

Washington University Water Quality Report

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WASHINGTON UNIVERSITY STABLE ISOTOPE LAB (WUSIL)

The Washington University Stable Isotope Lab (WUSIL) has studied the regional hydrology of the City of St. Louis and St. Louis County by the examining historical records, stable isotopes, and water quality parameters to determine the effects of urban development on flood severity, water chemistry, karst landscapes, stream discharge, and shallow groundwater as well as the effectiveness of best management practices (BMPs) used to remediate problems found in urban watersheds. The WUSIL conducted biweekly sampling operations in the Deer Creek basin during Fall 2008. The primary objectives were to identify and quantify the timing and magnitude of organic related pollutants in the targeted streams, which was viewed as background data needed for the development of better guidelines for BMPs. The monitoring effort included field data (specific conductivity, temperature, pH, DO, and turbidity) and laboratory work (total coliform, *E. coli*, ammonia, nitrate, phosphorus, and chloride). Monitoring practices consist of four types of activities; continuous monitoring of water levels or water quality, quantifying rainfall amounts, grab sampling, and automated storm water sampling. Six sampling sites located at US Geological Survey (USGS) gauging stations in the Deer Creek watershed are monitored by grab sampling and historically many more creeks and rivers have been sampled throughout the city and county. WUSIL also set up sampling sites at three BMPs located in the Deer Creek. In addition to these locations, WUSIL also analyzed discharge and water quality data obtained by the USGS and the Metropolitan St. Louis Sewer District (see report, below).

DATA AVAILABILITY

Significant, reliable data on the water quality parameters in Deer Creek have been measured by several different agencies and groups, notably the US Geological Survey (USGS), the Metropolitan St. Louis Sewer District (MSD), the Litzinger Road Ecology Center (LREC) Stream Team and the Washington University Stable Isotope Lab (WUSIL). The number of samples analyzed is significant and the information is up to date. The consistency of the data establishes that their reliability is very good to excellent. However, some sampling bias exists; for example, the LREC and WUSIL data bases include fewer samples representing above average flow conditions than do the MSD or USGS data sets, and the WUSIL data include few winter samples so the reported chloride levels are lower.

Identified Impairments

Selected reaches of St. Louis County creeks have been placed on the 303d list for high chloride (e.g., River des Peres), bacteria (e.g., Creve Coeur Ck.), and low D.O. (e.g., Fishpot Ck), and some for all three (e.g., Coldwater Ck. and Gravois Ck.; see MoDNR, 2009a). Available data indicates that many reaches of Deer Creek are as impaired in these pollutants as are those listed examples.

The methods used below for assessing compliance with the EPA water quality standards are taken from MoDNR (2009b), and regard standards that apply to the "Protection of Aquatic Life" (AQL) or for category B recreational waters. Specifically:

Low D.O.: No more than 10% of all samples exceed criterion (5 mg/L for AQL).

Chloride: No more than one acute toxic event in 3 years

E. coli: Water quality standards not exceeded as a geometric mean (206 E.Coli bacteria/100mL) in any of the last three years, for samples collected during Apr 1 to Oct 31.

Table 2-1 summarizes the available water quality data for Deer Creek and several of its tributaries for the aforementioned parameters. The data establish anomalously low D.O. values in several reaches, and a particularly low mean value (7.1 mg/L) for D.O. for Deer Creek at Maplewood, where 17% of all samples analyzed by USGS have less oxygen than the mandated minimum of 5 mg/L. This condition is chronic at this site during the warm period of late April through August, when the mean D.O. is only 4.8 m/L. Thus, this site alone establishes that low D.O. conditions exist in the Deer Creek watershed.

Table 2-1 also establishes that high chloride events in Deer Creek are common over lengthy reaches. The problems are most severe in the lower part of the basin, at and below the “Rock Hill” site, including the Black Creek tributary. In these areas, the mean chloride concentration typically exceeds the level of 230 mg/L established by EPA for a “chronic” condition, and many individual samples are well above the established value of 860 mg/L established for an “acute” condition. It is well understood that high chloride levels coincide with winter road salt applications, particularly with the first snowmelt events after such applications, as these quickly dissolve and mobilize the salt, then rapidly transport it over impervious road surfaces and through stormwater culverts into area streams (e.g., Shock *et al.*, 2003). However, the upper reaches of Deer Creek, the tributary at Chaminade, and especially the Twomile Creek are much less impaired by chloride; these watersheds have a lower population density.

Finally, Table 2-1 establishes that unhealthy levels of *E. coli* are common over lengthy reaches of Deer Creek. The problems are most severe in the lower part of the basin, at and below the “Rock Hill” site, including the Black Creek tributary. Note that the geometric means for most of the WUSIL sites are minimum values, as *E. coli* levels in several individual samples exceeded the upper limit (2420 col/dL) for the techniques used in that lab. Further study is needed in order to assess the lower geometric means for the MSD sites of Drury Avenue and Breckenridge Industrial Court when compared to other MSD, USGS or WUSIL data.

Table 2-1: Summary Water Quality Data for Deer Creek and Several Tributaries

Site Name	Site #	D.O. min mean max (# of samples)	% of all samples <5 mg/l	Chloride min mean max (# of samples)	% samples >230 mg/l	<i>E. coli</i> Geometric Mean (# of samples)	Sampling Period	Data Source
Deer Creek @ Ladue	07010075	3 8.1 18.6 (23)	13	94 256 430 (6)	50	1301 (14)	May 2001 to Aug 2004	USGS
Black Creek near Brentwood	07010082	7 9.2 15.2 (6)	0	180 455 730 (2)	50	1543 (3)	Dec 2003 to Aug 2004	USGS
Deer Creek @Maplewood	07010086	2.4 7.1 12.2 (23)	17	160 407 800 (6)	50	1860 (13)	May 2001 to Aug 2004	USGS
Deer Creek @ Drury Ave.	N/A	4 9.3 13.9 (36)	3	16 301 3400 (36)	28	171 (9)	Feb 2006 to May 2009	MSD
Deer Creek @ Breckenridge Industrial Ct.	N/A	3.5 8.2 13.3 (37)	5	20 239 2710 (37)	16	120 (11)	Feb 2006 to June 2009	MSD
Deer Creek @ Big Bend Ave.	N/A	5.3 7.5 11.0 (11)	0	34 151 640 (11)	18	3090 (4)	May 2006 to July 2009	MSD
Deer Creek @ Malcom Terrace Park	N/A	6 10.3 20 (16)	0	30 203 592 (16)	13	NA	Feb 2008 to Sept 2009	LREC*

Tributary @ Chaminade	N/A	1 9.6 23 (17)	6	130 162 409 (16)	25	NA	Feb 2008 to Sept 2009	LREC
Deer Creek @ Log Cabin Ln.	N/A	7 12.6 28 (16)	0	30 174 1375 (17)	12	NA	Feb 2008 to Sept 2009	LREC
Deer Creek @ LREC	07010055	4 8.8 26 (17)	6	42 123 600 (17)	6	NA	Feb 2008 to Sept 2009	LREC
Deer Creek @ Rock Hill	07010075	3 10.1 21 (16)	6	43 173 1048 (15)	20	NA	Feb 2008 to Sept 2009	LREC
Sebago Creek @ Old Warson Rd.	07010070	3 10.6 21 (18)	6	35 175 504 (18)	17	NA	Feb 2008 to Sept 2009	LREC
Twomile Creek @ Overbrook	07010061	3 8.7 18 (17)	12	31 42 65 (17)	0	NA	Feb 2008 to Sept 2009	LREC
Twomile Creek @ Ladue	07010061	5.3 8.4 11.0 (8)	0	29 36 49 (7)	0	73 (4)	Sept 2008 to Dec 2008	WUSIL
Sebago Creek near Rock Hill	07010070	1.5 9.6 15.0 (8)	25	8 140 313 (6)	17	> 645 (4)	Sept 2008 to Dec 2008	WUSIL
Black Creek near Brentwood	07010082	5.5 8.2 11.9 (8)	0	36 133 195 (6)	0	>1070 (4)	Sept 2008 to Dec 2008	WUSIL
Deer Creek @ Litzinger Rd. @ Ladue	07010055	5.1 9.1 12.4 (8)	0	67 79 104 (6)	0	> 325 (4)	Sept 2008 to Dec 2008	WUSIL
Deer Creek @ Ladue	07010075	2.5 9.2 13.5 (7)	14	24 68 104 (5)	0	> 665 (3)	Sept 2008 to Dec 2008	WUSIL
Deer Creek @ Maplewood	07010086	3.7 7.8 11.4 (9)	22	43 107 166 (6)	0	> 671 (4)	Sept 2008 to Dec 2008	WUSIL