BLUNN AND EAST BOULDIN WATER QUALITY SUMMARY, 2001-2003

By Cara Muscio, Environmental Scientist Associate
City of Austin - Watershed Protection and Development Review Department
Environmental Resource Management Division

Abstract

Beginning in 2001, COA staff collected bi-annual water quality samples at the USGS flow gage on both Blunn and East Bouldin creeks. This monitoring replaced the preceding USGS monitoring agreement, with the purpose of providing continued water quality information to assist with the management of these small urban watersheds. Only one baseflow data point was collected on Blunn in six data collections. The East Bouldin site was fairly consistent, except for an event captured on the April 18, 2003 sampling date. The frequency and scope of this monitoring program is not sufficient to characterize these small intermittent creeks, and has been terminated effective at the end of the 2003 fiscal year. Long-term data will continue to be collected on these creeks through the EII program. In addition, more intensive special studies will be undertaken in the future to characterize small urban creeks in Austin.

Introduction

Blunn Creek and East Bouldin Creek are neighboring tributaries just south of Town Lake in downtown Austin (Figure 1). Both of these tributaries are extremely small and urban, and flow is intermittent, particularly in Blunn. Both streams are largely limestone bed material. Blunn Creek is 3.12 miles in length, with a 1.5 square mile drainage area, and primarily residential land use. East Bouldin Creek is 3.5 miles in length, with a drainage area of 1.8 square miles, and primarily residential and commercial land uses. While East Bouldin has roughly double the population of Blunn, Blunn has more preserve and park space through the watershed.

COA staff has collected data on these two creeks since January 1991. Both Blunn and East Bouldin are included in the COA EII monitoring program. In addition, USGS has been collecting base flow and storm flow data in these creeks since 1997. In 2001, COA staff began sampling baseflow for Blunn and East Bouldin creeks in lieu of the previous USGS monitoring program. The goals of this study were to provide continued water quality information to assist with the management of these watersheds including:

- Characterizing smaller urban creeks
- Identifying changing needs for management and long- term improvement, including BMPs.
- Reducing loads to Town Lake as part of the Master Plan goals.

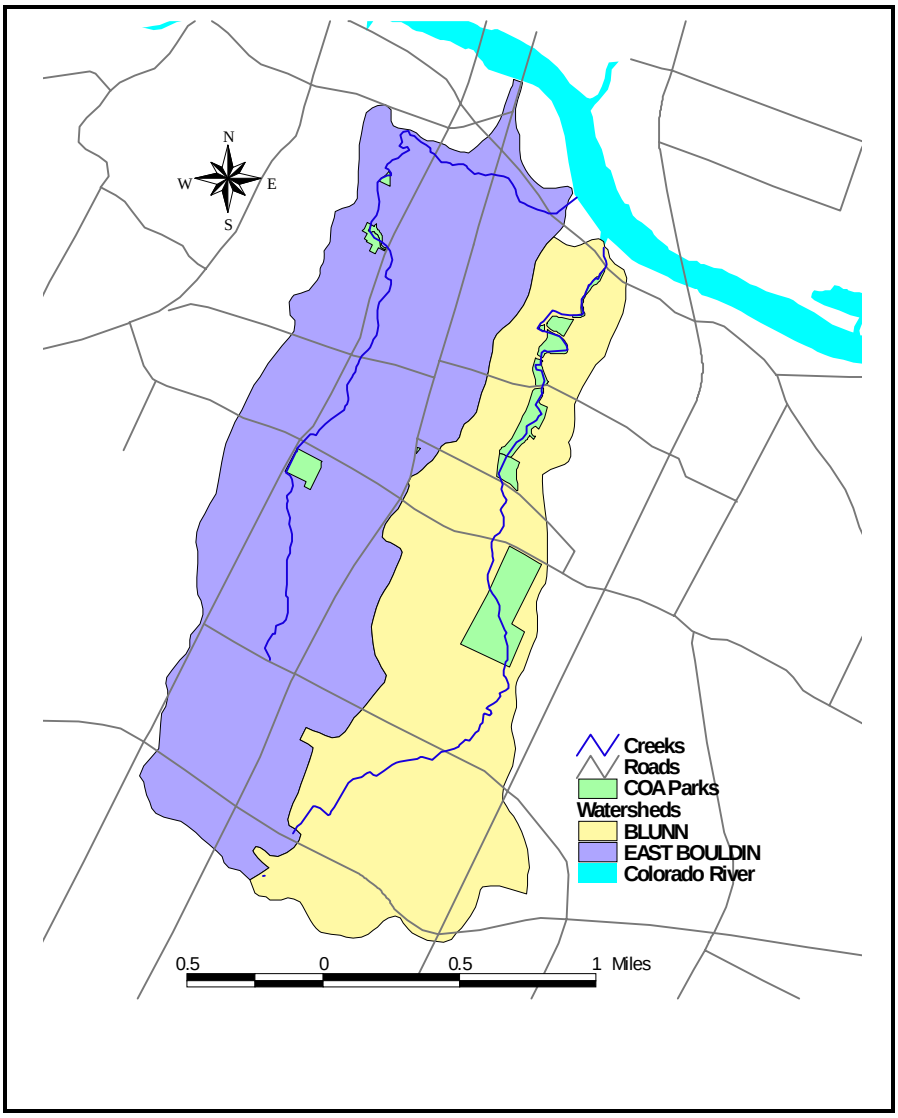

Figure 1. Map of Blunn and East Bouldin watersheds.

Methods

A suite of parameters (Table 1) were chosen that would allow comparison with historical USGS data, conform to basic parameter lists for current ERM projects, and meet TCEQ requirements for submittal through the Clean Rivers Program. Initially, chemical oxygen demand, arsenic, mercury, chlorides and sulfates were also to be monitored for an initial period and then evaluated. Biological oxygen demand, dissolved phosphorus, *E. coli*, chlorophyll *a*, and total organic carbon were individually assessed and eliminated from the potential parameter list.

Table 1. Primary parameter list for Blunn/East Bouldin monitoring program.

Field Parameters	Nutrients	Metals	Additional Lab Parameters
Temperature	Nitrate/Nitrite Nitrogen	Cadmium	Total Suspended Solids
Dissolved Oxygen	Ammonia Nitrogen	Copper	Volatile Suspended Solids
PH	Total Kj Nitrogen	Lead	Alkalinity
Conductivity	Dissolved Orthophosphate as P	Zinc	Fecal Coliform Bacteria
Discharge	Total Phosphorus		

One sample was collected at the USGS gauging station on each watershed (Table 2). Sampling occurred twice per year, during the TCEQ index period, primarily in April and September. Water quality samples were collected concurrently with field parameters, and analyzed by Walnut Creek Water and Wastewater Treatment Laboratory.

Table 2. Site information for Blunn/East Bouldin monitoring sites.

Site Name	COA Site No.	USGS Gauge No.
Blunn @ little Stacy Park	1654	08157700
East Bouldin @ South 1st St.	1655	08157600

Data was analyzed in Microsoft Excel and Statistica 6.0. The paucity of data for Blunn Creek site #1654 prevented statistical comparison of the two sites. As a result, descriptive statistics for the two watersheds were combined. Metals and nutrient parameters often contained censored data (less-than detection limits), so medians were more appropriate to describe the data than means. Most of the data exhibited non-normal distributions, so non-parametric Spearman rank-order correlations were used in an attempt to describe relationships between parameters, with significance at $p<0.05$.

Results

The biannual sampling has been conducted three times, for a total of six visits to each site. The Blunn site was dry for four of those sampling events. In addition, water was collected in Blunn in April 2002, but flow was localized out of disconnected pools. These two streams are very small and shallow, and Blunn was often dry or pooled during the TCEQ index period. Data from Blunn sampling events was combined with the East Bouldin data for the descriptive summary statistics (Table 3).

Although insufficient data existed to perform robust statistical analysis of parameters, Spearman's rank order correlations were calculated in an attempt to provide some preliminary relationships. Flow was strongly positively correlated to nitrate/nitrite and dissolved oxygen levels (Figure 2). In addition, the major deviation in conductivity occurred at the same time as a very substantial reduction in flow compared to the other sampling events (Figure 3). This relationship is expected, with larger flows diluting ion concentrations. Chlorides and sulfates also followed this pattern (Figure 4), and all three of these parameters were positively correlated.

Table 3. Ordinal descriptive statistics for measured parameters. Blunn and East Bouldin were grouped for this analysis.

	Mean	N	Median	Minimum	Maximum	Std.Dev.	Variance	Range
NH3	0.04	6	0.03	0.02	0.09	0.0315	0.0	0.070
As	6.00	6	6.00	6.00	6.00			0.000
Cd	1.00	6	1.00	1.00	1.00			0.000
Cl	151.85	6	73.70	34.50	560.00	203.1249	41259.7	525.500
Cr	2.18	1	2.18	2.18	2.18			0.000
Cond.	1113.75	6	787.30	627.50	2747.00	813.0181	660998.4	2119.500
Cu	6.00	5	6.00	6.00	6.00			0.000
flow	0.18	6	0.20	0.01	0.30	0.1236	0.0	0.287
Pb	11.59	6	6.04	4.45	30.40	10.3096	106.3	25.950
Hg	0.17	6	0.20	0.00	0.20	0.0816	0.0	0.200
NO3/2	0.36	6	0.33	0.03	0.77	0.3531	0.1	0.740
DOP	0.07	6	0.07	0.02	0.10	0.0389	0.0	0.080
TP	0.09	6	0.10	0.04	0.14	0.0482	0.0	0.100
SO4	115.90	6	75.50	45.00	343.00	113.7882	12947.8	298.000
TKN	0.35	6	0.39	0.08	0.74	0.2439	0.1	0.660
TSS	23.17	6	1.00	0.50	132.00	53.3337	2844.5	131.500
VSS	2.13	6	0.80	0.50	8.00	2.9432	8.7	7.500
Zn	11.63	6	6.00	6.00	29.80	9.7574	95.2	23.800
Alk	243.33	6	253.00	190.00	291.00	37.8294	1431.1	101.000
COD	13.15	6	13.35	5.00	22.50	7.3061	53.4	17.500
DO	6.46	6	6.56	4.20	8.21	1.7028	2.9	4.010
pH	7.37	6	7.37	7.06	7.70	0.2158	0.0	0.640
Temp	23.94	6	23.40	21.48	26.63	1.9593	3.8	5.150

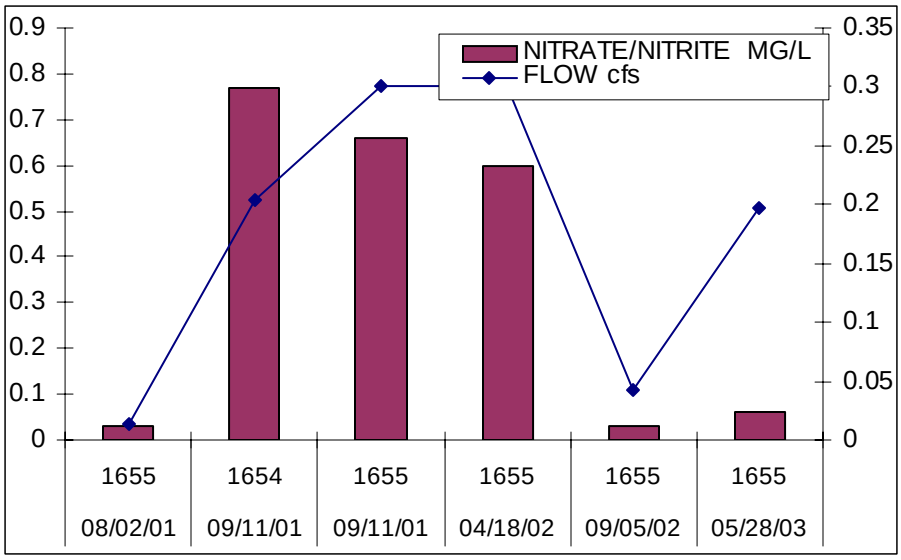

Figure 2. Nitrate/Nitrite values in Blunn and East Bouldin in relation to stream flow.

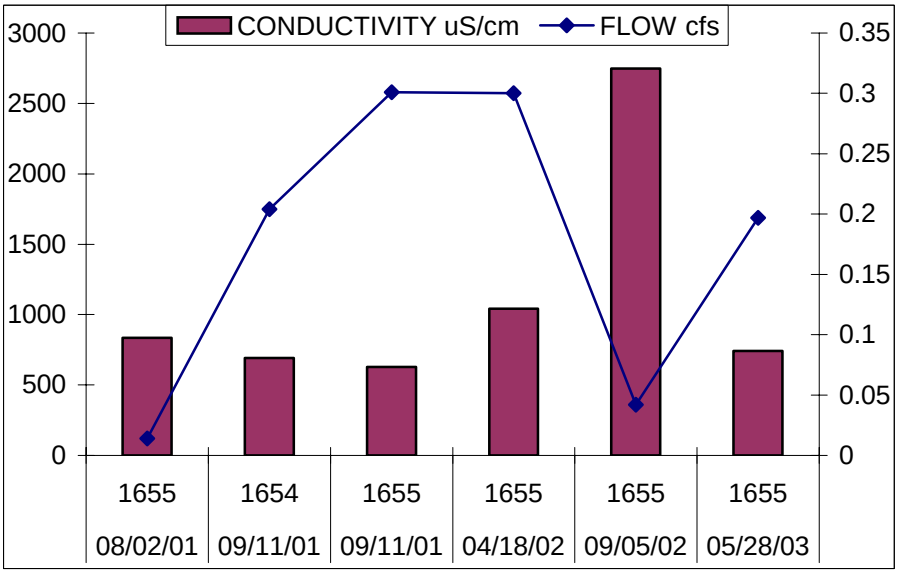

Figure 3. Conductivity values in Blunn and East Bouldin in relation to stream flow.

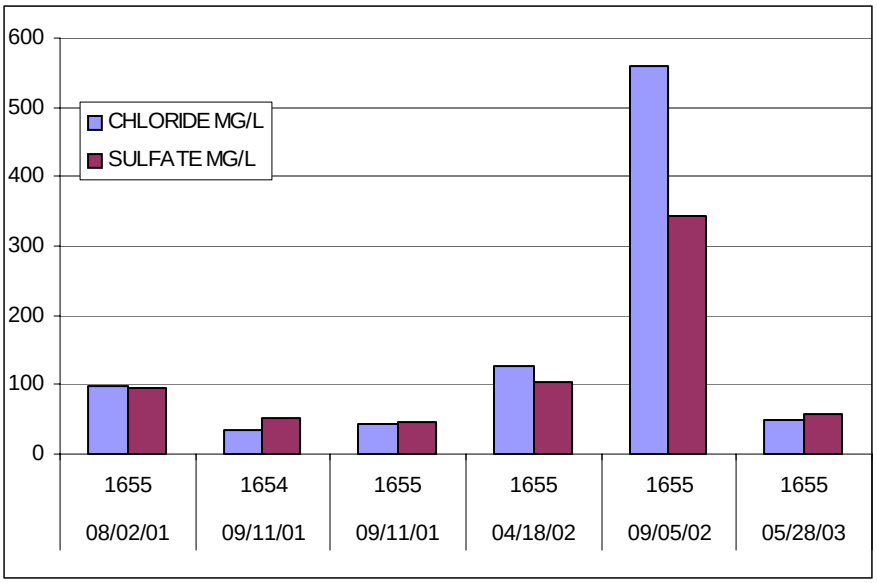

Figure 4. Chloride and Sulfate concentrations in Blunn and East Bouldin.

Thus far, little data has been obtained for the metals parameters. To date, arsenic and mercury, cadmium, and copper have been below detection limits for all samples. Zinc and chromium were below the detection limit for all samples except East Bouldin in April 2002. Lead was the only metal that was continually above the detection limits, and the value was also elevated in April 2002 (Figure 6).

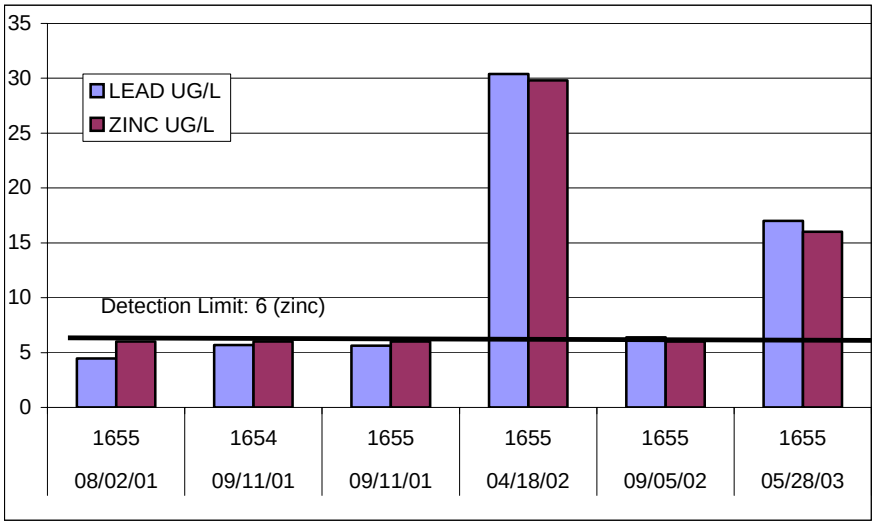

Figure 6. Lead and Zinc concentrations in Blunn and East Bouldin.

Discussion

The April 2002 East Bouldin sample has many elevated parameters and is likely the result of utility construction disturbance in and around the creek just upstream of the site at the time of sampling. A large sediment plume was moving downstream from this construction, which is documented, in the elevated TSS measurement (132 mg/L). Since the conditions at East Bouldin in April 2002 were clearly an isolated event, related to the heavy machinery working around the stream channel, those values will not be used to justify continued sampling of otherwise undetectable parameters. Arsenic, mercury, cadmium, copper, and chromium were all not detectable in base flow at these sites with the exception of the April event. Zinc was slightly elevated in the May 2003 sampling, but otherwise undetectable. Lead measurements were above detection limits, however they were below TCEQ Texas Surface Water Quality Standards (TSWQS) acute criteria for freshwater aquatic organisms.

Chlorides and sulfates were elevated compared to the TCEQ TSWQS criteria. For Town Lake, the criterion is currently 75 mg/L for both parameters, and these two creeks have exceeded these concern levels on more than one occasion. Since these parameters have been tied to impervious cover and development, the Environmental Integrity Index (EII) program has been revised to include sulfate as a regular parameter.

A combination of low flow conditions and the water quality results suggest redefining the purpose and scope of this monitoring program. Both Blunn and East Bouldin are small, urban, intermittent, first order streams and any sampling program in these watersheds should reflect these factors. Currently, little useful information is being collected during base flow conditions for this project. Historical data is present from both COA and USGS collections to provide a baseline for these creeks. In addition, long term monitoring for key parameters will continue through the EII program. The EII program has been revised to include additional sampling at USGS gages during base flow conditions. Currently, the data collected supports dropping the East Bouldin and Blunn program, but continuing to monitor long- term trends at these creeks through EII. At such a time that the data poses specific questions regarding these two small, urban creeks, a specific intensive program can be developed through the EII monitoring plan that will directly address any proposed concerns.

Appendix. Water Quality Data for Blunn and East Bouldin Collections, August 2001-May 2003.

Visit Date	Site	Flow Type	FLOW	DISSOLVED OXYGEN	PH	WATER TEMPERATURE	CONDUCTIVITY	COD (0.025N K2CR207)
			cfs	MG/L	Std. units	Deg. Celsius	uS/cm	MG/L
08/02/01	1655	B	0.014	4.2	7.39	26.63	834.1	12
09/11/01	1654	B	0.204	5.7	7.06	23.37	691.4	5
09/11/01	1655	B	0.301	8.21	7.25	23.43	627.5	5
04/18/02	1655	B	0.3	7.42	7.48	22.79	1042	14.7
09/05/02	1655	B	0.042	5.08	7.34	25.94	2747	19.7
05/28/03	1655	B	0.197	8.17	7.7	21.48	740.5	22.5

Visit Date	Site #	NITRATE/ NITRITE		AMMONIA		TOTAL KJELDAHL NITROGEN		TOTAL SUSPENDED SOLIDS		VOLATILE SUSPENDED SOLIDS	SULFATE	CHLORIDE
		MG/L		MG/L		MG/L		MG/L		MG/L	MG/L	MG/L
08/02/01	1655	0.03		0.08		0.36		4		2.2	94.2	97
09/11/01	1654	0.77		0.03		0.08	<	0.5	<	0.5	52.4	34.5
09/11/01	1655	0.66		0.02		0.41		0.5		0.5	45	42.2
04/18/02	1655	0.6		0.09		0.74		132		8	104	127
09/05/02	1655	0.03	<	0.02	<	0.1		0.8		0.8	343	560
05/28/03	1655	0.06		0.03		0.43		1.2		0.8	56.8	50.4

Visit Date	Site #		ARSENIC		CADMIUM	CHROMIUM		COPPER	LEAD		MERCURY		ZINC	ALKALINITY (AS CACO3)
			UG/L		UG/L	UG/L		UG/L	UG/L		UG/L		UG/L	MG/L
08/02/01	1655	<	6	<	1		<	6	4.45	<	0.0002	<	6	190
09/11/01	1654	<	6	<	1		<	6	5.7	<	0.2	<	6	250
09/11/01	1655	<	6	<	1		<	6	5.62	<	0.2	<	6	207
04/18/02	1655	<	6	<	1	2.18			30.4	<	0.2		29.8	291
09/05/02	1655	<	6	<	1		<	6	6.39	<	0.2	<	6	266
05/28/03	1655	<	6	<	1		<	6	17	<	0.2		16	256