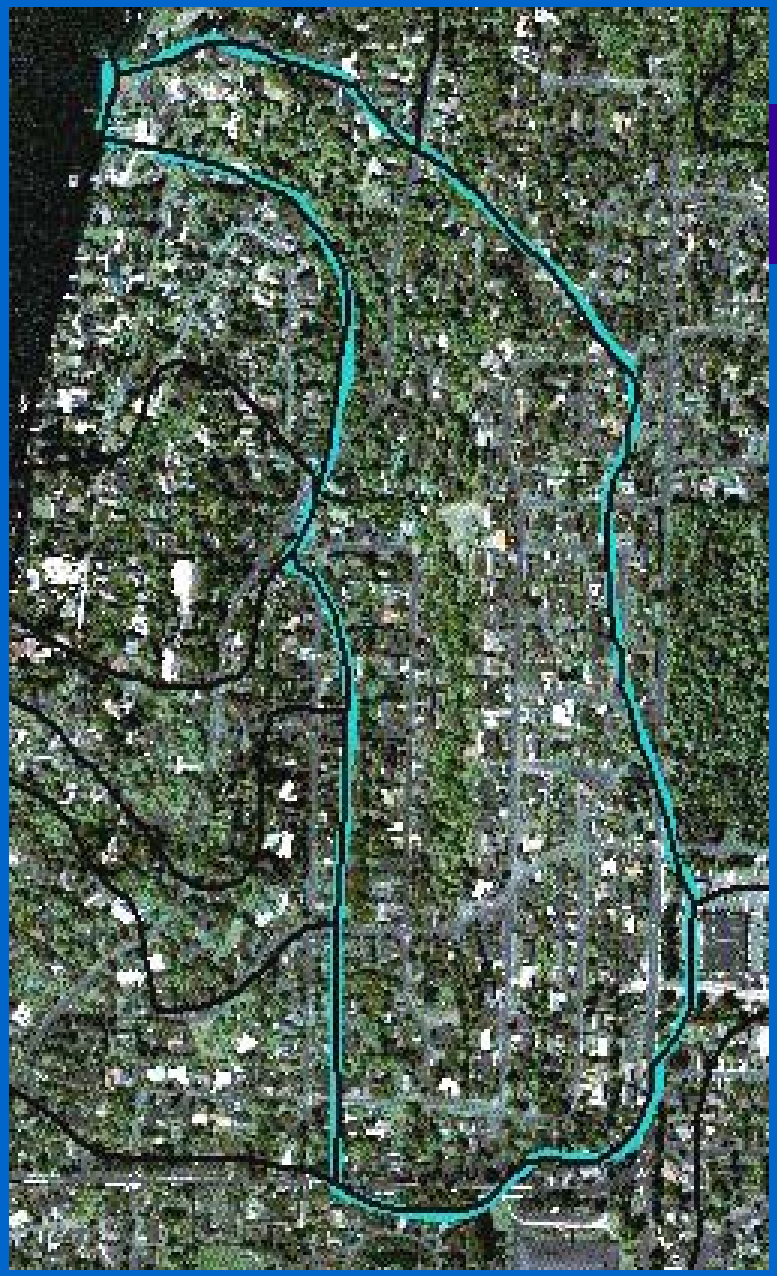
Subbasin No. 6



Subbasin No. 10



Subbasin 26



Subbasin No. 29

Subbasin 32

Parameters Considered

- Field Parameters (7)
- Nutrients (5)
- Metals (3)
- Organo-phosphorus Pesticides (7)
- Chlorinated Herbicides (10)
- Miscellaneous (3)
- Sediment (annually)
- Macroinvertebrates (annually)

Storm Sampling Criteria

Time Period	Precipitation Amount
6 hours	0.25 to 0.50 inches
12 hours	0.5 to 0.75 inches
24 hours	1.0 inch or more

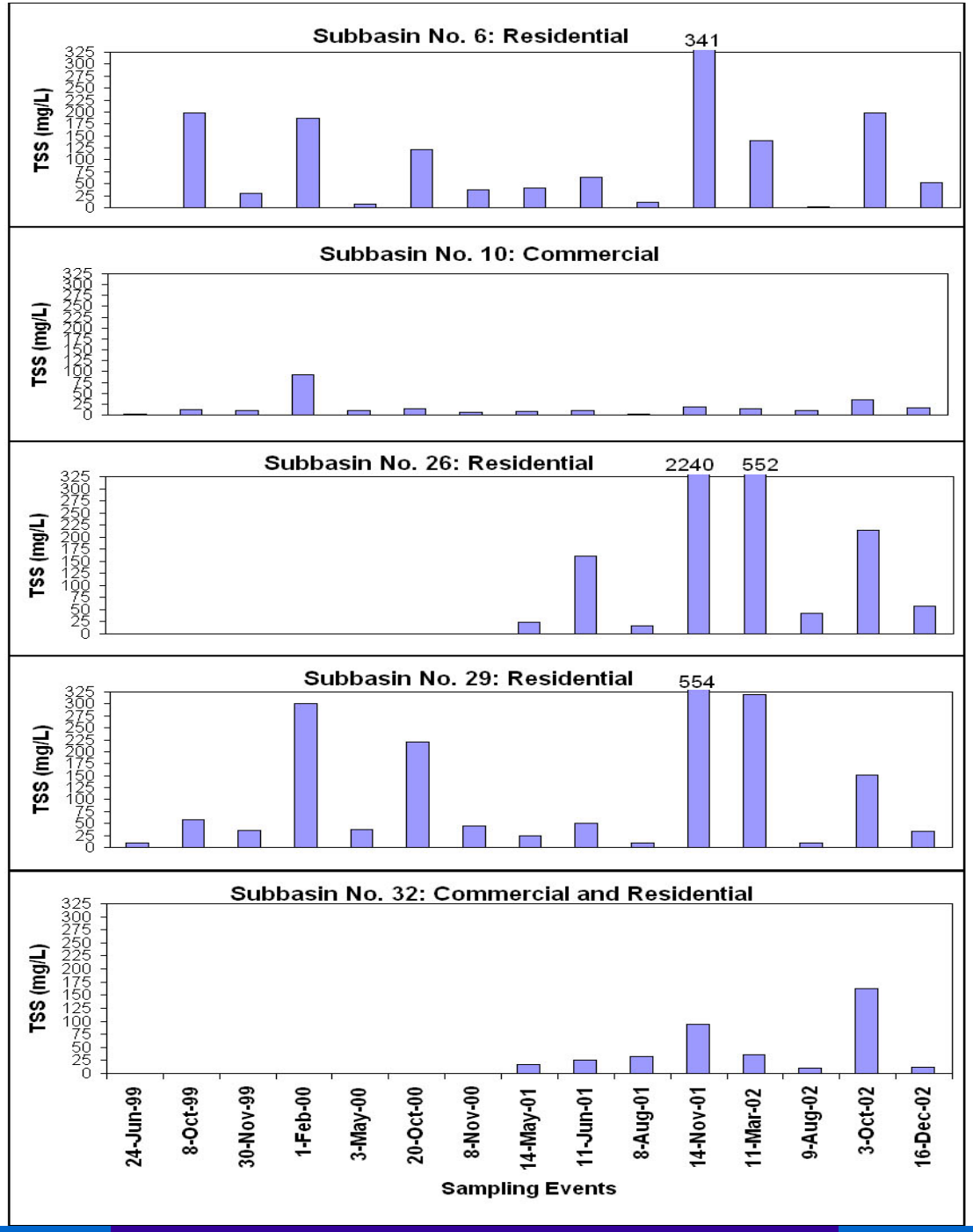
The ideal storm event follows three dry days where antecedent moisture totals less than 0.25 inches.

Storm Event Summary

Sampling Date	*Time Period Criteria Triggered*
16 Dec 2002	6 and 12
3 Oct 2002	6
9 Aug 2002	Baseflow
11 Mar 2002	6,12, and 24
14 Nov 2001	6,12, and 24
8 & 9 August 2001	Baseflow
11 June 2001	6 and 12
14 May 2001	6
8 Nov 2000	6 and 12
20 Oct 2000	6, 12, and 24
3 May 2000	6
1 Feb 2000	6, 12, and 24
30 Nov 1999	24 (almost)
8 Oct 1999	6 and 12
24 June 1999	12 and 24

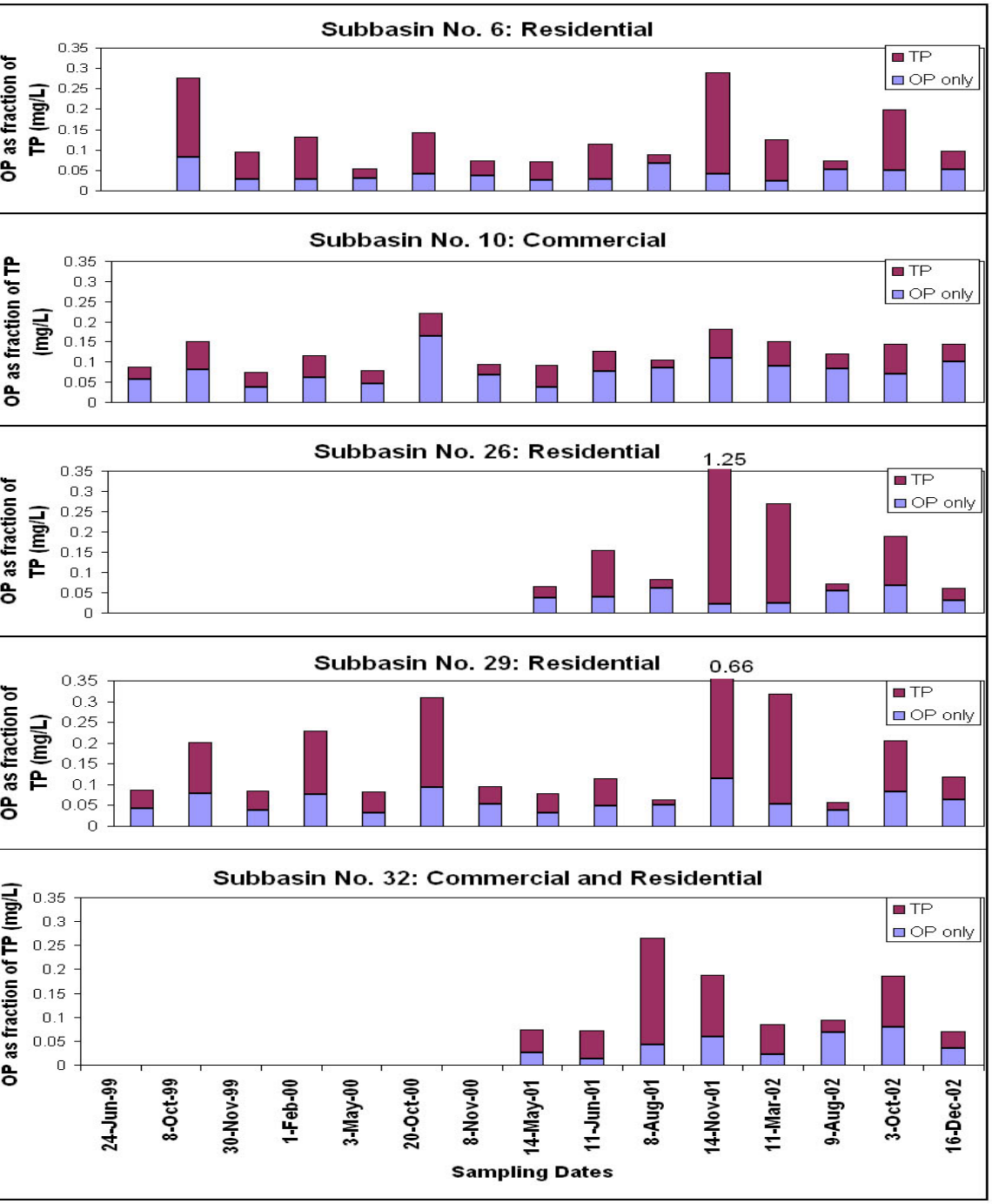
Key Field Parameter Results

- Discharge was greatest at 4 of the 5 sites in Nov 2001, corresponding to the largest storm event captured.
- Commercial districts (No.10 and No. 32) exceeded the WA State Freshwater Class AA Standards for temperature and dissolved oxygen most frequently.
- All sites routinely exceeded the AA turbidity standards; Basin No. 26 exhibited the most extreme responses.



Total Suspended Solids (TSS)

- TSS is a physical measure of particle concentration.
- No state standards or federal criteria exist.
- 3 of 5 subbasins had their highest reading in Nov 2001
- During any given event, Site No. 26 generally had the highest readings.



Ortho-phosphorus (OP) as fraction of Total Phosphorus (TP) (mg/l)

- Sources can be natural and/or human induced
- TP: both particulate and dissolved forms of P
- OP: dissolved form of P
- Basin No. 29: TP and OP parallel one another
- Basin No. 26: TP spikes without increases in OP

Nitrogen Summary

- Common sources: fertilizers and animal wastes
- No State Standard for TN, but recommended federal criteria for western 1/3 of WA and OR is 0.12 mg/l
- MI values for TN ranged from 0.564 mg/l to 2.79 mg/l based on all sites and all sampling events.
- Nitrate+Nitrite-Nitrogen values never exceeded the federal criterion of 10 mg/l.
- Ammonia values were always below state standards and federal criteria for acute exposure.

Total Oil and Grease

Subbasin No.	Frequency of Detection	Range (mg/l)	Dates Detected
6	10/14	<2 to 22.5	Nov 1999, 2000, 2001, Oct 2000, May and Aug 2001; all four 2002 events
10	9/15	<2 to 9.8	Nov 1999, 2000, 2001, May and Aug 2001; all four 2002 events
26	6/8	<2 to 10.7	Aug and Nov 2001; all four 2002 events
29	10/15	<2 to 22.8	Nov 1999, 2000, 2001, Oct 2000, May and June 2001; all four 2002 events
32	7/8	<2 to 6.5	May, June and Nov 2001; all four 2002 events

Chlorinated Herbicides and Organophosphate Pesticides

Parameter	Detected in Subbasins	Frequency of Detection (FOD)	Range of Values (µg/L)	Screening Threshold [1] (µg/L)		Frequency of Threshold Exceedance	
Chlorpyrifos	10,29	3/58	0.052 to 0.056	0.041 chronic	0.083 acute	**3/58** chronic	0/58 acute
Diazinon	All but 26	15/58	0.042 to 1.69	0.09		**10/58**	
Dicamba	29	2/58	0.10 to 0.23	30.5		0/58	
Malathion	10	1/58	0.050	0.1		0/58	
MCPA	All but 26	5/58	0.14 to 0.63	1400		0/58	
MCPP	All	16/58	0.10 to 1.50	2573.5		0/58	
2,4-D	All	16/58	0.21 to 1.80	30		0/58	
2,4,5-T	6	1/58	0.53	Not Available		Not Available	

Copper and Zinc above acute standards

- WA state acute freshwater quality standards for metals are 1-hour averages not to be exceeded more than once every 3 years on average.
- Copper levels have exceeded the hardness dependent standards in basins No. 10 and No. 32 -- the two commercial drainage areas
- Zinc also exceeded the state's acute freshwater quality standard in subbasin No. 10

Key Sediment Results

- Metals were detected in sediment on all occasions.
- Basin No. 10 routinely had Cu, Pb, and Zn levels at or above naturally occurring regional soil levels.
- Sediment samples never surpassed the FSQV's and LAET's for Cu, Pb, and Zn in any subbasin.
- None of the 17 pesticides and herbicides were detected in sediment samples.

Mercer Island BIBI Scores

Subbasin No.	1999 BIBI	2000 BIBI	2001 BIBI	2002 BIBI
6	18	16	16	14
10	14	14	14	14
26	NA	NA	16	18
29	14	12	14	14
32	NA	NA	NA	18

Results: In Summary

- Copper and Zinc exceeded acute criteria in stormwater from the business districts.
- 2,4-D and MCPP were the most commonly found chlorinated herbicides and appeared at all sites.
- Diazinon and Chlorpyrifos were the most common organo-phosphorus pesticides sampled.
- Nutrient pulses commonly accompanied stormflows and exhibited subbasin differences as well as seasonal trends.
- Total oil and grease were observed year-round.

So What?

- Knowledge of urban stormwater and sediment quality conditions improves responses to community, state, and federal agencies as well as the general public.
- Differentiating basin responses and key pollutants assists the City in tailoring drainage improvement projects and public education efforts.
- Results provide a basis for comparison as source control measures are implemented through time.

Special Thanks

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Subbasin No. 6