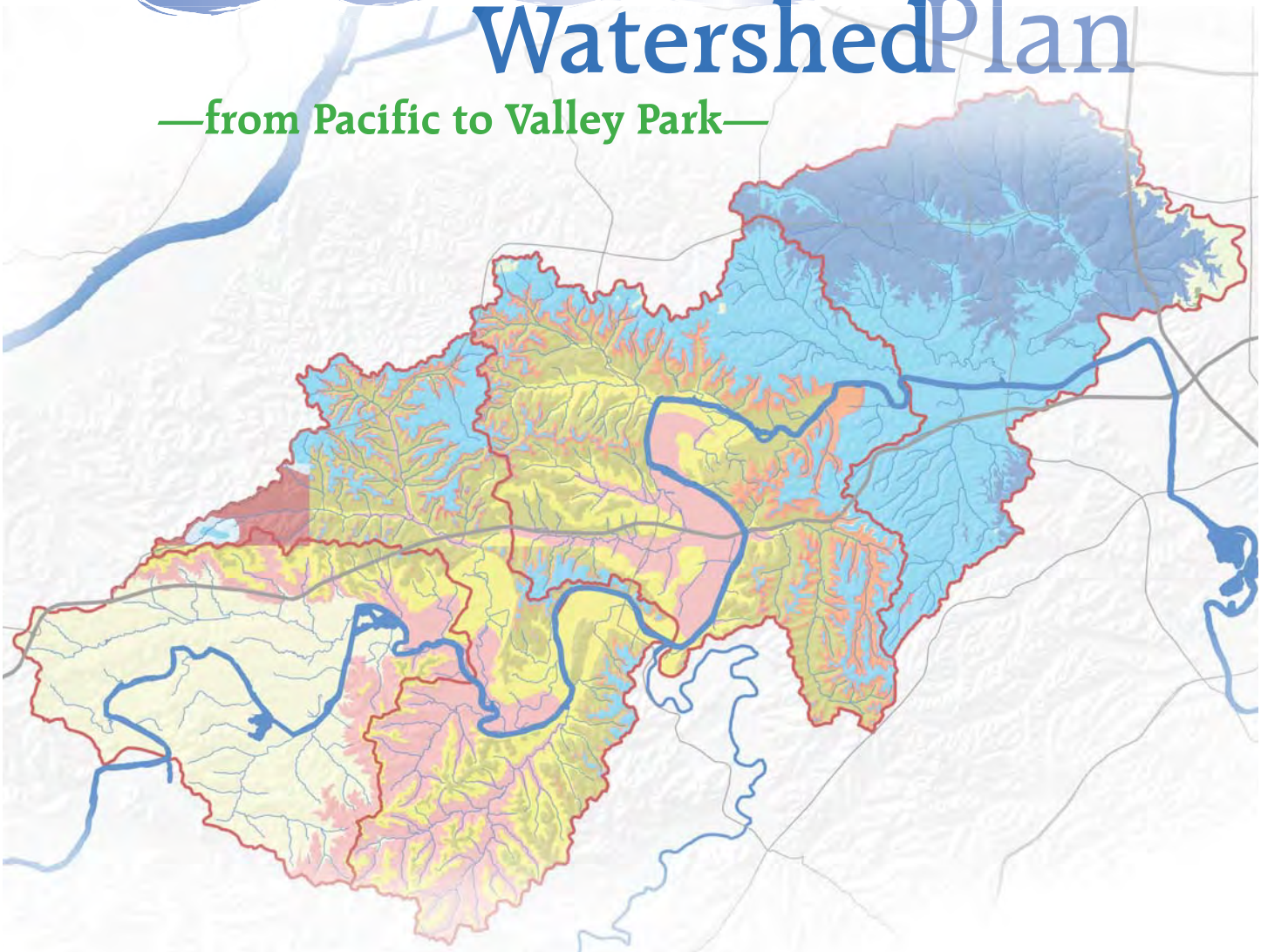
FINAL

Appendix | January 2012

Lower Meramec Watershed Plan

—from Pacific to Valley Park—



This project and report was supported by a grant from the
United States Environmental Protection Agency, Region 7

EAST-WEST GATEWAY
Council of Governments

Creating Solutions Across Jurisdictional Boundaries

Lower Meramec Watershed Plan

Water Quality, Green Infrastructure and Watershed Management for the Lower Meramec Watershed

APPENDIX

East-West Gateway Council of Governments

January 2012

U.S. Environmental Protection Agency Region 7 through the Missouri Department of Natural Resources has provided partial funding for this project under the American Recovery and Reinvestment Act of 2009 and Section 604(b) of the Clean Water Act.

Table of Appendices

Introduction

Table of Appendices - Continued

Documents available in pdf format at the Lower Meramec Watershed Plan web page:
http://www.ewgateway.org/environment/waterresources/Watersheds/LowerMeramec/lowermeramec.htm

LaBarque Creek Watershed Conservation Plan, 2009
Prepared by Missouri Department of Conservation for Friends of LaBarque Creek

Fishpot Creek Watershed: A Demonstration of Geomorphic-Based Stream Channel Management Method, 2003
Prepared by Intuition & Logic for the St. Louis County Soil and Water Conservation District

Lower Meramec River Source Water Protection Strategy Exchange Report, 2009
Prepared by the Meramec River Tributary Alliance

St. Louis County Meramec River Greenway Concept Plan, 2003
Prepared by St. Louis County Department of Parks and Recreation and St. Louis County Department of Planning

PowerPoint - Green Infrastructure, Nonpoint Education for Municipal Officials (NEMO), Lower Meramec Tributary Watershed Planning

PowerPoint - Rain Gardens, Nonpoint Education for Municipal Officials (NEMO), Lower Meramec Tributary Watershed Planning

PowerPoint - Native Plants, Nonpoint Education for Municipal Officials (NEMO), Lower Meramec Tributary Watershed Planning

PowerPoint - Natural Resource Based Planning, Nonpoint Education for Municipal Officials (NEMO), Lower Meramec Tributary Watershed Planning

INTRODUCTION TO THE APPENDIX

This document serves as the Appendix to the Lower Meramec Watershed Plan – from Pacific to Valley Park – produced by East-West Gateway Council of Governments. Contained within are mainly data and technical information concerning: National Pollutant Discharge Elimination System Permits; Cultural Resources; Water Quality Monitoring results; Pollutant Loadings for each of the watersheds within the study area; Pollutant Loading Modeling; Fish Population Analysis; Results of the Lower Meramec Watershed Planning Survey and Analysis; Proposed Projects from Missouri State Parks Division; Land Cover maps; recommendations from the Source Water Demonstration Project; and Grant Opportunities and Funding Resources information.

Other related documents too voluminous in total to be included are herein provided in PDF format as if incorporated in full.

Appendix A

National Pollutant Discharge Elimination System (NPDES) Permits

Table A-1
Study Area Domestic NPDES Permits Issued on or after January 11, 2002

Map 6 #	**Co.**	**Permit**	**Permit Expires**	**Name**	**Treatment**	**Flow (Gallons per Day)**	**Discharge Stream**
1	F	MO0119113	11-2014	FCPSWD#3 Twin View WWTP POTW	Flow equalization, extended aeration, chlorination	Design-18,500 Actual - 8,000	Tributary to Brush Ck
3	F	MO0106534	1-2014	FCPWSD#3 Ad Deum Subdivision POTW	Extended aeration, chlorination	Design - 16,400 Actual - 15,000	Tributary to Brush Ck
4	F	MO0108901	8-2011	Summit Hills Farm Subdivision	Extended aeration	Design - 16,650 Actual - 9,300	Tributary to Brush Ck
5	F	MO0041131	11-2013	Pacific WWTF	4 cell lagoon, 2 aerated cells with fixed film media, partial floating cover on 2nd aerated cell, seasonal UV disinfection	Design - 2 MGD Actual - 0.83 MGD	Meramec R
7	F	MO0095583	11-2014	Kober's MHP	3 cell facultative lagoon	Design - 4,800 Actual - 1,500	Tributary to Meramec R

Table A-1 - Continued
Study Area Domestic NPDES Permits Issued on or after January 11, 2002

Map 6 #	Co.	Permit	Permit Expires	Name	Treatment	Flow (Gallons per Day)	Discharge Stream
8	F	MO0115410	7-2013	Calvey Creek Sewer District - Catawissa Lagoon POTW	3 cell lagoon	Design - 185,000 Actual - 50,000	Winch Ck
9	F	MO0081035	6-2011	Windfall Estates MHP	Extended aeration, chlorination	Design - 10,000 Actual - 4,825	Tributary to Winch Ck
11	F	MO0090492	3-2012	Crestview Acres (MHP) Sewer District POTW	Single cell lagoon	Design - 10,000 Actual - 6,400	Barley Brh to Sandy Ck to Winch Ck
12	F	MO0098043	11-2011	Sylvan Manor - Sunset Acres Sewer District	Extended aeration, seasonal chlorination	Adjusted Design - 17,999 Actual - 17,800	Wet weather tributary to Meramec R
13	J	MO0106747	11-2014	Lake Cattails Subdivision (aka Fairways Subdivision)	Extended aeration, chlorination	Design - 22,220 Actual - 5,000	Tributary to Meramec R

Table A-1 - Continued
Study Area Domestic NPDES Permits Issued on or after January 11, 2002

Map 6 #	Co.	Permit	Permit Expires	Name	Treatment	Flow (Gallons per Day)	Discharge Stream
14	J	MO0120332	5-2015	Palisades Village Subdivision	Extended aeration, chlorination	Design - 28,000 Actual - 10,555	Tributary to Meramec R
15	F	MO0111937	3-2015	FCPWSD#3 Little Fox Creek POTW	Extended aeration	Design - 40,000 Actual - 60,000	Little Fox Ck
16	F	MO0132802	12-2012	FCPWSD#3 Horseshoe Valley WWTF	Flow equalization, extended aeration	Design - 10,500	Little Fox Ck
17	STL	MO0123871	4-2014	Estates at Autumn Farms	Septic tank, effluent filters, recirculating sand filter, chlorination	Design - 3,300 Actual - 2,000	Tributary to Fox Ck
19	STL	MO0120031	2-2010	Estates at August Tavern Creek	Septic tank, recirculating sand filter, chlorination	Design - 10,000 Actual - 6,000	Tributary to Fox Ck

Table A-1 - Continued
Study Area Domestic NPDES Permits Issued on or after January 11, 2002

Map 6 #	Co.	Permit	Permit Expires	Name	Treatment	Flow (Gallons per Day)	Discharge Stream
21	STL	MO0132331	12-2011	Hencken Valley Estates WWTF	STEP system, recirculating sand filter, chlorination, dechlorination	Design - 4,800	Tributary to Fox Ck
23	J	MO0124036	8-2013	Winterwood Subdivision	Septic tank, recirculating sand filter	Design - 20,000 Actual - Unknown, No observable flow	Tributary to LaBarque Ck
24	J	MO0134147	8-2013	Jefferson County Sewer District Mirasol WWTF POTW	Lift station, extended aeration, UV disinfection	Design - 150,000	Meramec R
25	STL	MO0039659	3-2016	Eureka WWTF POTW	Aerated lagoon, UV disinfection	Design - 2.8 MGD Actual - 1.3 MGD	Meramec R
29	STL	MO0122629	9-2010	Bartizan Point Estates	Septic tank, recirculating sand filter, UV disinfection	Design - 4,800 Actual - 2,000	Tributary to Hamilton Ck

Table A-1 - Continued
Study Area Domestic NPDES Permits Issued on or after January 11, 2002

Map 6 #	Co.	Permit	Permit Expires	Name	Treatment	Flow (Gallons per Day)	Discharge Stream
31	STL	MO0111261	3-2015	Radcliffe Place Subdivision	Extended aeration, UV disinfection	Design - 58,200 Actual - 23,000	Hamilton Ck
35	J	MO0095281	12-2011	NPSD Walnut Ridge WWTF POTW	Extended aeration, chlorination, dechlorination	Design - 14,400 Actual - 2,500	Tributary to Antire Ck (losing)
36	J	MO0090026	12-2011	NPSD Pere Cliff MHP POTW	Septic tank, sand filter, chlorination, dechlorination	Design - 2,475 Actual - 0	Tributary to Little Antire Ck (losing)
37	J	MO0044881	3-2013	Sunny Acres II MHP	Extended aeration, sock filter, chlorination	Design - 7,500 Actual - 2,800	Little Antire Ck
38	J	MO0084646	1-2015	Villas of Williams Creek MHP (formerly Rosecliff MHP)	Extended aeration, sock filter, chlorination	Design - 6,000 Actual - 1,200	Tributary to Little Antire Ck

Table A-1 - Continued
Study Area Domestic NPDES Permits Issued on or after January 11, 2002

Map 6 #	Co.	Permit	Permit Expires	Name	Treatment	Flow (Gallons per Day)	Discharge Stream
39	J	MO0091359	2-2012	Pembroke Park Apartments	Extended aeration, single cell storage lagoon, wastewater irrigation Domestic wastewater no discharge system	Average Dry Weather Design 5,000 Design with 1 in 10 year rainfall, less evaporation - 5,550 Actual - Unknown	Tributary to Antire Ck (losing)
40	J	MO0086347	10-2009	Laurel Acres MHP	2 cell lagoon, chlorination	Design - 12,120 Actual - 7,400	Little Antire Ck
41	J	MO0099252	6-2015	NPSD Antire Springs Plant POTW	Extended aeration, seasonal chlorination, dechlorination	Design - 20,000 Actual - 21,400	Antire Ck

Table A-1 - Continued
Study Area Domestic NPDES Permits Issued on or after January 11, 2002

Map 6 #	Co.	Permit	Permit Expires	Name	Treatment	Flow (Gallons per Day)	Discharge Stream
44	STL	MO0122751	3-2015	Pevely Farm (Subdivision) Interim WWTF	Extended aeration, UV disinfection	Design - 100,000 Actual 42,900	Meramec R
49	STL	MO0101362	1-2012	MSD Grand Glaize WWTF POTW	Outfall 1 - Lift station, primary clarification, activated sludge, chlorination, dechlorination Outfall 2 - 3 cell lagoon/wet weather flow retention/flow equalization Discharged flow enters main Outfall1 pipe Outfall 3, 4, 5 and 6 - Stormwater runoff, no treatment	Outfall 1 Design - 21 MGD Actual - 17 MGD	Outfall 1 - Meramec R Outfall 2 - Meramec R Outfalls 3, 4, 5 and 6 - Tributary to Grand Glaize Ck
52	J	MO0040347	4-2009	Woodridge Apartments	Septic tank, recirculating sand filter, chlorination	Design - 16,500	Tributary to Williams Ck
53	J	MO0113611	6-2011	NPSD - Paradise Valley POTW	Extended aeration, sock filter, chlorination, dechlorination	Design - 92,600 Actual - 19,500	Williams Ck

Table A-1 - Continued
Study Area Domestic NPDES Permits Issued on or after January 11, 2002

Map 6 #	**Co.**	**Permit**	**Permit Expires**	**Name**	**Treatment**	**Flow (Gallons per Day)**	**Discharge Stream**
58	F	MO0089656	10-2014	FCPWSD#3 - Victoria Gardens POTW	Bar screen, extended aeration, single pass sand filter, chlorination, dechlorination	Design - 32,500 Actual - 20,000	Tributary Little Fox Ck
59	F	MO0091413	1-2007	Circle “C” MHP	2 cell facultative lagoon	Design - 6,600 Actual - 4,300	Tributary Brush Ck

Source – Missouri Department of Natural Resources

Table A-2
Study Area Industrial NPDES Permits Issued on or after January 11, 2002

Map 6 #	Co.	Permit	Permit Expires	Name	Treatment	Discharge Stream
6	STL	MO0000493	2-2010	U.S. Silica Sand Mining	Outfall 1 - Stormwater runoff, sand washing, sand quarry Treatment - Settling basin/stormwater runoff Actual Flow - 0.863 MGD Outfall 2 - Stormwater runoff Treatment - Settling basin/stormwater runoff Actual Flow - 0.61 MGD	Outfall 1 - Clear Ck Outfall 2 - Tributary to Meramec R
34	J	MO0094956	7-2011	H.R. Electronics Manufacturing and warehouse Only warehouse in use	Outfall 1 - Warehouse wastewater system Septic tank, recirculating sand filter, chlorination, effluent pump Outfall 2 - Industry, stormwater Single cell lagoon, stormwater runoff	Antire Ck (losing)
46	STL	MO0113000	6-2011	Onyx Oak Ridge Landfill	Outfall 2 - Stormwater runoff Sedimentation basin, stormwater runoff Flow dependent upon precipitation Outfall 3- Stormwater runoff Stormwater runoff Flow dependent upon precipitation Outfall 5 - Stormwater runoff Stormwater runoff Flow dependent upon precipitation Outfalls 1 and 4 have been eliminated	Outfall 2 and 5 - Tributary to Fishpot Ck Outfall 3 - Meramec R

Table A-2 - Continued
Study Area Industrial NPDES Permits Issued on or after January 11, 2002

Map 6 #	Co.	Permit	Permit Expires	Name	Treatment	Discharge Stream
47	STL	MO0001341	11-2011	Reichhold Inc Plastic materials, synthetic resins and nonvulcanizable elastomers	Outfall 1 - Industry process water, stormwater Actual flow - 0.083 MGD Outfall 2 - Stormwater runoff retention basin Actual flow is 0.007 MGD	Tributary to Meramec R
48	STL	MO0123021	10-2013	Valley Park TCE Site Wainwright Operable Unit (Wainwright Industries) Fabricated metal products	Ground Water Remediation Treatment Unit by Air Stripping (Trichloroethylene) Design flow - 165 gallons per minute or 237,000 GPD	Meramec R
50	STL	MO0000167	10-2010	Daimler Chrysler St. Louis Facility closed	Outfall 2 - Industry process water, stormwater Outfall 4 - Industry process water, stormwater Outfalls 5 and 7 - Stormwater runoff	Meramec R
51	STL	MO0001627	12-2015	Bohn & Dawson, Inc Steel pipes and tubes	Industry process water Actual flow - 4,600 GPD	Grand Glaize Ck

Table A-2 - Continued
Study Area Industrial NPDES Permits Issued on or after January 11, 2002

Map 6 #	Co.	Permit	Permit Expires	Name	Treatment	Discharge Stream
55	STL	MO0110779	2-2015	Peerless Demolition Landfill Construction and demolition landfill	Outfall 2 - Stormwater runoff Design flow - 1.53 MGD based on 10-year, 24-hour rainfall event Average flow - 40,000 GPD Outfall 3 - Stormwater runoff Design flow - 0.98 MGD based on 10-year, 24-hour rainfall event Average flow - 30,000 GPD Outfall 4 - Stormwater runoff Design flow - 1.24 MGD based on 10-year, 24-hour rainfall event Average flow - 40,000 GPD Outfall 5 - Detention basin, emergency discharge only Receives flow from Outfalls 3 and 4. Discharge is normally 0 GPD except during unusual precipitation events Outfall 1 - eliminated	Outfall 2 - Tributary to Williams Ck Outfalls 3, 4 and 5 - Meramec R

33	J	MO0097926	7-2008	Engineered Coil, dba Marlo Coil Air conditioning and warm air heating equipment and commercial and industrial refrigeration equipment	Outfall 1 - Facility wastewater system Extended aeration, year round chlorination Design Flow - 3,000 GPD Actual Flow - 2,430 GPD Outfall 2 - Industry process water Design flow - 600 GPD Actual flow - 50 GPD Outfall 3 - Industry process water, building roof drain Design flow - including stormwater is 5,600 GPD (depends on precipitation) Actual process flow - 18 GPD Outfall 4 - Industry process water, intermittent roof runoff Design flow - including stormwater is 9,500 GPD Actual process flow - 288 GPD Outfall 5 - Industry process water Design flow - 300 GPD Actual flow - 25 GPD Outfall 7 - Stormwater runoff East Building roof Design flow - 325,413 GPD Actual flow - Dependent upon precipitation Outfall 8 - Stormwater runoff building roof Design flow - 298,080 GPD Actual flow - Dependent upon precipitation	Tributary to Antire Ck

Source – Missouri Department of Natural Resources

Table A-3
Study Area Commercial - Institutional NPDES Permits Issued on or after January 11, 2002

Map 6 #	Co.	Permit	Permit Expires	Name	Treatment	Flow (Gallons per Day)	Discharge Stream
2	F	MO0125504	7-2014	Shaw Nature Reserve	Septic tank, 2 cell wetland system	Design - 2,600 Actual - 525	Tributary to Brush Ck
10	F	MO0090603	11-2013	Meramec Valley R-3 School District Nike Elementary School	Imhoff tank, 4 open sand filters	Adjusted Design - 4,999 Actual - 2,500	Tributary to Winch Creek
18	STL	MO0120375	5-2012	Rockwood Harvest Assembly of God	Septic tank, recirculating sand filter, chlorination, dechlorination	Design - 1,500	Tributary to Fox Ck
20	STL	MO0122424	9-2010	Metro West FPD Station #5	Septic tank, recirculating sand filter, chlorination, dechlorination	Design - 1,000 Actual - 750	Tributary to Fox Ck
22	J	MO0081426	2-2012	St. Joseph's Hill Infirmary	Single cell aerated lagoon	Design - 20,000 Actual - 14,470	Tributary to LaBarque Ck

Table A-3 - Continued
Study Area Commercial - Institutional NPDES Permits Issued on or after January 11, 2002

Map 6 #	Co.	Permit	Permit Expires	Name	Treatment	Flow (Gallons per Day)	Discharge Stream
26	STL	MO0105473	1-2012	Six Flags St. Louis	Outfall 1 - 3 cell settling basin, dechlorination (seasonal discharge from water-based rides, stormwater runoff) Outfall 2 - single cell settling basin, dechlorination (seasonal discharge from water park, stormwater runoff)	Outfall 1 Design - 1.5 MGD Actual - 25,000 Outfall 2 Design - 225,000 Actual - 32,000	Tributary to Flat Ck
27	STL	MO0096083	8-2011	Kiwanis Camp Wyman	Extended aeration, voluntary chlorination	Design - 20,000 Actual - 10,000	Forby Ck
28	STL	MO0113131	11-2014	Hidden Valley Golf Course	Extended aeration, flow equalization tank, tertiary sock filter, chlorination-dechlorination	Design - 5,000 Actual - 1,500	Tributary to Carr Ck (losing)

Table A-3 - Continued
Study Area Commercial - Institutional NPDES Permits Issued on or after January 11, 2002

Map 6 #	Co.	Permit	Permit Expires	Name	Treatment	Flow (Gallons per Day)	Discharge Stream
30	STL	MO0113743	6-2011	Rockwood School District LaSalle Springs Middle School	Lift station, extended aeration, chlorination, dechlorination	Adjusted Design - 11,999 Actual - 9,760	Hamilton Ck
32	STL	MO0131733	7-2013	Marianist Retreat Center	Septic tank, recirculating sand filter, chlorination, dechlorination	Design - 5,250	Tributary to Hamilton Ck
42	STL	MO0107549	5-2014	BSA Beaumont Scout Reservation	Extended aeration, chlorination, dechlorination	Design - 9,000 Actual - 30	Little Antire Ck
43	STL	MO0107549	5-2015	BSA Beaumont Scout Reservation	Septic tank, sand filter, chlorination, dechlorination	Design - 4,650 Actual - 15	Little Antire Ck
45	STL	MO0098124	9-2012	Players Club of St. Louis Golf course	Extended aeration, sand filter, year round chlorination	Design - 2,500 Actual - 150	Tributary to Meramec R

Table A-3 - Continued
Study Area Commercial - Institutional NPDES Permits Issued on or after January 11, 2002

Map 6 #	Co.	Permit	Permit Expires	Name	Treatment	Flow (Gallons per Day)	Discharge Stream
54	STL	MO0134651	8-2013	Peerless Park I-44 Center	Lift station, flow equalization, extended aeration, chlorination, dechlorination	Design - 6,000	Williams Ck
56	STL	MO0081582	9-2010	Fred Weber Inc Waste Transfer	Extended aeration, seasonal disinfection by chlorination	Design - 3,600 Actual - 400	Tributary Meramec R
57	STL	MO0120910	9-2010	Motomart	Oil-water separator, lift station, extended aeration, chlorination, dechlorination	Design - 3,000	Meramec R
60	J	MO0114120	2-2007	Lakewood Care Center	Extended aeration, chlorination	Design - 2,130 Actual - 1,440	Tributary Meramec R

Source – Missouri Department of Natural Resources

Abbreviations
F – Franklin County
J – Jefferson County
STL – St. Louis County
FCPWSD#3 – Franklin County Public Water and Sewer District #3
WWTP – Wastewater Treatment Plant (same as Treatment Facility)
WWTF – Wastewater Treatment Facility
POTW – Publicly Owned Treatment Works
MHP – Mobile Home Park
NPSD – Northeast Public Sewer District
MSD – Metropolitan St. Louis Sewer District
UV - Ultraviolet
STEP – Septic Tank Effluent Pumping System
MGD – Million Gallons per Day
GPD – Gallons per Day

Appendix B

Cultural Resources by County

Table B-1
Franklin County Cultural Resources

Map 9 #	Name	Location	Source
2	Riverboat Dan's House (2010 - Catawissa Llamas)	Rte 3, Catawissa	1976 Historic Sites Inventory
1	Thomas W.B. Crews House (2010 - Bascom House at Shaw Nature Preserve)	Old Highway, 66 Gray Summit	1976 Historic Sites Inventory
3	Gustav Grauer Farm District (Maple Springs Farm/Creminscroft)	RR 5, w of Bouquet Rd N of Pacific	National Register

National Register location from State Historic Preservation Office, MoDNR GIS Map Gallery
www.dnr.mo.gov/shpo/mapgallery

Table B-2
Jefferson County Cultural Resources

Map 9 #	Name	Location	Source
9	Byrnesville Hotel	Byrnes Mill	Jefferson County Sites of Local Significance
8	Byrnesville Mill	on Big River, 3 mi n Cedar Hill	Jefferson County Sites of Local Significance
7	Byrnesville Store	Byrnes Mill	Jefferson County Sites of Local Significance
18	St. Martins United Church of Christ	High Ridge	Jefferson County Sites of Local Significance
17	Bear Creek Schoolhouse	w side Carol Park Road High Ridge	Jefferson County Sites of Local Significance
19	Murphy Store	se corner of Hwy 30 & Sugar Creek Rd; 5 mi ne High Ridge	Jefferson County Sites of Local Significance
4	Log Cabin	5 mi w Hoene Springs on F	Jefferson County Sites of Local Significance
12	House Springs General Store & houses	21/2 n of House Springs on W	Jefferson County Sites of Local Significance
13	Votaw Saloon	House Springs area	Jefferson County Sites of Local Significance
14	Henry Weber House	House Springs area	Jefferson County Sites of Local Significance
10	Mill of James Byrne	House Springs area	Jefferson County Sites of Local Significance
6	LaBarque Cabin	6 mi w House Springs	Jefferson County Sites of Local Significance
15	Log Cabin	Byrnesville-House Springs Rd	Jefferson County Sites of Local Significance
11A	Moder Archaeological District	Jefferson County*	National Register Jefferson County Sites of Local Significance

*Address Restricted

Table B-2 - Continued
Jefferson County Cultural Resources

Map 9 #	Name	Location	Source
12	Valentine Leight General Store	4566 Main St House Springs	National Register Jefferson County Sites of Local Significance
21A	Beaumont-Tyson Quarry Archaeological District	N Jefferson/St. Louis Counties*	National Register Jefferson County Sites of Local Significance
22A	Boland Archaeological District	N Jefferson County*	National Register Jefferson County Sites of Local Significance
20A	Boemler Archaeological District	Jefferson County*	National Register Jefferson County Sites of Local Significance
	Bonnacker Mill site		Jefferson County Sites of Local Significance
16	St. Philomena Church and Cemetery (Our Lady Queen of Peace)	House Springs	Jefferson County Sites of Local Significance
5	Wade Road Cabin	8 mi w of House Springs	Jefferson County Sites of Local Significance

* Address Restricted

National Register location from State Historic Preservation Office, MoDNR GIS Map Gallery
www.dnr.mo.gov/shpo/mapgallery

Table B-3
St. Louis County Cultural Resources

Map 9 #	Name	Location	Source
42	William D. Bacon Log House	687 Henry Ave at Spring Meadows Dr, Ballwin	St. Louis County**
39	Salem Methodist Church	14825 Manchester Rd Manchester/Ballwin	St. Louis County
41	Barn at Lucerne (was Ganahl Farm)	15444 Clayton Rd at Kehrs Mill, Ballwin	St. Louis County
40	Harrison-Schmidt-Dahlke Log House	Vlasis Park, Holloway & City Hall Dr, Ballwin	St. Louis County
23A	Crescent Quarry Archaeological Site	St. Louis County*	National Register
43	Bakemeier Farm	950 St. Paul Rd, Ellisville	St. Louis County
37	Augustine School and Farm (Donated to raptor rehabilitation & propagation project)	317 Augustine Rd, Eureka	St. Louis County
36	Deep Springs Farm Buildings (part of Ramada Inn at Six Flags)	4901 Allenton Six Flags Rd, Eureka	St. Louis County
61	Bopp House	115 W Monroe, Kirkwood	St. Louis County
62	Hoffman-Ward House	142 W Monroe, Kirkwood	St. Louis County
57	Kraus & Goetz House	120 N Ballas, Kirkwood Ebsworth Park	National Register St. Louis County
59	DePombiray-Moore-Locket-Ruhl House (“Mooreland”)	850 Rochdale, Kirkwood	St. Louis County
67	Mudd’s Grove	302 W Argonne, Kirkwood	National Register St. Louis County
64	Professor Frances Nipher House	435 N Harrison, Kirkwood	National Register

Table B-3 - Continued
St. Louis County Cultural Resources

Map 9 #	Name	Location	Source
66	James W. & Mary Way House	305 N Harrison, Kirkwood	National Register
68	Theodore & Lena Richter House	229 S. Van Buren, Kirkwood	National Register
63	Olive Chapel AME Church (was Lutheran)	309 S. Harrison, Kirkwood	National Register St. Louis County
69	Patrick & Moire McMullen House (Cronin House)	212 W Monroe, Kirkwood	National Register
56	William Bopp House (Green Parrot Inn)	12120 Old Big Bend Kirkwood	National Register
60	Hoch Farm Barn	211 Sugar Creek Ridge Dr Kirkwood	St. Louis County
58	Mary Schaffer House	510 McLain Lane, Kirkwood	St. Louis County
65	Robertson-Kraft House	434 N Harrison, Kirkwood	St. Louis County
55	Barretts Railroad Tunnels	National Museum of Transportation 3015 Barrett Station Rd Kirkwood Area	National Register St. Louis County
46	Lyceum Theatre (Now City Hall)	14318 Manchester Rd Manchester (National Register - 920 Manchester Rd)	National Register St. Louis County
45	Manchester Methodist Espicopal Church	129 Woods Mill Rd Manchester	National Register St. Louis County

Table B-3 - Continued
St. Louis County Cultural Resources

Map 9 #	Name	Location	Source
47	Thomas Mason House	1400 Thomas Mason Place near Manchester	St. Louis County
49	Hugh Tumilty Farmhouse	825 Sulphur Springs Rd Manchester	St. Louis County
44	Henry Avenue Historic District	120, 210, 211,218, 220, 226, 230,314 & 320 Henry Ave Manchester	National Register
50	John Dietrich House	355 Dietrich Rd near Manchester	St. Louis County
51	Wagonmaker's House Local Historic District	14360 Manchester Rd Manchester	St. Louis County
52	Woerner Cabin (demolished)	466 Carman Rd e of Dietrich near Manchester	St. Louis County
34	Red Cedar Inn	1047 E Osage, Pacific	National Register
48	Jarville	1723 Mason Rd in Queeny Park, Manchester	National Register St. Louis County
21A	Beaumont-Tyson Quarry District	St. Louis/ Jefferson Counties*	National Register
35	Meramec River US Rte 66 Bridge- J421 1932-1956	Route 66 State Park Eureka	National Register
54	Sacred Heart Church	10 Ann Ave, Valley Park	St. Louis County
53	Valley Park Grain Elevator	442 Meramec Station Rd Valley Park	St. Louis County

Table B-3 - Continued
St. Louis County Cultural Resources

Map 9 #	Name	Location	Source
29	Big Chief Restaurant (Pond)	17352 Old Manchester Rd Wildwood	National Register
30	"Overbrook" (Pond)	1333 Pond Rd, Wildwood	St. Louis County
31	Pond School (Pond)	17123 Manchester Rd Wildwood	St. Louis County
27	Ball-Essen Farmstead Historic District	749 Babler Park Dr Wildwood	National Register
32	Orrville School	554 Old Eatherton Rd Wildwood	St. Louis County
28	Orrville Historic District Hoppenberg-Fick Store	526 & 538 Eatherton Rd Wildwood	National Register St. Louis County
26	Dr. Edmund A. Babler Memorial State Park Historic District	Highway 109, Wildwood	National Register St. Louis County
33	Camp Wyman	600 Kiwanis Rd, Wildwood	St. Louis County
38	Stuart Log Cabin	2261 Valley Rd, Wildwood	St. Louis County
39	Tyler House	340 Laurey Lane off Wild Horse Creek Rd, Wildwood	St. Louis County
25	Kreienkamp Store	19160 Melrose Rd, Wildwood	National Register
24A	Williams Creek Archaeological District	St. Louis County*	National Register

* Address Restricted

** St. Louis County Designated Landmark

National Register location from State Historic Preservation Office, MoDNR GIS Map Gallery
www.dnr.mo.gov/shpo/mapgallery

Appendix C

Water Quality Sampling Results

Table C-1
Meramec River
Stream Team Sampling Water Chemical Data Results

Site (Map 13)	Stream Team	Date	Temp	DO mg/L	pH	Nitrate As N mg/L	Ammonia As N mg/L	Phosphate PO4 mg/L	Turbidity JTU
Shaw Nature Reserve Most recent sample out of 3	1343	7/16/2009	25	7	8.7	0	No Data	0	16
Pacific Palisades Most recent sample out of 6	1316	3/22/2009	15	11	8.5	0	No Data	No Data	15
Pacific Palisades 0.8 mi us of boat ramp Most recent sample out of 14	2297	5/1/2009	17	No Data	8.4	No Data	No Data	No Data	No Data
Pacific Palisades 300 yds ds of boat ramp Most recent sample out of 2	211	10/18/2008	16.5	10	8.37	0.25	No Data	0.05	10
Allenton Access Most recent sample out of 6	888	10/18/2008	17	11	8.3	No Data	0.52	No Data	10
500 ft us of I-44 Bridge Most recent sample out of 3	1561	5/4/2005	13	12	7.9	0.125	0	0.27	14
Under I-44 Bridge Most recent sample out of 3	888	10/18/2008	17	10	8.1	0.25	0.11	No Data	10

Table C-1 - Continued
Meramec River
Stream Team Sampling Water Chemical Data Results

Site (Map 13)	Stream Team	Date	Temp	DO mg/L	pH	Nitrate As N mg/L	Ammonia As N mg/L	Phosphate PO4 mg/L	Turbidity JTU
300yds ds Old Route 66 Bridge	888	10/17/2004	16	12	8.3	No Data	No Data	0	10
Glencoe Access Most recent sample out of 25	956	10/10/2007	23	11	8.9	No Data	No Data	No Data	No Data
Castlewood State Park access Most recent sample out of 2	1857	10/19/2006	12	8	9.3	0.125	0.46	0.31	10
Valley Park boat ramp	2746	10/21/2006	14	10	8.8	0.125	No Data	No Data	10
At confluence of Grand Glaize Creek	2746	10/21/2006	15	10	8.9	0.125	No Data	No Data	10
Greentree Park Access #5976 out of 3	888	10/18/2008	17	12	8.1	0. 5	0.15	No Data	10
Greentree Park Access #407 Most recent sample out of 5	2746	10/21/2006	14	6	8.7	0.125	No Data	No Data	12

Source – Stream Team Interactive Map

Abbreviation key can be found at the end of this section.

Table C-2
Meramec River
kayakswarm Water Chemistry

Meramec River Mile*	Date	PO4 mg/L	Cond uS/cm	Temp	pH	Turb NTU	Watershed
143	10/18/2008	0.07	360	16	8.3	10	Brush Creek
144	10/18/2008	0.05	360	16	8.3	10	Brush Creek
145	10/18/2008	0.06	360	16	8.3	10	Brush Creek
146	10/18/2008	0.08	360	16.5	8.3	10	Brush Creek
147	10/18/2008	0.04	350	16	8.3	10	Brush Creek
148	10/18/2008	0.05	350	16	8.3	10	Brush Creek
149	10/18/2008	0.02	340	17	8.3	10	Brush Creek
150	10/18/2008	0.04	340	16.5	8.4	10	Brush Creek
151	10/18/2008	0.07	350	17	8.4	10	Brush Creek
152	10/18/2008	0.08	360	17	8.4	10	Brush Creek
153	10/18/2008	0.06	360	17	8.2	10	Brush Creek
154	5/31/2008	0.06	320	23	8.0	17.5	Brush Creek
155	5/31/2008	0.17	310	23	8.1	19	Brush Creek
156	5/31/2008	0.05	310	23.5	8.2	20	Fox/LaBarque Creeks
157	5/31/2008	0.07	300	23	8.1	35	Fox/LaBarque Creeks
158	5/31/2008	0.12	300	23	8.0	26	Fox/LaBarque Creeks
159	5/31/2008	0.13	300	23	8.2	36	Fox/LaBarque Creeks
160	5/31/2008	0.09	300	23	8.1	38	Fox/LaBarque Creeks
161	5/31/2008	0.11	300	23	8.1	50	Fox/LaBarque Creeks
162	5/31/2008	0.04	300	23.5	8.2	40	Fox/LaBarque Creeks
163	5/31/2008	0.07	300	24	8.1	50	Fox/LaBarque Creeks
164	5/31/2008	0.05	300	24	8.1	50	Fox/LaBarque Creeks
165	5/31/2008	0.09	340	24	8.2	35	Hamilton Creek
166	5/31/2008	0.01	340	24	8.2	37	Hamilton Creek

Table C-2 - Continued
Meramec River
kayakswarm Water Chemistry

Meramec River Mile*	Date	PO4 mg/L	Cond uS/cm	Temp	pH	Turb NTU	Watershed
167	10/04/2008	0.00	390	17	8.2	10	Hamilton Creek
168	10/04/2008	0.09	390	17	8.1	11	Hamilton Creek
169	10/04/2008	0.11	390	17	8.1	10	Hamilton Creek
170	10/04/2008	0.14	390	17	8.1	10	Hamilton Creek
171	10/04/2008	0.08	390	17	8.1	10	Hamilton Creek
172	10/04/2008	0.11	380	17	8.1	11	Hamilton Creek
173	10/04/2008	0.16	380	18	8.1	11	Hamilton Creek
174	10/04/2008	0.05	380	18	8.1	12	Hamilton Creek
175	10/04/2008	0.10	380	18	8.1	12	Hamilton Creek
176	10/04/2008	0.10	380	18	8.1	12	Hamilton Creek
177	10/04/2008	0.05	380	18	8.1	12.5	Hamilton Creek
178	10/04/2008	0.10	370	18	8.1	12.5	Grand Glaize Creek
179	10/04/2008	0.08	380	19	8.2	12.5	Grand Glaize Creek
180	10/04/2008	0.11	380	19	8.1	13	Grand Glaize Creek
181	10/04/2008	0.07	380	19	8.1	14	Grand Glaize Creek

* River miles go from west to east

Source – kayakswarm Meramec River GPS Paddle 2008

Abbreviation key can be found at the end of this section.

Table C-3
Meramec River
Raw Water Grab Sample Results

Map 14 Site/Code	Date	Org	Chl mg/L	AN mg/L	DO mg/L	DOS %	FC	Flow CFS	IN mg/L	Op mg/L	pH	TP mg/L	TDS mg/L	TN mg/L	Temp
0.5 mi ds LaBarque Creek 1841/4.5	08/02/2009	USGS			9	113		1,100			8.1				26.9
0.5 mi ds Hwy 109 1841/0.8	08/03/2009	USGS			7.4	95		1,080			8.6				27.6
0.4 mi ds confluence with Big River 2185/14.9	08/03/2009	USGS			8.8	112		1,110			8.4				27.1
Near Eureka at I-44 2185/12.3 Representative sample Out of 346 collected from 1979-1994	06/07/1994	USGS	5	0.02	8.5	99	120	2,470	0.12	0.01	8	0.02	193	0.42	24
0.3 mi ds confluence with Hamilton Creek	08/04/2009	USGS			6.8	84		1,110			8.3				26.2
Near confluence with Keifer Creek 2185/1.9 Representative sample Out of 20 collected From Aug 2009-Jan 2010	12/11/2009	USGS	1840												8.7

Source – MoDNR Water Quality Assessment System

Abbreviation key can be found at the end of this section

Table C- 4
Tributaries of Meramec River
Metropolitan St. Louis Sewer District Raw Water Grab Sample Results

		In mg/L							Count/100 mL				In mg/L					
Site/Code	Date	Al	Cd	COD	Chl	Cr	Cu	DO	E	E. coli	FSGB	Flow	Fe	Pb	Ni	Zn	pH	Temp
Fishpot Creek at Vance Rd 2186/0.6 Most recent sample out of 54 from 2005-2010	7/7/10	<129	<0.2	15	117	<6	<2.4	7.9	279	464	720	0	<60	<0.9	<27	<21	6.6	19
Keifer Creek at Keifer Creek Rd 3592/0.5 Most recent sample out of 83 from 2001-2010	7/7/10	<129	<0.2	15	82	<6	<2.4	7.7	309	98	270	2.4	<60	<0.9	<27	97	6.9	21
Spring Branch Keifer Creek at New Ballwin Rd 3592/1.2/0.1 Most recent sample out of 54 from 2005-2010	7/7/10	<129	<0.2	13	51	<6	<2.4	8.7	987	131	2100		<60	<0.9	<27	<2	17	23

Table C-4 - Continued
Tributaries of Meramec River
Metropolitan St. Louis Sewer District Raw Water Grab Sample Results Title

		In mg/L							Count/ 100 mL				In mg/L					
Site/Code	Date	Al	Cd	COD	Chl	Cr	Cu	DO	E	E. coli	FSGB	Flow	Fe	Pb	Ni	Zn	pH	Temp
Williams Creek at I-44 N. Outer Road 3594/0.6 Most recent sample out of 54 from 2005-2010	7/7/10		<0.2	10	47	<6	<2.4	8	2250	2760	3100	2.5	<60	<0.9	<27	105	6.9	18
Antire Creek near Bussen Quarry 2188/0.9 Most recent sample out of 50 from 2005-2010	7/7/10		<0.2	9	25	<6	<2.4	6		187	650		<60	<0.9	<27	<21	7.1	23

Table C-4 - Continued
Tributaries of Meramec River
Metropolitan St. Louis Sewer District Raw Water Grab Sample Results

		In mg/L							Count/ 100 mL				In mg/L					
Site/Code	Date	Al	Cd	COD	Chl	Cr	Cu	DO	E	E. coli	FSGB	Flow	Fe	Pb	Ni	Zn	pH	Temp
Little Antire Creek near mouth at Antire Creek Rd 2188/1.9/0.1 Most recent sample out of 56 from 2005-2010	7/7/10		<0.2	12	12	<6	<2.4	8.1	1140	20	870		<60	<0.9	<27	<21	7.1	21
Grand Glaize Creek near mouth 2184/0.1 Most recent sample out of 94 from 2000-2010	2/18/10		<0.2	63	1460	<6	<2.4	13				9.5	<60	<0.9	<27	38	7.4	3

Table C-4 - Continued
Tributaries of Meramec River
Metropolitan St. Louis Sewer District Raw Water Grab Sample Results

		In mg/L							Count/ 100 mL				In mg/L					
Site/Code	Date	Al	Cd	COD	Chl	Cr	Cu	DO	E	E. coli	FSGB	Flow	Fe	Pb	Ni	Zn	pH	Temp
Sugar Creek tributary Of Grand Glaize Creek Near Barrett Station Rd 2184/4.0/0.7/0.3 Most recent sample out Of 54 from 2005-2010	7/6/10		<0.2	27	114	<6	<2.4	5.6	8660	1780	7600	.41	63	<0.9	<27	51	6.4	24

Table C-4 – Continued
Tributaries of Meramec River
Metropolitan St. Louis Sewer District Raw Water Grab Sample Results

		In mg/L		Count/100 mL		In mg/L		
Site/Code	Date	Chl	DO	FC	FSGB	KN	Op	TSS
Grand Glaize Creek near Big Bend Blvd 2184/3.3 Most recent sample out of 6 from 2002-2004	5/19/04	50	6.1	35500	640000	2.8	0.84	1000

Source – MoDNR Water Quality Assessment System

Abbreviation key can be found at the end of this section.

Table C-5
Tributaries of Meramec River
Missouri Department of Natural Resources Raw Water Grab Sample Results

		In mg/L						In mg/L			JTU		
Site/Code	**Date**	**AN**	**BOD**	**DO**	**IN**	**KN**	**pH**	**TP**	**TN**	**Chl**	**Turb**	**Temp**	**Flow**
Flat Creek at Eureka City Park 3593/1.7 Most recent sample out of 2 in 2007	5/22/07	0.13	<2	6	0.45	0.49	7.9	0.18	0.94		<10	18.3	
Flat Creek near Augustine Rd Eureka 3593/2.5 Most recent sample out of 2 in 2007	5/22/07	0.18	<2	4.7	0.18	0.65	7.9	0.16	0.83		16	19.3	0.5
Brush Creek at Hwy F 1844/1.0 Most recent sample out of 2 in 2008	9/26/08	<0.03		7	0.1	0.28	7.5	0.07	0.38		<10	18.5	0.1
Brush Creek at Hwy N 1844/2.0 Most recent sample out of 8 in 2005-2008	9/26/08	<0.03		7.1	0.07	0.33	7.7	0.07	0.4		<10	19.4	
N Fork Brush Creek 1844/2.2/1.9/0.5	6/8/05	<0.03		4.6	0.12	0.61	7.8	0.1	0.73	617		24.1	0.02
Brush Creek at Robertsville Rd 1844/2.2/4.3	6/8/05	<0.03		5.8	0.06	0.46	8.2	0.16	0.52	34		22	0

Source – MoDNR Water Quality Assessment System

Abbreviation key can be found at the end of this section.

Table C-6
Tributaries of Meramec River
U.S. Geological Survey Raw Water Grab Sample Results

		In mg/L		%	Count/100 mL				In mg/L					
Site/Code	**Date**	**AN**	**DO**	**DOS**	**EColi**	**FC**	**FSGB**	**Flow**	**IN**	**Op**	**TP**	**TN**	**TSS**	**Temp**
Fishpot Creek at Hanna Rd Bridge Valley Park 2186/1.7 Most recent sample out of 71 from 1996-2004	8/3/04	<0.04	4.5	55	240	500	260	0.37	0.73	0.14	0.16	0.88	<10	24.4
Keifer Creek near Ballwin 3592/0.5/0.8 Most recent sample out of 71 from 1996-2004	8/3/04	<0.04	8.2	84	86	210	230	4	2.06	0.04	0.04	2.18	<10	14.9
Williams Creek near Peerless Park 3594/0.7/0.1 Most recent sample out of 64 from 1997-2004	8/3/04	<0.4	8.3	84	680	850	990	5.1	1.32	0.12	0.14	1.48	<10	14.9
Grand Glaize Creek at Quinette Rd Valley Park 2184/3.2 Most recent sample out of 91 from 1997-2007	9/12/07	0.103	3.3	37	589	1300		2.5	0.41	0.085	0.15	1	23	21

Source – MoDNR Water Quality Assessment System

Abbreviation key can be found at the end of this section.

Abbreviation key

Al – Aluminum, dissolved
AN - Ammonia-nitrogen
BOD – Carbonaceous biochemical oxygen demand, standard conditions, 5-day incubation
Cd – Cadmium, dissolved
Chl –Chloride
COD – Chemical oxygen demand
Cond – Conductivity, can be used as a measure of total dissolved solids
Counts/mL – Counts per milliliter
Cr – Chromium, dissolved
Cu – Copper, dissolved
DO - Dissolved oxygen
DOS - Dissolved oxygen saturation
ds - Down stream
E – Enterococcus bacteria
E. coli – Escherichia coli bacteria
FC - Fecal Coliform measured in count/100 milliliters
Fe – Iron, dissolved
Flow – Stream flow in cubic foot per second
FSGB – Fecal streptococcus group bacteria
IN - Inorganic nitrogen (nitrate & nitrite) as N
JTU – Jackson turbidity unit (amount of suspended material in the water)
KN – Kjeldahl nitrogen, total
mi - Miles
mg/L – milligrams per liter
N - Nitrogen
Ni – Nickel, dissolved
Op - Orthophosphate, as P
Org - Organization that conducted the sampling
Pb – Lead, dissolved
pH – measurement of how acidic or basic a substance is
PO4 - Phosphate
TDS - Total dissolved solids
Temp - Water temperature in centigrade
TN - Total nitrogen, unfiltered
TP - Phosphorus, total
TSS – Total suspended solids
Turb – Turbidity measured in Jackson Turbidity Units (amount of suspended material in the water)
Turb NTU – Turbidity measured in Nephelometric Turbidity Units (amount of suspended material in the water)
us – Up stream
uS/cm – microsiemens per centimeter (Conductivity measurement unit)
USGS – U.S. Geological Survey
Zn – Zinc, dissolved

Appendix D

Pollutant Loadings

Table D-1
Pollutant Loadings Brush Creek Watershed

Land Use/ Pollutant	**CF** Conversion Factor	*** R** Annual Runoff (Inches/Year)	*** C** Pollutant Concentration (Milligrams/Liter)	*** A** Total Acreage	**= L** Annual Loading (Pounds/Year)
Commercial					
Phosphorus	0.226	25.8	0.2	257.6	300.4
Nitrogen	0.226	25.8	2	257.6	3,004.0
Total Suspended Solids	0.226	25.8	75	257.6	112,651.1
BOD	0.226	25.8	9.3	257.6	13,968.7
Industrial					
Phosphorus	0.226	19.5	0.3	239.2	316.2
Nitrogen	0.226	19.5	2.5	239.2	2,635.4
Total Suspended Solids	0.226	19.5	120	239.2	126,498.5
BOD	0.226	19.5	5.1	239.2	5,376.2
Institutional					
Phosphorus	0.226	13.3	0.2	147.9	88.9
Nitrogen	0.226	13.3	1.8	147.9	800.2
Total Suspended Solids	0.226	13.3	67	147.9	29,785.4
BOD	0.226	13.3	7.8	147.9	3,467.6
Multi-Family Residential					
Phosphorus	0.226	16.2	0.4	32.6	47.7
Nitrogen	0.226	16.2	2.2	32.6	262.6
Total Suspended Solids	0.226	16.2	100	32.6	11,935.5
BOD	0.226	16.2	5.1	32.6	608.7
Single-Family Residential					
Phosphorus	0.226	9.9	0.4	512.1	458.3
Nitrogen	0.226	9.9	2.2	512.1	2,520.7
Total Suspended Solids	0.226	9.9	100	512.1	114,577.3
BOD	0.226	9.9	5.1	512.1	5,843.4
Roads					
Phosphorus	0.226	35	0.5	530.3	2,097.3
Nitrogen	0.226	35	3	530.3	12,584.0
Total Suspended Solids	0.226	35	150	530.3	629,201.0
BOD	0.226	35	9.3	530.3	39,010.5
Watershed Total					
Phosphorus					3,308.8
Nitrogen					21,806.9
Total Suspended Solids					1,024,648.8
BOD					68,275.1

Table D-2
Pollutant Loadings Fox Creek Watershed

Land Use/ Pollutant	**CF** Conversion Factor	*** R** Annual Runoff (Inches/Year)	*** C** Pollutant Concentration (Milligrams/Liter)	*** A** Total Acreage	**= L** Annual Loading (Pounds/Year)
Commercial					
Phosphorus	0.226	25.8	0.2	24.2	28.2
Nitrogen	0.226	25.8	2	24.2	282.2
Total Suspended Solids	0.226	25.8	75	24.2	10,582.9
BOD	0.226	25.8	9.3	24.2	1,312.3
Industrial					
Phosphorus	0.226	19.5	0.3	42.5	56.2
Nitrogen	0.226	19.5	2.5	42.5	468.2
Total Suspended Solids	0.226	19.5	120	42.5	22,475.7
BOD	0.226	19.5	5.1	42.5	955.2
Institutional					
Phosphorus	0.226	13.3	0.2	12	7.2
Nitrogen	0.226	13.3	1.8	12	64.9
Total Suspended Solids	0.226	13.3	67	12	2,416.7
BOD	0.226	13.3	67	7.8	1,570.8
Multi-Family Residential					
Phosphorus	0.226	16.2	0.4	44.9	65.8
Nitrogen	0.226	16.2	2.2	44.9	361.7
Total Suspended Solids	0.226	16.2	100	44.9	16,438.8
BOD	0.226	16.2	5.1	44.9	838.4
Single-Family Residential					
Phosphorus	0.226	9.9	0.4	410.7	367.6
Nitrogen	0.226	9.9	2.2	410.7	2,021.6
Total Suspended Solids	0.226	9.9	100	410.7	91,890.0
BOD	0.226	9.9	5.1	410.7	4,686.4
Roads					
Phosphorus	0.226	35	0.5	288.6	1,141.4
Nitrogen	0.226	35	3	288.6	6,848.5
Total Suspended Solids	0.226	35	150	288.6	342,423.9
BOD	0.226	35	9.3	288.6	21,230.3
Watershed Total					
Phosphorus					1,666.4
Nitrogen					10,047.1
Total Suspended Solids					486,228.0
BOD					30,593.4

Table D-3
Pollutant Loadings LaBarque Creek Watershed

Land Use/ Pollutant	**CF** Conversion Factor	*** R** Annual Runoff (Inches/Year)	*** C** Pollutant Concentration (Milligrams/Liter)	*** A** Total Acreage	**= L** Annual Loading (Pounds/Year)
Commercial					
Phosphorus	0.226	25.8	0.2	4.8	5.6
Nitrogen	0.226	25.8	2	4.8	56.0
Total Suspended Solids	0.226	25.8	75	4.8	2,099.1
BOD	0.226	25.8	9.3	4.8	260.3
Industrial					
Phosphorus	0.226	19.5	0.3	46.2	61.1
Nitrogen	0.226	19.5	2.5	46.2	509.0
Total Suspended Solids	0.226	19.5	120	46.2	24,432.4
BOD	0.226	19.5	5.1	46.2	1,038.4
Institutional					
Phosphorus	0.226	13.3	0.2	4.9	2.9
Nitrogen	0.226	13.3	1.8	4.9	26.5
Total Suspended Solids	0.226	13.3	67	4.9	986.8
BOD	0.226	13.3	7.8	4.9	114.9
Multi-Family Residential					
Phosphorus	0.226	16.2	0.4	0	0.0
Nitrogen	0.226	16.2	2.2	0	0.0
Total Suspended Solids	0.226	16.2	100	0	0.0
BOD	0.226	16.2	5.1	0	0.0
Single-Family Residential					
Phosphorus	0.226	9.9	0.4	378.6	338.8
Nitrogen	0.226	9.9	2.2	378.6	1,863.6
Total Suspended Solids	0.226	9.9	100	378.6	84,708.0
BOD	0.226	9.9	5.1	378.6	4,320.1
Roads					
Phosphorus	0.226	35	0.5	183.4	725.3
Nitrogen	0.226	35	3	183.4	4,352.1
Total Suspended Solids	0.226	35	150	183.4	217,604.1
BOD	0.226	35	9.3	183.4	13,491.5
Watershed Total					
Phosphorus					1,133.7
Nitrogen					6,807.2
Total Suspended Solids					329,830.4
BOD					19,255.2

Table D-4
Pollutant Loadings Hamilton Creek Watershed

Land Use/ Pollutant	**CF** Conversion Factor	*** R** Annual Runoff (Inches/Year)	*** C** Pollutant Concentration (Milligrams/Liter)	*** A** Total Acreage	**= L** Annual Loading (Pounds/Year)
Commercial					
Phosphorus	0.226	25.8	0.2	274.5	320.1
Nitrogen	0.226	25.8	2	274.5	3,201.1
Total Suspended Solids	0.226	25.8	75	274.5	120,041.6
BOD	0.226	25.8	9.3	274.5	14,885.2
Industrial					
Phosphorus	0.226	19.5	0.3	252.9	334.4
Nitrogen	0.226	19.5	2.5	252.9	2,786.3
Total Suspended Solids	0.226	19.5	120	252.9	133,743.6
BOD	0.226	19.5	5.1	252.9	5,684.1
Institutional					
Phosphorus	0.226	13.3	0.2	207	124.4
Nitrogen	0.226	13.3	1.8	207	1,120.0
Total Suspended Solids	0.226	13.3	67	207	41,687.4
BOD	0.226	13.3	7.8	207	4,853.2
Multi-Family Residential					
Phosphorus	0.226	16.2	0.4	88.9	130.2
Nitrogen	0.226	16.2	2.2	88.9	716.1
Total Suspended Solids	0.226	16.2	100	88.9	32,548.1
BOD	0.226	16.2	5.1	88.9	1,660.0
Single-Family Residential					
Phosphorus	0.226	9.9	0.4	1376	1,231.5
Nitrogen	0.226	9.9	2.2	1376	6,773.1
Total Suspended Solids	0.226	9.9	100	1376	307,866.2
BOD	0.226	9.9	5.1	1376	15,701.2
Roads					
Phosphorus	0.226	35	0.5	739.5	2,924.7
Nitrogen	0.226	35	3	739.5	17,548.3
Total Suspended Solids	0.226	35	150	739.5	877,416.8
BOD	0.226	35	9.3	739.5	54,399.8
Watershed Total					
Phosphorus					5,065.3
Nitrogen					32,144.9
Total Suspended Solids					1,513,303.7
BOD					97,193.5

Table D-5
Pollutant Loadings Grand Glaize Creek Watershed

Land Use/ Pollutant	**CF** Conversion Factor	*** R** Annual Runoff (Inches/Year)	*** C** Pollutant Concentration (Milligrams/Liter)	*** A** Total Acreage	**= L** Annual Loading (Pounds/Year)
Commercial					
Phosphorus	0.226	25.8	0.2	952.1	1,110.3
Nitrogen	0.226	25.8	2	952.1	11,103.0
Total Suspended Solids	0.226	25.8	75	952.1	416,362.9
BOD	0.226	25.8	9.3	952.1	51,629.0
Industrial					
Phosphorus	0.226	19.5	0.3	385.6	509.8
Nitrogen	0.226	19.5	2.5	385.6	4,248.3
Total Suspended Solids	0.226	19.5	120	385.6	203,920.7
BOD	0.226	19.5	5.1	385.6	8,666.6
Institutional					
Phosphorus	0.226	13.3	0.2	367.1	220.7
Nitrogen	0.226	13.3	1.8	367.1	1,986.2
Total Suspended Solids	0.226	13.3	67	367.1	73,929.8
BOD	0.226	13.3	7.8	367.1	8,606.7
Multi-Family Residential					
Phosphorus	0.226	16.2	0.4	358.9	525.6
Nitrogen	0.226	16.2	2.2	358.9	2,890.8
Total Suspended Solids	0.226	16.2	100	358.9	131,400.5
BOD	0.226	16.2	5.1	358.9	6,701.4
Single-Family Residential					
Phosphorus	0.226	9.9	0.4	2603.6	2,330.1
Nitrogen	0.226	9.9	2.2	2603.6	12,815.6
Total Suspended Solids	0.226	9.9	100	2603.6	582,529.5
BOD	0.226	9.9	5.1	2603.6	29,709.0
Roads					
Phosphorus	0.226	35	0.5	1622.3	6,416.2
Nitrogen	0.226	35	3	1622.3	38,497.2
Total Suspended Solids	0.226	35	150	1622.3	1,924,859.0
BOD	0.226	35	9.3	1622.3	119,341.3
Watershed Total					
Phosphorus					11,112.7
Nitrogen					71,541.1
Total Suspended Solids					3,333,002.4
BOD					224,654.0

Impervious Coverage Calculation (Ia)

Estimated impervious cover percentages were calculated using GIS software and the land attributes of parcels covered by these watersheds. Parcels with commercial, industrial and institutional uses were assigned mean impervious cover percentages of 72, 53 and 34, respectively. Institutional uses incorporate activities serving large segments of the population, whether developed and provided by public or private interests. It includes governmental office and service structures, cemeteries, museums, libraries, schools, colleges, prisons, hospitals, religious facilities and nursing homes. There is a more complete discussion of this methodology in the May 2002 "Estimating Impervious Cover and Its Impact on Water Resources", a technical report for the Upper Delaware Watershed Management Plan, from the North Jersey Resource Conservation and Development.
http://www.upperdelaware.org/Documents/tech_rep/Imperv/final_imperv.pdf)

In the Upper Delaware report, there were four distinct single-family residential coverage based on lot size and multi-family impervious coverage was broken down into town home and multi-family residences. For the Lower Meramec River study, land use information was available for single-family and multi-family residential uses. An average was calculated of the four single-family mean impervious percentages. The average single-family impervious percentage was calculated as 24 percent. The impervious cover percentages for town home and multi-family residential land uses were also averaged which resulted in an average of 43 percent for multi-family impervious area. Using those percentages, mean impervious acres by land use by watershed were estimated. (See Table D-6)

Several adjustments were made to the process. GIS was used to determine the acreage of quarries, landfills and demolished manufacturing facilities within each watershed. These activities were originally part of the industrial land use category however, these specific uses do not have the same runoff characteristics as industrial facilities. In order to have accurate information on impervious acreage of active industrial uses, the acreage of these specific passive land uses were subtracted from the industrial land use total.

It was assumed that roads made up ten percent of the single-family residential acreage and the multi-family residential acreage. Acreage in both residential categories was reduced by ten percent and then the residential impervious percentages were applied.

The LaBarque Creek watershed contains two large tracts of land which were owned (in 2008) by the Franciscan Missionary Brothers (St. Joseph's Hill Infirmary) and the Wild Canid Survival and Research Center. Using GIS and aerial photographs, it was estimated that approximately 14 acres of these properties can be considered as developed impervious areas and they were included in the calculation of impervious acreage in this watershed.

GIS was used to estimate the area, and in turn the imperviousness, of the roads in each watershed. First, calculated how many feet of roadway of each roadway by functional

class type was located in each watershed. Random locations of each functional class type were spot-checked and an average roadway width was calculated from the random locations. Finally, length by width was multiplied to get road area. From this calculation, it was assumed that 100 percent of these roadway areas were impervious.

Table D-6
Lower Meramec River Study
Mean Impervious Cover Percentages

Land Use	**Impervious Cover Percentage**
Commercial	72
Industrial	53
Institutional	34
Multi-Family Residential	43
Single-Family Residential	24
Roads	100

Source - North Jersey Resource Conservation and Development

Please note - The impervious cover percentages for the two multi-family residential categories were averaged to develop the multi-family impervious cover percentage used in the Simple Method for the Lower Meramec River study area. The impervious cover percentages for the four single-family residential categories were averaged to develop the single-family impervious cover percentage used in the Simple Method for the Lower Meramec River study area.

Annual Runoff by Land Use Category (R)

Formula contained in The Simple Method to Calculate Urban Stormwater Loads

Table D-7
Annual Runoff by Land Use Category (R)

Land Use	**P** 1981-2010 Annual Precipitation (inches)	*** Pj** Fraction of Annual Rainfall Event that Produce Runoff	*** Rv** Runoff Coefficient .05 + (.9* Ia) = Rv	**= R** Annual Runoff (inches)
Commercial	40.9	0.9	.05 + (.9*.72) = 0.70	25.8
Industrial	40.9	0.9	.05 + (.9*.53) = 0.53	19.5
Institutional	40.9	0.9	.05 + (.9*.34) = 0.36	13.3
Multi-Family Residential	40.9	0.9	.05 + (.9*.43) = 0.44	16.2
Single-Family Residential	40.9	0.9	.05 + (.9*.24) = 0.27	9.9
Roads	40.9	0.9	.05 + (.9*1) = 0.95	35.0

P – 30 year running average taken from 1981-2010 St. Louis MO Annual Precipitation Record, National Weather Service.
Pj – from The Simple Method to Calculate Urban Stormwater Loads
Ia – Impervious Coverage fraction

Pollutant Concentrations (C)

The Simple Method was used to calculate the pollutant loadings for total phosphorus, total nitrogen, total suspended solids and biological oxygen demand (5 day). The table presents the pollutant concentrations used in the Simple Method

Table D-8
Pollutant Concentration Factors by Land Use Category (milligrams/liter)

Land Use	Total Phosphorus P	Total Nitrogen N	Total Suspended Solids TSS	Biological Oxygen Demand (5 Day) BOD
Commercial	0.2	2	75	9.3
Industrial	0.3	2.5	120	5.1
Institutional	0.2	1.8	67	7.8
Multi-Family Residential	0.4	2.2	100	5.1
Single-Family Residential	0.4	2.2	100	5.1
Roads	0.5	3	150	9.3

Sources – The Simple Method to Calculate Urban Stormwater Loads
Spreadsheet Tool for Estimating Pollutant Load (STEPL)

The Simple Method did not identify pollutant concentration factors for institutional land use category. For phosphorus, it was assumed that the concentration factor for commercial land use category would apply to institutional land use category. For the remaining pollutants, the institutional concentration factors were taken from the Spreadsheet Tool for Estimating Pollutant Load (STEPL).

The Simple Method did not identify pollutant concentration factors for multi-family residential and single-family residential land use categories. It was assumed that the residential pollutant concentration factors would apply to both categories.

For commercial, institutional and road land use categories, the Biological Oxygen Demand (BOD) concentration factors came from STEPL. For the remaining land use categories, the BOD concentration factor from the Simple Method was utilized. It came from the New Suburban National Urban Runoff Program (NURP) site inventory conducted by U.S. Environmental Protection Agency.

The Simple Method to Calculate Urban Stormwater Loads

Stormwater Manager's Resource Center, Center for Watershed Protection Stormwatercenter.net

Introduction

The Simple Method estimates stormwater runoff pollutant loads for urban areas. The technique requires a modest amount of information, including the subwatershed drainage area and impervious cover, stormwater runoff pollutant concentrations, and annual precipitation. With the Simple Method, the investigator can either break up land use into specific areas, such as residential, commercial, industrial, and roadway and calculate annual pollutant loads for each type of land, or utilize more generalized pollutant values for land uses such as new suburban areas, older urban areas, central business districts, and highways.

Stormwater pollutant concentrations can be estimated from local or regional data, or from national data sources. Tables 1 through 3 summarize pollutant concentration data for Total Suspended Solids (Table 1), Total Phosphorous (Table 2), and Total Nitrogen (Table 3) for residential, commercial, industrial, and roadway land uses, and identify default values. Table 4 identifies pollutant concentration values for Phosphorus, Nitrogen, COD, BOD, and some metals for more generalized land use categories. In general, the selected data sources are nationwide in scope, or are summaries of several regional studies. Some studies included in these data did not characterize stormwater concentrations for specific land uses, and instead reported a concentration for "urban runoff." In these instances, the data are reported as the same concentration for each land use in Tables 1 through 3.

Fecal coliform is more difficult to characterize than other pollutants. Data are extremely variable, even during repeated sampling at a single location. Because of this variability, it is difficult to establish different concentrations for each land use. Although some source monitoring data exists (Steuer *et al.*, 1997; Bannerman *et al.*, 1993), the simple method assumes a median urban runoff default value, derived from NURP data (Pitt, 1998), of 20,000 MPN/100ml. For more information on sources and pathways of bacteria in urban runoff, consult Schueler (1999).

The Simple Method estimates pollutant loads for chemical constituents as a product of annual runoff volume and pollutant concentration, as:

$$L = 0.226 * R * C * A$$

Where: L = Annual load (lbs)
R = Annual runoff (inches)
C = Pollutant concentration (mg/l)
A = Area (acres)
0.226 = Unit conversion factor

For bacteria, the equation is slightly different, to account for the differences in units. The modified equation for bacteria is:

$$L = 1.03 * 10^{-3} * R * C * A$$

Where: L = Annual load (Billion Colonies)
R = Annual runoff (inches)
C = Bacteria concentration (#/100 ml)
A = Area (acres)
$1.03 * 10^{-3}$ = Unit conversion factor

Annual Runoff

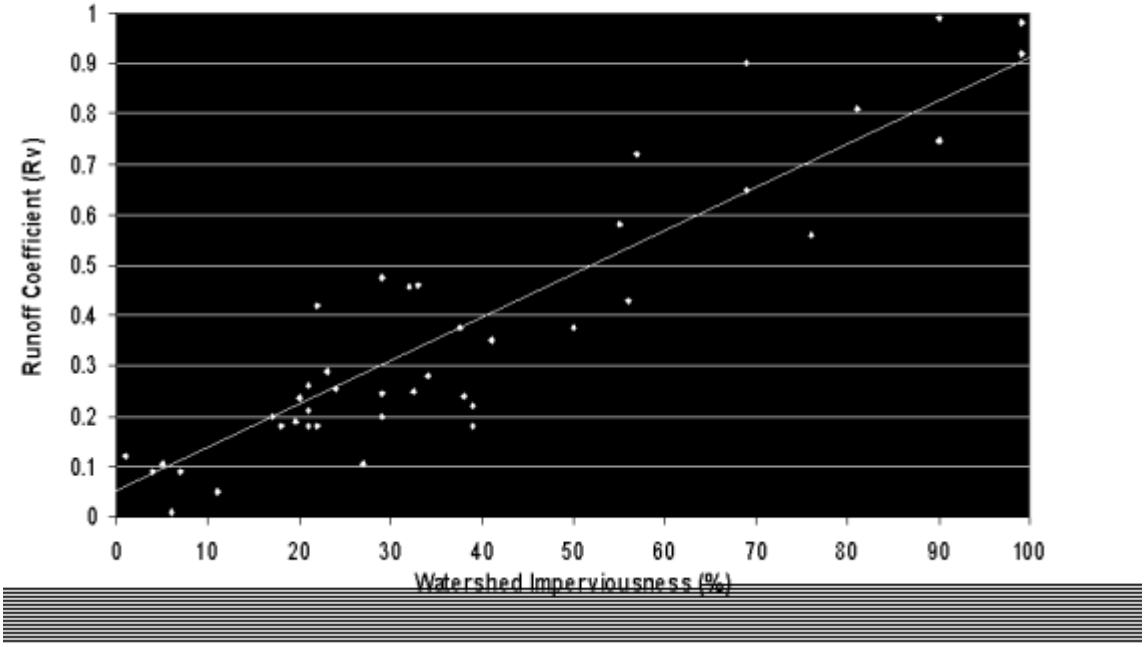
The Simple Method calculates annual runoff as a product of annual runoff volume, and a runoff coefficient (Rv). Runoff volume is calculated as:

$$R = P * P_j * Rv$$

Where: R = Annual runoff (inches)
P = Annual rainfall (inches)
P_j = Fraction of annual rainfall events that produce runoff (usually 0.9)
Rv = Runoff coefficient

In the Simple Method, the runoff coefficient is calculated based on impervious cover in the subwatershed. This relationship is shown in Figure 1. Although there is some scatter in the data, watershed imperviousness does appear to be a reasonable predictor of Rv.

Relationship Between Watershed Imperviousness (I)
and the Storm Runoff Coefficient (Rv)
(Source: Schueler, 1987)



The following equation represents the best fit line for the dataset (N=47, R^2=0.71).

Rv=0.05+0.9Ia

Where: Ia = Impervious fraction

Impervious Cover Data

The model uses different impervious cover values for separate land uses within a subwatershed. Representative impervious cover data, along with Model default values, are presented in Table 5. A study is currently being conducted by the Center for Watershed Protection under a grant from the U.S. Environmental Protection Agency to update impervious cover estimates for these and other land uses. The results of this study will be available by 2001. In addition, some jurisdictions may have detailed impervious cover information if they maintain a detailed land use/land cover GIS database.

Limitations of the Simple Method

The Simple Method should provide reasonable estimates of changes in pollutant export resulting from urban development activities. However, several caveats should be kept in mind when applying this method.

The Simple Method is most appropriate for assessing and comparing the relative stormflow pollutant load changes of different land use and stormwater management scenarios. The Simple Method provides estimates of storm pollutant export that are probably close to the "true" but unknown value for a development site, catchment, or subwatershed. However, it is very important not to over emphasize the precision of the results obtained. For example, it would be inappropriate to use the Simple Method to evaluate relatively similar development scenarios (e.g., 34.3% versus 36.9% Impervious cover). The simple method provides a general planning estimate

likely storm pollutant export from areas at the scale of a development site, catchment or subwatershed. More sophisticated modeling may be needed to analyze larger and more complex watersheds.

In addition, the Simple Method only estimates pollutant loads generated during storm events. It does not consider pollutants associated with baseflow volume. Typically, baseflow is negligible or non-existent at the scale of a single development site, and can be safely neglected. However, catchments and subwatersheds do generate baseflow volume. Pollutant loads in baseflow are generally low and can seldom be distinguished from natural background levels (NVPDC, 1979). Consequently, baseflow pollutant loads normally constitute only a small fraction of the total pollutant load delivered from an urban area. Nevertheless, it is important to remember that the load estimates refer only to storm event derived loads and should not be confused with the total pollutant load from an area. This is particularly important when the development density of an area is low. For example, in a large low density residential subwatershed (Imp. Cover < 5%), as much as 75% of the annual runoff volume may occur as baseflow. In such a case, the annual baseflow nutrient load may be equivalent to the annual stormflow nutrient load.

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Table 1: Pollutant Concentrations by Land Use: Total Suspended Solids (mg/l)					
	Land Use				
Source	**Residential**	**Commercial**	**Roadway**	**Industrial**	**Notes**
Schueler, 1987 mean	100[1]	-	-	-	This value reflects an estimate based on 25 data points from a wide range of watershed sizes. Data reflect instream concentrations. A small watershed size (i.e., 10 acres) was assumed to minimize the influence of the channel erosion component.
Gibb *et al.*, 1991 mean	150	-	220	-	These values represent recommended estimates for planning purposes and are based on an analysis of mean concentrations from over 13 studies from the US and British Columbia.
Smullen and Cave, 1998 median	55	55	55	55	This study probably represents the most comprehensive data set, with 3,047 event samples being included from across the nation. Data includes pooled NURP, USGS, and NPDES sources. The value is a median of EMCs and applies to general urban runoff (i.e., mixed land uses). The low concentration relative to other data can be attributed to the fact that, while NURP data represent small watersheds where channel erosion may play a role, NPDES data are collected as "end of the pipe" concentrations for very small drainage areas of a uniform land use. The NPDES concentrations were approximately 70% lower than concentrations from NURP or USGS..
US EPA, 1983 median	101	69	-	-	These values represent NURP data for residential and commercial land use. NURP data were collected in the early 1980s in over 28 different metropolitan areas across the US.
Claytor and Schueler, 1996	-	-	142	124	The roadway value is the un-weighted mean of 8 studies conducted by the FHWA. The industrial value is the mean value from 6 storms monitored at a heavy industrial site in Auckland, NZ.

Table 1: Pollutant Concentrations by Land Use: Total Suspended Solids (mg/l) - Continued					
	Land Use				
Source	**Residential**	**Commercial**	**Roadway**	**Industrial**	**Notes**
Barrett and Malina, 1998	-	-	173	-	This data reflects a study of vegetative swales treating highway runoff in Austin, TX. Value represents average of the mean inflow concentrations measured at 2 sites. Data were collected over 34 storm events.
Caraco and Schueler (1999). Arid Climates	242	242	242	242	This value represents an average of EMC data collected from 3 arid climate locales (Phoenix, Boise, and Denver). A total of 90 data points are used, with each site having at least 16 data points. Value applies to general urban runoff (i.e., mixed land uses).
Driscoll, 1986	-	-	242	-	This value is the average of 4 median EMCs collected from highway sites in Nashville, Denver, Milwaukee, and Harrisburg. A total of 93 data points were used to develop value, with each site having at least 16 data points.
Shelley and Gaboury, 1986	-	-	220	-	This value is the median value of 8 highway studies from across the US. Some of the data from the Driscoll study (1986) is included.
Whalen and Cullum, 1988	228	168	-	108	These data are from an assessment of urban runoff quality that looked at NURP and State of Florida data. The NURP data are presented. Residential and commercial values are mean values for specified land uses and reflect between 200 and 1,100 sampling events depending on the parameter and land use. Industrial values are from 4 NURP sites and generally represent light industrial land use.
Model Default Value[2]	**100**	**75**	**150**	**120**	

- 1: Concentration based on a 10-acre drainage area The model default values represent best professional judgement, and give additional weight to studies conducted at a national level. Data do not incorporate studies on arid climates.

Table 2. Pollutant Concentrations by Land Use: Total Phosphorus (mg/l)					
	Land Use				
Source	Residential	Commercial	Roadway	Industrial	Notes
Schueler, 1987 mean	0.26	-	0.59	-	These values are taken from a Washington DC NURP study in 1980-81. At least 27 storm events were sampled at multiple sites within the specified land use.
Gibb *et al.*, 1991 mean	0.33	-	0.59	-	These values represent recommended estimates for planning purposes and are based on analysis of mean concentrations from over 13 studies from the US and British Columbia.
Smullen and Cave, 1998 median	0.26	0.26	0.26	0.26	This study probably represents the most comprehensive data set, with 3,047 event samples being included from across the nation. The data includes pooled NURP, USGS, and NPDES sources. The value is a median of EMCs and applies to general urban runoff (i.e., mixed land uses).
US EPA, 1983 median	0.38	0.201	-	-	These values represent NURP data for residential and commercial land use. NURP data were collected in the early 1980s in over 28 different metropolitan areas across the US.
Barrett and Malina, 1998	-	-	0.4	-	This data reflects a study of vegetative swales treating highway runoff in Austin, TX. Value represents average of the mean inflow concentrations measured at 2 sites. Data were collected over 34 storm events.
Caraco and Schueler, 1999	0.65	0.65	0.65	0.65	This value represents an average of EMC data collected from 3 arid climate locales (Phoenix, Boise, and Denver). A total of 90 data points are used, with each site having at least 16 data points. The value applies to general urban runoff (i.e., mixed land uses).

Table 2. Pollutant Concentrations by Land Use: Total Phosphorus (mg/l) - Continued					
	Land Use				
Source	Residential	Commercial	Roadway	Industrial	Notes
Whalen and Cullum, 1988	0.62	0.29	-	0.42	These data are from an assessment of urban runoff quality that looked at NURP and State of Florida data. The NURP data summaries are what is shown. Residential and commercial values are mean values for specified land uses and reflect between 200 and 1,100 sampling events depending on the parameter and land use. Industrial values are from 4 NURP sites and generally represent light industrial land use.
Model Default Value	**0.4**	**0.2**	**0.5**	**0.4**	
1: The model default values represent best professional judgement, and give additional weight to studies conducted at a national level. Data do not incorporate studies on arid climates.					

Table 3. Pollutant Concentrations by Land Use: Total Nitrogen (mg/l)					
	Land Use				
Source	Residential	Commercial	Roadway	Industrial	Notes
Schueler, 1987 mean	2.0	2.17	-	-	These values are taken from a Washington DC NURP study in 1980-81. At least 27 storm events were sampled at multiple sites within the specified land use.
Gibb *et al.*, 1991 mean	1.5	-	2.72	-	These values represent recommended estimates for planning purposes and are based on analysis of mean concentrations from over 13 studies from the US and British Columbia.
Smullen and Cave, 1998 median	2.0	2.0	2.0	2.0	This study probably represents the most comprehensive data set, with 3,047 event samples being included from across the nation. The data includes pooled NURP, USGS, and NPDES sources. The value is a median of EMCs and applies to general urban runoff (i.e., mixed land uses).
US EPA, 1983 median	2.6	1.75	-	-	These values represent NURP data for residential and commercial land use. NURP data were collected in the early 1980s in over 28 different metropolitan areas across the US.
Barrett and Malina, 1998	-	-	3.48	-	This data reflects a study of vegetative swales treating highway runoff in Austin, TX. Value represents average of the mean inflow concentrations measured at 2 sites. Data were collected over 34 storm events.
Caraco and Schueler (1999). Arid Climates	4.06	4.06	4.06	4.06	This value represents an average of EMC data collected from 3 arid climate locales (Phoenix, Boise, and Denver). A total of 90 data points are used, with each site having at least 16 data points. The value applies to general urban runoff (i.e., mixed land uses).

Table 3. Pollutant Concentrations by Land Use: Total Nitrogen (mg/l) - Continued					
	Land Use				
Source	Residential	Commercial	Roadway	Industrial	Notes
Whalen and Cullum, 1988	2.03	2.3	-	2.53	These data are from an assessment of urban runoff quality that looked at NURP and State of Florida data. The NURP data summaries are what is shown. Residential and commercial values are mean values for specified land uses and reflect between 200 and 1,100 sampling events depending on the parameter and land use. Industrial values are from 4 NURP sites and generally represent light industrial land use.
Model default Value[1]	**2.2**	**2.0**	**3.0**	**2.5**	
1: The model default values represent best professional judgement, and give additional weight to studies conducted at a national level. Data do not incorporate studies on arid climates.					

Table 4. Urban "C" (Pollutant Concentration) Values for Use With the Simple Method (mg/l)

Pollutant	New Suburban NURP Sites (Wash., DC)	Older Urban Areas (Baltimore)	Central Business District (Wash., DC)	National NURP Study Average	Hardwood Forest (N. Virginia)	National Urban Highway Runoff
Phosphorus						
Total	0.26	1.08	-	0.46	0.15	-
Ortho	0.12	0.26	1.01	-	0.02	-
Soluble	0.16	-	-	0.16	0.04	0.59
Organic	0.10	0.82	-	0.13	0.11	-
Nitrogen						
Total	2.00	13.6	2.17	3.31	0.78	-
Nitrate	0.48	8.9	0.84	0.96	0.17	-
Ammonia	0.26	1.1	-	-	0.07	-
Organic	1.25	-	-	-	0.54	-
TKN	1.51	7.2	1.49	2.35	0.61	2.72
COD	35.6	163.0	-	90.8	>40.0	124.0
BOD (5 day)	5.1	-	36.0	11.9	-	-
Metals						
Zinc	0.037	0.397	0.250	0.176	-	0.380
Lead	0.018	0.389	0.370	0.180	-	0.350
Copper	-	0.105	-	0.047	-	-

Table 5. Impervious Cover (%) for Various Land Uses							
Land Use	**Density (dwelling units/acre)**	**Source**					
		Northern Virginia (NVPDC, 1980)[1]	**Olympia (COPWD, 1995)**	**Puget Sound (Aqua Terra, 1994)**	**NRCS (USDA, 1986)**	**Rouge River (Kluitenberg, 1994)**	**Model Default[2]**
Low Density Residential	<0.5	6	-	10	-	19	**10**
	0.5	-	-	10	12		
	1	12	-	10	20		
Medium Density Residential	2	18	-	-	25		**30**
	3	20	40	40	30		
	4	25	40	40	38		
High Density Residential	5-7	35	40	40	-	38	**40**
Multifamily	Townhouse (>7)	35-50	48	60	65	-	**60**
Industrial	--	60-80	86	90	72	76	**75**
Commercial	--	90-95	86	90	85	56	**85**
Roadway							**80**

1: NVPDC data measure effective impervious cover (i.e., rooftops are not included in residential data)

2: Model default values are approximately equal to the median of Olympia, Puget Sound, NRCS, and Rouge River data, with adjustments made where studies estimate impervious cover for a broad range of densities.

Appendix E

Pollutant Loading Model Evaluation

Pollutant Loading Model Evaluation Matrix

Name	Full Name	Developers	Model/System	Components	Description	Quantity	Quality	Quantity & Quality	Land Use	Map	GIS	COST	Maybe	Def No	Comments	Yes	No
WASP	Water Quality Analysis Simulation Program	EPA	Model		Helps to interpret and predict water quality responses to natural phenomena and manmade pollution for various pollution management decisions. Models contaminent fate and transport in surface waters. Biochemical oxygen demand, dissolved oxygen dynamics, nutrients and eutrophication, bacterial contamination, & organic chemical & heavy metal contamination. Modular structure. Does not look at land use impacts.		x					$0		x	No GIS, input data required does not match what we have available, & would be complicated to gather and prepare.		x
BASINS	Better Assessment Science Integrating point & Non-point Sources	EPA	System	v4.0: SWMM5, WASP7, SWAT2005, WinHSPF, PLOAD, & AQUATOX - V3.1: includes AGWA, SWAT, & KINEROS	Multipurpose environmental analysis system designed for use by regional, state, & local agencies in performing watershed & water quality-based studies. Open-source GIS architecture.			x	x	x	x	$0	X		More quality driven and newest version does not have all of the submodels that we would need. Not as user friendly as others that we are looking at and most of the submodels have already been determined not appropriate.		x
HSPF	Hydrological Simulation Program - FORTRAN	EPA	Model		Simulates watershed hydrology & water qua;ity for both conventional & toxic organic pollutants. Comprehensive model of watershed hydrology & water quality that allows the integrated simulation of land & soil contaminant runoff processes with in-stream hydraulic & sdiment-chemical interactions. Results in a time history of the runoff, flow rate, sediment load, & nutient & pesticide concentrations, along with a time history of water quality & quantity at any point in a watershed.		x					$0	X		On its own answers the question of quantity and quality, but no user friendly GUI or GIS integration mentioned. Also no specific mention of land use change impacts or map driven data and inputs. If coupled with another model or program may be an efficient component.		x
WAM	Water Assessment Model	EPA	Model		Assesses water quality of both surface and groundwater based on land use, soils, climate, & other factors. Primarily used for agricultural lands in Florida.		x		x	x	x	$0		x	Stated that it is for use in watersheds located in Florida only.		x
WARMF	Watershed Analysis Risk Management Framework	EPA	Model		Decision support system for watershed management that calculates most conventional pollutants(coliform, TSS, BOD, nutrients) and guides statekeholders to reach a consensus on an implementation plan. Comprised of 5 linked modules under 1, GIS based, GUI. Engineering module calculates daily runoff, shallow ground water flow, hydrology, & water quality of a river basin.			x	x	x	x	$0	X		Quality driven and focus, but has quantity capabilities. Designed to be a decision support system and not just a modeling program. GIS-based GUI, but still requires some extensive data collection and preparation.		x
SWMM	Storm Water Management Model	EPA	Model		Stormwater runoff planning, analysis, & design for combined sewers, sanitatry sewers, and other urban drainage systems. Dynamic rainfall-runoiff simulation used for single even or long-term(continuous) simulation. Model tracks flow rate, flow depth, & quality of runoff. Uses spatial variability principles. Hydraulic modeling tools. Pollution loads. used toasist in the design & sizing of drainage system components for flood control and water quality protection.			x	x	x	x	$0		x	Although seems comprehensive and a strong possibility, looks like there is still a fair amount of complexity and possible concerns with user's level of knowledge and understanding of the watershed. Also seems like it might tend more to the agricultural side of watersheds with less focus on urban lands.		x
SUSTAIN	System for Urban Stormwater Treatment & Analysis Integration Model	EPA	Model		Decision support system to facilitate in the selection of BMP's nad LID techniques in urban watersheds for flow and pollution control and protection. Answers the question of how effective BMP's are at reducing runoff and pollutant loadings and what are the most cost-effective solutions. Comprised of 7 modules.			x				$0		x	Decision making tool for urban watersheds. Although it looks at BMPs and LID techniques, it does not fit the regional scale that we are looking at.		x

Name	Full Name	Developers	Model/System	Components	Description	Quantity	Quality	Quantity & Quality	Land Use	Map	GIS	COST	Maybe	Def No	Comments	Yes	No
GSFLOW	Coupled Ground water & Surface-water FLOW model based on the USGS Precipitation Modeling System (PRMS) & Modular Ground Water Flow Model (MODFLOW-2005)	USGS	System	PRMS & MODFLOW-2005	Simulates groundwater/surfacewater flow in 1 or more watersheds by simultaneously simulationg flow across the land surface, within subsurface saturated and unsaturated materials, and within streams and lakes. Can be used to evaluate effects of land use change, climate variability, and groundwater withdrawals on surface and subsurface flows. Written in Fortran 90 and C programming lanuages only.	x						$0		x	No GIS or mention of land use impacts. Written in a non-user friendly computer language.		x
PRMS	Precipitation Runoff Modeling System	USGS	Model		Modular design, distributed parameter, physical process watershed model used to evaluate the effects of various combinations of precipitation, climate, & land use on a watershed response(streamflow, sediment yields, and general basin hydrology). Uses HRU's to divide basin into subunits based in basin characteristics. Written in Fortran 77. No Maps or GIS mentioned.	x						$0		x	No GIS. Supported by a non-user friendly programming platform.		x
MODFLOW-2005	Modular Ground Water Flow Model - 3D finite-difference analysis	USGS	Model		3-D finite-difference ground-water model used to simulate steady & nonsteady flow in an irregularly shaped flow system in which aquifer layers can be confined, unconfined, or a combination of. Flow from evapotranspiration, flow to drains, and flow through river beds can be simulated. Has capability to model solute transport and ground-water management. Assumes uniform medium properties. Calculates flow-rate & cumulative-volume balances. Written primarily in Fortran 90.	x						$0		x	No GIS or mention of land use impacts. Written in a non-user friendly computer language.		x
PeakFQ	Flood Frequency Analysis Based on Bulliten 17B	USGS	Model		Flood frequency analysis. Provides estimates of instantaneous annual-maximum peak flows for a range of recurrence intervals. Pearson Type III frequency distribution. No Maps & no GIS. Written Fortran 77	x						$0		x	Is an issue of concern, but does not do enough to be efficient or beneficial to our time constraints and process.		x
MMS	Modular Modeling System - A Modeling Framework for Multidisciplinary Research & Operational Applications	USGS	System		User selectively couples the most appropriate process algorithms from applicable models to create an optimal model for the desired application. 3 components: pre-process, model, & post-process within a GUI interactive environment. Models can be written in either Fortran or C programming languages. GIS integration for spatial data analysis and manipulation.			x	x	x	x	$0		x	Way to complex and complicated. No one would be able to efficiently understand and execute a watershed simulation with the time and resources that are available.		x
WinTR-20	Program for Project Formulation Hydrology	USDA-NRCS	Model		Single event watershed sclae runoff & routing model. Computes direct runoff & develops hydrographs from any simulated or natural rainstorm. Can be used to evaluate flooding problems, alternatives for flood control, & impacts of changing land use on the hydrologic response of a watershed. NRCS Geo-Hydro is an ArcView interface for WinTR-20. Designed to be used for use in any watershed where required GIS data are available. Uses CN#'s & standard USGS land use categories.	x			x	x	x	$0	X		If it came down to using multiple models for different components this one would be a strong possibility for quantity only. Has GIS capabilities and uses land use and CN#s.		x
WinTR-55	Program for Project Formulation Hydrology	USDA-NRCS	Model		Uses WinTR-20 program as its driving engine for a more accurate analysis of the hydrology of small watersheds.	x			x	x	x	$0	X		Same as WinTR-20, but for small watersheds.		x
AGNPS	Agricultural Non-Point Source Pollution Model	USDA-NRCS	Model		Predicts non point source pollutant loadings within agricultural watersheds. Contains a continuous simulation surface runoff model designed to assist with determining BMP's the setting of TMDL's, & for risk & cost/benefit analyses.			x	x	x	x	$0		x	Although comprehensive, it primarily focuses on agricultural lands only with little to no mention of urban watersheds.		x

Name	Full Name	Developers	Model/System	Components	Description	Quantity	Quality	Quantity & Quality	Land Use	Map	GIS	COST	Maybe	Def No	Comments	Yes	No
AGWA	Automated Geospatial Watershed Assessment	EPA & USDA-ARS	System	KINEROS & SWAT	Colletcts and prepares GIS spatially-distributed data for input files and evaluate model results. Prepares input files for KINEROS & SWAT, distributed models that can compute runoff & erosion at different spatial & temporal scales.			x	x	x	x	$0		x	Answers some of the questions that we are looking at, but not as efficiently as other models that have been looked at.		x
SWAT	Soil & Water Assessment Tool	USDA-ARS & Texas A&M University	Model		Predicts the effect of management decisions on water, sediment, nutrient & pesticide yields with reasonable accuracy on large, ungaged river basins. Components: weather, surface runoff, return flow, percolation, ET, transmission losses, pond & reservoir storage, crop growth & irrigation, groundwater flow, reach routing, nutrient & pesticide loading, & water transfer. Based on the water balance equation and uses a distributed SCS curve #. ArcSwat is an Arc-GIS/ArcView extension and a graphical user input interface for SWAT.			x	x	x	x	$0	x				x
KINEROS	Kinematic Runoff & Erosion Model	USDA-ARS	Model		An event-oriented, physically-based model used to describe the processes of interception, infiltration, surface runoff, and erosion from small watersheds characterized by overland flow. Can be used ot determine the effects of various artificial feature on flood hydrographs and sediment yield.	x			x			$0		x	Only for small watersheds and not really what we are ultimately looking for.		x
SWIM	Soil & Water Integrated Model	PIK Potsdam	Model		Developed to investigate climate & land use change impact at the regional scale, where impacts are manifested & adaptation measures take place. Combines the relevant ecohydrological processes at the mesoscale such as runoff generation, nutrient & carbon cycling, river discharge, plant growth & crop yield, and erosion. Model setup and postprocessing are supported by GIS. Too complex for what we are looking for.			x				$0		x	Not in the USA		x
HEC-HMS	Hydrologic Engineering Center - Hydrologic Modeling System	USACE	Model		Generalized modeling system designed to simulate the precipitation-runoff process of dendritic watershed systems. Can be applied to wide range of watershed sizes, from large river basins to small urban watersheds. Employs SCS method processes for infiltration loss and surface runoff. Also uses the SCS hypothetical storm method. Quasi-distributed model. A GIS companion product can be used to create basin models for various projects - HEC-GeoHMS.	x			x	x	x	$0	x		Very general, but provides a good overview. With GIS companion, inputs would not be too difficult to prepare. Uses SCS methods. If stand alone, would only answer quantity. If coupled with other models might be a good fit.		x
HEC-RAS	Hydrologic Engineering Center - River Analysis System	USACE	Model		Performs one dimensional steady flow, unsteady flow, sediment transport/mobile bed computations & water temperature modeling, with some other pollutant cabalibilities. GIS companion - HEC-GeoRAS.		x		x	x	x	$0	x		Inputs can be time consuming a intensive to prepare. GIS companion may help reduce input preparation issues, but not enough to make it efficient for our use.		x
HEC-EFM	Hydrologic Engineering Center - Ecosystem Functions System	USACE	Model		Determines ecosystem responses to change in the flow regime of a river or connected wetland. Analyses involves: 1) statistical analyses of relationshipt between hydrology & ecology, 2) hydraulic modeling, & 3) use of GIS to display results & other relevant spatial data.	x						$0		x	To extensive. We are not, at least at this point in time, looking at ecosystems.		x
WMS	Department of Defense Watershed Modeling System	USACE	System	TR-20, TR-55, HEC-1, HEC-HMS, HEC-RAS, GSSHA, CE-QUAL W2	Integrates hydrology, hydraulics, & water quality. Integrates & simplifying the process of hydrologic models by bringing together all the tools needed to complete a successful study. Reduces the amount of time needed to assimilate sources of data & construct hydrologic model inputs.			x	x	x	x	$5,600	x		Although costly, seems to be the most efficient and comprehensive modeling solution at present. Limits user inputs and opportunities for error. Timely and efficient data collection and preparation. Complete GIS integration. Outputs can be used stand alone or coupled with other models.	x	

Name	Full Name	Developers	Model/System	Components	Description	Quantity	Quality	Quantity & Quality	Land Use	Map	GIS	COST	Maybe	Def No	Comments	Yes	No
L-THIA	Long-Term Hydrologic Impact Assessment	Purdue University	Model		Estimates the impacts of land use change on water resources and the water quality impacts of land use change. Estimates changes in recharge, runoff, & nonpoint source pollution resulting from past or proposed development. Produces maps of runoff depth & volume along with nonpoint source pollution loadings.			x	x			$0	x		Easy to use, but has been determined by the Leam Group to not be an adequate and thorough model. Gives estimations, but implies that results should not be taken as concrete and should be used as warning signs or indicators of further investigation.		x
CASC2D	CASCade of Planes in 2 Dimensional	CO State Univ	Model		Determines the runoff hydrograph generated from a temporally-spatially varied rainfall event by using a 2D overland flow routing algorithm, Green & Ampt infiltration, detention sotage, & diffusive-wave channel routing. Erosion & sediment rates can also be predicted. Solves equations of conservation of mass, energy, and linear momentum to estimate watershed runoff for a given rainfall input.	x			x	x		$0	x		Has become outdated and replaced with GSSHA. Based on assumptions in the model it only works well for hortonian watersheds and neglects the effects of soil water and groundwater in runoff production.		x
GSSHA	Gridded Surface Subsurface Hydrologic Analysis	USACE-ERDC-CHL	Model		Significant reformation & enhancement of the CASC2D model that is designed to correctly identify & realistically simulate the important hydrologic processes in watersheds. Intended to simulate different types oif runoff production & determine the controlling physical process in a watershed, i.e. infiltration excess, saturated source areas, & groundwater discharge.	x			x	x		$0	x		Works with a wide range of watersheds and takes into account nonhortonian watersheds by including soin water and groundwater in runoff calculations. Quality only, but would work well if it was coupled with other models.		x
CE-QUAL-W2 V3	Hydrodynamic & Water Quality Model	USACE & Portland State Univ	Model		A longitudinal/vertical hydrodynamic & water quality model. Predicts water surface elevations, velocities, & temperature, as well as water quality.		x			x	x	$0	x		Extensive water quality modeling capabilities. If multiple models are to be used, might be a good fit.		x

Appendix F

LaBarque Creek and Fox Creek Fish Population Analysis

LaBarque RAM Fish Summary
Comparison of 2001, 2005, and 2010 Samples

Species	2001 # Collected	2005 # Collected	2010 # Collected	2001 % Abundance	2005 % Abundance	2010 % Abundance
common carp		1			0.0%	
hornyhead chub	1			0.0%		
bigeye chub			14			0.4%
creek chub	52	75	104	1.7%	2.0%	2.6%
southern redbelly dace	3	1	39	0.1%	0.0%	1.0%
redfin shiner	154	183	46	4.9%	4.9%	1.2%
bleeding shiner	147	61	246	4.7%	1.6%	6.3%
carmine shiner			21			0.5%
striped shiner	168	543	296	5.4%	14.5%	7.5%
wedgespot shiner			1			0.0%
steelcolor shiner			2			0.1%
red shiner	1			0.0%		
bigeye shiner		13	9		0.3%	0.2%
sand shiner			16			0.4%
mimic shiner			3			0.1%
silverjaw minnow	75	474	95	2.4%	12.7%	2.4%
ozark minnow	20	2	8	0.6%	0.1%	0.2%
bluntnose minnow	49	142	37	1.6%	3.8%	0.9%
fathead minnow		8			0.2%	
largescale stoneroller			350			8.9%
central stoneroller			1118			28.4%
stoneroller spp.	1696	1065		54.2%	28.5%	
white sucker	12	10	32	0.4%	0.3%	0.8%
northern hog sucker	24	5	12	0.8%	0.1%	0.3%
spotted sucker		2	3		0.1%	0.1%
black redhorse	20	1	18	0.6%	0.0%	0.5%
golden redhorse	14	3	6	0.4%	0.1%	0.2%
black bullhead	3			0.1%		
yellow bullhead	9	10	16	0.3%	0.3%	0.4%
slender madtom	4	1	7	0.1%	0.0%	0.2%
northern studfish	26	129	52	0.8%	3.4%	1.3%
blackstripe topminnow	60	169	13	1.9%	4.5%	0.3%
blackspotted topminnow	21	183	108	0.7%	4.9%	2.7%
mosquitofish	9	14	3	0.3%	0.4%	0.1%
brook silverside	9			0.3%		
mottled sculpin	71	72	375	2.3%	1.9%	9.5%
spotted bass	3		1	0.1%		0.0%

LaBarque RAM Fish Summary - Continued Comparison of 2001, 2005 and 2010 Samples						
Species	**2001 # Collected**	**2005 # Collected**	**2010 # Collected**	**2001 % Abundance**	**2005 % Abundance**	**2010 % Abundance**
smallmouth bass		2			0.1%	
largemouth bass	6	9	24	0.2%	0.2%	0.6%
warmouth	1	2	3	0.0%	0.1%	0.1%
green sunfish	26	81	104	0.8%	2.2%	2.6%
redear sunfish			2			0.1%
longear sunfish	155	162	244	5.0%	4.3%	6.2%
bluegill	44	33	50	1.4%	0.9%	1.3%
rock bass	7	3	4	0.2%	0.1%	0.1%
hybrid sunfish	2		5	0.1%		0.1%
johnny darter	46	32	28	1.5%	0.9%	0.7%
orangethroat darter	121	191	270	3.9%	5.1%	6.9%
rainbow darter	35	20	21	1.1%	0.5%	0.5%
fantail darter	32	34	110	1.0%	0.9%	2.8%
greenside darter	3	7	14	0.1%	0.2%	0.4%
TOTALS:	3129	3743	3930	100.00%	100.00%	100.0%

Source – Missouri Department of Conservation, Resource Assessment and Monitoring (RAM) program

LaBarque Creek RAM Fish Summary

Species gained in 2005
bigeye shiner
smallmouth bass
fathead minnow
common carp
spotted sucker

Species lost in 2005
red shiner
black bullhead
brook silversides
spotted bass
hybrid sunfish
hornyhead chub

Species gained in 2010
bigeye chub
carmine shiner
wedgespot shiner
steelcolor shiner
sand shiner
mimic shiner
redear sunfish
hybrid sunfish
spotted bass

Species lost in 2010
fathead minnow
common carp
smallmouth bass

LaBarque Creek	**2001**	**2005**	**2010**
# Native Families	9	8	8
# Native Species	36	36	42

Average Index of Biologic Integrity (IBI)
(A measure of aquatic biodiversity)

Year	**IBI**
2001	77.6
2005	82.3
2010	80.4

Fox Creek 2001-2005 comparison				
Species	**2001 # Collected**	**2005 # Collected**	**2001 % Abundance**	**2005 % Abundance**
goldfish	1		0.0%	
bluntnose minnow	13	114	0.4%	3.6%
ozark minnow	142	298	4.1%	9.3%
creek chub	21	4	0.6%	0.1%
hornyhead chub	1		0.0%	
bigeye chub	10		0.3%	
redfin shiner	12	26	0.4%	0.8%
bleeding shiner	262	166	7.6%	5.2%
striped shiner	17	20	0.5%	0.6%
stonerollers	2093	1518	61.1%	47.6%
southern redbelly dace	28	48	0.8%	1.5%
golden redhorse	2		0.1%	
northern hogsucker	4		0.1%	
white sucker	4		0.1%	
slender madtom	9	16	0.3%	0.5%
yellow bullhead	3	1	0.1%	0.0%
northern studfish	8	29	0.2%	0.9%
blackstripe topminnow	10	16	0.3%	0.5%
blackspotted topminnow	43	5	1.3%	0.2%
mosquitofish	8	5	0.2%	0.2%
mottled sculpin	107	406	3.1%	12.7%
largemouth bass	9		0.3%	
hybrid sunfish	4		0.1%	
longear sunfish	108	93	3.2%	2.9%
bluegill	186	17	5.4%	0.5%
green sunfish	59	16	1.7%	0.5%
greenside darter	3		0.1%	
rainbow darter	10	35	0.3%	1.1%
orangethroat darter	248	357	7.2%	11.2%
johnny darter		2		0.1%
	3425	3192	100.0%	100.0%

Source – Missouri Department of Conservation

Fox Creek Fish Summary

Species gained	Species lost
johhny darter	goldfish
	hornyhead chub
	bigeye chub
	golden redhorse
	northern hogsucker
	white sucker
	largemouth bass
	hybrid sunfish
	greenside darter

Fox Creek	**2001**	**2005**
# Native Families	8	7
# Native Species	27	21

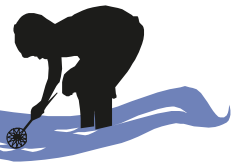
Average Index of Biologic Integrity (IBI)
(A measure of aquatic biodiversity)

Year	**IBI**
2001	59.6
2005	59.5

Appendix G

Lower Meramec Watershed Planning Survey and Analysis

Lower Meramec Watershed Planning Survey



Geographic survey area:
Lower Meramec River and its tributary streams including Brush Creek; Fox and LaBarque Creeks; Hamilton, Carr, Flat, Forby, and Kiefer Creeks; and Grand Glaize, Williams and Fishpot Creeks. These tributaries enter the Meramec between Pacific and Valley Park. (This survey is also available online at: **ewgateway.org/watershedsurvey**. Please pass this link on to others living in the watersheds listed above.)

What are the issues of greatest concern in the watersheds of these tributary streams?
Please fill out this short questionnaire and provide any suggestions for others we should survey.

Please enter your zip code: _____

---

1. **Please rank each of the subject areas below as to whether they are very important (5) or not important (1) to you and your community.** (please fill in one ⬭)

	Not Important 1	2	3	4	5 Very Important
Flooding	⬭	⬭	⬭	⬭	⬭
Stream bank erosion	⬭	⬭	⬭	⬭	⬭
Water quality	⬭	⬭	⬭	⬭	⬭
Greenways and trails	⬭	⬭	⬭	⬭	⬭
Riparian corridor (land next to a stream vegetated with trees and shrubs)	⬭	⬭	⬭	⬭	⬭
Stormwater runoff	⬭	⬭	⬭	⬭	⬭
On-site sewage treatment systems (e.g. septic tanks)	⬭	⬭	⬭	⬭	⬭
Small-scale sewage treatment systems serving more than one home or business	⬭	⬭	⬭	⬭	⬭
Fishing	⬭	⬭	⬭	⬭	⬭
Access to recreation around the Meramec River	⬭	⬭	⬭	⬭	⬭

(Identify specific areas of concern _____)

2. **If specific creeks are a concern, please identify which ones and why:**

_____

_____

3. **Do you or members of your family participate in the following activities?** (⬭ fill in all that apply)

- ⬭ Swimming in the Meramec River
- ⬭ Fishing in the Meramec River
- ⬭ Boating on the Meramec River
- ⬭ Hiking/biking along the Meramec River
- ⬭ Hiking/biking along tributary creeks
- ⬭ Wading in tributary creeks (List all tributaries where you wade, swim or fish)

  _____

- ⬭ Other activities: _____

  _____

  _____

  _____

  _____

...continued on back

4. What recreational facilities are in the area do you use? And how frequently?
(⬬ fill in all that apply)

	Occasionally	3x/Year	Monthly	More
Al Foster Trail	⬬	⬬	⬬	⬬
Beck Park	⬬	⬬	⬬	⬬
Blue Bird Park	⬬	⬬	⬬	⬬
Castlewood State Park	⬬	⬬	⬬	⬬
Forrest Staley Park	⬬	⬬	⬬	⬬
Greensfelder County Park	⬬	⬬	⬬	⬬
LaBarque Hills Conservation Area (CA)	⬬	⬬	⬬	⬬
Lone Elk Park	⬬	⬬	⬬	⬬
Pacific Palisades CA	⬬	⬬	⬬	⬬
Packwood Park	⬬	⬬	⬬	⬬
Riverside Park	⬬	⬬	⬬	⬬
Rock Hollow Trail	⬬	⬬	⬬	⬬
Rockwoods Range CA	⬬	⬬	⬬	⬬
Rockwoods Reservation CA	⬬	⬬	⬬	⬬
Route 66 State Park	⬬	⬬	⬬	⬬
Shaw Nature Reserve	⬬	⬬	⬬	⬬
Sherman Beach	⬬	⬬	⬬	⬬
Simpson Park	⬬	⬬	⬬	⬬
West Tyson Park	⬬	⬬	⬬	⬬
Young CA	⬬	⬬	⬬	⬬
Other parks or recreational areas:				
_____	⬬	⬬	⬬	⬬
_____	⬬	⬬	⬬	⬬
_____	⬬	⬬	⬬	⬬

5. Please provide any other relevant information:

_____

_____

_____

If you are interested in serving on a Watershed Plan Working Group, please provide your name, e-mail address, and phone number (including area code).

_____

_____

_____

Thank you for your participation.

Missouri Department of Natural Resources

U. S. Environmental Protection Agency Region 7 through the Missouri Department of Natural Resources has provided partial funding for this project under the American Recovery and Reinvestment Act of 2009, Section 604(b) of the Clean Water Act.

The Open Space Council for the St. Louis Region

Missouri Coalition for the Environment

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Lower Meramec Watershed Planning Survey

Introduction

The purpose of the survey was to understand the issues of greatest concern in the lower Meramec watershed and associated tributaries. The survey was provided to community leaders and the public via watershed meetings, the East-West Gateway website, and partner organizations.

The survey was administered online through the East-West Gateway website and in person, in paper form. The survey was made available to the public from February 24 to October 31, 2011 and was accessible online at http://www.ewgateway.org/lowermeramec/lowermeramec.htm.

The individuals who responded to this survey were self-selected. Thus, respondents to this survey do not constitute a random sample designed to be representative of the region's population. Rather, this survey elicited attitudes and issues of concern to citizens informed and motivated enough to choose to participate. The value of a survey like this is to alert planners and policy makers to potential areas of concern that may warrant additional study. As with focus groups, open-ended surveys such as this allow unfiltered information to emerge, unconstricted by predefined responses.

This report contains a summary, analysis and conclusion that highlight the survey's major findings. A summary of the responses to the survey is provided for each question and is presented in the order in which they appear in the survey. To preserve the sentiment of respondents, responses to open-ended questions are recorded in this report in participants' own words, with no edits made by the authors of the report. Where possible the leading themes that emerge from the responses are summarized.

The most notable finding was that, when given the opportunity to rank ten issues of greatest concern in the Meramec's watersheds, respondents identified water quality as the most important issue. This sentiment was also reflected in many of the subsequent open-ended survey responses that asked participants to comment on the subject.

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Table of Contents

Questions

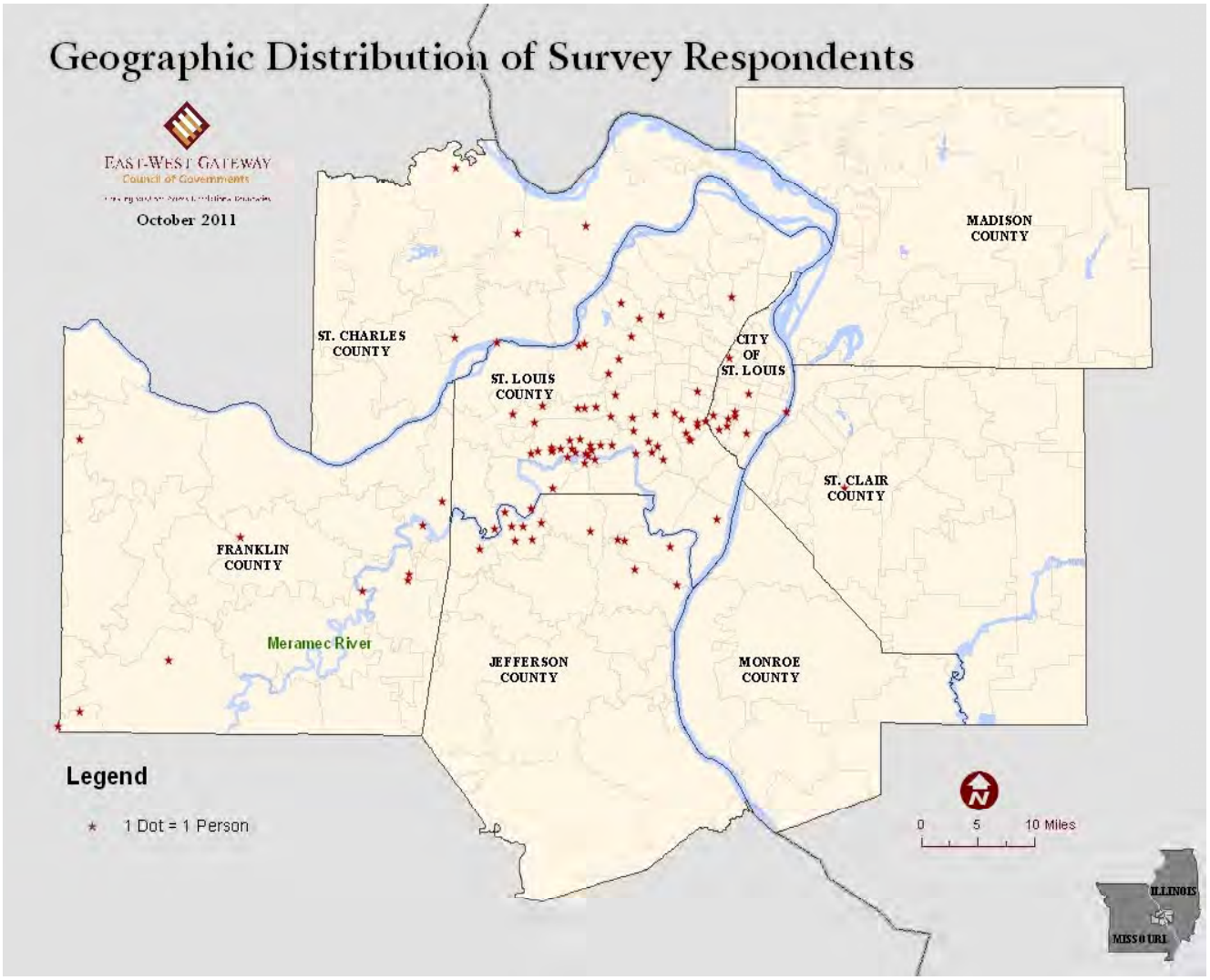
Supplemental Materials

Results

The survey was available to the public from February 24 to October 31, 2011. During this period, 130 people residing in at least 40 unique zip codes located within the eight-county East-West Gateway region completed the survey.

Map 1 displays the geographic distribution of the survey respondents by zip code of residence. In general, the majority of responses came from individuals located in the central part of the region in areas north of the Meramec River in St. Louis County and City and slightly south of the Meramec River in Jefferson County.

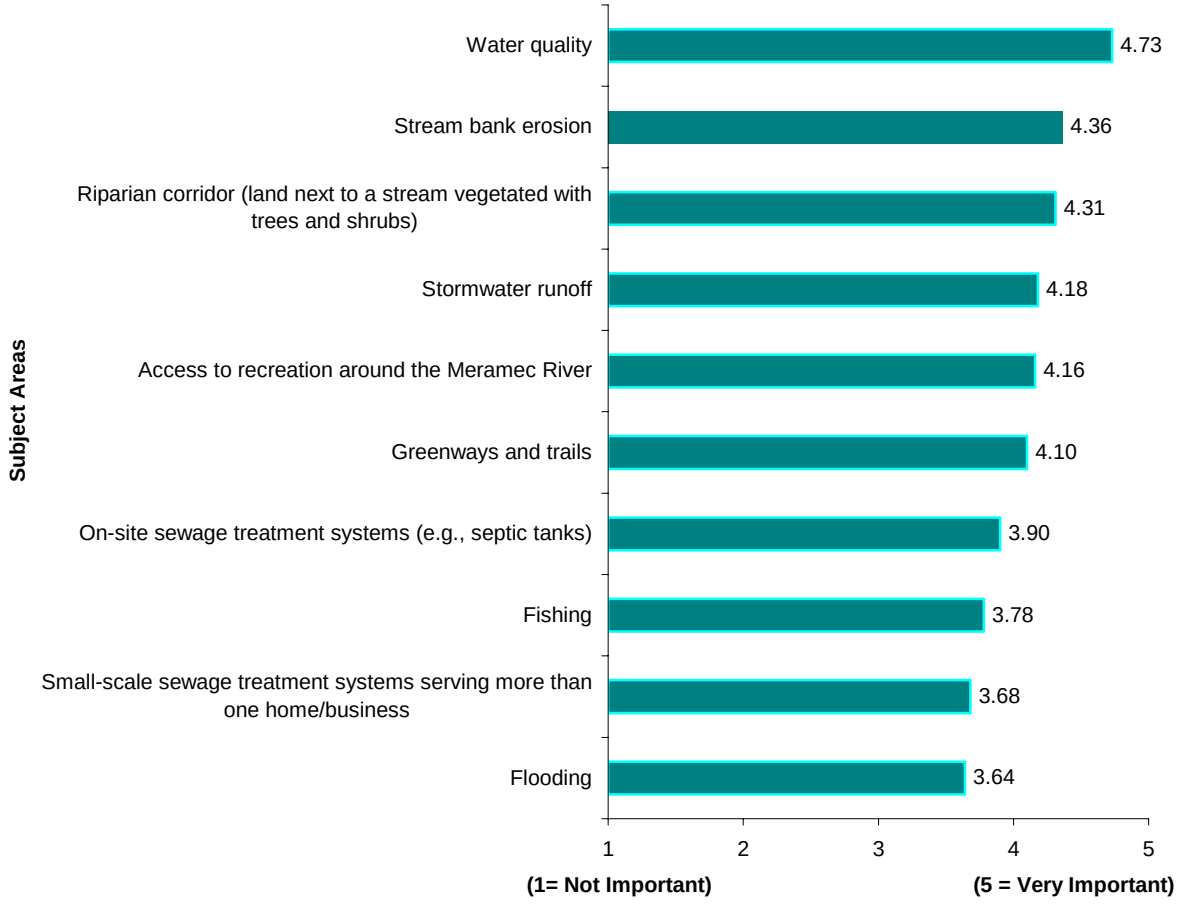
Map 1. Geographic distribution of survey respondents by zip code.



Question 1: Please rank each of the subject areas below as to whether they are very important (5) or not important (1) to you and your community.

Question 1 asked respondents to rank ten subject areas according to their level of importance on a scale of 1 (not important) to 5 (very important). Figure 1 presents the average scores for each subject area. The chart below indicates that, on average, respondents are most concerned about water quality (4.73), stream bank erosion (4.36), and riparian corridor (4.31). Areas of least concern include flooding (3.64), small-scale sewage systems serving more than one home or business (3.68), and fishing (3.78).

Figure 1. Ranked scores by subject areas



Note: Riparian corridor is land next to a stream vegetated with a trees and plants. This category could represent various concerns to any individual respondent i.e., watershed related, trash, unauthorized activity or building, erosion, etc.

1a. Identify specific areas of concern:

Question 1a asked survey respondents to identify specific areas of concern. Respondents emphasized a number of concerns including water quality, trash, erosion and flooding, overdevelopment and encroachment. The results are presented in Table 1a.

Table 1 presents the responses from the participants in their own words. The text in this table is the exact phrasing used by the respondents.

Table 1a. Responses to Question 1a (unedited)

"Detroit riprap" around Pacific and abandoned barges at Glenco and I-44.
After a weekend the overall water quality is affected by recreational use. The motor boats disturb the silt and erode the banks causing murky water incresing the water temp. This settles down by Wed. and then the cycle starts again on the weekend.
“Asian jumping carp”
“Bank Erosion”
“clean water, open space, wildlife habitat”
“cleanliness of the feeder streams”
“Confluence of Big and Meramec River”
“Degradation of fish habitat”
“Development eroding/destroying tributary quality, lack of upkeep of onsite and small-scale sewage treatment systems”
“fishing and outdoor recreation; maintaining water quality for today and future generations!”
“Flooding and small-scale sewage treatment systems do not directly impact my particular neighborhood, but I am certainly concerned about how these activities effect our streams and rivers.”
“Fluctuating water levels; overall ability to sustain well rounded aquatic life; the need to have regional plan for entire river, not just a portion here and there.”
“How about tackling all the tires, washer/dryers, cars, and the trash on the back-side of Castlewood State Park. Have more concentrated clean ups to work on the big stuff still out there. And tires...”
“i want to see riverside hydro kinetic electricity generation and filtration at the closed chrysler plant location near valley park, additional lakes adjacent the river, more deep areas in tributaries for salamanders, a mammal and eagle river bank feeding strategy”
“incredible amounts of trash in certain tributaries, esp. Grand Glaize and Simpson Lake; unsightly leftover private bank stabilization efforts such as old autos & concrete rip-rap; remnants of old clubhouses, e.g., steps, concrete blocks, pipes, barrels, etc. on the river bank; poor water quality, which means fewer fish, minnows, mussels, etc. than farther upstream”
“It is a river, some bank erosion and flooding should be expected and allowed for. Runoff that is excessive because of developement needs to be slowed from getting into the streams in some way. As long as sewages systems are kept in good repair, it should not be a great problem.”
“Keeping the river clean. Providing canoe/kayak access”
“Limit access. Keep the river and riparian areas undisturbed. Keep trails outside the floodplain - learn from the eroding river trails in castlewood and the attractive nuisance they become. Prioritize canoe and kayak as the preferred means of access/travel along the river.”
“Meramec riverfront in Emmenegger Nature Park”

“Need more water patrol coverage.”
“Opening ecologically sensitive areas up to the public threatens the survival of wildlife. Trails along the river and the increase in human presense can only contribute to the demise of nature. Leave it like nature intedned.”
“Overdevelopment; encroachment of development into riparian corridors”
“Repair of trail through Castlewood State Park. Extension of trails west of 141.”
“Seems there are fewer and fewer places to just fish or swim along the lower Meramec. Impermeable surfaces on roads, driveways, and parking lots needs to be addressed so they don"t continue to add to the flooding problems.”
“Septic Tanks outfall should be reduced wherever possible.”
“Source Water Protection”
“stream bank erosion-Fishpot, Kiefer and Grand Glaize Creeks”
“Streams that enter the Meramec”
“suburban housing tracts built almost up to the riverbank. Home owners often fight visitors for access to these roads causing traffic problems.”
“That any/all Lower Meramec Watershed projects fully account for the needs of native plant and animal life, especially those listed as Species of Concern by the MO Dept of Conservation.”
“The degrading Water Quality from city and rural runoff, and it"s effect on the native populations of muscles, amphibians and fish.”
“Toxic contamination of waterways and limited regulations and monitoring in Missouri”
“trash, continued building throughout watersheds, reduction of wildlife and fish species, loss of habitat, building in floodplains, destruction of bottomland forest for gravel dredging operations”
“Upper quality is the invisible enemy”
“Vance and Hanna road area erosion by fish pot creek”
“Water monitoring for toxins”
“Water qualilty issues in Kiefer Creek; trash, debris & general pollution of Fishpot & Grand Glaize creeks”
“water quality”
“Water quality - protection of our drinking water (Meramec supplies water to 200,00 households and commercial properties) Very important to make sure the goals of the clean Water Act are attained. Combined Sewer Overflows add disenase carying bacteria to the Meramec River.”
“Water quality and recreation...preserving the beauty and natural areas for habitat are very important.”
“Water quality and strem bank erosion are significant issues for the Meramec and its tributaries. Also, not all tributaries are protected by numeric water quality standards under the state"s inadequate system.”
“Water quality degradation due to development. Decreasing access to streams for recreation, by foot mostly.”
“water quality. We swim and boat at george winter park.”
“Would like more access points for fishing on the Meramec”

Question 2: If specific creeks are a concern, please identify which ones and why:

Respondents identified a variety of specific concerns. Fox Creek and Kiefer Creek were mentioned most frequently as creeks of concern. Pollution, water quality, erosion, and storm water were all listed as concerns.

Table 2 presents the responses from the participants in their own words. The text in this table is exact phrasing of the respondents.

Table 2. Responses to Question 2 (unedited)

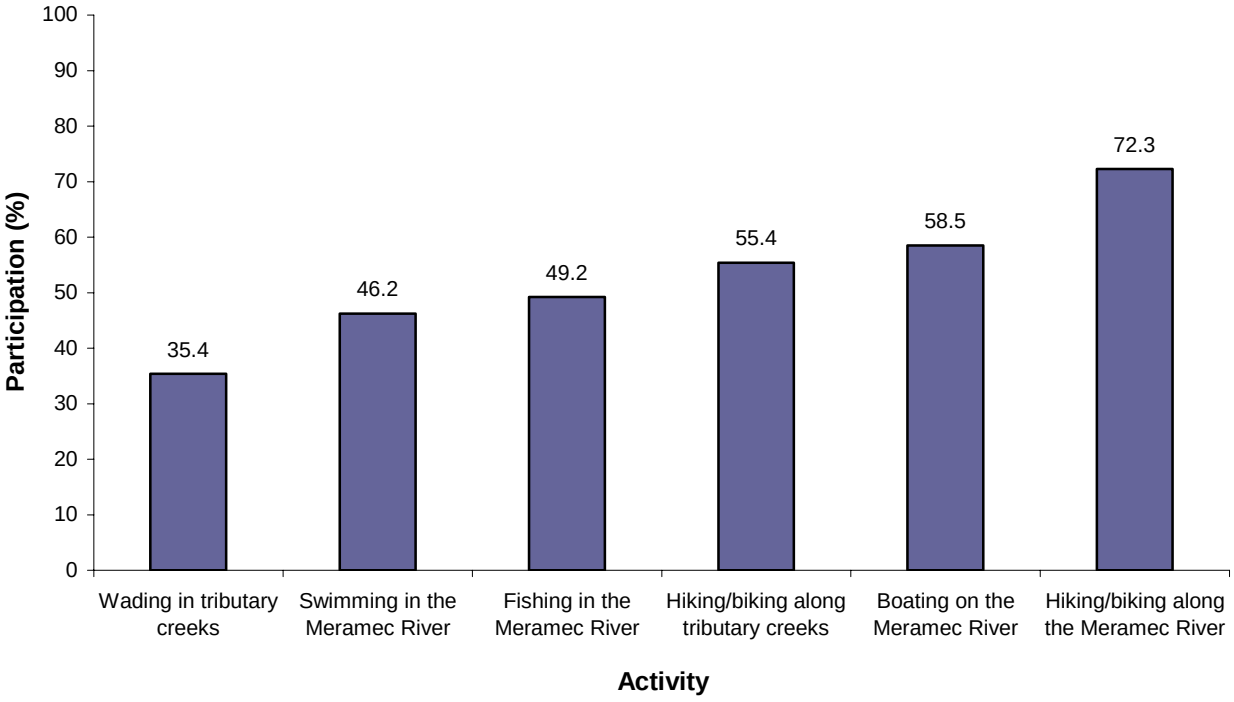
"All of them! They are all connected and therefore important."
"Bourbeuse River Erosion - I see large trees down every year in the river, the banks change and widen every month."
"failing Septic tanks, and unauthorized stream disturbance are areas of particular concern. Development preacites that do not take into account wise storm water management is another area of critical concern."
"FISH POT CREEK THE MAJOR EROSION IS A CATASTROPHIC RISK TO LIFE AND PROPERTY. PARKWAY SCHOOL BUSES ARE RIGHT NEXT TO THIS EROSION EVERY SCHOOL DAY FLOODING COULD WASH THEM AWAY THINK OF ALL THE LAWSUITS FROM THE PARENTS THIS WOULD BRING , HOMES AND CONDOS NEXT TO THIS CREEK ARE OTHERS WHO COULD SUE WE ARE PREPARED TO JOIN TOGETHER TO FORCEL. MSD TO SHORE UP THIS AREA TO A SAFE LEVEL ... WE NEED THIS DONE ..NOW.. 10..12..2011."
"Fishpot Creek and Grand Glaize Creek"
"Fox Creek and the ill-advised plans to develop the floodplain; Fishpot Creek and the rampant erosion caused by uncontrolled development; Kiefer Creek and the intrusion of failing septic systems."
"Fox Creek has been a high water quality stream recently but has gotten too much development upstream which is too close to the stream."
"Fox Creek, La Barque Creek, Hamilton Creek, Brush Creek, Kieffer Creek, see below activities to a greater or lesser extent."
"Fox, Labarque and Hamilton Creeks because they all risk future large scale development that could seriously degrade tributary quality and thus Meramec River quality."
"grand glaize"
"Grand Glaize is right next to Manchester Ball Field. Kids go in creek bed. Is water quality good? Kiefer Creek in Castlewood State Park."
"Hamilton and Carr Creeks"
"Kiefer Creek erosion and pollution"
"Kiefer Creek has become a sewage receptical as more and more humans more into the watershed with little or no provisions for the creek."
"Kiefer Creek is polluted by e.coli. Sediment and excess stormwater runoff are other concerns in all Meramec River tributaries."
"Kiefer Creek, Grand Glaize, Fish Pot & LaBarque are those I am most familiar with"

“LaBaroque Creek> When I was young, this was the number one spot for large and smallmouth bass spawning. Silt has filled it in and the area is useless now.”
“Little creeks that feed into major ones. Little Saline Creek. springs and wetlands destroyed by construction such as in Arnold”
“Missouri River floodplain”
“Pollution - damage that can never be undone.”
“The Grand Glaize Creek has some old dump sites that we are working with MSD to get cleaned up. These dump sites simply do not belong along a creek. The septic tank issue needs to be resolved along Kiefer Creek.”
“Trash in Grand Glaize because it flows into Simpson Lake”
“Water quality issues w/ Kiefer Creek.....this is a beautiful creek running through a State Park and should NOT have signs warning people about the water quality....this MUST be remediated!”

Question 3: Do you or members of your family participate in the following activities?

Figures 3 presents the level of participation by types of activities. The results show that respondents, or members of their family, participate in all of the activities listed in Question 3. The largest percentage of respondents (72.3%) said they participate in hiking/biking along the Meramec River, while fewer (about 35 %) said they waded.

Figure 3. Level of participation by activity type



3a. List all tributaries where you wade, swim or fish

Question 3a asked respondents to list all tributaries where they wade, swim, or fish. The most frequently mentioned tributaries were LaBarque (11), Kiefer Creek (7), Fish Pot (6), Grand Glaize (6) and Courtois Creek (3).

Table 3a presents the responses from the participants in their own words. The texts in this table are exact phrasing of the respondents.

Table 3a. Responses to Question 3a (unedited)

All of them.
Bourbeuse River
Brazil Creek
Brush Creek Pacific
Calvey creek
Courtois creek, Huzzah creek, Mineral Fork, Brazil creek, Big river
Fish Pot
fishpot
Fishpot, Kiefer Creek
Fox, Kiefer, Hamilton, Grand Glaize
Grand Glaize (Simpson park)
Grand Glaize Creek, Kiefer Creek
grand glaize,
Grand Glaize, Labarque, Fishpot
Hamilton and Labarque Creeks
Huzzah
huzzah,coutois
Indian creek, little meramec,
Indian creek, fox creek, meramec, La Barque, unnamed tributaries.
Kiefer Creek
Kiefer Creek, Fishpot Creek
La Barque
LaBaroque Creek and Fox Creek
labarque creek
LaBarque Creek
LaBarque Creek, Brush creek, the mainstem of the Meramec
LaBarque Creek; Hamilton and Kiefer Creeks; Grand Glaize and Fishpot Creeks.
LaBarque, Kiefer
Meramec & Kiefer Creek
Meramec River
Rubidoux, Courtois, Blue Spring Creek and Meramec Springs Branch.
wade and do water quality monitoring, hike near LaBarque Crk

3b. Other Activities:

Question 3b asked respondents to identify activities that they engage in, but were not listed on the Question 3. In addition to the activities identified in Figure 3, respondents reported engaging in additional activities including bird watching, camping, canoeing, photography, cave exploring and arrowhead hunting around the creeks and tributaries of the Meramac Watershed.

Table 3b presents the responses from the participants in their own words. The texts in this table are exact phrasing of the respondents.

Table 3b. Other activities reported by participants

Bird Watching
Bird watching, plant ID
Bird/wildlife watching
Birding
Camping, hunting,
Canoeing and kayaking on the Meramec River! Fly-fishing on the Meramec River!
Canoeing in the tributaries when river level allows it.
Canoeing/kayaking, geology studies, rock collecting
cave exploring, bio inventory, and water quality monitoring of our underground treasures in Missouri - the Cave State
Developers, MSD and municipalites should use green infrastructure and storm water BMP"s at every oppotunity. Protecting water quality should be a way of doing business.
Floating, Camping
Floating, fishing
I enjoy swimming in the Meramec River, but only in the upstream stretches
Mushroom hunting, kayaking, arrowhead hunting, trash cleanup
None
Of the selections made above that deal with direct contact of the water [swim, fish, canoe], we only do in the vicinity of the upper Meramec, upstream from the Caverns &/or MSP.
Photography
Picnicing, Outdoor Photography, Landscape Painting and drawing, Bird watching,
research
Snorkling
Stream team monitoring - trying to get interest in WQ on Hamilton and Carr Creeks where 2-point source small plants seem to be degrading water.
Stream Team Participation - Fox Creek
Water quality monitoring
We only use none motored boats eg canoes/kayaks

Question 4: What recreational facilities in the area do you use and how frequently?

Table 4 presents the percent distribution of respondent recreational facility usage. Lone Elk Park was used the most by respondents (68.5%), followed by Castlewood State Park (67%) and Route 66 State Park (59.9%). At least ten percent of respondents reported using the following parks once-a-month or more: Lone Elk Part, Rockwoods Reservation, Al Foster Trail, Castlewood State Park, Simpson Park, and Route 66 State Park. Additionally, all of the recreational facilities were used occasionally, and a majority of them were used more than occasionally. Respondents reported using all parks 'occasionally' more than any other level of usage.

Table 4. Level of facility usage by recreational facility

Facility	Not Used	Occasionally	3x/Year	Monthly	More	Overall Use
Lone Elk Park	31.5%	33.1%	23.8%	8.5%	3.1%	68.5%
Castlewood State Park	32.3%	31.5%	18.5%	10.8%	6.2%	67.0%
Route 66 State Park	40.0%	33.8%	13.1%	9.2%	3.8%	59.9%
Shaw Nature Reserve	42.3%	33.8%	15.4%	5.4%	3.1%	57.7%
Rockwoods Reservation	50.0%	23.8%	15.4%	6.2%	4.6%	50.0%
Greensfelder County Park	52.3%	26.9%	13.8%	5.4%	1.5%	47.6%
Al Foster Trail	63.8%	16.9%	8.5%	7.7%	3.1%	36.2%
Pacific Palisades	69.2%	14.6%	10.0%	3.1%	3.1%	30.8%
Simpson Park	70.8%	10.8%	7.7%	6.2%	4.6%	29.3%
LaBarque Hills Conservation Area	71.5%	16.9%	6.9%	3.1%	1.5%	28.4%
Rockwoods Range	71.5%	13.8%	8.5%	4.6%	1.5%	28.4%
West Tyson Park	74.6%	10.8%	7.7%	6.2%	0.8%	25.5%
Blue Bird Park	78.5%	14.6%	2.3%	2.3%	2.3%	21.5%
Sherman Beach	79.2%	10.0%	4.6%	4.6%	1.5%	20.7%
Rock Hollow Trail	82.3%	9.2%	3.1%	2.3%	3.1%	17.7%
Beck Park	89.2%	7.7%	3.1%	0.0%	0.0%	10.8%
Riverside Park	91.5%	6.2%	0.0%	1.5%	0.8%	8.5%
Packwood Park	92.3%	6.9%	0.8%	0.0%	0.0%	7.7%
Forrest Staley State Park	94.6%	4.6%	0.8%	0.0%	0.0%	5.4%

Question 4a: Other parks or recreational areas

Respondents were asked to identify parks or recreational areas that they use, but were not listed on Question #4. In addition to the recreational facilities listed in Table 4, respondents identified more than 34 additional recreational areas they use.

Table 4a presents the responses from the participants in their own words. The texts in this table are exact phrasing of the respondents.

Table 4a. List of other parks or recreation areas

Babler Park
Buder Park
CA on Fox Creek
Cahokia Mound, urban parks in St. Louis City
Columbia Bottom Conservation Area
Forest, Grants Trail
Frances_Carondelet_TowerGrove
Geo Winter Park, fenton
George Winter
Grant''s Trail
Greentree Park - Kirkwood
Katry Trail
Kirkwood Park and Lake
Laumeier
Lower Meramec County Park
Meramec Greenway Trails
Meramec River Accesses
Meramec State Park
meramectrailheadareaVALLEYPK
Meremac Springs/Woodson k woods
New Ballwin Park (Ballwin)
onondaga cave state park
Pacific alisades
parks futher upstream such as Meramec St Pk and Onondaga.
Powder Valley and Laumeir Park
river round
Robertsville state park
sappington bridge
Steelville city parks
Sugar Creek Park
Valley Park levee trail; Fenton riverway trail; Pak
Vance Trails Park
Vlasis Park (Ballwin)
Washington Riverfront

Question 5: Please provide any other relevant information

Question 5 provided respondents the opportunity to make additional comments and suggestions. Respondents offered opinions on how trails should be constructed, the ecological value of the river, how the survey raised awareness of the recreational facilities in the area, river access, pollution, and policy enforcement. Table 5 presents the responses from the participants in their own words. The texts in this table are exact phrasing of the respondents.

Table 5. Responses to Question 5 (unedited)

"Although trails are an important part of river recreation and public education - all thrails should be consturcted so as not to add to storm water run-off."
"At my age, I don''t utilize these facilities as I did years ago."
"Beyond immediate recreational uses along the stream corridors and the concerns of those who live in the watershed, the lower Meramec is a very high quality natural area that is a gem for all of the St. Louis Region. The wild areas and clean water and healthy plant communities should be protected and restored as part of creating a green, livable St. Louis region."
"Ecological Value of Greenways should be stressed more on the water with not just on trails."
"Fishpot Creek water at the Vance bridge always looks nasty and there is often trash at that location."
"I could wish the lower Meramec River was as clear and clean as the stretches through Meramec St. Park and upstream from there. The lower Meramec I enjoy kayaking, fishing and hiking/biking along, but am not comfortable swimming in."
"I currently live in South City but I grew up in Eureka. My family and I still use these recreational opportunities near Eureka."
"I was not aware that there were so many recreation areas along this area; I want to check this out more carefully. We do own a Botanical Garden membership which includes Shaw Nature Reserve."
"I''m sure why you stop the survey region at Valley Park. We''re very involve in the watershed in the Arnold area. The Meramec River below Valley Park has its own unique problems because the recent prolong backwater flooding from the Mississippi has denuded the banks."
"Need access to river for recreationin Labadie Bottoms"
"Please consider ways to eleminate or reduce heavy metal toxins that are increasingly and bioaccumulating: making it safe to eat fish from our own streams."
"Please give an agency the power to enfource the scenic easment along the Meramec on land formerly owned by the army core of engineers."
"really want river filtering and aerating stations and more and more lakes alongside the river to increase the water to land ratio and fishig. The meremec flows too fast and becomes too muddy for its own good. Suggest a houseboat for flood plain acreage exchange."
"Support more potable sampling in all communities."

Conclusion

This survey was aimed at identifying the issues of greatest concern in the lower Meramec watershed and associated tributaries. The results reflect a wide range of opinions from 130 St. Louis area residents, with 93 percent (121 individuals) having used at least one recreational facility in the area and 87 percent (113 individuals) having used more than one facility.

When presented with a list on common areas of concern for watersheds, on average, all items were ranked as important to very important. On average, respondents identified water quality as the most important among all concerns. Hiking/Biking along the Meramec River were the most frequently participated in recreational activities. Recreational facility use varies from 5.4 percent (Forrest Staley State Park) to 68.5 percent (Lone Elk Park). Additionally, all recreational facilities were used at least occasionally and the majority were used monthly or more than monthly.

Due to the constraints on time and the resources needed to conduct the survey, the number of participants was limited to those who willingly filled out the questionnaire online and at public meetings. Nevertheless, the survey results provide timely and valued information regarding the concerns of citizens and stakeholders and issues surrounding the Meramec River and its tributaries.

Appendix H

Lower Meramec Source Water Protection Strategy Exchange
Demonstration Project (2009)

Draft Action Plan – Land Acquisition Subcommittee
Draft Action Plan – Septic Systems Subcommittee

LOWER MERAMEC SOURCE WATER DEMONSTRATION PROJECT - ACTION PLAN - LAND ACQUISTION SUBCOMMITTEE Lower Meramec Source Water Demonstration Project
Draft - October 8, 2009
Members Presents:

1. Steve Nagle
2. Ron Coleman
3. Dave De Geus
4. John Behrer
5. Kevin Meneau
6. Brittany Barton

Members Non-Present:

1. Abigail Lambert
2. Scott Hamilton
3. Lonny Boring
4. Nancy Battersby

Note: the group decided to adopt all of the items on the strawman action plan, with modifications, as described below, except to pursue legislative changes to the Missouri Clean Water State Revolving Fund. While they thought it was a good idea and something that could be kept in mind for the future, they decided instead to focus on pursuing the feasibility of county sales tax measures.

Implementation Strategy	Requirements (e.g. new funding, council approval, inter-agency MOU, etc.)	Time Frame[1]	Level Of Effort Req'd[2]	Impact on Water Protection[2]	Primary Organization	Overall Priority Ranking[2]
Raise dollars for land conservation: make feasibility determination	1. Develop road show power-point making case for sales tax measures. 2. Determine which counties are allowed to have sales tax measures that are in Meramec River Watershed besides Franklin, St. Louis and Jefferson Counties (counties must be within MSMA or have populations above 900,000). 3. Convene peer group meeting in each of the eligible counties with political leaders to determine if they are open to the idea of a sales tax measure. Note: This discussion will not focus exclusively on idea of county joining GRGD, can levy measure to spend themselves without joining GRGD. 4. Talk to Great Rivers Greenway District (board members and new executive director) about their short or long term interest in expanding their study area and	Short (next 3-6 months)	Medium – probably need $30k seed to deliver this step and the next	Potentially high	TPL to provide technical services if dollars can be identified for reimbursement of TPL's costs and costs of hiring pollster. MRTA	1A.

[1] Select from Categories: Short (1 –3 years), Medium (4 – 6 years), or Long (7 – 10 years)
[2] Select from Categories: Low, Medium or High

	the types of lands they conserve (beyond trails to larger swaths of flood protection and source water lands)		one.		subcommittee to advise.	
Raise dollars for land conservation: if feasible (as determined in step 1), prepare for county ballot measures	1. Conduct feasibility research to examine fiscal options, including spending tolerance, legal issues such as ballot language requirements, election timing, and other competing spending priorities. 2. Conduct a public opinion survey to determine voter priorities, test potential ballot language, assess messages, determine willingness to pay and test arguments for and against funding. 3. Create a broad-based coalition of supporters who reflect the area. This should include political leaders, supporters of greenspace and conservation, the business community, owners of farm and forestland, heads of civic and religious groups and others. Also involve recreation groups active in Meramec. 4. Raise private dollars to leverage interests of local governments. 5. Develop a ballot measure, based on survey results, that incorporates the messages found to be most compelling at a price voters are willing to pay. 6. Conduct education and outreach to inspire support for the ballot measure [additional funding likely needed to cover these costs, should be raised privately, see #4]	Short (next 6 – 18 months?)	Medium – see above.	Potentially high	TPL to provide technical services if dollars can be identified. MRTA to advise.	1B
Identify the most promising options for federal dollars for land acquisition	1. Look at eligibility requirements for Forest Legacy projects. 2. Look at eligibility requirements for Land and Water Conservation Fund [Additional steps need to be added here]					
Raise dollars privately to support land conservation.	1. Hire consultants to conduct a feasibility study re: availability of private dollars to support a capital campaign. [group to consider: does this apply to MRTA subcommittee or is this a separate item for Open Space Council?]					

Coordinate to formulate an acquisition plan for the Lower Meramec to guide additional prioritization among the parcels shown on the GIS maps as being important for water quality protection (or restoration)	The land acquisition subcommittee has already formed. Members include: Open Space Council, East-West Gateway COG, Great Rivers Greenway District, The Trust for Public Land, Missouri Department of Conservation, The Nature Conservancy, Shaw Nature Reserve, Henry Shaw Ozark Corridor, Ozark Regional Land Trust, and US Fish and Wildlife Service. 1. Talk to Missouri Department of Conservation leadership about their land acquisition priorities (and vet county sales tax measure idea above). 2. The subcommittee should establish criteria for selecting the highest priority tracts. (Ideas on p. 16 of Strategy Exchange report) Note: TPL has already begun this task. Will be discussed at next meeting. 3. Subcommittee members can create lists of priority parcels from GIS internet mapping site and then investigate them to determine which offer the best combination of natural features, funding leverage, and landowner motivation.	Short – 6 months				
Establish a demonstration site	1. Ideas: Look to recent FEMA buyouts near Pacifica for a good location. An alternative would be to look for a site in Wildwood. Steve, John and Ron to investigate. Need to discuss more the purpose of the demonstration site – what would it be demonstrating (we began this conversation but ran out of time)?	Short – 12 months				
Develop a floodplain buyout strategy	1. Do a study that makes the case for floodplain buyouts (e.g. calculate cost savings and include a climate analysis) 2. Add this layer to the GIS analysis so that location in a floodplain can be one of the searchable criteria. [More action planning needed here]					

Next meeting of this committee will be by telephone: Tuesday November 10, 2009 at 11:00 CT.877-737-0509, 507948# During this call TPL will give an orientation to the internet mapping site that has been created for this project. This site showcases the draft land acquisition plan for the demonstration project. This initial meeting is to orient Land Acquisition Committee members to the site and get their feedback on it. There may be a subsequent call in early December to conduct additional training on how to use all the features on the site.

LOWER MERAMEC SOURCE WATER DEMONSTRATION PROJECT - ACTION PLAN - SEPTIC SYSTEMS SUBCOMMITTEE

Version 2 Draft – October 15, 2009

Members Present [assisted by Katherine Dockery – OSC]:

Terri Gaston – City of Wildwood
Scott Harding – SCI Engineering
Bruce Litzsinger – MSD
Jeff Nieroda - MAWC
Judy Brown – Friends of LaBarque Creek
Matt Rousseau – MR Soil Consulting
Bob Coffing - LaBarque Creek Stream Team Association

Members Absent:

Martin Toma – Jefferson County
Rich Barr – R. Barr Consulting
Rich Wilson – Franklin County

Implementation Strategy	Requirements (e.g. new funding, council approval, inter-agency MOU, etc.)	Time Frame[1]	Level Of Effort Req'd[2]	Impact on Water Protection[2]	Primary Organization	Overall Priority Ranking[2]
Verify County Ordinances pertaining to current code for septic systems; amend if necessary to meet minimum standard.	1. Requirements for septic system inspections.* 2. Renewable operating permit [minimum every 2 years]. 3. Potential licensure. 4. Tailor ordinance amendments to individual Counties, due to type of system based upon topography/morphology/parcel size.	Short (<1 yr)	Medium	High	Jefferson, Franklin, St. Louis Counties	1
Septic system Inspection and Maintenance Agreement	1. Create a checklist pertaining to inspection items, containing critical points on homeowner's system. 2. Require on-site inspection by installer [if new system], inspector [if existing system] and property owner with regular maintenance check-ups [2 yr. renewal], with inspection slip/maintenance agreement to be signed by all. 3. MDOH Evaluation 4. Make use & maintenance demonstration a requirement when homes switch hands, at permit issuance/renewal.	Short	High	High	Jefferson, Franklin, St. Louis Counties; Plumbing Code Commissions; MDOH; property owners	2
Develop training and licensing for inspectors	1. Inspectors for sales need training through MDOH [required for renewing MDOH licenses...12 hours of CEU(Continuing Education Credits) every three years]. 2. Inspectors are few in some counties; need more properly trained inspectors.	Medium	Medium	Low	Jefferson, Franklin, St. Louis Counties; MDOH	3

[1] Select from Categories: Short (1 –3 years), Medium (4 – 6 years), or Long (7 – 10 years)
[2] Select from Categories: Low, Medium or High

	3. Ensure proper installation of systems [MDOH licenses CEU's the same as inspectors].					
Funding program for failing systems	1. Identify Counties/Municipalities where programs exist 2. Affordability of new systems [Jefferson Co. requires engineer to redesign failing systems]. 3. Availability of lateral campaign. 4. Special Assessment by HOA to install CTF if more than 30% [?] of systems are failing.	Medium	High	High	MDNR EWGCOG HOA	4
Demonstration Model	1. Mobile system for educational purposes.	Medium	Medium	Low	Ed/Outreach Comm	5

Strategy findings since meeting discussion:

* Engineer certification does not apply to repair of existing septic systems for SLC and for conventional systems for FC. All alternative systems require engineer designs in both SLC and FC

The Jefferson County On-site Treatment Ordinance does require the installer to service new units for two years and it is enforcing this provision. It also contains a provision for the homeowner to secure an operating permit that is renewed every two years upon provision of evidence that the system has been properly maintained. This is not being enforced for two reasons. First, the software the county bought before the current Department of County Services and Code Enforcement Director arrived was flawed, so a reliable database could not be established. Second, administering such a system requires manpower and resources. These would have to be paid through a permit fee for on-site systems. The elected officials have not approved that fee. Jefferson County now has the software and will seek the funding approval with the code revisions anticipated next year. Second, Jefferson County is currently moving to require soil scientists to be licensed within the county. While they are licensed by the state, whenever a system fails, there is a problem identifying who is at fault. In a couple of cases the sol scientist provided bad data, but there was no recourse against them. The code that is under consideration is to grant a county license to any individual who has a state license and provides a bond and insurance to the county so it has some place to turn for correcting bad work.

Next meeting of the Septic System Subcommittee: November 9, 2009 at 11 a.m. at Wildwood City Hall, 183 Plaza Drive, 63040

Appendix I

In-Stream Water Quality Monitoring Data

Missouri Department of Natural Resources

Missouri Department of Natural Resources – August 5, 2009
Fishpot Creek – WBID 2186
Water Chemistry data by U.S. Geological Survey (USGS)

Org	Site	Site Name	Yr	Mo	Dy	C	H	DO	pH	NH3N	Hard	Cl	DFE	DAL	DCD	DPB	DZN	Ecoli
USGS	2186/1.7	Fishpot Cr.@Valley Park	2000	1	5	5		9.5	7.6	0.65	180	33	20	25	0.499	0.499	130	180
USGS	2186/1.7	Fishpot Cr.@Valley Park	2000	2	18	3	7	12.8	7	0.31	42		1700	1800	0.499	5	120	12000
USGS	2186/1.7	Fishpot Cr.@Valley Park	2000	2	28	11		7.8	7.6	0.03	200	93	10	14	0.499	0.499	55	2
USGS	2186/1.7	Fishpot Cr.@Valley Park	2000	5	7	19	7	7.7	7.3	0.15	85		4200	3300	0.499	12	69	62000
USGS	2186/1.7	Fishpot Cr.@Valley Park	2000	6	14	25		6.1	7.7	0.06	150		80	65	0.499	0.499	5	220
USGS	2186/1.7	Fishpot Cr.@Valley Park	2000	7	31	24		5.5	7.2	0.05	170		3	9	0.499	0.499	3	200
USGS	2186/1.7	Fishpot Cr.@Valley Park	2000	12	18	3		9.3	7.3	0.00499	290	160	40	7	0.499	0.499	50	11
USGS	2186/1.7	Fishpot Cr.@Valley Park	2001	2	9	9	7	9.8	7.3	0.02	170		1000	1000	0.499	4	51	3700
USGS	2186/1.7	Fishpot Cr.@Valley Park	2001	2	27	7		8.7	7.3	0.02	160	120	80	88	0.499	0.499	86	50
USGS	2186/1.7	Fishpot Cr.@Valley Park	2001	4	9	17	7	9	7.9	0.39	170		12500	8300	1	55	140	66000
USGS	2186/1.7	Fishpot Cr.@Valley Park	2001	5	30	19		4.1	7.4	0.00499	180		0.99	7	0.499	0.499	33	220
USGS	2186/1.7	Fishpot Cr.@Valley Park	2001	8	28	26		4	7	0.01	180		0.99	9	0.499	0.499	25	73
USGS	2186/1.7	Fishpot Cr.@Valley Park	2001	10	10	16.9	7	7.5	8	0.04	45		997	1060	1	2	34	40000
USGS	2186/1.7	Fishpot Cr.@Valley Park	2001	12	11	7.3	7	6.1	6.9	0.03	210	46.2	45	1.499	1	0.499	56	20
USGS	2186/1.7	Fishpot Cr.@Valley Park	2002	2	5	4.4		12.3	7.1	0.00499	200	72	26	27	0.499	0.499	22	5
USGS	2186/1.7	Fishpot Cr.@Valley Park	2002	3	9	12.1		9.2	7.6	0.11	150		170	274	0.499	0.499	95	4800
USGS	2186/1.7	Fishpot Cr.@Valley Park	2002	5	29	19.5	5	4.9	7.3	0.04	230		14	6	0.499	0.499	160	25
USGS	2186/1.7	Fishpot Cr.@Valley Park	2002	8	6	26.1		2.6	7.1	0.02	210		4	1.499	0.499	0.499	0.499	7
USGS	2186/1.7	Fishpot Cr.@Valley Park	2002	10	25	12.5		8.9	7.8	0.05	66		16	5	0.499	0.499	3	6000
USGS	2186/1.7	Fishpot Cr.@Valley Park	2002	12	16	7		10	7.4	0.00499	300	91	40	1.499	0.499	0.499	49	1
USGS	2186/1.7	Fishpot Cr.@Valley Park	2003	2	4	4.3		10.2	7.2	0.00499	250	180	11	1.499	0.499	0.499	0.99	0.499
USGS	2186/1.7	Fishpot Cr.@Valley Park	2003	3	19	12.9		10.7	7.8	0.15	87		20	5	0.499	0.499	3	5200
USGS	2186/1.7	Fishpot Cr.@Valley Park	2003	5	25	25.3		5.2	7.4	0.02	200		8	1.499	0.499	0.499	4	42
USGS	2186/1.7	Fishpot Cr.@Valley Park	2003	8	12	23.3		2	6.9	0.02	230		8	1.499	0.499	0.499	3	28
USGS	2186/1.7	Fishpot Cr.@Valley Park	2003	10	9	18		7.7	7.2	0.06	60		10	4	0.499	0.499	2	31000
USGS	2186/1.7	Fishpot Cr.@Valley Park	2003	12	15	4.9		11.3	7.2	0.02		69	25	1.499	0.499	0.499	0.99	6
USGS	2186/1.7	Fishpot Cr.@Valley Park	2004	2	10	2	4	12.2	7.5	0.03	330	430	43	1.499	0.499	0.499	2	7
USGS	2186/1.7	Fishpot Cr.@Valley Park	2004	3	4	8.6		10.5	7.5	0.16	100		506	509	0.499	2	7	3600
USGS	2186/1.7	Fishpot Cr.@Valley Park	2004	6	1	22.6		7.3	7.7	0.02	180		3	1.499	0.499	0.499	0.99	33
USGS	2186/1.7	Fishpot Cr.@Valley Park	2004	8	3	24.4		4.5	7.3	0.0199	160		2.99	2	0.02	0.0399	0.99	240

Missouri Department of Natural Resources, Water Pollution Control Branch – August 5, 2009
Elements in milligrams/liter; E. coli in colonies/milliliter
Shaded values indicate that measurements failed to meet standards for the protection of aquatic life. For more information, see the accompanying notes.

Fishpot Creek – Water Chemistry Analysis (2000-2004)

Fishpot Creek is a Class B Whole Body Contact recreational water with an *E. coli* standard of 206 colonies/100ml. This standard is for the geometric (log) mean of all bacterial samples taken during the recreation season, April 1 to October 31. For *E. coli* bacteria, a waterbody is judge to be impaired if the geometric mean has exceeded the standard in the last three years for which data is available. The Listing Methodology Document (LMD) requires that there be at least five samples per year during the recreational season to assign judgment. Fishpot Cr. does not meet these requirements. Therefore **additional monitoring** is required.

The dissolved oxygen (DO)water quality standard for the protection of aquatic life is 5.0 mg/L as a minimum. The water is judged as impaired if more than ten percent of the samples fail to meet the water quality standard. Six of 30 DO measurements failed to meet the standard (shaded value). For a waterbody with a 10 percent frequency of exceedence of a standard, six exceedances in 30 measurements has a binomial probability of 0.026. Since this probability is less than the minimum allowable Type One error rate of 0.1, Fishpot Creek is judged to be **impaired** by low dissolved oxygen.

The chronic water quality standards for protection of aquatic life for dissolved aluminum, iron, cadmium, lead and zinc were exceeded (shaded values). A water body is judged to be impaired if chronic or acute numeric criteria are exceeded on more than one occasion during the last three years for which data is available. There was once exceedence for aluminum, two for cadmium and one for zinc during the last three years of available data. Chronic criteria must be exceeded for a period of at least 96 hours. All of these four exceedences occurred during stormwater flow conditions of short duration and are judged not to be representative of periods as long as 96 hours. Thus, Fishpot Creek is judged to be **unimpaired** by these metals.

The chronic water quality standard for protection of aquatic life for chloride is 230 mg/L. A water body is judged to be impaired if chronic or acute numeric criteria are exceeded on more than one occasion during the last three years for which data is available. During the last three years of available data there was only one occasion when chloride levels exceeded the criterion. Thus, Fishpot Creek is judged to be **unimpaired** by chloride.

This information was assembled by the Missouri Department of Natural Resources, Water Pollution Control Branch on August 5, 2009.

Missouri Department of Natural Resources – May 26, 2011
Fishpot Creek - WBID 2186
Water Chemistry Data by U.S. Geological Survey (USGS) and Metropolitan St. Louis Sewer District (MSD)

Org	Site Code	Site Name	Mo	Dy	Yr	Time	H	Flow	Cl	DO	NH3N	pH	Ecoli	Rec Season E. coli
USGS	2186/1.7	Fishpot Cr.@Valley Park	2	9	2001	1030	7	119		9.8	0.02	7.3	3700	
USGS	2186/1.7	Fishpot Cr.@Valley Park	2	27	2001	1030	9	0.62	120	8.7	0.02	7.3	50	
USGS	2186/1.7	Fishpot Cr.@Valley Park	2	27	2001	1031	9	0.62	120	8.7	0.02	7.3	50	
USGS	2186/1.7	Fishpot Cr.@Valley Park	4	9	2001	2312	7	1960		9	0.39	7.9	66000	
USGS	2186/1.7	Fishpot Cr.@Valley Park	5	30	2001	1400	4	0.04		4.1	<0.01	7.4	220	
USGS	2186/1.7	Fishpot Cr.@Valley Park	8	28	2001	1240	4	0.01		4	0.01	7	73	
USGS	2186/1.7	Fishpot Cr.@Valley Park	10	10	2001	715	7	808		7.5	0.04	8	40000	
USGS	2186/1.7	Fishpot Cr.@Valley Park	12	11	2001	1055	9	0.1	46.2	6.1	0.03	6.9	20	
USGS	2186/1.7	Fishpot Cr.@Valley Park	2	5	2002	1250	5	0.79	72	12.3	<0.01	7.1	5	
USGS	2186/1.7	Fishpot Cr.@Valley Park	3	9	2002	426	7	89		9.2	0.11	7.6	4800	
USGS	2186/1.7	Fishpot Cr.@Valley Park	5	29	2002	1055	9	0.32		4.9	0.04	7.3	25	
USGS	2186/1.7	Fishpot Cr.@Valley Park	8	6	2002	900	4	0.01		2.6	0.02	7.1	7	
USGS	2186/1.7	Fishpot Cr.@Valley Park	10	25	2002	855	7	6.1		8.9	0.05	7.8	6000	
USGS	2186/1.7	Fishpot Cr.@Valley Park	12	16	2002	1240	4	0.01	91	10	<0.01	7.4	1	
USGS	2186/1.7	Fishpot Cr.@Valley Park	2	4	2003	1525	4	0.01	180	10.2	<0.01	7.2	<1.0	
USGS	2186/1.7	Fishpot Cr.@Valley Park	3	19	2003	1112	7	54		10.7	0.15	7.8	5200	
USGS	2186/1.7	Fishpot Cr.@Valley Park	5	25	2003	1155	9	0.05		5.2	0.02	7.4	42	
USGS	2186/1.7	Fishpot Cr.@Valley Park	8	12	2003	1015	4	0.01		2	0.02	6.9	28	
USGS	2186/1.7	Fishpot Cr.@Valley Park	10	9	2003	1329	7	6.5		7.7	0.06	7.2	31000	
USGS	2186/1.7	Fishpot Cr.@Valley Park	12	15	2003	1230	9	0.29	69	11.3	0.02	7.2	6	
USGS	2186/1.7	Fishpot Cr.@Valley Park	2	10	2004	1005	9	0.16	430	12.2	0.03	7.5	7	
USGS	2186/1.7	Fishpot Cr.@Valley Park	3	4	2004	906	7	41		10.5	0.16	7.5	3600	
USGS	2186/1.7	Fishpot Cr.@Valley Park	6	1	2004	1415	5	2.3		7.3	0.02	7.7	33	
USGS	2186/1.7	Fishpot Cr.@Valley Park	8	3	2004	1100	9	0.37		4.5	<0.04	7.3	240	
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	7	27	2005			0.12	91	6.8	<0.7	8.9	100	
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	8	30	2005	1009		0.32	61	6.7	<0.7	7.9	<100.0	
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	10	26	2005	1028		0.16	71	6.2	<0.7	7.5	<100.0	
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	11	28	2005	859		510	16	6.7	<0.7	7.3	1100	
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	12	13	2005	1103	5	0	268	11		7.6	<100.0	

Fishpot Creek – Water Chemistry Data May 2011

Org	Site Code	Site Name	Mo	Dy	Yr	Time	H	Flow	Cl	DO	NH3N	pH	Ecoli	Rec Season E. coli
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	3	6	2006	856		0.13	136	6.3		6.8	<100.0	
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	8	1	2006	1005		0	58	6.6		6.4	<100.0	49.99
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	8	14	2006	1005		0	74	6		6.3	270	270
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	10	3	2006	949		0	78	6		6.9	<100.0	49.99
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	10	30	2006	959		0.37	43	7.9		7.4	<100.0	49.99
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	11	27	2006	933		0.08	81	7.8		7.6	<100.0	49.99
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	12	12	2006	1044	5	3.6	277	10.1		7.3		
Geometric Mean Recreation Season 2006														70
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	1	17	2007	943		1.2	144	8.8		7.7		
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	2	6	2007	1037		0.06	228	9.5		7.9		
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	2	26	2007	1013	9	1.8	248	9.5		7.8		
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	4	2	2007	910		1.4	101	8.6		7.6	940	940
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	4	25	2007	938		11	61	7		6.9	4600	4600
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	7	31	2007	945		0.02	85	7.9		8.3	140	140
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	9	4	2007	932		0	92	7		7.7	50	50
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	9	26	2007	934		0	93	6.3		7.7	45	45
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	10	16	2007	1047		0	94	6.9		7.9	200	200
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	10	31	2007	1033		0.01	76	8.6		8	9	9
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	11	27	2007	922		0.09	45	7		7.8		
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	12	12	2007	1041	9	0.29	385	7.8		7.6		
Geometric Mean Recreation Season 2007														158
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	1	9	2008	1050		0.75	121	8.1		7.9		
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	3	27	2008	919		44	78	10.2		7.2		
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	4	23	2008	930		0.06	159	7.6		9.1	27	27
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	6	18	2008	1005		0	60	5.6		7.5	50	50
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	6	25	2008	953		0	55	5.6		7.1	230	230
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	7	9	2008	955		0.6	53	4.9		7	200	200
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	8	13	2008	957		0	29	8.3		7.3	64	64
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	10	22	2008	1018		0	103	7.2		7.4	160	160
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	12	2	2008	949		0	97	9		7.2		

Fishpot Creek – Water Chemistry Data May 2011														
Org	**Site Code**	**Site Name**	**Mo**	**Dy**	**Yr**	**Time**	**H**	**Flow**	**Cl**	**DO**	**NH3N**	**pH**	**Ecoli**	**Rec Season E. coli**
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	12	29	2008	1019		16	124	9.3		6.5		
Geometric Mean Recreation Season 2008														93
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	1	20	2009	1038		0	134	11.8		7.7		
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	2	4	2009	954		0	96	8		7.2		
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	3	3	2009	925		1.2	160	10.4		7.5		
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	3	24	2009	859		18	136	7.4		6.8		
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	4	28	2009	945		0.14	121	7.6		6.7	2480	2480
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	5	19	2009	857		0.22	93	6.8		6	315	315
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	5	26	2009	904		13	40	6.9		8.3	14100	14100
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	7	29	2009	910		0	103	6.7		7.6	712	712
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	8	25	2009	916		0	75	7		7.8	285	285
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	9	16	2009	740		0	104	7.4		7.5	327	327
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	10	6	2009	923		15	93	9		7.2	4610	4610
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	11	3	2009	957		0.47	37	6.5		7.4		
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	12	8	2009	852		11	62	10		6.3		
Geometric Mean Recreation Season 2009														1190
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	1	12	2010	910	9	0	250	10		6.3		
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	1	27	2010	1007		0.81	95	8		6.4		
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	2	18	2010	916	9	0.17	1140	10		7.2		
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	4	6	2010	923		0.44	149	7		6.8	910	
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	4	13	2010	911		0.01	154	6.7		7.6	52	
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	4	26	2010	907		2.5	87	8		7.7	1090	
MSD	2186/0.6	Fishpot Cr. @Vance Rd.	7	7	2010	938		0	117	7.9		6.6	464	

Missouri Department of Natural Resources, Water Pollution Control Branch – May 26, 2011
Elements in milligrams/liter; E. coli in colonies/milliliter

Shaded values indicate that measurements failed to meet standards for the protection of aquatic life. For more information see the accompanying notes.

Fishpot Creek – Water Chemistry Analysis (2001-2010)

Fishpot Creek is a Class B Whole Body Contact Recreational water with an *E. coli* standard of 206 colonies/100 ml. This standard is interpreted as the geometric mean of at least five samples taken during the recreational season, April 1 to October 31, of any given year. A water is judged to be impaired if the standard is exceeded in any of the last three years for which there is adequate data. There was adequate data in 2007, 2008 and 2009 and the data in 2009 failed to meet state standards. Thus Fishpot Creek is judged to be **impaired** by bacteria.

Seven of 78 dissolved oxygen measurements (9 percent) failed to meet state standards. Since this is less than the allowable ten percent exceedence rate, this stream is judged to be **unimpaired** by low dissolved oxygen.

The Listing Methodology Document (LMD) allows a water to be judged as impaired by toxics, such as chloride, if the standard is exceeded more than once in the last three years of data when the stream is at stable flow conditions. Exceedences of the chronic chloride standard of 230 mg/L are highlighted and thoses exccedences under stable flow conditions are shown with a bold black border. There were three of these occurrences between July 2007 and July 2010. Thus Fishpot Creek is judged to be **impaired** by chloride.

Six if 78 pH measurements (7.7 percent) failed to meet state standards. This is less than the allowable exceedence rate of ten percent. Thus Fishpot Creek is judged to be **unimpaired** by low pH.

This information was assembled by the Missouri Department of Natural Resources, Water Pollution Control Branch on May 26, 2011.

Missouri Department of Natural Resources – May 26, 2011
Fishpot Creek – WBID 2186
Water Pesticide Data by U.S. Geological Survey (USGS)

Org	Site Code	Site Name	Mo	Dy	Yr	Flow	Dieldrin (ug/l)	PCBs (ug/l)
USGS	2186/1.7	Fishpot Cr.@Valley Park	4	1	1998			
USGS	2186/1.7	Fishpot Cr.@Valley Park	1	1	1999			
USGS	2186/1.7	Fishpot Cr.@Valley Park	5	1	1999			
USGS	2186/1.7	Fishpot Cr.@Valley Park	2	1	2001		0	
USGS	2186/1.7	Fishpot Cr.@Valley Park	2	9	2001	119		<0.1
USGS	2186/1.7	Fishpot Cr.@Valley Park	4	1	2001		0	
USGS	2186/1.7	Fishpot Cr.@Valley Park	4	9	2001	1960		<0.1
USGS	2186/1.7	Fishpot Cr.@Valley Park	10	1	2001		0	
USGS	2186/1.7	Fishpot Cr.@Valley Park	10	10	2001	808		<0.1
USGS	2186/1.7	Fishpot Cr.@Valley Park	3	1	2002		0	
USGS	2186/1.7	Fishpot Cr.@Valley Park	3	9	2002	89		<0.1
USGS	2186/1.7	Fishpot Cr.@Valley Park	10	1	2002		0.001	
USGS	2186/1.7	Fishpot Cr.@Valley Park	10	25	2002	6.1		<0.1
USGS	2186/1.7	Fishpot Cr.@Valley Park	3	1	2003		0	
USGS	2186/1.7	Fishpot Cr.@Valley Park	3	19	2003	54		<0.1
USGS	2186/1.7	Fishpot Cr.@Valley Park	10	9	2003		0	
USGS	2186/1.7	Fishpot Cr.@Valley Park	10	9	2003	6.5		<0.1
USGS	2186/1.7	Fishpot Cr.@Valley Park	3	4	2004		0	
USGS	2186/1.7	Fishpot Cr.@Valley Park	3	4	2004	41		<0.1
Mean Concentration							0.000	<0.1
Water Quality Standard: Human Health Fish Consumption							0.000076	0.000045

Missouri Department of Natural Resources – August 5, 2009
Grand Glaize Creek – WBID 2184
Water Chemistry Data by U.S. Geological Survey (USGS) 2000-2007

Org	Site	Site Name	Yr	Mo	Dy	H	C	DO	pH	NH3N	Hard	Cl	DC1	DCD	Ecoli	Rec Season Ecoli
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2000	1	5		3	12.4	7.7	0.09	180	110		0.499	2700	
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2000	2	28		12	11.3	8	0.04	220	200		0.499	120	
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2000	3	26		14	9.3	7.7	0.11				0.499	24000	
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2000	6	14		26	5.1	7.8	0.08	170			0.499	1000	1000
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2000	7	31		24	5.8	7.5	0.13	190			0.499	1600	1600
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2000	12	18		1	12.6	7.4	0.19	585	2050		0.499	200	
														2000 Geometric Mean		**1264.91**
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2001	1	29		1	12.2	7.9	0.2	380			0.499	200	
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2001	2	27		6	9.8	7.5	0.08	320	250		0.499	112	
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2001	3	15		10	10	7.5	0.26	140			0.499	720	
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2001	5	30		20	5.4	8	0.05	260			0.499	180	180
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2001	8	28		24	3	7.2	0.12	190			0.499	520	520
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2001	10	5		16.1	7.1	7.6	0.07	260			1	14000	14000
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2001	12	11		4.1	11.4	7.5	0.03	390	173		1	37	
														2001 Geometric Mean		**1094.30**
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2002	2	5		2	11.6	7.7	0.01	370	170		0.499	27	
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2002	2	19		8.4	10.6	8	0.21	300			0.499	670	
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2002	5	29		20	5.8	7.8	0.1	300			0.499	3200	3200
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2002	8	9		23.9	3.2	7.7	0.03	290			0.499	83	83
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2002	10	25		11.6	10.6	8	0.05	230			0.499	1000	1000
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2002	12	16	9	4	13	7.9	0.02	410	590		0.499	12	
														2002 Geometric Mean		**642.80**
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2003	2	4	4	2	8.6	7.7	0.08	360	850		0.499	15	
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2003	3	19		13.5	9.9	8.4	0.13	240			0.499	5500	
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2003	6	25		26.2	9.7	8	0.01	360			0.499	80	80
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2003	8	12		24.1	4.2	7.4	0.07	270			0.499	340	340
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2003	10	9		17.3	7.3	7.5	0.1	170			0.499	28500	28500
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2003	12	15	9	2.8	13.4	7.7	0.09		690		0.499	23	
														2003 Geometric Mean		**918.62**
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2004	2	9	8	1.4	17.7	7.8	0.36	530	1460		0.499	0.99	
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2004	3	4		9	9.6	7.2	0.23	180			0.499	5600	
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2004	6	1		20.1	6.9	7.6	0.05	270			0.499	470	470
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2004	8	3		25	7.2	7.6	0.03	300			0.09	480	480
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2004	10	4		15.6	6.2	7.7	0.0199	340			0.07	2	2

Grand Glaize Creek – Water Chemistry Data 2009																
Org	**Site**	**Site Name**	**Yr**	**Mo**	**Dy**	**H**	**C**	**DO**	**pH**	**NH3N**	**Hard**	**Cl**	**DC1**	**DCD**	**Ecoli**	**Rec Season Ecoli**
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2004	10	12		15.2	8.2	7.7	0.0199	130			0.13	5800	5800
															2004 Geometric Mean	**226.18**
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2005	3	22		7.9	12	7.7	0.05	370			0.13	1200	
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2005	4	20		18.7	8.1	7.6	0.05	410			0.04	150	150
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2005	6	22		23.9	2.5	7.6	0.0199	330			0.05	420	420
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2005	8	10		26.7	3	7.3	0.04	270			0.09	92	92
Org	**Site**	**Site Name**	**Yr**	**Mo**	**Dy**	**H**	**C**	**DO**	**pH**	**NH3N**	**Hard**	**Cl**	**DC1**	**DCD**	**Ecoli**	**Rec Season Ecoli**
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2005	10	5		21.1	4.8	7.9	0.0199	330			0.04	540	540
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2005	10	31		14.2	7.8	7.6	0.0199	270			0.14	3800	3800
															2005 Geometric Mean	**412.16**
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2006	4	3		13.1	7.7	7.7	0.0199	180		<	0.04	3600	3600
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2006	5	1		18.4	7	7.6	0.14	140		<	0.04	14000	14000
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2006	6	6		26.3	6.1	7.6	0.06	200		<	0.04	270	270
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2006	8	23		24	3.1	7.4	0.22	180		<	0.04	760	760
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2006	10	3	4	21	4.7	7.8	0.015	280			0.04	80	80
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2006	10	16	5	11.4	10.3	7.5	0.0099	290			0.11	1000	1000
															2006 Geometric Mean	**968.91**
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2007	1	17	5	1.2	15.9	7.8	0.0099	310	123		0.04	1100	
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2007	2	6	9	0.6	19.9	7.6	0.013	480	417		0.07	10	
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2007	3	20	5	10.5	10.7	7.8	0.015	370	190		0.08	140	
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2007	4	3	7	16.6	8.4	7.8	0.051	300	126	E	0.03	2000	2000
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2007	4	10	6	10.2	9.8	8	0.014	360	159	E	0.02	200	200
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2007	5	22	6	23.6	7.1	7.9	0.045	380	136		0.04	300	300
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2007	6	19	5	25.1	4.8	7.2	0.031	150	63.4	E	0.03	4000	4000
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2007	7	23	8	26.9	11.1	7.4	0.07	190	70.5	E	0.03	400	400
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2007	8	8	4	33.5	5.2	7.3	0.079	160	58.9		0.05	370	370
USGS	2184/3.2	Grand Glaize Cr. @Valley Park	2007	9	12	5	21	3.3	7.2	0.103	210	67.7	E	0.04	580	580
															2007 Geometric Mean	**634.06**

Missouri Department of Natural Resources, Water Pollution Control Branch – August 5, 2009

Elements in milligrams/liter; E. coli in colonies/milliliter

Shaded values indicate that measurements failed to meet standards for the protection of aquatic life. For more information see the accompanying notes.

Grand Glaize Creek – Water Chemistry Analysis

The water quality standard for the protection of aquatic life is 5.0 mg/L as a minimum. The Listing Methodology Document (LMD) allows a water to be judged as impaired if more than ten percent of the samples fail to meet the water quality standard. Where more than 30 measurements are made the 10 percent compliance rule is compared directly. Ten exceedances out of 53 measurements (18.9 percent) is greater than the maximum allowable 10 percent. Therefore, Grand Glaize Creek is judged to be **impaired** due to low dissolved oxygen.

The chronic water quality standard for protection of aquatic life for chloride is 230 mg/L. A water body is judged to be impaired if chronic or acute numeric criteria are exceeded on more than one occasion during the last three years for which data is available. There were three samples that exceeded the chronic chloride standard in the last three years of available data. These samples were taken during stable flow conditions where the samples are expected to be representative of a 96 hous period surrounding the sample's collection data. Thus, Grand Glaize Creek is judged to be **impaired** by chloride.

Grand Glaize Creek is a Class B Whole Body Contact recreational water with an *E. coli* standard of 206 colonies/100 ml. This standard is for the geometric (log) mean of all bacterial samples taken during recreational season, April 1 to October 31. For *E. coli* bacteria, a waterbody is judged to be impaired if the geometric mean is greater than the standard for the last three years for which data is available. The geometric mean for 2005, 2006 and 2007 exceeded the standard. Therefore Grand Glaize Creek is judged to be **impaired** due to bacteria.

This information was assembled by the Missouri Department of Natural Resources, Water Pollution Control Branch on August 5, 2009.

Missouri Department of Natural Resources – October 21, 2009
Grand Glaize Creek – WBID 2184
Lead and Mercury in Fish Tissue Data 2002-2008
Sampling performed by Missouri Department of Conservation (MDC), U.S. Environmental Protection Agency (EPA) and Missouri Department of Natural Resources (MDNR)

Org	Site Name	Year	Species	# in Sample	Preparation	Length, in.	Weight, lbs.	Fat, %	Pb, mg/kg	Pb (numeric)	Hg, mg/kg
MDC	Grand Glaize Creek (Simpson Park Lake)	2002	largemouth bass	15	fillet		2.1		< 0.02	0.01	0.333
EPA/MDNR	Grand Glaize Creek (Simpson Park Lake)	2006	buffalo	3	fillet	16.8	2.5	2	< 0.14	0.07	
EPA/MDNR	Grand Glaize Creek (Simpson Park Lake)	2006	buffalo	3	fillet	16.8	2.5	3	< 0.14	0.07	
EPA/MDNR	Grand Glaize Creek (Simpson Park Lake)	2006	largemouth bass	5	fillet	15.7	2.4	0	2.31	2.31	0.574
EPA/MDNR	Grand Glaize Creek (Simpson Park Lake)	2006	largemouth bass	4	fillet	13.6	1.2	1	1.13	1.13	0.318
MDC	Grand Glaize Creek (Simpson Park Lake)	2008	largemouth bass	5	fillet	16.4	2.8		< 0.002	0.001	
MDC	Grand Glaize Creek (Simpson Park Lake)	2008	largemouth bass	5	fillet	16.1	2.5		< 0.002	0.001	
MDC	Grand Glaize Creek (Simpson Park Lake)	2008	white crappie	5	fillet	10.1	0.5		< 0.002	0.001	
MDC	Grand Glaize Creek (Simpson Park Lake)	2008	white crappie	5	fillet	11	0.6		< 0.001	0.0005	
MDC	Grand Glaize Creek (Simpson Park Lake)	2008	largemouth bass	5	fillet	14.9	2		0.013	0.013	
MDC	Grand Glaize Creek (Simpson Park Lake)	2008	largemouth bass	5	fillet	15.1	2.2		0.029	0.029	
MDC	Grand Glaize Creek (Simpson Park Lake)	2008	white crappie	5	fillet	11	0.7		0.013	0.013	
MDC	Grand Glaize Creek (Simpson Park Lake)	2008	white crappie	5	fillet	8.9	0.3		0.013	0.013	
MDC	Grand Glaize Creek (Simpson Park Lake)	2008	black buffalo	5	fillet	18.8	3.7		0.086	0.086	
MDC	Grand Glaize Creek (Simpson Park Lake)	2008	black buffalo	5	fillet	18.1	2.9		0.12	0.12	
									Average:	**0.258**	**0.408**

Missouri Department of Natural Resources, Water Protection Program - October 21, 2009

Shaded values indicate that measurements failed to meet standards for the protection of aquatic life. For more information see the accompanying notes.

Grand Glaize Creek – Lead and Mercury in Fish Tissue Analysis

The Missouri Department of Health and Senior Services (MDHSS) is the agency that analyzes human health risk caused by eating contaminated fish. In developing their annual fish consumption advisory, the MDHSS has used a lead criterion value of 0.3 mg/kg in the edible portions (fillets) of fish. Lead poisoning via fish consumption does not pose the sample level of health risk to all Missourians. Those at greatest risk are children sever years of age or younger who live in areas of the state where active or historic lead mining or smelting has occurred. These areas have high levels of lead in soils and dust.

Lead consumption models are used to predict the percent of the high-risk population that would be protected from lead poisoning at a given level of lead in fish tissue. As used here, the word "protected" means that the federal "intervention level" of 10 ug/dl in human blood is not exceeded. Federal guidelines assume environmental lead levels are acceptable if 95 percent of the at-risk population have blood lead levels below the intervention level. The table below gives the percent of the high-risk population that would be protected at twelve different lead levels in fish fillets ranging from 0.0001 to 1.5 mg/kg (IEUBK Model, Version 1.0 using 400 parts per million [ppm] lead in soil, 290 ppm lead in dusts and assuming 10 percent of meat intake was fish). Note that because of high levels of lead in soils and dusts in certain areas of Missouri, eliminating lead from fish tissue would still not protect 95 percent of the high-risk population.

Lead in Fish Fillets (mg/kg)	0.0001	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	1.2	1.5
Percent of High-Risk Population Protected At 10 ug/dl Level	93.4	91.6	90.8	90.0	89.1	88.2	87.3	86.3	85.4	83.4	81.4	79.2

The mean level of lead in fish fillets in Grand Glaize Creek is 0.26 mg/kg. This would equate to approximately a three percent reduction in the percent of the high-risk population protected at the 10 ug/dl level. This is not judged to be a significant department from the 95 percent of the population protected by the federal guidelines. It is recommended that Grand Glaize Creek, including Simpson Park Lake, be considered **not impaired** due to lead in fish tissue.

The EPA guideline for mercury in fish tissue is 0.3 mg/kg ("Water Quality Criterion for Protection of Human Health: Metylmercury", EPA-823-R-01-001, Jan. 2001). The guidance document states that this is a concentration that "should not be exceeded" based on a total consumption of 17.5 grams of fish per person per day. The 0.3 mg/kg criterion is also based on the assumption that the fish diet is composed of a mixture of fish from different trophic levels. This document also encourages states to consider other relevant data

while adopting or modifying the 0.3 mg/kg criterion value, such as regional differences in the species consumed and the amount of fish consumed.

McKee, 2002 ("Sport-Caught Fish Consumption in Missouri-2002 Mail Survey", Dept. of Conservation, Columbia, MO), found that Missourians that eat sport-caught fish do eat a mixture of species from different trophic levels. This study found that the most commonly consumed sport-caught fish were crappie, catfish, bluegill and other sunfish, bass (largemouth, smallmouth and spotted), trout and walleye. This survey also found that the median level of fish consumption was 50 grams per day, or 2.8 times the amount used to develop EPA's criterion value of 0.3 mg/kg. If the information on consumption rates in Missouri accurate, a criterion value significantly less than 0.3 mg/hg would be necessary to protection fish consumers from mercury poisoning.

Fish samples were taken from an impounded section of Grand Glaize Creek called Simpson Park Lake. The mean level of mercury in fish fillets in Grand Glaize Creek from higher trophic level fish 0.408 mg/kg. The 60 percent lower confidence limit is 0.387 mg/Kg. This is greater that the national criterion value of 0.3 mg/Kg. Additionally the fish consumption rate for Missourians that eat sport-caught fishing is much greater than the fish consumption estimate used for the federal criterion. Therefore, Grand Glaize Creek, including Simpson Park Lake, is judged to be **impaired** by mercury in fish tissue.

The Missouri Department of Health and Senior Services (MDHSS) has issued an advisory for Simpson Park Lake advising all consumers to limit their consumption of buffalo over 16 inches in length to one meal per mouth, and not to consume any largemouth bass over 12 inches in length.

This information was assembled by the Missouri Department of Natural Resources, Water Pollution Control Branch on October 21, 2009.

Missouri Department of Natural Resources – May 27, 2011
Kiefer Creek – WBID 3592
Water Chemistry Data by U.S. Geological Survey (USGS) and Metropolitan St. Louis Sewer District (MSD)

Org	Site Code	Site Name	Mo	Dy	Yr	Time	H	Flow	C	Cl	DO	NH3N	pH
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	2	9	2001		7	40	11				
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	2	9	2001	1027	7	40	11		10.9	0.02	7.4
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	2	28	2001	750	6	4.1	12	220	9.2	0.02	6.8
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	4	9	2001		7	270	18				
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	4	9	2001	2237	7	274	18		9.3	0.45	7.5
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	5	30	2001	1300	8	2.6	14		8.7	<0.01	7.2
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	8	28	2001	1130	9	1.1	14		8.8	<0.01	7
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	10	10	2001			108	16.5				
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	10	10	2001	744	7	108	16.5		9	0.14	7.4
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	12	11	2001	950	9	1.3	13.1	80.8	9.3	0.03	6.8
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	2	5	2002	1142	5	3.8	12.5	94	9.4	<0.01	7.2
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	5	29	2002	1350	7	5.7	13.9		9.1	0.01	7.1
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	8	6	2002	1010	8	1.7	14		9.4	<0.01	7.2
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	10	25	2002		7	62	12.9				
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	10	25	2002	827	7	62	12.9		10.5	0.07	7.2
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	12	16	2002	1345	9	0.97	13.9	110	9.1	<0.01	7.2
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	2	4	2003	1425	9	1.4	13.4	310	9.2	<0.01	7.1
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	3	19	2003		7	46	13				
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	3	19	2003	1052	7	46	13		10.7	0.1	7.4
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	6	25	2003	1025	9	1.1	14.4		9.6	<0.01	7.1
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	8	12	2003	815	9	1.1	14.1		8.8	<0.01	7.1
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	10	9	2003		7	86	17.4				
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	10	9	2003	1242	7	86	17.4		8.5	0.09	7.3
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	12	15	2003	1100	9	3.3	13.2	660	8.7	0.02	7
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	2	9	2004	1330	6	2.6	12.8	390	10.3	<0.01	7.2
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	3	4	2004		7	27	10				
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	3	4	2004	1007	7	27	10		10	0.03	7.2
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	6	1	2004	1145	5	23	14.6		9.5	<0.01	7.2
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	8	3	2004	1010	5	4	14.9		8.2	<0.04	7

Kiefer Creek – Water Chemistry Data 2011													
Org	**Site Code**	**Site Name**	**Mo**	**Dy**	**Yr**	**Time**	**H**	**Flow**	**C**	**Cl**	**DO**	**NH3N**	**pH**
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	7	27	2005	851		4.4	21	71	7	<0.7	8.1
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	8	30	2005	857		2.2	19	67	7.5	<0.7	7.1
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	10	26	2005	1108		1.8	12	65	9.8	<0.7	7.5
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	11	28	2005	922		4.4	13	32	9	<0.7	7.6
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	12	13	2005	1138		1.7	11	125	12.4	<0.7	7.7
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	3	6	2006	941		2.1	10	78	10.2	<0.7	7.3
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	8	1	2006	1102		1.9	24	69	8.9		6
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	8	14	2006	1059		2	26	68	7.7		7.4
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	10	3	2006	1102		0.97	19	77	7.7		7.2
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	10	30	2006	1100		1.6	13				8
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	11	27	2006	1011		1.9	17	72	9.3		8
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	12	12	2006	1127		1.9	16	152	11.3		7.7
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	1	17	2007	1038		8.3	8	86	9.4		8
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	2	6	2007	1144		1.5	5	100	13.2		8.4
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	2	26	2007	1104		8.8	10	130	10.2		8
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	4	2	2007	951		7	13	71	11.2		8.1
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	4	25	2007	1024		11	16	70	8.4		7
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	7	31	2007	1040		1.5	21	66	8.5		7.9
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	9	4	2007	1031		1	21	67	8		7.8
Org	Site Code	Site Name	Mo	Dy	Yr	Time	H	Flow	C	Cl	DO	NH3N	pH
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	9	26	2007	1032		1.3	19	73	7.7		8
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	10	16	2007	954		1.8	16	67	7.2		8
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	10	31	2007	940		1.9	12	67	9.5		7.9
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	11	27	2007	1033		3.1	10	58	10.4		7.8
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	12	12	2007	929		5.8	10	194	9		7.7
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	1	9	2008	944		8.9	10	123	10		8.2
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	3	27	2008	1010		36	11	94	9.9		7.2
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	4	23	2008	958		2	19	100	8.8		8.6
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	6	18	2008	1043		2.7	19	80	9.8		8
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	6	25	2008	1035		4.2	20	76	9		7.3
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	7	9	2008	1058		5.6	20	78	7.2		7.6

Kiefer Creek – Water Chemistry Data 2011													
Org	Site Code	Site Name	Mo	Dy	Yr	Time	H	Flow	C	Cl	DO	NH3N	pH
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	8	13	2008	1028		2.5	19	79	8.6		7.7
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	10	22	2008	1118		1.8	14	74	9.6		8
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	12	2	2008	1052		2.2	8	77	10		7.9
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	12	29	2008	1058		10	10	81	10.8		6.8
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	1	20	2009	1145		1.4	5	81	14		7.8
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	2	4	2009	1048	9	1.2	3	392	14		7.8
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	3	3	2009	1015		1.8	7	105	14.5		7.4
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	3	24	2009	959		4.7	14	105	8.1		7.1
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	4	28	2009	1023		4.8	15	77	9		6.8
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	5	19	2009	937		2.5	17	82	6		6.2
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	5	26	2009	945		12	17	69	7		7.9
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	7	29	2009	1009		3	19	88	9.3		7.3
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	8	25	2009	1008		1.7	18	70	8.5		7.4
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	9	16	2009	835		1.7	19	82	7.9		7.2
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	10	6	2009	1014		8.4	15	52	10.9		6.4
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	11	3	2009	1050		8.2	14	74	8.2		7.5
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	12	8	2009	1007		9.7	8	67	13.3		7
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	1	12	2010	1014		2.2	5	90	13		6.6
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	1	27	2010	1102		6.2	9	77	7		6.7
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	2	18	2010	1019	6	3.3	4	277	12		7.8
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	4	6	2010			5.8	16	85	9		7.1
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	4	13	2010			2.8	17	81	8		8
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	4	26	2010			29	14	66	9		7.7
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	7	7	2010			2.4	21	82	7.7		6.9

Missouri Department of Natural Resources, Water Protection Program – May 27, 2011
Elements in milligrams/liter

Shaded values indicate that measurements failed to meet standards for the protection of aquatic life. For more information see the accompanying notes.

Kiefer Creek – Water Chemistry Analysis

Three of 76 pH measurements (3.9 percent) fail to meet the state standard. Since this rate is lrdd than the allowable exceedence rate of 10 percent, Kiefer Creek is judged to be **unimpaired** by low dissolved oxygen.

The Listing Methodology Document allows a water to be judged as impaired by toxics, such as chloride, if the standard is exceeded more that once in the last three years of data when the stream is at stable flow conditions. Exceedences of the chronic chloride standard of 230 mg/L are highlighted, and those exceedances under stable flow conditions are shown with a bold black border. There were two of these occurrences between July 2007 and July 2010. Thus Kiefer Creek is judged to be **impaired** by chloride.

This information was assembled by the Missouri Department of Natural Resources, Water Pollution Control Branch on May 27, 2011.

Missouri Department of Natural Resources
Kiefer Creek – WBID 3592
Pesticide Data by U.S. Geological Survey (USGS) in ug/L

Org	Site Code	Site Name	Mo	Dy	Yr	Chlorpyrifos	Chlordane	Diazinon	Dieldrin
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	4	1	1998	0.01		0.68	
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	1	1	1999	0.015		0.025	
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	5	1	1999	0.018		0.538	
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	2	1	2001			0	0
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	4	1	2001			0.29	0
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	10	1	2001	0	0	0.02	0
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	10	1	2002	0		0.18	
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	3	1	2003	0	0	0.16	0
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	10	9	2003	0	0	0.07	0
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	3	4	2004	0	0	0	0
WQ Standard: Human Health Fish Consumption							0.00048		0.000076
WQ Standard: Protection of Aquatic Life						0.04			
WQ Standard: Drinking Water Supply*								0.6	

*This standard does not apply to Kiefer Creek

Missouri Department of Natural Resources – May 27, 2011
Kiefer Creek – WBID 3592
Bacterial Data by U.S. Geological Survey (USGS) and Metropolitan St. Louis Sewer District (MSD)

Org	Site Code	Location	Mo	Dy	Yr	E. coli	Rec. Season E. coli
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	8	1	2006	50	50
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	6	1	2004	170	170
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	2	9	2001	5600	
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	2	28	2001	88	
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	4	9	2001	590000	590000
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	5	30	2001	41	41
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	8	28	2001	55	55
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	10	10	2001	28000	28000
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	12	11	2001	70	
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	2	5	2002	20	
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	5	29	2002	160	160
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	8	6	2002	160	160
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	10	25	2002	10000	10000
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	12	16	2002	15	
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	3	19	2003	13000	
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	6	25	2003	120	120
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	8	12	2003	10	10
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	10	9	2003	499	499
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	12	15	2003	28	
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	2	9	2004	4	
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	3	4	2004	2500	
USGS	3592/0.5/0.8	Kiefer Cr. nr. Ballwin	8	3	2004	86	86
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	8	24	2004	100	100
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	10	27	2004	100	100
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	4	13	2005	1500	1500
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	4	21	2005	50	50
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	7	27	2005	50	50
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	8	30	2005	50	50
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	8	14	2006	50	50

Kiefer Creek – Bacterial Data 2011							
Org	**Site Code**	**Location**	**Mo**	**Dy**	**Yr**	**E. coli**	**Rec. Season E. coli**
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	10	3	2006	50	50
Geometric Mean Recreation Season 2006							88
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	4	2	2007	150	150
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	4	25	2007	150	150
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	7	31	2007	27	27
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	9	4	2007	100	100
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	9	26	2007	36	36
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	10	16	2007	18	18
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	10	31	2007	5	5
Geometric Mean Recreation Season 2007							41
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	4	23	2008	5	5
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	6	18	2008	40	40
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	6	25	2008	73	73
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	7	9	2008	64	64
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	8	13	2008	18	18
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	10	22	2008	18	18
Geometric Mean Recreation Season 2008							26
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	4	28	2009	63	63
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	5	19	2009	31	31
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	5	26	2009	620	620
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	7	19	2009	132	132
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	7	29	2009	132	132
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	8	25	2009	146	146
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	9	16	2009	602	602
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	10	6	2009	9210	9210
Geometric Mean Recreation Season 2009							254

Kiefer Creek – Bacterial Data 2011							
Org	**Site Code**	**Location**	**Mo**	**Dy**	**Yr**	**E. coli**	**Rec. Season E. coli**
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	4	6	2010	20	20
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	4	13	2010	<10.0	4.99
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	4	26	2010	1500	1500
MSD	3592/0.5	Kiefer Cr. @Kiefer Creek Rd.	7	7	2010	98	98
Geometric Mean Recreation Season 2010							62

Missouri Department of Natural Resources, Water Protection Program – May 27, 2011

E. coli in colonies/milliliter

Shaded values indicate that measurements failed to meet standards for the protection of aquatic life. For more information see the accompanying notes.

Bacterial Data for Spring Branch, an unclassified tributary of Kiefer Creek

Org	Site Code	Location	Mo	Dy	Yr	E. coli	Rec. Season E. coli
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	7	27	2005	180	180
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	8	30	2005	<100.0	49.99
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	10	26	2005	100	100
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	12	13	2005	<100.0	
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	3	6	2006	<100.0	
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	3	21	2006	<100.0	
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	8	1	2006	<100.0	49.99
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	8	14	2006	<100.0	49.99
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	10	3	2006	<100.0	49.99
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	10	30	2006	<100.0	49.99
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	11	27	2006	<100.0	
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	4	2	2007	73	73
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	4	25	2007	490	490
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	7	31	2007	27	27
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	9	4	2007	50	50
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	9	26	2007	160	160
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	10	16	2007	10	10
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	10	31	2007	<10.0	4.99
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	4	23	2008	<10.0	4.99
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	6	18	2008	180	180
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	6	25	2008	27	27
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	7	9	2008	190	190
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	8	13	2008	45	45
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	10	22	2008	18	18
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	4	28	2009	63	63
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	5	19	2009	63	63
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	5	26	2009	1120	1120
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	7	29	2009	332	332
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	8	25	2009	384	384
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	9	16	2009	213	213
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	10	6	2009	2490	2490
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	4	6	2010	390	390
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	4	13	2010	<10.0	4.99
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	4	26	2010	1780	1780
MSD	3592/1.2/0.1	Spring Br. @ New Ballwin Rd.	7	7	2010	131	131
Geometric Mean for all Recreation Season data 2005-2010							86

Missouri Department of Natural Resources, Water Protection Program – May 27, 2011

Kiefer Creek – Bacterial Data Analysis

State water quality standards designate the classified portion of Kiefer Creek as a Whole Body Contact Recreational Class B water which carries a *E. coli* standard of 206 colonies/100 ml interpreted as the geometric mean of all samples collected within the recreational season of April 1 until October 31. The standards also identify all but approximately the lowest 0.2 miles of Kiefer Creek as a losing stream. *E. coli* levels in losing streams may not exceed 126 colonies/100 ml at any time.

The *E. coli* standard for Whole Body Contact Recreational waters is interpreted as the geometric mean of at least five samples taken during the recreational season, April 1 to October 31, of any given year. A water is judged to be impaired by bacteria if the criterion is exceeded in any of the last three years. Thus Kiefer Creek is judged to be **impaired** by bacteria.

The current Listing Methodology Document does not have a specific method to evaluate "not to be exceeded" criteria for *E. coli*. To evaluate compliance with the losing stream *E. coli* standard Missouri Department of Natural Resources (MoDNR) used the same "ten percent" rule MODNR uses for "not to be exceeded" dissolved oxygen, pH and temperature criteria. Over the last six years, 11 of 35 *E. coli* measurements (31.4 percent) exceeded the126 criterion value. Thus the losing stream portion of Kiefer Creek is judged to be **impaired** based on losing stream standards.

Spring Creek, a tributary to Kiefer Creek is unclassified and therefore is not designated as a Whole Body Contact Recreational water and thus is not required to meet a bacterial standard. The Metropolitan St. Louis Sewer District (MSD) does sample this stream for bacteria. Over the last six years, counts are generally rather low but have been higher in the last two years.

This information was assembled by the Missouri Department of Natural Resources, Water Pollution Control Branch on May 27, 2011.

Missouri Department of Natural Resources – August 5, 2009
Meramec River – WBID 2183
Water Chemistry, U.S. Geological Survey (USGS) Data 2000-2008
Data is in mg/kg
Note – Meramec River at Paulina Hills is outside of the Lower Meramec Watershed Plan Study Area

Org	Site	Site Name	Yr	Mo	Dy	H	Flow	C	DO	pH	NH3N	TN	TP	Hard	Ecoli	Rec Season Ecoli
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2000	12	11	9	635	4	12.4	7.8	0.0199	0.47	0.1			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2000	11	29	9	778	5	11.3	8.1	0.0199	0.55	0.11	220		
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2000	10	3	9	624	23	8.9	8.3	0.0099	1.01	0.25			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2000	9	12	4	458	26	5.3	7.9	0.04	1.05	0.26		92	92
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2000	8	1	9	656	28	9.2	7.9	0.02	1.05	0.18		580	580
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2000	7	12	9	1140	29	5.8	7.5	0.04	0.75	0.14	190	21	21
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2000	6	12	9	1000	27	7	8.1	0.0099	0.83	0.14		80	80
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2000	5	23	9	1080	24	8.6	7.9	0.0099	0.79	0.11	190	17	17
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2000	4	4	5	1480	13	8.7	7.8	0.1	0.62	0.14		36	36
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2000	3	13	9	1100	12	11.4	8.4	0.14	0.7	0.1			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2000	2	8	9	771	3	10.6	8.1	0.3	0.77	0.11			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2000	1	19	9	862	4	13	7.9	0.07	0.64	0.11	210		
													2000 Geometric Mean			**61.64**
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2001	12	11		1210	8.4	6.6	7.5	0.21	0.87	0.1			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2001	11	14		744	14.1	11	8.1	0.21	0.98	0.14	210		
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2001	10	16		846	14.5	5.8	7.7	0.11	1.12	0.18		92	92
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2001	9	5	4	519	28	7.9	7.9	0.04	0.73	0.15		60	60
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2001	8	21	5	592	25	6.2	7.9	0.04	0.75	0.17		29	29
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2001	7	23	9	667	32	6.9	7.9	0.0199	0.8	0.14	180	72	72
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2001	6	20	5	940	28	7.5	8.1	0.0199	0.76	0.08		30	30
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2001	5	15	9	904	23	10.2	8.3	0.0199	0.53	0.05	190	88	88
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2001	4	23	9	1740	18	10	8.3	0.0199	0.77	0.1		19	19
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2001	3	28	9	1470	9	11.5	8.1	0.04	0.79	0.09			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2001	2	21	5	2060	6	12.7	8	0.065	0.88	0.06			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2001	1	10	9	744	0	15.2	7.6	0.28	0.93	0.11	240		
													2001 Geometric Mean			**47.89**
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2002	12	19	8	2600	7.8	12.4	7.9	0.42	0.94	0.13			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2002	11	6	9	1550	9.3	8.2	7.8	0.15	0.93	0.1	170		
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2002	10	9	9	756	18.2	7.3	7.8	0.08	1	0.14		38	38

Meramec River – Water Chemistry Data 2009																
Org	**Site**	**Site Name**	**Yr**	**Mo**	**Dy**	**H**	**Flow**	**C**	**DO**	**pH**	**NH3N**	**TN**	**TP**	**Hard**	**Ecoli**	**Rec Season Ecoli**
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2002	9	4		1020	29.5	5.3	8.5	0.0199	0.66	0.12		21	21
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2002	8	14		2860	27.2	5.7	7.8	0.09	0.94	0.14		27	27
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2002	7	10		1260	31.2	6.4	8	0.0199	0.75	0.11	190	14	14
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2002	6	4		2580	25.8	6.9	8	0.0199	0.49	0.06		28	28
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2002	5	28		4410	19.9	5.3	7.7	0.0199	0.88	0.07	140	33	33
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2002	4	3		3680	11.7	8	8	0.07	0.79	0.08		0.99	0.99
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2002	3	12		7460	8.6	9.8	7.6	0.0199	0.88	0.11			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2002	2	12		2380	6.3	11	7.9	0.14	1.06	0.06			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2002	1	15		1070	6.4	12.6	7.8	0.0199	1.09	0.08	200		
													2002 Geometric Mean			**16.06**
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2003	12	17	5	2130	3.1	11.9	7.9	0.15	0.97	0.08			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2003	11	13	9	882	11.4	7.2	8	0.15	0.75	0.09	200		
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2003	10	20	9	882	18.6	10.6	8.1	0.07	0.6	0.08		16	16
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2003	9	3	7	2040	23.6	5.5	7.4	0.0199	1.3	0.23		950	950
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2003	8	6	7	963	28.9	7.5	8	0.0199	0.8	0.13		13	13
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2003	7	22	8	1540	29.3	8.7	7.8	0.0199	1.1	0.21	190	110	110
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2003	6	17	5	6270	23.2	7.2	7.4	0.0199	0.97	0.12		150	150
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2003	5	21	6	3050	19.5	5.3	7.5	0.04	0.95	0.08	170	23	23
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2003	4	9	8	3410	11.2	9.5	7.7	0.13	0.55	0.03		20	20
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2003	3	5	8	4150	5.2	11.8	8	0.1	0.67	0.05			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2003	2	26	5	4640	3.1	13.3	7.9	0.1	0.78	0.06			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2003	1	7	5	2930	4.6	11.7	8.2	0.09	0.7	0.07	170		
													2003 Geometric Mean			**54.88**
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2004	12	13		4580	7	11.9	7.6	0.04	0.75	0.07			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2004	11	2		3630	16.5	5.7	7.6	0.04	0.63	0.1	210		
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2004	10	13		990	17.1	7.6	8.2	0.09	1.01	0.14		540	540
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2004	9	15		2760	24.2	5.6	7.6	0.04	0.82	0.09		62	62
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2004	7	20	9	780	28.7	6.9	7.4	0.0199	0.79	0.12	210	33	33
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2004	6	15		4240	23.1	5.7	7.9	0.0199	0.91	0.1		210	210
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2004	5	3	8	25200	15.1	7.2	7.5	0.0199	1.17	0.23	83	1500	1500

Meramec River – Water Chemistry Data 2009																
Org	**Site**	**Site Name**	**Yr**	**Mo**	**Dy**	**H**	**Flow**	**C**	**DO**	**pH**	**NH3N**	**TN**	**TP**	**Hard**	**Ecoli**	**Rec Season Ecoli**
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2004	4	19	6	1730	21.2	8.9	8.1	0.17	0.57	0.06		6	6
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2004	3	2	6	1630	10.3	11.1	8	0.14	0.58	0.06			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2004	2	9	5	2650	2.6	13.3	7.8	0.18	0.96	0.08			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2004	1	12	5	3340	4.5	11.3	8	0.1	0.9	0.06	150		
															2004 Geometric Mean	**113.06**
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2005	12	19	9	947	3	8.4	7.6	0.12		0.1			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2005	11	8	9	1300	16.1	10.2	7.7	0.09	0.83	0.14	210		
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2005	10	12	9	816	18.4	5.5	8.2	0.0199	0.64	0.1		38	38
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2005	9	8		586	26.6	6.2	8.2	0.0199	0.81	0.12		23	23
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2005	8	17		755	26.4	6	7.5	0.08	1.13	0.17		200	200
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2005	8	1		597	30.6	4.8	8.3	0.0199	0.75	0.11		20	20
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2005	7	27		909	29.5	4.8	8.2	0.03	0.81	0.12	210	5	5
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2005	6	7		1100	26.4	7.8	8.2	0.0199	0.77	0.11		640	640
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2005	5	3		4930	14.8	6.8	7.6	0.04	0.7	0.09	160	78	78
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2005	4	5		2430	15.7	9.1	8.2	0.11	0.5	0.04		7	7
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2005	3	10		2200	9.9	8.6	8	0.15	0.54	0.05			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2005	2	2		2990	5.3	16	7.3	0.17	1	0.04			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2005	1	19	9	947	3	8.4	7.6	0.12	0.95	0.07			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2005	1	4		6410	4.6	10.7	7.2	0.04	1.19	0.2	130		
															2005 Geometric Mean	**39.65**
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2006	12	4	7	7990	3.6	12.5	7.9	0.04	1.15	0.1			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2006	11	6	9	947	12.1	10.5	7.9	0.11	0.82	0.11	200		
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2006	10	11	4	465	18.4	6.1	7.7	0.14	1.03	0.15		33	33
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2006	9	5	4	701	26	8	7.9	0.00499	0.91	0.15		29	29
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2006	8	15	4	570	28.7	6.9	8.1	0.04	1.22	0.18		21	21
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2006	7	20	7	1010	31.2	7.1	7.8	0.00499	1.37	0.18	180	10	10
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2006	6	14	9	1380	25.5	6	7.8	0.08	1.17	0.14		280	280
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2006	5	16	5	5340	15.5	8.2	7.8	0.0199	0.81	0.09	120	9	9

Meramec River – Water Chemistry Data 2009																
Org	**Site**	**Site Name**	**Yr**	**Mo**	**Dy**	**H**	**Flow**	**C**	**DO**	**pH**	**NH3N**	**TN**	**TP**	**Hard**	**Ecoli**	**Rec Season Ecoli**
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2006	4	11	5	2210	17.2	9.6	8.1	0.07	0.54	0.06		21	21
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2006	3	6	9	1050	10.5	10.3	8.2	0.22	0.83	0.1			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2006	2	7	5	1670	4.4	12.8	8	0.18	0.61	0.07			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2006	1	9	9	1190	6.3	13.6	8.2	0.27	0.75	0.08	200		
															2006 Geometric Mean	**27.06**
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2007	12	5		730	5.8	7.7	7.1	0.193	0.84	0.14			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2007	11	6		539	12.1	9	8.2	0.123	0.98	0.17	210		
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2007	10	23		586	16.4	5.9	7.4	0.068	0.94	0.15		52	52
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2007	9	5	4	311	28	8.9	7.9	0.02	0.75	0.13		620	620
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2007	8	13	4	321	30.6	7.5	7.7	0.0099	1.04	0.17		40	40
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2007	7	9	5	1180	31.5	8.2	8.4	0.0099	0.75	0.12	170	15	15
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2007	6	4	6	1410	25.3	8.8	8.3	0.02	0.79	0.09		460	460
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2007	5	22	5	1780	21.7	5.9	7.4	0.01	0.51	0.08	180	50	50
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2007	4	25	5	3480	19.1	7.5	7.5	0.05	0.65	0.09		48	48
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2007	3	12	5	2030	12.1	12.2	7.9	0.09	0.55	0.06			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2007	2	20	5	3460	4.2	12	7.5	0.15	0.93	0.08			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2007	1	9	6	1540	6.6	12.4	8.2	0.12	0.62	0.04	180		
															2007 Geometric Mean	**80.21**
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2008	9	4		1330	25.6	5.8	7.4	0.083	0.76	0.15		1200	1200
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2008	8	5		1730	28	4.8	7.8	0.011	0.85	0.1		79	79
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2008	7	22		1130	27.6	4.7	7.8	0.07	0.73	0.1	190	27	27
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2008	6	3			23.8	8	7.4	0.035	0.67	0.09		310	310
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2008	5	21		5220	19.2	9.2	7.3	0.0099	0.55	0.06	140	82	82
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2008	4	15		12800	9.9	9.3	7.2	0.032	0.86	0.12		360	360
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2008	3	26		8650	9.2	8.4	7.5	0.061	1.04	0.1			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2008	2	6		11200	5.3	9.6	8.1	0.124	1.46	0.28			
USGS	2183/10.2	Meramec R. @ Paulina Hills,MO.	2008	1	23		1380	2.2	15.3	8.1	0.242	1.09	0.09	190		
															2008 Geometric Mean	**169.15**

Missouri Department of Natural Resources, Water Pollution Control Program – August 5, 2009
Elements in milligrams/liter; E. coli in colonies/milliliter
Shaded values indicate that measurements failed to meet standards for the protection of aquatic life. For more information see the accompanying notes.

Meramec River – Water Chemistry Analysis

The dissolved oxygen water quality standard for the protection of aquatic life is 5.0 mg/L as a minimum. The water is judged as impaired if more than ten percent of the samples fail to meet the water quality standard. Four of 107 dissolved oxygen (DO) measurements failed to meet the standard. For a water with a ten percent frequency of exceedence of a standard, four exceedences in 107 measurements (3.7 percent) is than 10 percent exceedence. Therefore this portion of the Meramec River is judged to be **unimpaired** by low dissolved oxygen.

Meramec River is a Class A Whole Body Contact recreational water with an *E. coli* standard of 126 colonies/100 ml. This standard is for the geometric (log) mean of all bacterial samples taken during the recreational season, April 1 to October 31. The water body is judged to be impaired if the geometric mean exceeds the water quality standard within the last three years. The Meramec River WBID 2183 section exceeded the *E. coli* standard in 2008, therefore this portion of the Meramec River is judged to be **impaired** due to bacteria.

This information was assembled by the Missouri Department of Natural Resources, Water Pollution Control Branch on August 5, 2009.

Missouri Department of Natural Resources – February 2008
Meramec River – WBID 1841, 1846, 2183, 2185
Mercury in Fish Tissue Data 1991-2007
Sampling performed by Missouri Department of Conservation (MDC), U.S. Environmental Protection Agency (EPA) and Missouri Department of Natural Resources (DNR)
Data is in ug/kg
Note - Meramec River at Valley Park and Meramec River at Yeatman sites are within the study area of the Lower Meramec Watershed Plan

Org	WBID	Site Name	Year	Species	# in Sample	Prep	Weight, lbs.	Hg, mg/kg
EPA/DNR	1841	Meramec R. @ Chouteau Access	2007	Kentucky Bass	1	fillet	0.4	0.169
MDC	1841	Meramec R. @ Hwy W	2001	Bass	8	fillet	1.7	0.470
				Mean for WBID 1841				0.320
EPA/DNR	1846	Meramec R. @ Birds Nest Acc.	2007	Smallmouth Bass	3	fillet	0.6	0.301
MDC	1846	Meramec R. @ Meramec St. Pk.	1998	Bass	6	fillet	0.6	0.095
MDC	1846	Meramec R. @ Meramec St. Pk.	2001	Bass	22	fillet	0.6	0.240
MDC	1846	Meramec R. @ Meramec St. Pk.	2001	Kentucky Bass	9	fillet	0.9	0.121
				Mean for WBID 1846				0.189
MDC	2183	Meramec R. @ Fenton	1991	Smallmouth Bass		fillet		0.170
MDC	2183	Meramec R. @ Fenton	1994	Kentucky Bass	6	fillet	1.4	0.240
EPA/DNR	2183	Meramec R. @ Fenton	1999	Largemouth Bass	3	fillet	1.4	0.034
MDC	2183	Meramec R. @ Hwy 61/67	1991	Largemouth Bass		fillet		0.250
MDC	2183	Meramec R. @ Paulina Hills	1999	Largemouth Bass	9	fillet	0.5	0.093
EPA/DNR	2183	Meramec R. @ Valley Park	2008	Kentucky Bass	3	fillet	0.3	0.096
EPA/DNR	2183	Meramec R. @ Valley Park	2007	Largemouth Bass	4	fillet	0.3	0.103
				Mean for WBID 2183				0.141
MDC	2185	Meramec R. @ Yeatman	1998	Bass	13	fillet	1.3	0.19
MDC	2185	Meramec R. @ Yeatman	2001	Bass	13	fillet	0.9	0.224
				Mean for WBID 2185				0.207

Missouri Department of Natural Resources, Water Protection Program – February 2008

Shaded values indicate that measurements failed to meet standards for the protection of aquatic life. For more information see the accompanying notes.

Meramec River – Mercury in Fish Tissue Analysis

The EPA guideline for mercury in fish tissue is 0.3 mg/kg ("Water Quality Criterion for Protection of Human Health: Metylmercury", EPA-823-R-01-001, Jan. 2001). The guidance document states that this is a concentration that "should not be exceeded" based on a total consumption of 17.5 grams of fish per person per day. The 0.3 mg/kg criterion is also based on the assumption that the fish diet is composed of a mixture of fish from different trophic levels. This document also encourages states to consider other relevant data while adopting or modifying the 0.3 mg/kg criterion value, such as regional differences in the species consumed and the amount of fish consumed.

McKee, 2002 ("Sport-Caught Fish Consumption in Missouri-2002 Mail Survey", Dept. of Conservation, Columbia, MO), found that Missourians that eat sport-caught fish do eat a mixture of species from different trophic levels. This study found that the most commonly consumed sport-caught fish were crappie, catfish, bluegill and other sunfish, bass (largemouth, smallmouth and spotted), trout and walleye. This survey also found that the median level of fish consumption was 50 grams per day, or 2.8 times the amount used to develop EPA's criterion value of 0.3 mg/kg. If the information on consumption rates in Missouri accurate, a criterion value significantly less than 0.3 mg/hg would be necessary to protection fish consumers from mercury poisoning.

The mean level of mercury in fish fillets in four segments of the Meramec River is shown in the table on the preceding page. One segement, WBID 1841, has mean levels of mercury in fish tissue that exceeds the criterion value of 0.3 mg/Kg. Since there are only two samples from this segment of the river, this sample size is judged to be inadequate since confidence limits around the sample mean cannot be calculated. This segment is on the current 303(d) list and the above data do not provide 'good cause' for delisting.

Fish consumption rate for Missourians that eat sport-caught fishing is much greater than the fish consumption estimate used for the federal criterion. However, there is **inadequate data** collected from this segment of the Meramec to perform an assessment. Therefore, it is recommended that it be prioritized for further monitoring of mercury levels in fish tissue.

The Missouri Department of Health and Senior Services (MDHSS) has issued a general advisory for mercury in fish tissue, stating that members of sensitive populations (pregnant women, women of childbearing age, nursing mothers and children under 13 year old) should limit their consumption of all fish caught in Missouri to one meal per week, due to the widespread presence of mercury. It all states that those same populations should limit their consumptions of largemouth, smallmouth and spotted bass over 12 inches in length to one meal per month. This advisory does not affect those who are not members of the sensitive populations.

This information was assembled by the Missouri Department of Natural Resources, Water Pollution Control Branch in February 2008.

Missouri Department of Natural Resources – August 19, 2009
Meramec River – WBID 2183, 2185
Sediment Chemistry 1998-2007 performed by Missouri Department of Natural Resources (MDNR)
Data is in mg/kg
Note – Meramec River above Rte 66 State Park site is within the Lower Meramec Watershed Plan study area

ORG	SITE	DATE	SITE NAME	AL	AS	BA	CD	CO	CR	CU	FE	HG	MN	NI	PB	ZN
MDNR	2183/12.0	19991018	MERAMEC R. NR. WINTER PARK	25500	5.57	290	1.49	10.6	37.1	25.9	17100	42.9	1210	21.4	196	134
MDNR	2183/16.8	20070109	Meramec R. US Hwy 30 @ Fenton	9340	5.88	213	0.612	10.7	11.6	12	11900	33.8	753	11.9	215	91.8
MDNR	2183/16.8	20070905	Meramec R. US Hwy 30 @ Fenton	8980	2.22	181	0.714	8.73	10.8	12.9	10900	24.6	506	10.6	143	84.1
MDNR	2183/16.2	20060112	Meramec R. ab. Hwy 30 bridge	12400	3.61	292	1.98	14.4	17.8	19.4	15500	43.6	1300	16.8	402	198
			Mean	**14055**	**4**	**244**	**1**	**11**	**19**	**18**	**13850**	**36**	**942**	**15**	**239**	**127**
			Probable Effect Level		**33**		**4.98**		**111**	**149**				**48.6**	**128**	**459**
MDNR	2185/12.6	19980603	Meramec R. 0.5 mi ab. Rte 66 St.Pk.	19300	3.14	312	1.83	8.85	25.4	20.7	16000	20	756	11.5	283	120
MDNR	2185/12.6	20070905	Meramec R. 0.5 mi. ab. Rte 66 St.Pk.	11400	2.47	246	1.27	10.2	13.4	17.1	13600	28.9	768	12.4	271	130
MDNR	2185/12.6	20060112	Meramec R. 0.5 mi.ab. Rte 66 St.Pk.	8870	2.63	261	1.43	10	13.1	14.2	11700	36.3	704	11.4	291	143
MDNR	2185/12.6	20070109	Meramec R. 0.5 mi ab. Rte 66 St.Pk.	9640	4.48	266	1.46	10.5	11.1	16.6	12000	30.4	709	11.1	330	140
			Mean	**12303**	**3**	**271**	**1**	**10**	**16**	**17**	**13325**	**29**	**734**	**12**	**294**	**133**
			Probable Effect Level		**33**		**4.98**		**111**	**149**				**48.6**	**128**	**459**

Missouri Department of Natural Resources, Water Protection Program – August 19, 2009

Elements in milligrams/liter
Shaded values indicate that measurements failed to meet standards for the protection of aquatic life. For more information see the accompanying notes.

Meramec River – Sediment Chemistry Analysis

The U.S. Environmental Protection Agency has not yet established federal guidelines for toxic chemicals in stream or lake sediments. The relationship between the amount of a toxicant in sediment and the strength of the toxicity it exerts is not simple or straightforward. Two publications, *Calculation and Evaluation of Sediment Effect Concentrations for the* Amphipod Hyalella azteca *and the* Midge Chironomus riparus, C. Ingersoll et al., 1996, and *Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems*, D. MacDonald, et al., 2000, reviewed a large number of research papers on sediment toxicity and suggested numvberic guidelines that could be used to judge the potential for toxicity to aquatic life.

The mean level of lead in the Meramec River sites 2183/16.8 and 2183/16.2 is **253**. This greater than 150 percent of the PEL (the concentration at which some toxic effect on aquatic life is likely) in MacDonald, 2000.

The mean level of Lead in the Meramec River sites 2185/12.6 is **294**. This more that **two** times the PEL (the concentration at which some toxic effect on aquatic life is likely) in MacDonald, 2000.

Both of these waterbodies are judged to be **impaired** due to lead in the sediment.

This information was assembled by the Missouri Department of Natural Resources, Water Pollution Control Branch on August 19, 2009.

Abbreviation Key

AL	Aluminum
AS	Arsenic
BA	Barium
C	Water temperature in centigrade
CD	Cadmium
CL	Chloride
CO	Cobalt
CR	Chromium
CU	Copper
DAL	Dissolved aluminum
DCD	Dissolved cadmium
DFE	Dissolved iron
DO	Dissolved oxygen
DPB	Dissolved lead
DY	Day
DZN	Dissolved zinc
Ecoli	Escherichia coli bacteria
FE	Iron
Flow	Stream flow in cubic feet/second
H	Hour of day
Hard	Hardness
HG	Mercury
mg/kg	Milligrams per kilogram
mg/l	Milligrams per liter
MN	Manganese
MO	Month
NH3N	Ammonia nitrogen
NI	Nickel
PB	Lead
pH	Measurement of how acidic or base a substance is
Rec Season	Recreational season (April 1 – October 31)
TN	Total nitrogen
TP	Total phosphorus
ug/dl	Micrograms per deciliter
ug/kg	Micrograms per kilogram
ug/l	Micrograms per liter
YR	Year
ZN	Zinc

Appendix J

Grant Opportunities and Funding Resources

Missouri Department of Natural Resources

Water Pollution Control Program

Water Protection Program

Section 319 Nonpoint Source Minigrant Program

When nonpoint source pollution enters our waters as runoff (water that has flowed over the surface of a yard, feedlot, construction site, or parking lot) it can degrade Missouri streams, rivers, reservoirs and groundwater. If there is a nonpoint source pollution problem in a water body near you, a minigrant may allow you to address the problem. Minigrants are available to a variety of groups and non-profit organizations, as well as state and local government agencies. Minigrants are a good way to begin addressing local issues. They allow citizens to organize and build capacity. Small grants help local citizen groups become familiar with the grant process and requirements, preparing them for future grants.

Overview

All department nonpoint source pollution grant funds are provided by the U.S. Environmental Protection Agency through Section 319(h) of the Clean Water Act. These funds are awarded by the U.S. EPA, Region 7 who awards them to the department. The department administers these funds to eligible sponsors. Eligible sponsors include state and local agencies, educational institutions, and nonprofit organizations with 501(c)(3) status who are interested in addressing nonpoint source pollution problems. Minigrants are a type of subgrant that can be used to fund a project that addresses nonpoint source pollution. Like other 319 nonpoint source pollution subgrants, research projects or activities required by a National Pollutant Discharge Elimination System are not eligible for funding through the Minigrant Program.

Program Goal
The current goal of the Minigrant Program is to provide financial assistance for building watershed protection capacity in watersheds targeted by Missouri's Nonpoint Source Management Plan and other water quality initiatives. The Minigrant Program provides funds to implement projects that deal with nonpoint source pollution of water bodies in Missouri. Specifically, the program will support small projects that:

- Create a citizenry that is accurately informed about the causes, extent, and control of nonpoint source water pollution and water quality issues.
- Provide an opportunity for involved citizens to achieve environmental success through nonpoint source water pollution prevention or remediation.

Project Requirements

1. Eligible organizations include state and local agencies, educational institutions, and non-profit organizations with 501(c)(3) status. Proof of 501(c) status is required.
2. Minigrants are awarded and funded two times during the calendar year.
3. Projects must address nonpoint source water pollution to be considered for funding (e.g., provide information, education, demonstration, prevention, or correction of existing environmental impacts).
4. Projects that are funded through the Minigrant Program are usually short-term and cannot exceed 24 months in duration from the project's start date.
5. Minigrants can provide up to $10,000 in federal funding for a project, and a matching 40 percent of funding or non-federal in-kind contributions is required by the sponsoring agency or subgrantee as in the form of donated goods and services, volunteer hours, equipment or materials, or other type of "in-kind" services or contributions. Calculating 40% match on $10,000 equals $6,667. The required minimum match can be calculated as follows: (40/60) x (the requested federal amount).

Ineligible Activities

- Research type projects and activities
- Activities required under National Pollutant Discharge Elimination System

Application Criteria
A minigrant may provide information and education on nonpoint source issues, fund water quality monitoring, support restoration or conservation of water resources, or directly address nonpoint source pollution problems. All minigrant applications must explain how they will address nonpoint source pollution in at least one of the following ways:

1. Increase public knowledge of nonpoint source pollution and their impact on surface water and groundwater quality.

2. Provide information to the public about nonpoint source pollution problems or issues of interest and what the project is doing to these problems or issues.
3. Increase public awareness of alternatives that can prevent nonpoint source water pollution.
4. Stimulate individuals to assess and modify practices and behaviors that contribute to nonpoint source pollution.
5. Develop tools and programs to encourage behavioral changes toward sound preventive practices.
6. Encourage local partnerships and public participation in efforts to restore, conserve, and protect water resources threatened by nonpoint source pollution.

Application Schedule

Preliminary proposals may be submitted at any time, early submittal of an electronic copy allows staff to review and offer suggestions for proposal improvement prior to the closing date.

Complete proposals submitted to the department by April 1 and October 1 of each calendar year will be considered for funding at that time. A complete proposal must include the

- Application Form
- Narrative
- Detailed Budget
- Letters of Commitment from Partners
- One signed copy of the proposal and one electronic copy

The table below lists a typical schedule of grant reviews, awards, negotiations, and approvals that are done within several months following submittal of the application:

Task	Date	Date
Final date for sponsors to submit project applications	April 1	Oct. 1
DNR intra-department review and project selection	By May 5	By Nov. 5
DNR informs sponsors, assigns project to DNR project manager	By May 15	By Nov. 15
Negotiations between DNR and sponsoring agency, and DNR management approval and final award	By July 15	By Jan. 15
Estimated project start date	Aug. 1	Feb. 1

Minigrant Application
Download an application, detailed budget spreadsheet and instructions or contact the department for a hardcopy of application or additional information.
Please submit the one original signed copy and one electronic copy to the addresses below:
Missouri Department of Natural Resources
Attention: Water Protection Program, Watershed Protection Section, Nonpoint Source Unit
P.O. Box 176
Jefferson City, MO 65102-0176
Darlene.Schaben@dnr.mo.gov

For additional information, please call 573-751-7428 or FAX 573-526-6802

Missouri Department of Natural Resources

Water Pollution Control Program

Water Protection Program

Section 319 Nonpoint Source Major Subgrants

Major Subgrant Notification of Available Funding

Targeted Watershed Plan Implementation

The Department of Natural Resources has funding available to assist watershed-based groups with implementing best management practices and associated activities as described in their department-accepted watershed management plan. The purpose of the funding is to implement on-the-ground practices aimed at controlling, reducing or managing nonpoint source pollution as described in the Missouri Nonpoint Source Management Plan.

Fund Source

Funding for this federal grant is authorized by Section 319 of the Clean Water Act to address nonpoint source water pollution, such as polluted runoff from unregulated or unpermitted sources and in waters needing improvements or protection from further

degradation. The funding is provide by the U.S. Environmental Protection Agency through the Department of Natural Resources.

Grant Use
Funding is available for watershed groups to implement best management practices as detailed in their watershed management plan. The department anticipates meeting with each qualified group that expresses interest in this announcement to discuss the implementation process. Funding decisions will be made based in part on the criteria listed in the qualifications section of this notice. Priority will be given to watersheds with an EPA-approved total maximum daily load, frequently referred to as a TMDL, that includes nonpoint source components.
Refer to the "Priority watersheds with a watershed management plan for the Request for Proposals FY2010" map for additional information.
Additional resources can be found at: /env/wpp/nps/319applicationresourcetools.htm
Section 319 project examples can be found at: 319 Project Examples

Qualifications
To be considered for funding, eligible applicants must meet the following requirements:

- Have a department-accepted watershed management plan containing the nine critical elements as identified by EPA.
- Address the current EPA-approved nonpoint source 303(d) listed water body (or nonpoint source TMDL), Outstanding State or National Resource Water, or state prioritized water body.
- Have an active and diverse watershed partnership to carry out implementation of best management practices as described in their watershed management plan.
- Have, or be able to recruit, staff with the capability, expertise and experience to perform the proposed work and grant administration.
- Have the ability to maintain partnerships to ensure project implementation as well as long-term operation and maintenance for the installed best management practices.
- Have a water quality monitoring component to document water quality changes and help confirm load reductions, whether provided by recipient, contractor, the department, or another partnering agency.
- Have the ability to model or contract out modeling of best management practices to report load reduction of the impairment(s).
- Have an information and education component relative to the impairment(s) and practices to be implemented, as described in their watershed management plan.

Eligible Applications
All major subgrant applications must explain how they will address nonpoint source pollution in at least one of the following ways:

- Increase public knowledge of nonpoint source water pollutants and their impact on surface and groundwater quality.
- Increase public awareness of alternatives that can prevent nonpoint source water pollution.
- Stimulate individuals to assess and modify practices and behaviors that contribute to nonpoint source water pollution.
- Develop tools and programs to encourage behavioral changes toward sound preventive practices.
- Encourage local partnerships and public participation in efforts to restore, conserve, and protect water resources threatened by nonpoint source water pollution.

Grant Amount
Funding awards will be based on the number of eligible applicants and depend on the ability of the watershed group to mobilize, stay on schedule and meet the implementation milestones of the best management practices in their watershed management plans. Implementation costs will be negotiated prior to final approval of the project. Funding awarded to eligible applicants will be based on practices to be implemented, as detailed in their nine element watershed management plan and costs will be negotiated prior to final approval of the project. The project sponsor is required to provide 40 percent of the total project cost with non-federal dollars or in-kind activities. Partnerships with local Soil and Water Conservation Districts, University Extension, Natural Resources Conservation Service, local and state governments are strongly encouraged.

To Schedule a Preliminary Meeting
A formal request must be submitted in writing and should include the following information:

- Name of organization and contact information.
- One paper and one electronic copy of the watershed management plan and date of development or revisions.
- List of partners, including contact information, and proposed contributions.
- Watersheds and HUCs that will be addressing the nonpoint source 303(d) impairment by implementing the watershed management plan.
- Brief summary of proposed scope of work and preliminary cost of efforts.
- Ability to provide group's organizational hierarchy, separation of duties, payroll, time accountability, etc. during preliminary meeting.

Grant Agency Contact
Missouri Department of Natural Resources
Water Protection Program
P.O. Box 176
Jefferson City, Mo 65102-0176
573-751-7428

Depending on amount of interest, the department will be meeting with the organizations requesting a formal meeting as soon as available. A formal request for proposal will be provided to qualifying organizations who have submitted a formal request. Only at that time shall a major subgrant application be completed.

Application Information

Major Subgrant Application and Detailed Budget Spreadsheet

- Major Subgrant Application
- Instructions for Major Subgrant
- Detailed Budget Spreadsheet XLS

Water Quality Monitoring Worksheet and Detailed Budget Spreadsheet *(required for all projects proposing a water quality monitoring component as part of the 319 project effort)*

- Water Quality Monitoring Worksheet
- Detailed Budget Spreadsheet XLS *(the water quality monitoring expenses shall be addressed separately)*

Eligible applications will be reviewed to determine:

- Application is complete and all required documentation submitted by posted deadline.
- Application contains detailed yet concise information to enable the review team to understand the purpose of the funding request.
- Project has strong, achievable goals and objectives.
- Project thoroughly and concisely describes how efforts will address/improve nonpoint source water quality issues.
- The project indicates strong support and interest, and has established partnerships to complete the goals and objectives of the project - letters of support and level of contribution.
- Milestones are realistic and reasonable.
- Budget detailed and ties directly back to the project activities.
- Cost-effectiveness of the project. Projects that include higher percentages of funds for administrative, overhead or indirect costs will be considered a lower priority. Indirect rates cannot exceed 13 percent.
- If water quality monitoring or watershed modeling is to be conducted, applicant indicates they are capable of planning and budgeting for water quality monitoring to document on the ground improvements and/or provide enough information to calculate pollutant load reductions and/or the applicant is capable of running a simplified watershed model (e.g. STEPL) to accurately estimate pollutant load reductions and have the resources to do so. If not, then the applicant shall indicate the ability/willingness to subcontract.

Application Submittal

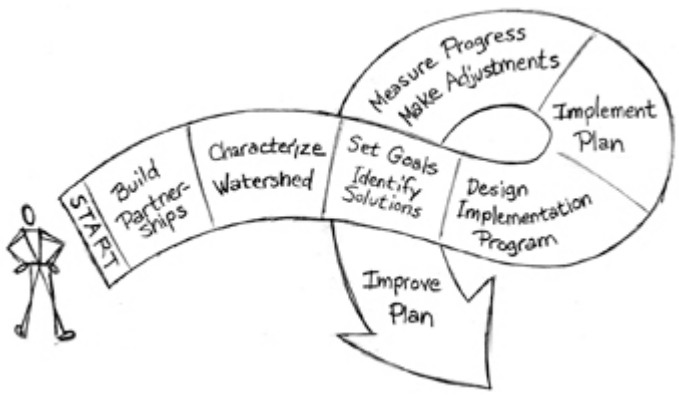
Mail completed application forms, along with one electronic copy on CD, with all necessary documentation to:
Missouri Department of Natural Resources
Water Protection Program
Attn: Darlene Schaben
P. O. Box 176
Jefferson City, MO 65102-0176

Missouri Department of Natural Resources

Water Pollution Control Program

Water Protection Program

Watershed Management Plan Development Grant Program



Program Background

Since the late 1980's, organizations and agencies have moved toward managing water quality by using a watershed approach, which includes stakeholder involvement and management actions supported by sound science and appropriate technology.
A watershed management plan, best defined by the U.S. EPA, is a strategy and a work plan for achieving water resource goals that provides assessment and management information for a geographically defined watershed. It includes the analysis, actions, participants, and resources related to development and implementation of the plan. The watershed planning process uses a series of cooperative, iterative steps to characterize existing conditions, identify and prioritize problems, define management objectives and develop and implement protection or remediation strategies as necessary.

Below is a list of the key elements to be discussed in a watershed management plan:

- **Causes and Sources of Pollution** - *What are the watershed problems and threats?*

- **Nonpoint Management Measures** - *What are you going to do about the problem and threats and where will you do it?*
- **Water Quality-based Goals** - *What you hoping to achieve?*
- **Technical and Financial Assistance** - *How are you going to pay for the implementation of the plan?*
- **Information and Education** - *How will you garner support for the plan and its implementation?*
- **Schedule** - *How long will it take?*
- **Milestones** - *What steps will you take along the way?*
- **Criteria** - *How will you know you are successful?*
- **Monitoring** - *How will you measure your success?*

Overall, watershed-based plans that are developed and implemented to manage and protect against nonpoint source pollution using Clean Water Act Section 319 funding must address EPA's nine critical planning elements. To help communities, watershed organizations, and local, state, tribal, and federal environmental agencies with the development and implementation of watershed management plans, the U.S. EPA developed the *"Handbook for Developing Watershed Plans to Restore and Protect Our Waters*" for additional information. A detailed explanation of the nine elements can be found in Section 2.6 of the Handbook.
Additional resources on watershed planning can be found at:
/env/wpp/nps/319applicationresourcetools.htm
Section 319 project examples can be found at: 319 Project Examples

Grant Background

Funding Source
Funding for this federal grant is authorized by Section 319 of the Clean Water Act to address nonpoint source water pollution, such as polluted runoff from unregulated or unpermitted sources and in waters needing improvements or protection from further degradation. The funding is provided by the U.S. Environmental Protection Agency through the Department of Natural Resources.
Grant Purpose
The Missouri Department of Natural Resources provides funding for the development of watershed-based management plans to restore waters impaired by nonpoint source pollution. A goal of Missouri's Nonpoint Source Grant Program is to protect or improve the quality of Missouri's waters that are impaired by nonpoint source pollution (polluted runoff from unregulated or unpermitted sources). This funding is provided pursuant to Section 319 of the Clean Water Act. The funds are administered by the U.S. Environmental Protection Agency (EPA) through the department.

Funding Amount
The size and scope of watershed management plans may vary significantly based on the drainage area chosen; therefore, the funding request for plan development should reflect the scope of work required to complete the plan. Up to $30,000 is available however, the application will be required to collect detailed assessment work as needed where

information is lacking. Watershed assessments shall include: identification of water quality issues and sources of pollution, identification of critical areas, and estimate of water quality pollutant loads through modeling or water quality assessments, field verifications or windshield surveys. Funding decisions will be made based on the merit of the application. Available funding for this grant is limited.

Qualifications

To be considered for funding, eligible applicants must meet the following requirements:

- Eligible organizations include state and local agencies, educational institutions, and non-profit organizations with 501(c)(3) status. Proof of 501(c) status is required.
- Have an active and diverse watershed partnership to carry out watershed planning efforts.
- Have, or be able to recruit, staff with the capability, expertise and experience to perform the proposed work and grant administration.
- Have the ability to maintain partnerships to ensure project implementation as well as long-term cooperation and commitment to the implement watershed management plan.
- Have the ability to model or contract out modeling to estimate current pollutant loads and the levels that are needed to bring the water body back into compliance with the state's water quality criteria.
- Familiar with a variety of best management practices needed to address and obtain pollutant load reductions.
- Applicant must submit the Watershed Management Plan Development Grant application form, and detailed budget. If the project proposes to conduct water quality monitoring as part of the project efforts, a Water Quality Monitoring Worksheet in addition to a separate detailed budget explaining the proposed water quality monitoring expenses.

Ineligible Activities

- Research type projects and activities
- Activities required under National Pollutant Discharge Elimination System permits

Project Requirements:

- Projects may be up to three years in length.
- A well written application that thoroughly and concisely describes the issues, defines the activities to be conducted, and contains realistic milestones and budget.
- Complete Watershed Management Plan that addresses all of EPA's nine critical planning elements.

- Address the current EPA-approved nonpoint source 303(d) listed water body (or nonpoint source TMDL), Outstanding State or National Resource Water, or state prioritized water body.
- Non-federal match required in a ratio of 60 percent 319 funds to 40 percent non-federal funds. Matching support may include "in-kind" contributions. (Soil and Water Conservation Districts are not required to document match on agricultural projects.)
- Watershed assessments must specifically identify water quality issues, impacts and sources; identify critical areas of the watershed to target specific management practices; document current pollutant load(s) through water quality monitoring or watershed modeling, etc.
- Projects must be eligible for funding under Section 319 of the Clean Water Act, and consistent with the Missouri Nonpoint Source Management Plan.
- Completed watershed management plans must be designed to achieve the load reductions called for in any completed Total Maximum Daily Load (TMDL) addressing nonpoint source impairment. If a TMDL has not been completed, the plan must be designed to reduce pollutant loads to meet water quality standards. TMDLs in progress and approved TMDLs are available on the Web at www.dnr.mo.gov/env/wpp/tmdl/index.html.
- Projects should encompass a complete watershed or sub-watershed of manageable size (e.g. 12-digit hydrologic unit code) and address all significant pollutant sources.
- Implementation schedule shall note critical areas of the watershed that will be targeted for future implementation.
- Involve interagency coordination and cooperation. Locally led projects are preferred. Letters of support should be included with the application.

Schedule

Applications will be accepted three times a year and due on February 1, June 1, and September 1.
Applications will be accepted until this limited pool of grant money is exhausted.
Applications will be reviewed based on the dates stated above. Applications will be reviewed and awards made approximately 90 to 120 days after the deadline date.

Application Information

Watershed Management Planning Application and Detailed Budget Spreadsheet

- Watershed Management Planning Application
- Detailed Budget Spreadsheet XLS

Water Quality Monitoring Worksheet and Detailed Budget Spreadsheet *(required for all projects proposing a water quality monitoring component as part of the 319 project effort)*

- Water Quality Monitoring Worksheet
- Detailed Budget Spreadsheet XLS *(the water quality monitoring expenses shall be addressed separately)*

Eligible applications will be reviewed to determine:

- application is complete and all required documentation submitted by posted deadline,
- application contains detailed yet concise information to enable the review team to understand the purpose of the funding request,
- project has strong, achievable goals and objectives,
- project thoroughly and concisely describes how efforts will address/improve nonpoint source water quality issues,
- the project indicates strong support and interest, and has established partnerships to complete the goals and objectives of the project - letters of support and level of contribution,
- milestones are realistic and reasonable,
- budget detailed and ties directly back to the project activities,
- cost-effectiveness of the project. Projects that include higher percentages of funds for administrative, overhead or indirect costs will be considered a lower priority. Indirect rates cannot exceed 13 percent.
- if water quality monitoring or watershed modeling is to be conducted, applicant indicates they are capable of planning and budgeting for water quality monitoring to document on the ground improvements and/or provide enough information to calculate pollutant load reductions and/or the applicant is capable of running a simplified watershed model (e.g. STEPL) to accurately estimate pollutant load reductions and have the resources to do so. If not, then the applicant shall indicate the ability/willingness to subcontract.

Application Submittal

Mail completed application forms, along with one electronic copy on CD, with all necessary documentation to:
Missouri Department of Natural Resources
Water Protection Program
Attn: Darlene Schaben
P. O. Box 176
Jefferson City, MO 65102-0176

U.S. Army Corps of Engineers – Planning Assistance to States

Section 22 of the Water Resources Development Act (WRDA) of 1974, as amended, provides authority for the Corps of Engineers to assist the States, local governments, and other non-federal entities, in the preparation of comprehensive plans for the development, utilization and conservation of water and related land. Section 208 of the Water Resources Development Act of 1992 amended the WRDA of 1974 to include Native American Tribes as equivalent to a State. Non-profit organizations are not eligible but could partner with state or local governments.

Typically, studies are only at the planning level of detail and do not include detailed design for project construction. Studies conducted in recent years under this program include: riverfront development; water supply and demand studies; water quality studies; environmental conservation/restoration studies; and flood damage reduction studies.

The Planning Assistance to States program is funded annually by Congress. Federal allotments for each State or Tribe from the nationwide appropriation are limited to $500,000 annually, but typically are much less. Individual studies, of which there may be more than one per State or Tribe per year, generally cost $25,000 to $75,000. These studies are cost shared on a 50 percent federal and 50 percent non-federal basis. A portion of the non-federal cost can be performed as in-kind work.

The needed planning assistance is determined by the individual States and Tribes. Every year, each State and Indian Tribe can provide the Corps of Engineers its request for studies under the program, and the Corps then accommodates as many studies as possible within the funding allotment.

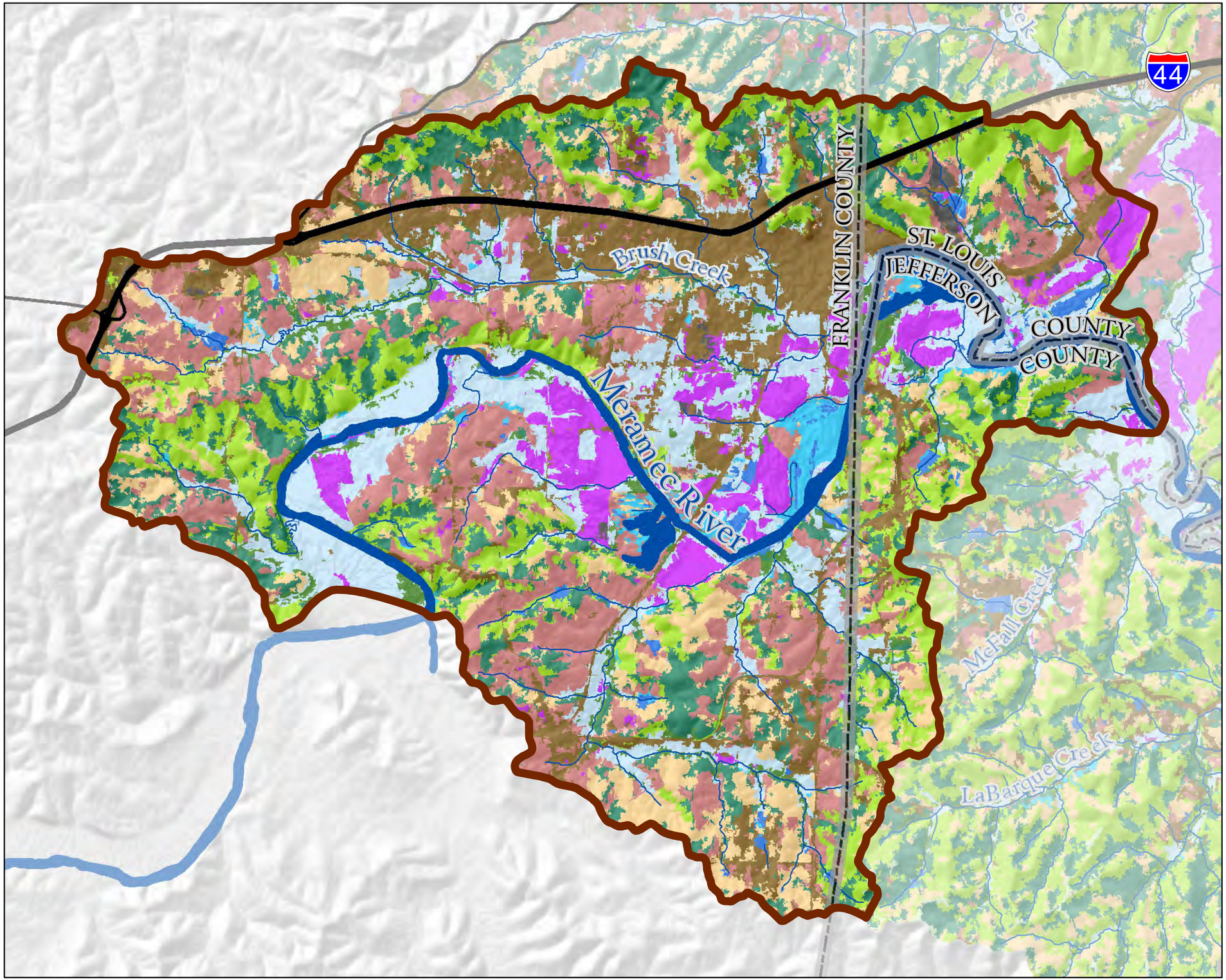
For more information contact the Planning Assistance to States Program point of contact at the St. Louis District, U.S. Army Corps of Engineers.

Appendix K

Land Cover Maps by Subwatersheds

Brush Creek Watershed

Land Cover (2009)



Legend

Basemap Elements

- Watershed Boundary
- County Boundary
- Interstate Highway
- Major Road
- River or Stream

Land Cover Categories

- Barren or Sparsely Vegetated
- Bottomland
- Bottomland Forest
- Cropland
- Disturbance/Successional Grassland
- Open Water
- Cliff/Talus Complex
- Forest or Woodland
- Glade/Woodland Complex
- Grassland and Shrubland
- Prairie and Savanna
- Successional Forest and Shrubland
- Urban
- Wetlands

0 0.5 1 2 Miles

Sources: Missouri Resource Assessment Partnership, East-West Gateway Council of Governments
October 2010

The Open Space Council for the St. Louis Region

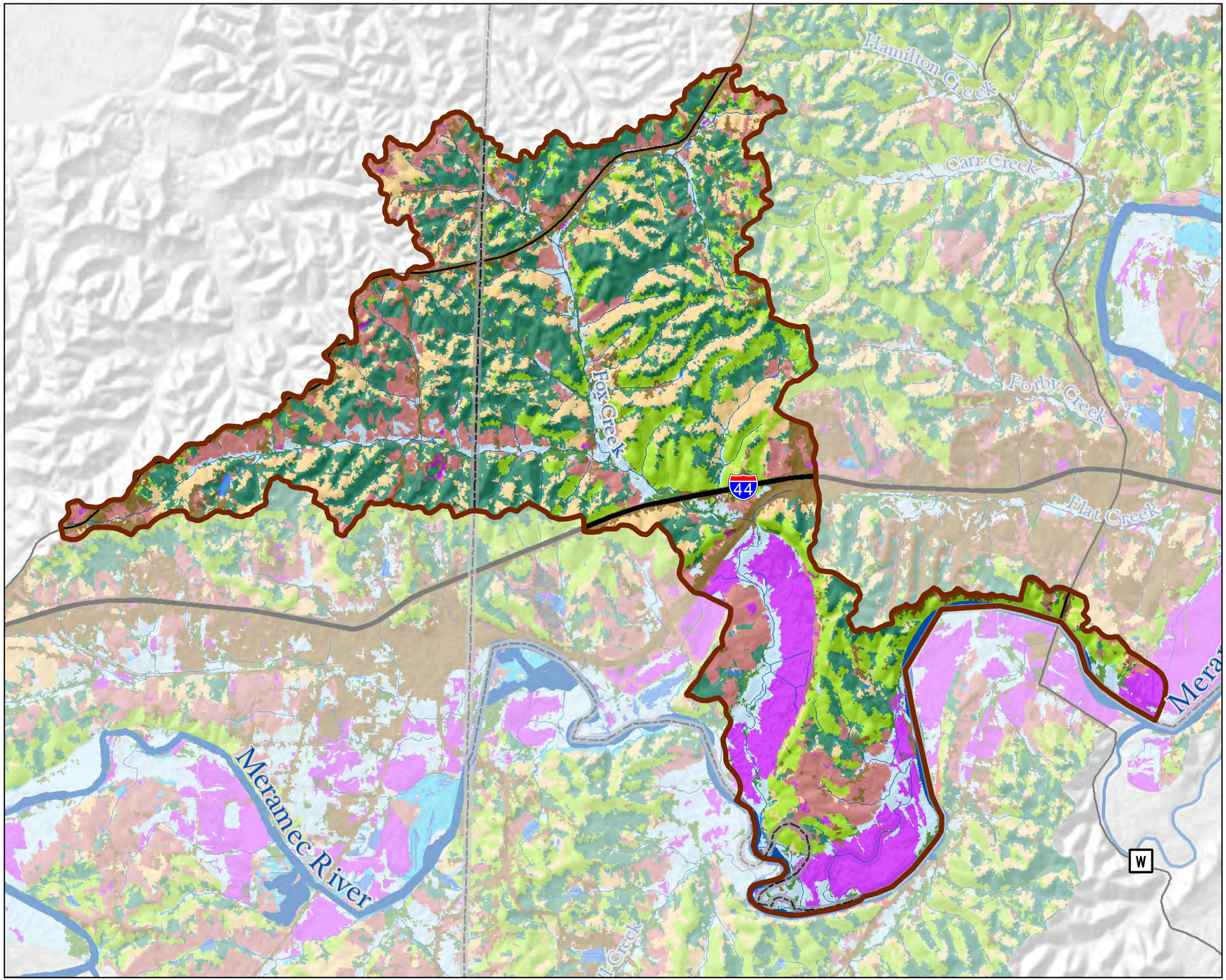
East-West Gateway Council of Governments
Creating Solutions Across Jurisdictional Boundaries

Missouri Department of Natural Resources

U.S. Environmental Protection Agency Region 7 through the Missouri Department of Natural Resources has provided partial funding for this project under the American Recovery and Reinvestment Act of 2009, Section 604(b) of the Clean Water Act.

Fox Creek Watershed

Land Cover (2009)



Legend

Basemap Elements

- Watershed Boundary
- County Boundary
- Interstate Highway
- Major Road
- River or Stream

Land Cover Categories

- Barren or Sparsely Vegetated
- Bottomland
- Bottomland Forest
- Cropland
- Disturbance/Successional Grassland
- Open Water
- Cliff/Talus Complex
- Forest or Woodland
- Glade/Woodland Complex
- Grassland and Shrubland
- Prairie and Savanna
- Successional Forest and Shrubland
- Urban
- Wetlands

N

0 0.5 1 2 Miles

Sources: Missouri Resource Assessment Partnership, East-West Gateway Council of Governments October 2010

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Grand Glaize Creek Watershed

Land Cover (2009)

Legend

Basemap Elements

- Watershed Boundary
- County Boundary
- Interstate Highway
- Major Road
- River or Stream

Land Cover Categories

- Barren or Sparsely Vegetated
- Bottomland
- Bottomland Forest
- Cropland
- Disturbance/Successional Grassland
- Open Water
- Cliff/Talus Complex
- Forest or Woodland
- Glade/Woodland Complex
- Grassland and Shrubland
- Prairie and Savanna
- Successional Forest and Shrubland
- Urban
- Wetlands

0 0.5 1 2 Miles

Sources: Missouri Resource Assessment Partnership, East-West Gateway Council of Governments
October 2010

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Missouri Department of Natural Resources

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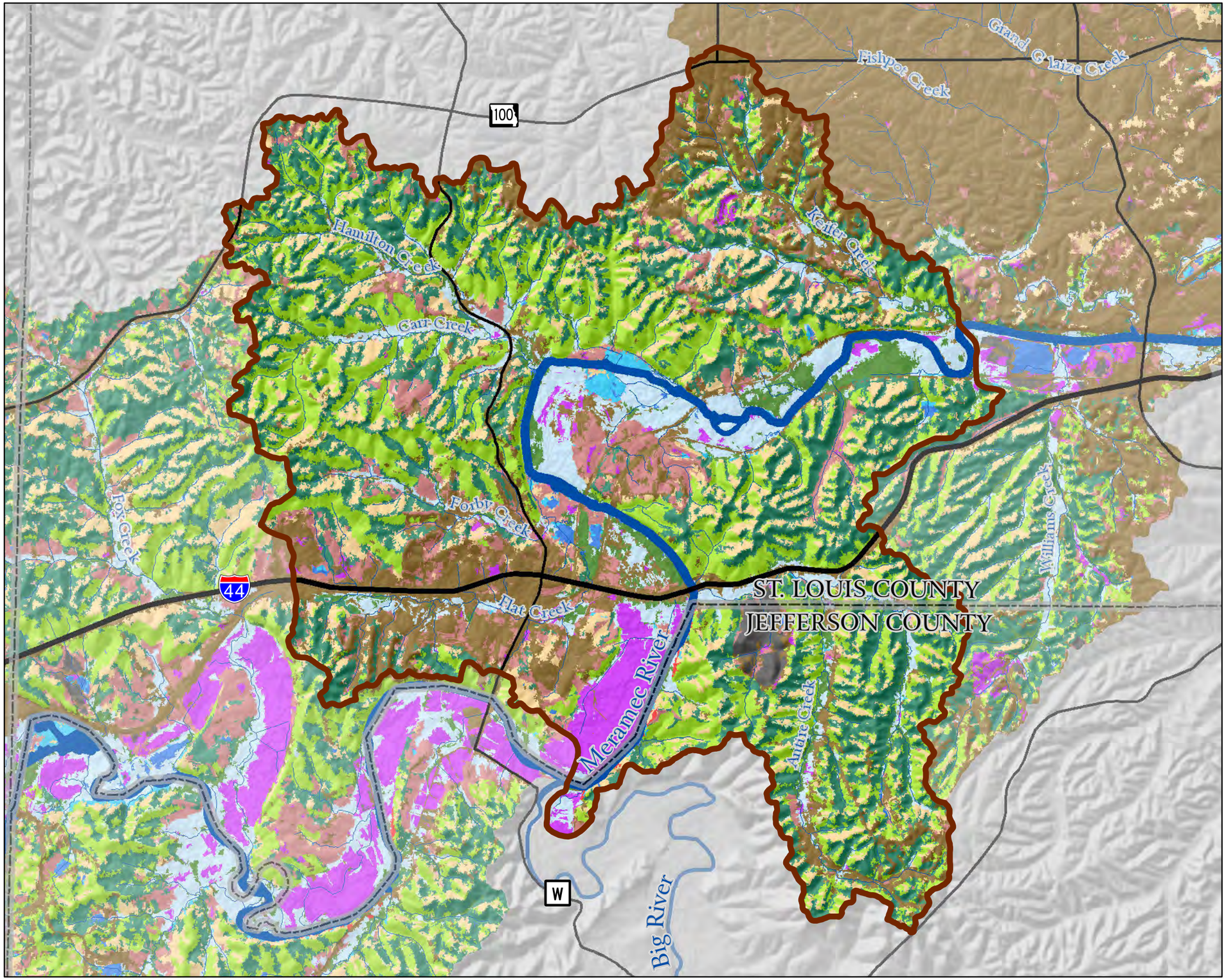
Hamilton Creek Watershed

Land Cover (2009)



Legend

Basemap Elements

- Watershed Boundary
- County Boundary
- Interstate Highway
- Major Road
- River or Stream

Land Cover Categories

- Barren or Sparsely Vegetated
- Bottomland
- Bottomland Forest
- Cropland
- Disturbance/Successional Grassland
- Open Water
- Cliff/Talus Complex
- Forest or Woodland
- Glade/Woodland Complex
- Grassland and Shrubland
- Prairie and Savanna
- Successional Forest and Shrubland
- Urban
- Wetlands

N

0 0.5 1 2 Miles

Sources: Missouri Resource Assessment Partnership, East-West Gateway Council of Governments
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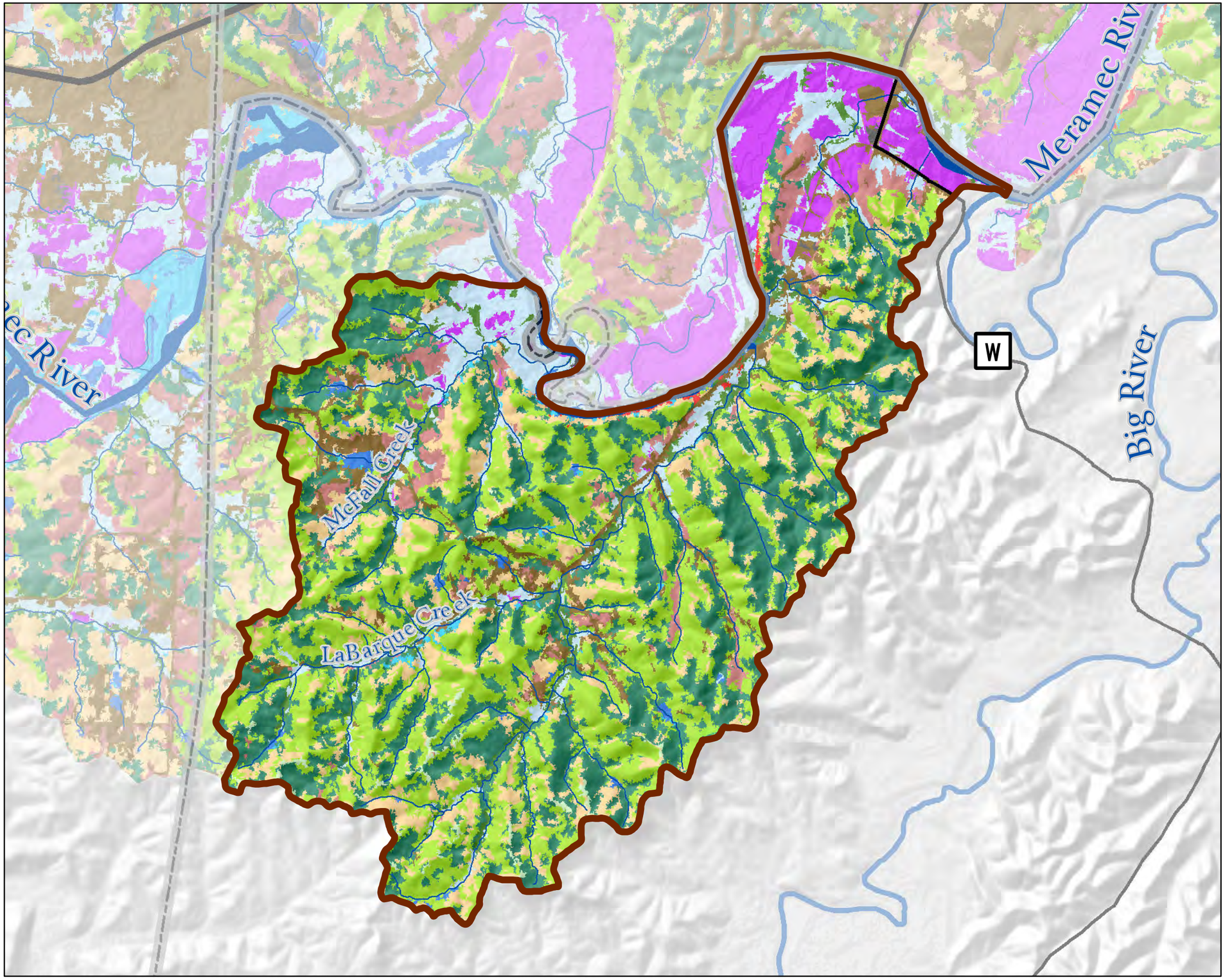

LaBarque Creek Watershed

Land Cover (2009)

Legend

Basemap Elements

- Watershed Boundary
- County Boundary
- Interstate Highway
- Major Road
- River or Stream

Land Cover Categories

- Barren or Sparsely Vegetated
- Bottomland
- Bottomland Forest
- Cropland
- Disturbance/Successional Grassland
- Open Water
- Cliff/Talus Complex
- Forest or Woodland
- Glade/Woodland Complex
- Grassland and Shrubland
- Prairie and Savanna
- Successional Forest and Shrubland
- Urban
- Wetlands

N 0 0.5 1 2 Miles

Sources: Missouri Resource Assessment Partnership, East-West Gateway Council of Governments
October 2010

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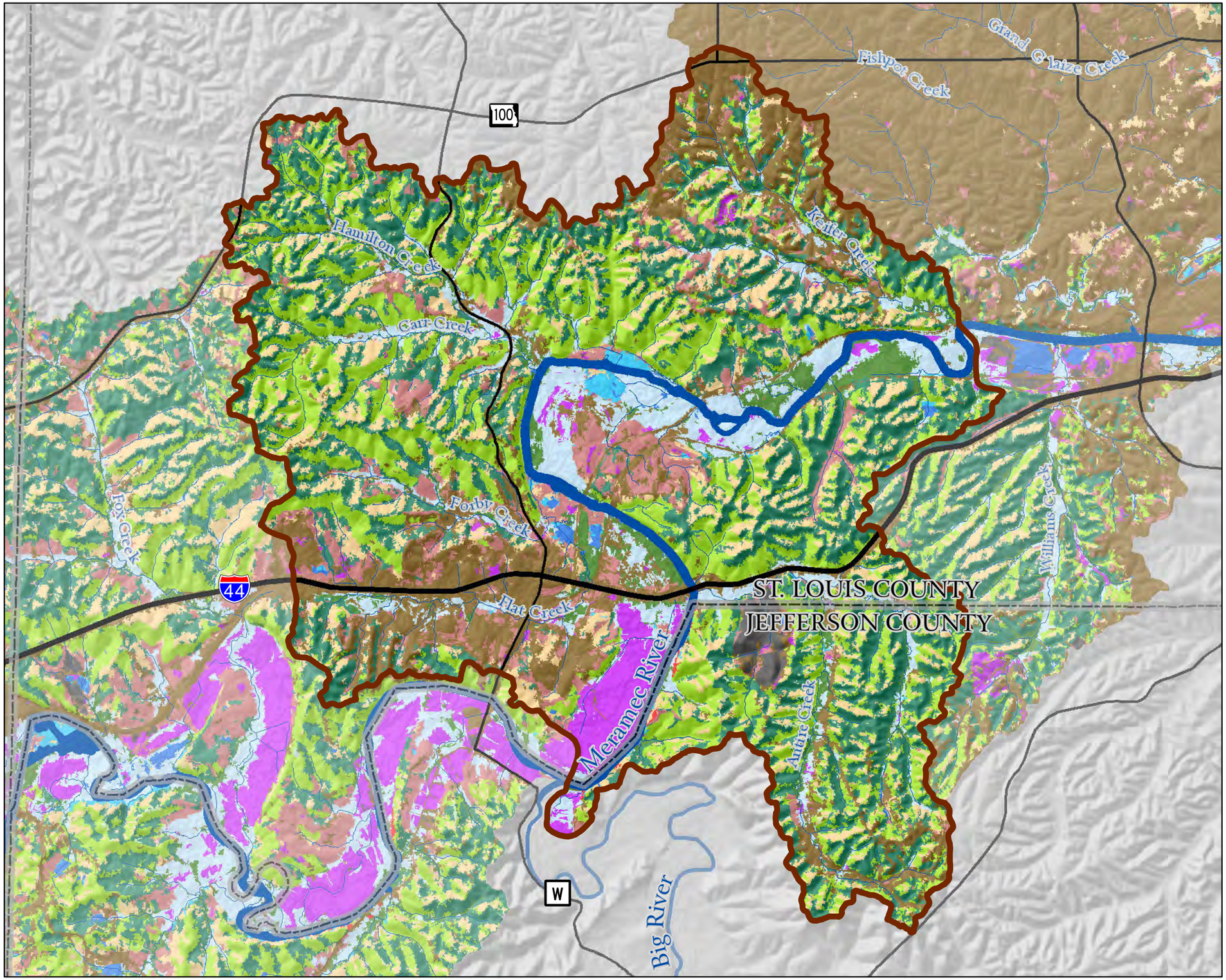
U.S. Environmental Protection Agency Region 7 through the Missouri Department of Natural Resources has provided partial funding for this project under the American Recovery and Reinvestment Act of 2009, Section 604(b) of the Clean Water Act.

Hamilton Creek Watershed

Land Cover (2009)



Legend

Basemap Elements

- Watershed Boundary
- County Boundary
- Interstate Highway
- Major Road
- River or Stream

Land Cover Categories

- Barren or Sparsely Vegetated
- Bottomland
- Bottomland Forest
- Cropland
- Disturbance/Successional Grassland
- Open Water
- Cliff/Talus Complex
- Forest or Woodland
- Glade/Woodland Complex
- Grassland and Shrubland
- Prairie and Savanna
- Successional Forest and Shrubland
- Urban
- Wetlands

N

0 0.5 1 2 Miles

Sources: Missouri Resource Assessment Partnership, East-West Gateway Council of Governments
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Appendix L

Proposed Projects from
Missouri State Parks

STORM WATER MANAGEMENT
PROPOSED PROJECTS FOR
MISSOURI STATE PARKS
2011
Division of State Parks, Missouri Department of Natural Resources

Meramec State Park

- Design and construct bank stabilization structures (hard and vegetative) at boat launch; day use areas; campground
- Design and construct new boat launches
- Design and construct no discharge wastewater system for park
- Install pervious paving; drainage structures and catch basins at boat launch parking area
- Replace turf grass and establish native grasses, trees and shrubs throughout the park as appropriate
- Replace vault toilets with composting toilets
- Install cisterns to catch rain water at park service area
- Install rain barrels at all structures- cabins, visitor center, shelters etc.
- Research and develop education programs

Robertsville State Park

- Replace vault toilet with composting toilet to service the boat launch area
- Stabilize boat launch area with plantings and retaining structures
- Install pervious paving in parking areas near boat launch
- Replace turf grass and establish native grasses, trees and shrubs throughout the park as appropriate
- Install cisterns to catch rain water at park service area
- Install rain barrels at residence and shelter
- Research and develop education programs

Castlewood State Park

- Connect all facilities to sewer district
- Replace vault toilet with composting toilet
- Design and construct additional parking in day use/launch area utilizing pervious paving; installation of drainage structures and catch basins
- Replace turf grass and establish native grasses, trees and shrubs throughout the park as appropriate
- Design and construct new boat launch
- Install cistern to collect rain water at park service area
- Install rain barrels at residence and shelter
- Research and develop education programs

Rt. 66 State Park

- Install pervious paving at visitor center, day use and boat launch parking areas
- Design and construct bank stabilization structures (vegetation/hard) for boat launch and day use areas
- Establish native grasses, trees and shrubs throughout the park as appropriate
- Replace vault toilets with composting toilets
- Install rain barrels at visitor center and shelters
- Research and develop education programs

U.S. Environmental Protection Agency Region 7 through the Missouri Department of Natural Resources has provided partial funding for this project under the American Recovery and Reinvestment Act of 2009. Section 604(b) of the Clean Water Act.

Missouri Department of Natural Resources

Lower Meramec Watershed Partners supporting development of this project:

Missouri Department of Natural Resources

MISSOURI AMERICAN WATER

The Open Space Council for the St. Louis Region

Special thanks to other participating organizations and communities:

American Rivers
Audubon Society
Ducks Unlimited
Ecoworks Unlimited
Franklin County Public Works
Friends of LaBarque Creek
Great Rivers Greenway
Hellmuth & Bicknese Architects
Jefferson County Government
Meramec River Greenway
Meramec River Recreation Association
Missouri Botanical Garden – Shaw Nature Reserve
Missouri Coalition for the Environment
Missouri Department of Health
Missouri Smallmouth Alliance
Missouri Stream Team
Museum of Transportation
The Nature Conservancy of Missouri
Northern Ozark Rivers Partnership
Ozark Outdoors Riverfront Resort
Ozark Regional Land Trust
Pacific Ring Initiative
R. Barr Consulting
St. Louis County Municipal League
St. Louis County Parks and Recreation Department
St. Louis Earth Day
The Trust for Public Land
U.S. Fish and Wildlife Service
U.S. Forest Service
City of Ballwin
City of Ellisville
City of Eureka
City of Des Peres
City of Kirkwood
City of Manchester
City of Pacific
City of Valley Park
City of Wildwood

EAST-WEST GATEWAY
Council of Governments

Creating Solutions Across Jurisdictional Boundaries

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