

CHARACTERIZATION OF STORMWATER SEDIMENTS, CATCH BASIN SEDIMENTS, AND STREET SWEEPINGS IN FLORIDA FOR DISPOSAL AND REUSE

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Project Sponsors

- FDEP
- Florida Center for Solid and Hazardous Waste Management
- Florida Stormwater Association
- St. Lucie County Public Works
- Brevard County Surface Water Management
- Reedy Creek Improvement District
- Seminole County Stormwater Division
- City of Ft. Myers
- City of Orlando
- Sarasota County Public Works
- City of Lake Worth - Public Works
- City of Winter Park
- Palm Beach County Solid Waste Authority.

Presentation Outline

- Motivation
- Objectives
- Methods
- Results

Motivation

- Maintenance practices by stormwater utilities and their contractors result in the generation of waste residuals.
- Residuals:
 - Street sweepings
 - Catch basin sediments
 - Stormwater pond sediments

Motivation

- These residuals are solid wastes under Florida regulations. They must be managed appropriately.
- Generators have the option of having the materials tested for chemical constituents.
- The existing database of chemical characteristics was insufficient to make broad policy decisions on how these materials should be managed.

Project Objective

- Collect samples of residuals from around Florida from a broad range of generators.
- Chemically characterize the samples for those parameters typically required in decision-making process.
- Provide a database of sample results that could be used in future policy making.

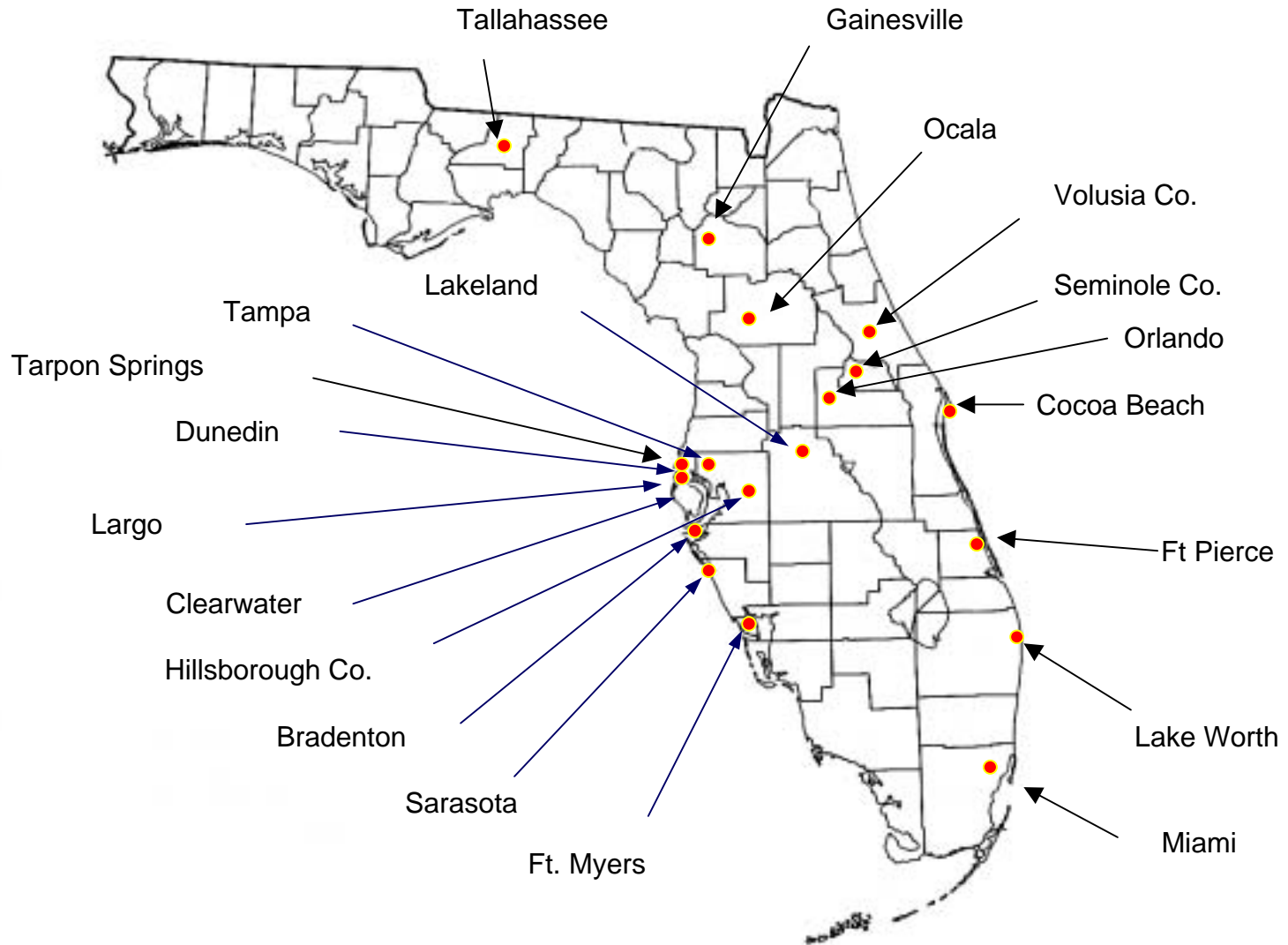
Methods

- Sample residuals from around the state
 - Street Sweepings
 - Catch Basin Sediments
 - Stormwater Pond Sediments
- Analyze for a list of target chemicals

Target Chemicals (total, leachable)

- Heavy metals: Ag, As, Ba, Cd, Cr, Cu, Hg, Ni, Pb, Se, Zn
- Organic compounds: VOC, Semi-VOC, Organochlorine Pesticides, Nitrogen-Phosphorous Pesticides, Chlorinated Herbicides, N-Methylcarbamates
- Total content analysis and leaching analysis (SPLP)
- Secondary water quality parameters

20 Sampling locations



Results

- Organics
- Metals
- Secondary Standards

Organic Analysis Results

-Total -

- Volatile Organic Compounds
- Semi-VOC (including PAHS, PCBs)
- Organochlorine Pesticides (e.g., DDT, DDE)
- Nitrogen-Phosphorous Pesticides
- Chlorinated Herbicides
- N-Methylcarbarnates

Organic Samples -Total

	VOC	SVOC	OC/Pest	NPD Pest	Herb	Carb
Street sweeping	169	169	193	185	188	202
Storm water pond sediment	68	65	65	61	69	73
Catch Basin sediment	65	66	65	68	66	79
Total	302	300	323	314	323	354

Note: No nitrogen-phosphorous Pesticides, Herbicides and Carbamates were found in any of the samples

VOC – 302 Samples, 74 Compounds

unit:ug/kg

Element	No. of Detected	Conc. Range	No. of Exceedance (Resid)	No. of Exceedance (Ind.)	SCTLs (Residential)	SCTLs (Industrial)
acrylonitrile	5	10.1 - 67.8	0	0	300.0	500.0
n-butylbenzene	1	76.7	--	--	NA	NA
isopropylbenzene	8	7.5 - 249.0	--	--	NA	NA
isopropyltoluene	4	6.6 - 11.7	--	--	NA	NA
toluene	3	9.7 - 12.2	0	0	380000	2600000
1,2,3 trimethylbenzene	1	166.9	0	0	13000	89000
1,2,4 trimethylbenzene	1	48.2	0	0	13000	88000
1,3,5 trimethylbenzene	2	11.1 - 14.6	0	0	11000	74000
xylene	1	13.2	0	0	5900000	40000000

Note: Acetone, methylene chloride, and acetonitrile were found in many samples due to lab glassware cleaning as well as organic extractions

SVOC – 300 Samples, 116 Compounds

unit:mg/kg

anthracene	1	11.8	0	0	18000	260000
benzo(a)anthracene	2	11.8 - 36.5	2	2	1.4	5.0
benzo(a)pyrene	2	8.0 - 31.3	2	2	0.1	0.5
benzo(b)fluoranthene	2	11.4 - 95.1	2	2	1.4	4.8
benzo(k)fluoranthene	1	20.2	1	0	15	52
benzo(g,h,i)perylene	1	7.1	0	0	2300	41000
bis(2-ethylhexyl)phthalate	5	1.8 - 6.1	0	0	76	280
chrysene	1	51.5	0	0	140	450
di-n-butylphthalate	17	5.1	0	0	7300	140000
di-n-octylphthalate	1	2.8 - 6.4	--	--	NA	NA
fluoranthene	7	5.4 - 133.3	0	0	2900	48000
fluorene	1	6.0	0	0	2200	28000
Indeno(1,2,3-cd)pyrene	1	43.2	1	1	1.5	5.3
phenanthrene	3	5.5 - 18.7	0	0	2000	30000
pyrene	17	7.1 - 81.8	0	0	2200	37000

Organochlorine Pesticides (323 Samples, 43 Compounds)

unit:ug/kg

Element	No. of Detected	Conc. Range	No. of Exceedance (Resid)	No. of Exceedance (Ind.)	SCTLs (Residential)	SCTLs (Industrial)
4,4'-D D D	11	25.8 - 700.2	0	0	4600	18000
4,4'-D D E	10	25.5 - 97.3	0	0	3300	13000
4,4'-D D T	66	26.3 - 508.8	0	0	3300	13000
Aldrin	1	25.3	0	0	70.0	300.0
alpha-BHC	6	26.6 - 128.2	--	--	NA	NA
alpha-Chlordane	15	25.0 - 118	0	0	3100*	12000*
beta-BHC	6	26.2 - 104.9	--	--	NA	NA
delta-BHC	2	28.0 - 28.1	--	--	NA	NA
Dieldrin	8	28.4 - 440.8	3	1	70	300
Endosulfan II	44	27.1 - 2310	--	--	NA	NA
Endosulfan Sulfate	1	25.6	--	--	NA	NA
Endrin	3	46.7 - 68.6	0	0	21000	340000
Endrin Aldehyde	2	89.3 - 203.4	0	0	NA	NA
gamma-Chlordane	12	25.1 - 897.5	0	0	3100*	12000*

Chlordane

Organic Leaching Samples

	V O C	S V O C	O c l P e s t	N P D P e s t	H e r b	C a r b
S t r e e t s w e e p i n g	91	94	88	92	78	94
S t o m w a t e r p o n d s e d i m e n t	36	28	33	32	34	36
C a t c h B a s i n s e d i m e n t	28	25	45	8	8	46
T o t a l	155	147	166	132	120	176

Note: No SVOC, nitrogen-phosphorous Pesticides, Herbicides and Carbamates were found in any of the samples

VOC – 155 Samples, 74 Compounds

unit:ug/L

Element	No. of Detected	Conc. Range	No. of Exceedance	GW CTL
n-butylbenzene	1	142.0	--	NA
1,4-dichlorobenzene	2	90.3 - 142	2	75.0
naphthalene	1	890.0	1	20.0
p-isopropyltoluene	1	17.1	--	NA
1,3,5-trimethylbenzene	1	12.4	1	10
o-xylene	1	594.0	1	20

Note:

Organochlorine Pesticides

(166 Samples, 43 Compounds)

unit:ug/L

Element	No. of Detected	Conc. Range	No. of Exceedance	GW CTL
4,4'-DDT	13	0.13 - 0.22	13*	0.1
beta-BHC	7	0.1 - 0.24	--	NA
Endosulfan II	1	0.45	--	NA

8 Street samples, 5 Stormwater pond sediments samples

Summary of Organic Results

Analyte Group	Total				Leaching		
	No. of Samples	No. of Detected Compounds	Max.No. of Exceedance (Resid)	Max.No. of Exceedance (Ind.)	No. of Samples	No. of Detected Compounds	Max.No. of Exceedance (GW CTL)
VOC	302	9	0	0	155	6	0
SVOC	306	12 PAHs, 3 B N	2 (benzo [a] pyrene)	2 (benzo [a] pyrene)	147	0	0
OC lPest	323	14	3 (die lrin)	1 (die lrin)	166	3	13 (4,4 '-D D T)
NP Pest	306	0	0	0	132	0	0
Herb	354	0	0	0	120	0	0
Carb	354	0	0	0	176	0	0

Results - Total Metals

Ag, As, Ba, Cd, Cr, Cu, Hg, Ni,
Pb, Se, Zn

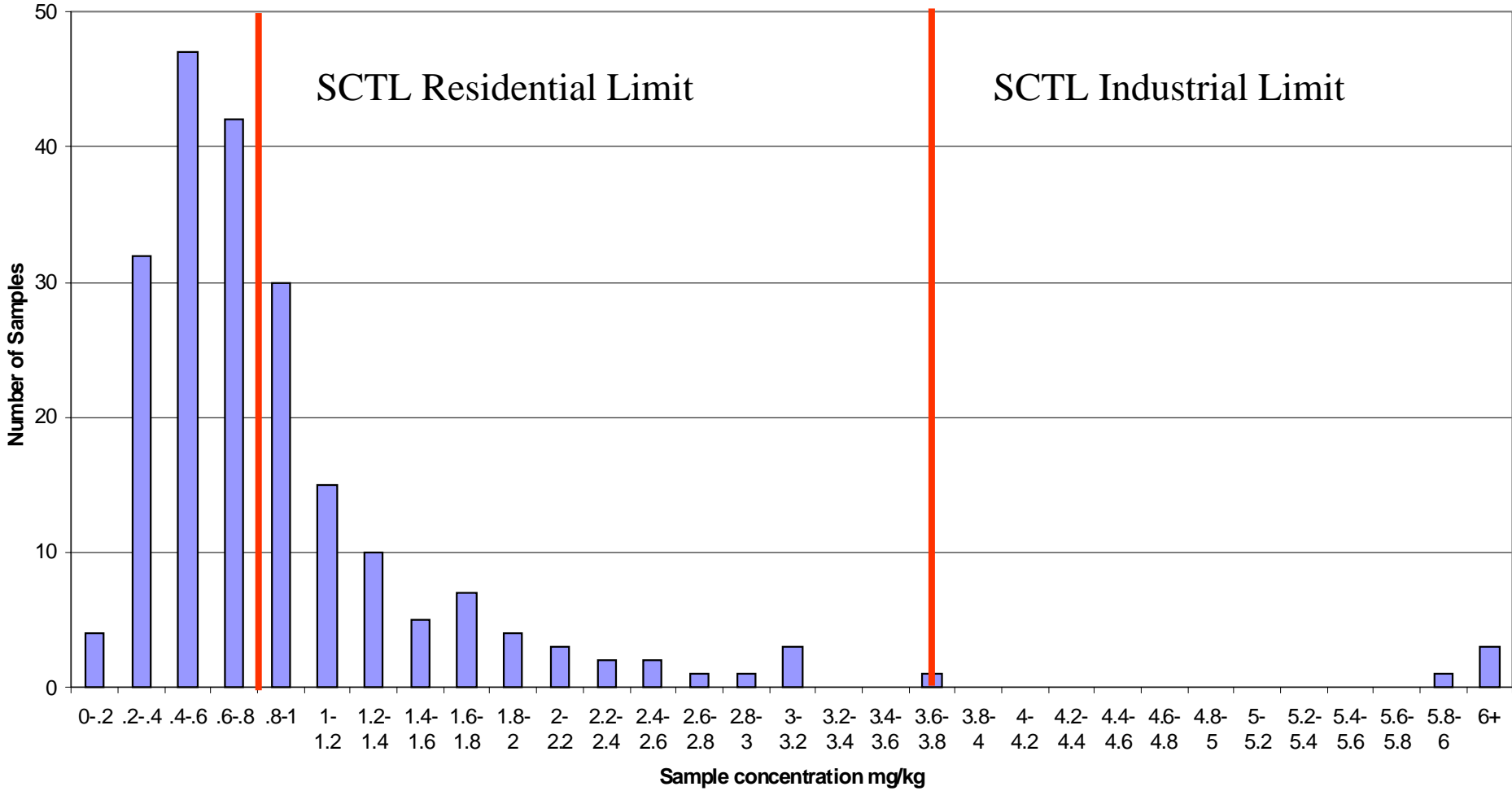
Unit: mg/kg

Element	No. of Samples	No. of Detected	Ave. Conc.	Max.	Min.	No. of Exceedance (Resid)	No. of Exceedance (Ind.)	SCTLs (Residential)	SCTLs (Industrial)
Ag	306	6	37.5	130.2	12.3	0	0	390	9100
As	355	178	1.7	24.8	0.5	105	10	0.8	3.7
Ba	306	279	32.5	1019.4	3.0	9	0	110	87000
Cd	354	4	38.6	54.1	5.3	0	0	75	1300
Cr	306	225	23.7	552.0	2.4	1	2	210 (Cr VI)	420 (Cr VI)
Cu	354	353	20.2	398.4	2.5	4	0	110	76000
Hg	303	0	--	--	--	0	0	3.4	26
Ni	354	350	9.4	69.9	2.4	0	0	110	28000
Pb	354	246	40.8	1059.7	2.7	1	1	400	920
Se	354	6	10.0	14.1	7.4	0	0	390	10000
Zn	354	354	91.8	1080.1	4.3	0	0	23000	560000

As

- 355 samples
- 105 samples above 0.8 mg/kg SCTL
(residential limits)
- 10 samples above 3.7 mg/kg SCTL
(residential limits)
- Average 1.7 mg/kg
- Max 24.8 mg/kg

As mg/kg
0.8 mg/Kg SCTL



Leachable Metals

- SPLP Test Results

Element	No. of Samples	No. of Detected	Ave. Conc. (mg/L)	Max.	Min.	No. of Exceedance	GW CTLs (mg/L)
Ag	150	0	--	--	--	0	0.1 (secondary)
As	185	27	0.010	0.045	0.003	0	0.05 (primary)
Ba	150	78	0.078	0.122	0.055	0	2.0 (primary)
Cd	178	3	0.004	0.009	0.001	1	0.005 (primary)
Cr	150	3	0.090	0.099	0.077	0	0.1 (primary)
Cu	184	2	0.190	0.211	0.169	0	1.0 (secondary)
Hg	169	0	--	--	--	0	0.002 (primary)
Ni	184	3	0.680	1.071	0.189	3	0.1 (primary)
Pb	184	50	0.117	3.295	0.003	8	0.015 (primary)
Se	154	0	--	--	--	0	0.05 (primary)
Zn	184	44	0.342	2.689	0.055	0	5.0 (secondary)

As

- 185 leaching samples
- 0 samples above 50 $\mu\text{g/L}$ GWCTLs
- Average 10.0 $\mu\text{g/l}$
- Max 45.0 $\mu\text{g/l}$
- Min 3.0 $\mu\text{g/l}$

Summary of Metal Results

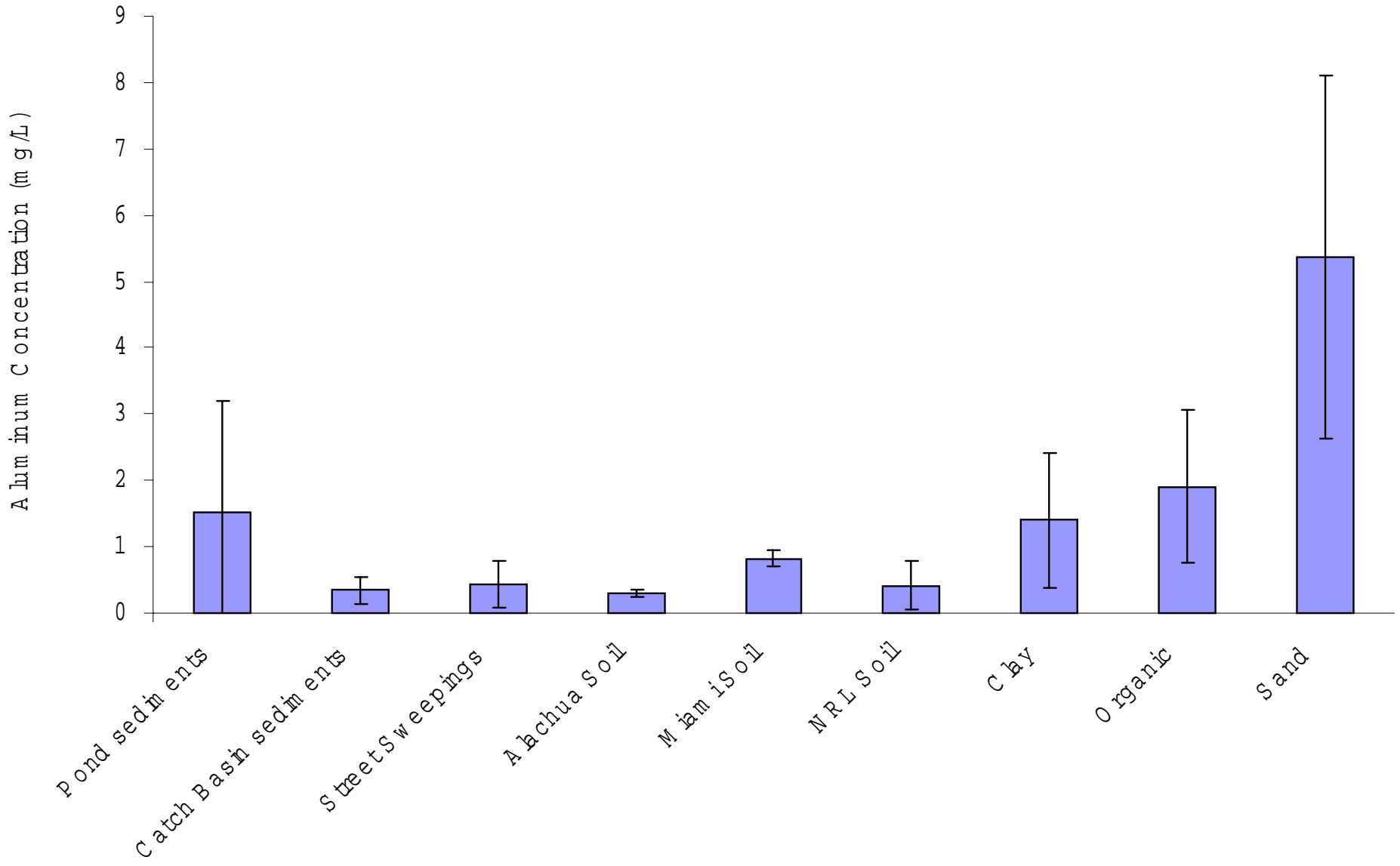
Element	Total				Leaching		
	No. of Samples	No. of Detected	No. of Exceedance (Resid)	No. of Exceedance (Ind.)	No. of Samples	No. of Detected	No. of Exceedance
As	355	178	105	10	185	27	0
Ba	306	279	9	0	150	78	0
Cd	354	4	0	0	178	3	1
Cr	306	225	1	2	150	3	0
Cu	354	353	4	0	184	2	0
Ni	354	350	0	0	184	3	3
Pb	354	246	1	1	184	50	8

Note: Ag, Hg, Se, and Zinc do not exceed both SCTLs and GWCTLs.

Secondary Water Quality Parameters

- 30 SPLP samples
- Parameters: Aluminum, chloride, fluoride, iron, manganese, pH, sulfate, TDS
- Exceedance:
 - 20 samples for aluminum
 - 8 samples for iron
 - 9 samples for pH
- Soil study - potential source of Al and Fe
 - 6 samples from 4 different locations

Aluminum Leaching



Iron Leaching

