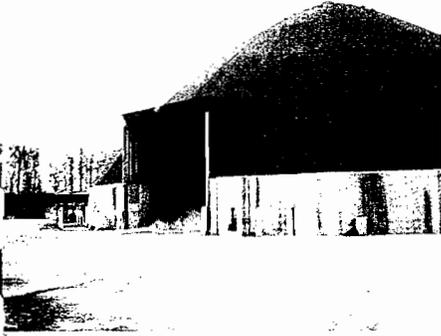
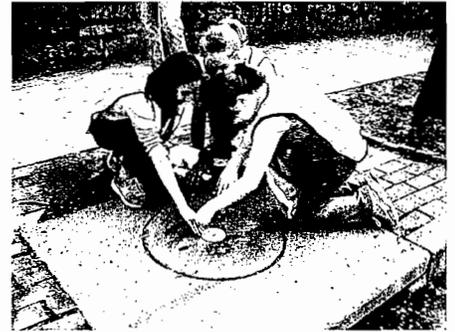


MUNICIPAL  
POLLUTION PREVENTION



WATER PROTECTION PROGRAM  
PUBLIC INVOLVEMENT



ST. LOUIS COUNTY  
PHASE II

STORM WATER MANAGEMENT PLAN

SECOND PERMIT TERM  
2008 - 2013



POST CONSTRUCTION  
MANAGEMENT



CONSTRUCTION  
SITE CONTROLS



ILLICIT DISCHARGE  
DETECTION

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# St. Louis County Phase II Storm Water Management Plan

## Prepared by

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Summer 2007



## Executive Summary

The Phase II Storm Water Regulations were promulgated to provide appropriate storm water management for political subdivisions in urbanized areas which were exempted under the 1990 (Phase I) regulations. Exemption of certain urbanized areas because of the size of the political subdivisions created so-called “donut holes” in the national storm water program. Appendix 6, *Governmental Entities Located Fully or Partially Within an Urbanized Area*, of the preamble to the USEPA’s December 8, 1999 rule listed nearly all of the political subdivisions in St. Louis County as entities requiring a Phase II NPDES Permit. The St. Louis metropolitan area may have been the largest “donut hole” in the nation because of combined sewers serving the City of St. Louis and the numerous small political subdivisions in St. Louis County.

Missouri’s Phase II Storm Water Regulations for small MS4s are contained in 10 CSR 20-6.200. The statute allows three permit options for small MS4 discharges: a general permit, a site specific permit, or a co-permittee option. It is emphasized in the regulations at (5)(C)1 that:

*“the department encourages cooperation between potential small MS4 applicants when addressing application requirements and in the development, implementation and enforcement of the six minimum measures under issued permits.”*

It is also stated that:

*“applicants within one urbanized area...should consider applying as co-applicants...to become co-permittees under an issued permit.”*

There is a “patchwork” of political jurisdictions in St. Louis County connected by shared streets and highways. Utilities are provided on a regional basis by both private and public entities. The Metropolitan St. Louis Sewer District (MSD) provides collection and treatment of wastewaters generated by residential, commercial and industrial activities. The MSD is also responsible for operation and maintenance of the separate storm sewer systems serving all of the municipalities in the St. Louis County area.

Many communities provide services such as trash pickup under private contract. Permitting each municipality separately under the Phase II Regulations did not seem appropriate or administratively feasible because of service overlap. The topography of the area suggested individual municipal permits with respect to storm water conveyance identification would be overly complex with possible jurisdictional disputes. Natural watercourses often leave one municipality, enter the jurisdictional boundaries of a second or third municipality and re-enter a portion of the first municipality. Individual municipal permits were not considered a viable means of insuring control of storm water pollutants to the maximum extent practicable.

St. Louis County storm water drains into three major watersheds: the Mississippi River, the Meramec River, and the Missouri River. All storm water runoff from the County ultimately enters the Mississippi River. The Mississippi River forms the eastern boundary of the southernmost and northernmost portions of the County with the remainder entering the western boundary of the City of St. Louis and its combined sewer system. The Meramec River generally forms the southern boundary of the County except for a portion in the west of the County where the border includes land south of the Meramec River that is drained by its tributaries. The Missouri River forms the northern boundary of the County. Many small tributaries located within the County feed into each of these three major rivers.

The Metropolitan St. Louis Sewer District (MSD) has been given the responsibility for providing adequate sewer and drainage facilities within its boundaries by its Charter (Plan). Under the Phase II Storm Water Regulations, MSD was recognized as the coordinating authority under the St. Louis Metropolitan Small MS4 Storm Water Permit, MO-R040005, issued by the Missouri Department of Natural Resources (MDNR) Water Pollution Control Program. Sixty additional co-permittees were named under the permit. Under the first permit term ending March 9, 2008, the first St. Louis County Phase II Storm Water Management Plan Fall 2002 has been implemented.

Public education activities have been implemented, including various methods such as printed materials, videos, internet, and presentations. During the first permit term, MSD has developed over nine different brochures and distributed over two million copies. The pollution prevention video and four infomercials were developed and aired over three thousand times. An internet web presence was developed, resulting in thousands of downloads. Finally, over 260 public presentations were given by MSD and its partners to educate the public. Public involvement and participation activities have increased significantly under all the programs. Household hazardous waste events have collected a total of 1,576 tons of hazardous waste. MSD and its community partners have held 33 clean up events, and placed 7500 storm drain markers on inlets. Under Minimum Control Measure (MCM) 3, MSD will have surveyed over 1120 stream miles to identify illegal discharges, walking all the named minor watersheds identified in the SWMP. Under MCM 4, the co-permittees will have a Phase II land disturbance program to control construction site runoff. Under post-construction storm water management, structural and non-structural BMPs are required throughout the plan area for all new development and redevelopment under MSD's new Rules and Regulations. Educational information on planning and zoning strategies to protect water quality have been distributed, and a baseline for implementation established. Under good housekeeping for municipal operations in MCM 6, a model operation and maintenance program has been developed and distributed to all co-permittees, and all co-permittees will have implemented the program.

This revision of the Storm Water Management Plan for the second permit term incorporates the implementation of the first Plan, and discusses ongoing and new goals for improving the effectiveness of the programs. The 2002 Plan will be maintained as a resource as much of the background information in the original Plan, which was helpful

for development and implementation of the programs, will not be duplicated. The Phase II Storm Water program is a regulatory issue that is conducive to forming partnerships to achieve a common goal. Therefore, the emphasis in this second plan will be to increase communication with the goal of improving partnerships and education.



## Table of Contents

CHAPTER 1	
Phase II Plan Coordination.....	1-1
A. Plan Coverage.....	1-1
B. Major Watersheds.....	1-3
C. Minor Watersheds.....	1-5
D. Permitting Strategy.....	1-6
E. Selection of a Coordinating Authority.....	1-7
F. Establishing a Planning Committee.....	1-7
G. Keeping the Community Informed.....	1-10
H. Plan Revisions.....	1-10
CHAPTER 2	
Demographics of the St. Louis Area.....	2-1
CHAPTER 3	
Water Quality in St. Louis County Streams.....	3-1
A. Missouri Water Quality Standards.....	3-1
B. Impaired Waters.....	3-4
C. USGS Water Quality Monitoring.....	3-4
D. Identification of Area Storm Water Pollution Problems/Sources.....	3-5
1. Wet Weather Flow Water Quality.....	3-7
2. Suspended Solids.....	3-8
3. Fecal Coliform.....	3-9
4. Chloride.....	3-10
5. Trash.....	3-10
6. Mercury.....	3-11
CHAPTER 4	
Public Education and Outreach (MCM 1).....	4-1
A. MS4 Permit Requirements.....	4-1
B. General Pollution Prevention Compliance Activities.....	4-1
C. Compliance Activities using Printed Material.....	4-2
D. Compliance Activities using Presentations.....	4-2
E. Compliance Activities using Other Media.....	4-2
F. Rationale for New Goals.....	4-3
CHAPTER 5	
Public Involvement and Participation (MCM 2).....	5-1
A. MS4 Permit Requirements.....	5-1
B. Public Involvement in Storm Water Plan Development.....	5-1
C. Public Participation Programs.....	5-2
D. Pet Owner Responsibilities.....	5-2
E. Rationale for New Goals.....	5-3
CHAPTER 6	
Illicit Discharge Detection and Elimination (MCM 3).....	6-1
A. MS4 Permit Requirements.....	6-1
B. Identification of Storm System Components.....	6-2
C. Illicit Discharge Enforcement Mechanism.....	6-5
D. Illicit Discharge Detection/Elimination.....	6-7
E. Publicizing Hazards Associated With Illicit Discharges.....	6-8
F. Rationale for New Goals.....	6-9

CHAPTER 7	
Construction Site Storm Water Runoff Control (MCM 4) .....	7-1
A. MS4 Permit Requirements .....	7-1
B. Land Disturbance Requirements .....	7-1
C. Land Disturbance Activities .....	7-2
1. Metropolitan St. Louis Sewer District .....	7-2
2. St. Louis County .....	7-2
D. MDNR Land Disturbance Permit Requirements .....	7-3
E. Plan Area Land Disturbance Programs .....	7-5
1. St. Louis County .....	7-5
2. Municipalities .....	7-6
3. Other Entities .....	7-7
F. Rationale for New Goals .....	7-7

CHAPTER 8	
Post-Construction Storm Water Management in New Development and Redevelopment (MCM 5) .....	8-1
A. MS4 Permit Requirements .....	8-1
B. Program Intent .....	8-2
C. Best Management Practice Implementation .....	8-2
1. Metropolitan St. Louis Sewer District (MSD) .....	8-3
2. Planning and Zoning Authorities .....	8-4
3. Missouri Department of Transportation .....	8-5
D. Flood Control .....	8-5
E. Rationale for New Goals .....	8-7

CHAPTER 9	
Pollution Prevention/Good Housekeeping for Municipal Operations (MCM 6) .....	9-1
A. MS4 Permit Requirements .....	9-1
B. Storm Water Discharges Associated with Industrial Activity .....	9-2
C. Storm Water Conveyance Construction and O&M .....	9-2
D. Operation and Maintenance Program .....	9-4
E. Municipal Employee Training Program .....	9-9
F. Trash and Pet Waste Ordinances .....	9-10
G. Rationale for New Goals .....	9-10

CHAPTER 10	
Record Keeping and Reporting .....	10-1
A. MS4 Permit Requirements .....	10-1
B. Record Keeping .....	10-2
C. Reporting .....	10-3

CHAPTER 11	
BMP Goals, Measurements, and Responsibilities .....	11-1
A. Purpose .....	11-1
B. BMP Implementation Information .....	11-1
C. Effectiveness of BMPs .....	11-6

## APPENDICES

Appendix A3-1 USGS Storm Water Sampling  
Appendix A6-1 Storm Water Outlets  
Appendix A6-2 Outlet Map Index

# CHAPTER 1

## Phase II Plan Coordination

### A. Plan Coverage

The Metropolitan St. Louis Sewer District (MSD) is a regional sewer district, formed in 1954, under the provisions of Article 6, Section 30(a) of the Missouri constitution. Under these provisions, voters in the City of St. Louis and in the portion of St. Louis County roughly east of current Interstate 270, adopted a plan proposed by a board of freeholders. The size of the district was increased in 1977 through a voter-approved annexation of most of the rest of St. Louis County east of Highway 109. The boundaries of the MSD and land area covered by the MSD are shown in Figure 1.1.

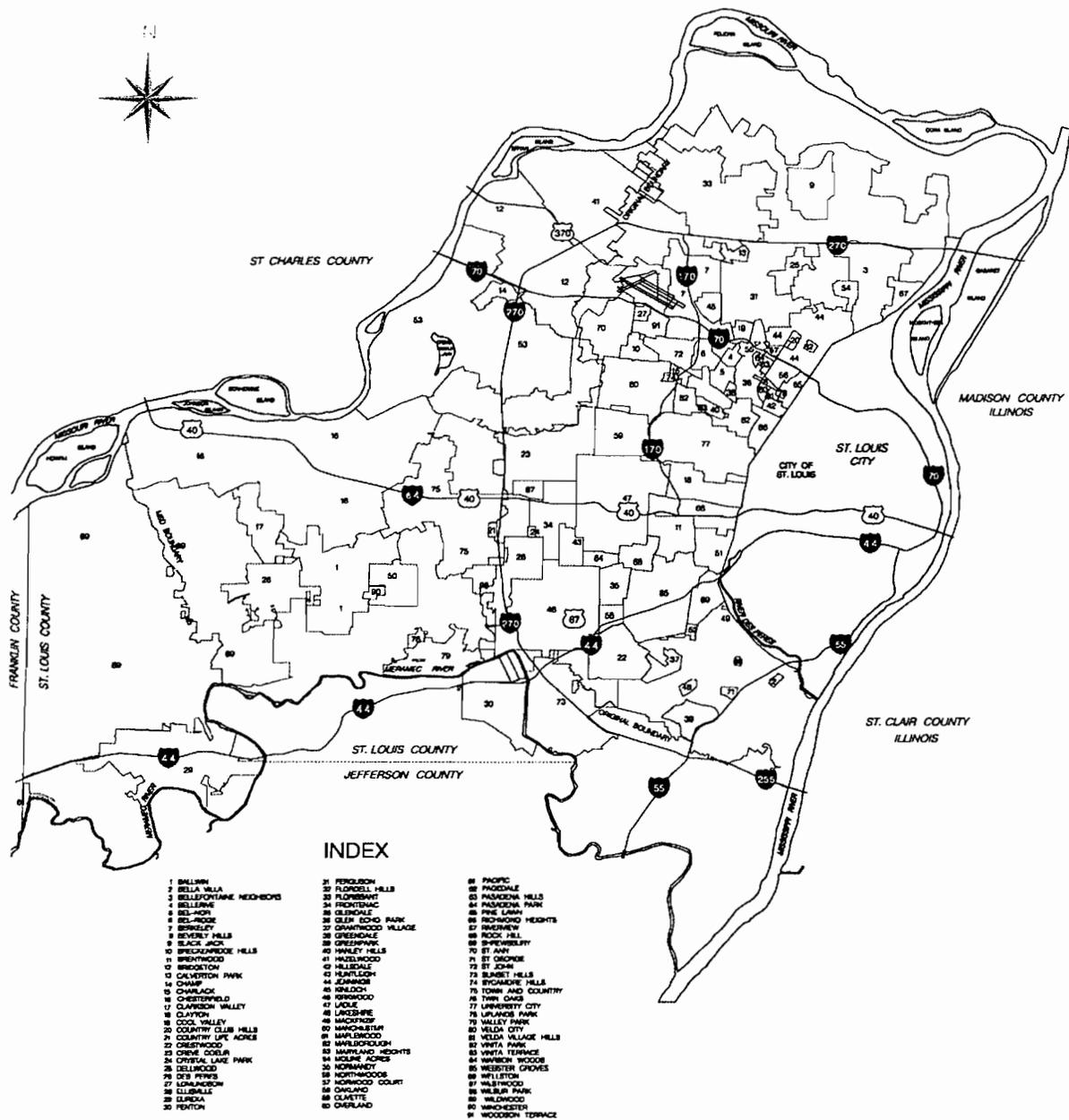
This Plan is intended to cover the portion of St. Louis County that is included within the Metropolitan St. Louis Sewer District boundaries, excluding those county municipalities which are served by combined sewers or have populations less than 1000. Of the 91 municipalities in St. Louis County, two municipalities, the City of Pacific and the City of Eureka, are located outside of MSD's service area. MSD's boundaries cover approximately 436 square miles, and will henceforth be referred to as the "Plan Area." Although there are 89 municipalities located within MSD's county service area, only 59 will be co-permittees under this Plan. Of the 89 municipalities, twelve are served by combined sewers and are, therefore, excluded pursuant to Section (1)(C)16.C of the Missouri storm water regulation 10 CSR 20-2.600. An additional 18 municipalities are exempt under the provisions of Section (1)(C)24.A of the regulation based on having populations less than 1000. These 18 municipalities can be viewed as "donut holes" within the overall Plan Area. While these communities will not be co-permittees, they will benefit from some of the activities proposed within this Plan. Figure 1.2 shows the St. Louis County municipalities and the City of St. Louis.

Of the 59 municipalities which will be co-permittees, 58 lie wholly within the Plan Area. About 61% of the City of Wildwood, on the western edge of the MSD boundary, lies outside the Plan Area, but it is anticipated that the city will apply all elements of this Plan to its entire corporate area. Likewise, St. Louis County will apply all elements of the Plan to its entire area of jurisdiction. MSD's western boundary may change slightly as small voluntary annexations occur. As new areas are annexed into the MSD service area, they will be fully covered by all elements of the Plan for which MSD and others have responsibility.

Figure 1.1 Map Showing MSD Boundaries



Figure 1.2 Locations of Incorporated Places in St. Louis County

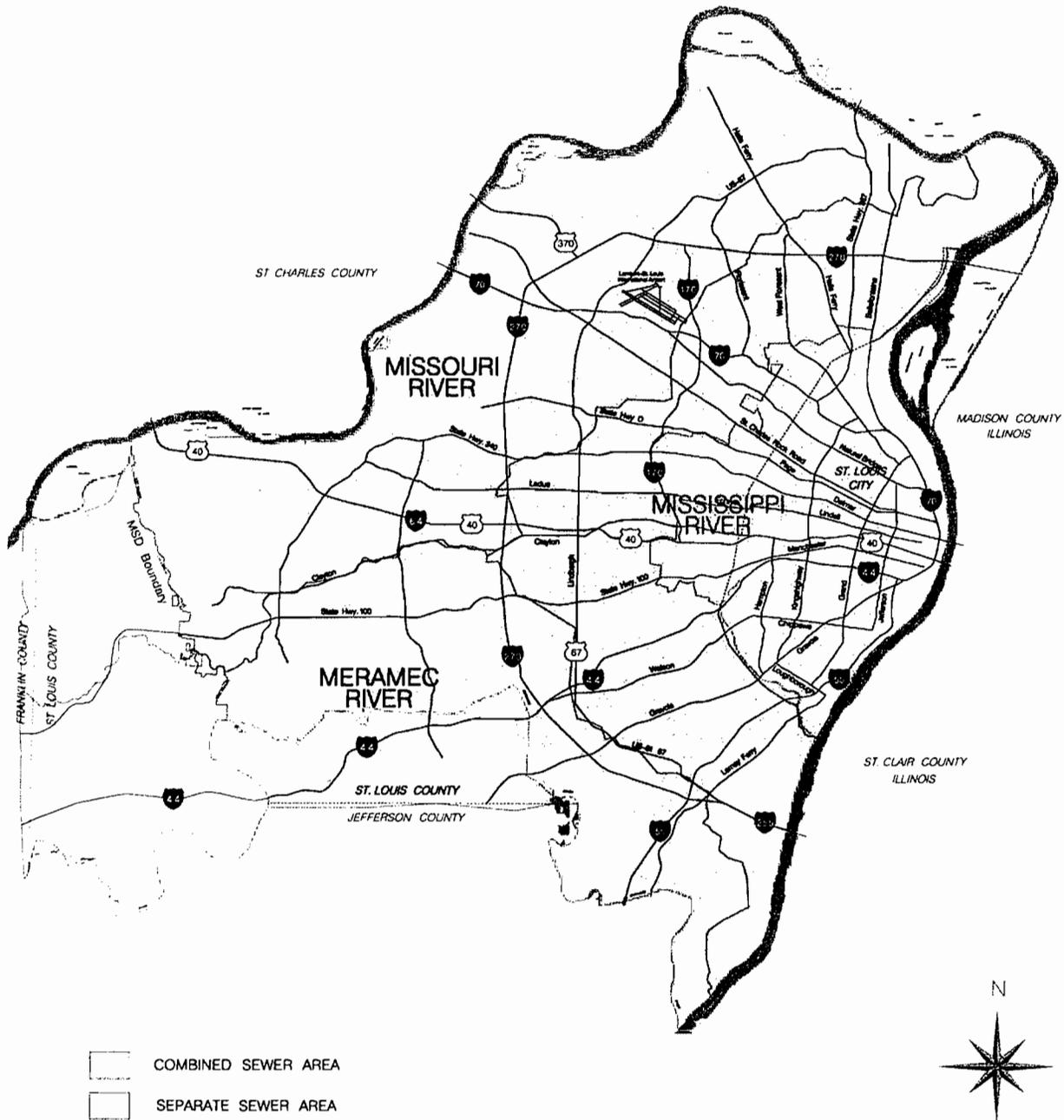


**B. Major Watersheds**

St. Louis County storm water drains into three major watersheds: the Mississippi River, the Meramec River, and the Missouri River as illustrated in Figure 1.3. All storm water runoff from the Plan Area ultimately enters the Mississippi River. The Mississippi River

forms the eastern boundary of the southernmost and northernmost portions of the Plan Area with the remainder of the Plan Area entering the western boundary of the City of St. Louis and its combined sewer system. The extent of the combined sewer area is also shown in Figure 1.3. The Meramec River, tributary to the Mississippi River to the south, forms the southern boundary of the Plan Area except for a portion of the Plan Area in which tributaries to the Meramec drain from the south to the north into the Meramec River. The Missouri River, tributary to the Mississippi on the north, forms the northern boundary of the Plan Area. Many small tributaries located within the Plan Area feed into each of these three major rivers.

Figure 1.3 Location of Combined Sewer Area





### **D. Permitting Strategy**

The State's Phase II Storm Water Regulations for small MS4s are contained in 10 CSR 20-6.200. The regulations allows three permit options for small MS4 discharges: a general permit, a site specific permit, or co-permittee option. It is emphasized in the regulations at (5)(C)1 that:

*“the department encourages cooperation between potential small MS4 applicants when addressing application requirements and in the development, implementation and enforcement of the six minimum measures under issued permits.”*

It is also stated that:

*“applicants within one urbanized area...should consider applying as co-applicants...to become co-permittees under an issued permit.”*

The Planning Committee agreed with the State's regulatory recommendations and has promoted utilization of the co-permittee option to encourage cooperation among municipal governments, and so that legal, financial and administrative responsibilities can be shared.

The 2002 Planning Committee decided to pursue one Phase II Storm Water Management Plan and one NPDES permit for the entire area of St. Louis County under MSD's jurisdiction. The topography of the area suggested individual municipal permits with respect to storm water conveyance identification would be overly complex with possible jurisdictional disputes. Natural watercourses often leave one municipality, enter the jurisdictional boundaries of a second or third municipality and re-enter a portion of the first municipality. Individual municipal permits were not considered a viable means of insuring control of storm water pollutants to the maximum extent practicable. The St. Louis County urbanized area is complex from a jurisdictional viewpoint.

The one plan and permit approach simplified the overall administration of the program and avoided many of the problems associated with permits issued on the basis of watersheds or the five MSD service areas. Each municipality is a co-permittee on one permit regardless of service area location. Best management practices selected will be applicable to all of St. Louis County and its municipalities. One storm water management plan with one annual reporting obligation has been developed. Cooperation is encouraged among all municipalities, regional authorities and state agencies in the development, implementation and enforcement of the plan provisions.

Each co-permittee has been assigned responsibilities related to their obligation to comply with the six Minimum Control Measures (MCM). For example, since the MSD already has responsibility to operate and maintain the separate storm sewer systems in the county, it has responsibility to comply with the requirements of MCM 3, Illicit Discharge Detection and Elimination. St. Louis County and the municipalities with their

land disturbance programs control pollution from land disturbance activities to comply with the requirements of MCM 4, Construction Site Storm Water Runoff Control. Because the MSD is the recognized continuing authority for sewer extensions within its jurisdictional boundaries and has plan review responsibilities for storm water control, it is responsible for best management practices in storm water facility design to comply with MCM 5, Post Construction Storm Water Management in New Development and Redevelopment. St. Louis County and the municipalities control the land use aspect of MCM 5. All co-permittees are responsible for complying with requirements under MCM 6, Pollution Prevention/Good Housekeeping for Municipal Operations. Public Education and Outreach (MCM 1) on storm water impacts and Public Involvement and Participation (MCM 2) can best be coordinated by the MSD with municipal support because of its various educational activities already in place and its policy to work with community groups in cleaning up streams impacted by pollution discharges.

Eighty-nine municipalities exist in the Plan Area. Eighteen of the municipalities are exempt from the Phase II Regulations because of populations less than 1,000. Twelve additional St. Louis County municipalities within the Plan Area are exempt because of combined sewer service. A complete list of municipalities within the Plan Area is provided in Table 1.1. The location of a listed municipality can be determined by using the "map reference number" included in the Table and the map of municipalities in Figure 1.3. The co-permittee list will remain the same for the second permit term because the census data has not been updated since the 2000 census.

### **E. Selection of a Coordinating Authority**

Under its charter, MSD has been given the responsibility for providing adequate sewer and drainage facilities within its boundaries. For the St. Louis County Plan Area, MSD is the obvious agency of choice to coordinate compliance activities associated with the Phase II Storm Water Regulations. However, the Phase II Regulations were specific in naming cities that must be issued permits under the program and must meet certain minimum control requirements related to municipal operations, e.g. vehicle maintenance, salt storage and street sweeping. The MSD has been recognized as the coordinating authority for development and implementation of the St. Louis Area Phase II Storm Water Management Plan by St. Louis County municipalities and the Missouri Department of Natural Resources.

### **F. Establishing a Planning Committee**

The second St. Louis Municipalities Phase II Storm Water Planning Committee was formed in December 2006 and held planning meetings once per month through June 2007 to evaluate best management practices, and make decisions regarding goals for the second permit term. Membership of the committee is identified at the beginning of this Plan (on page i), and includes a number of municipal representatives from small and large cities, and representatives from local and state agencies.

Table 1.1 Land Area and Population of Municipalities in MSDs Service Area

MUNICIPALITY	MAP	AREA**						2000	EXEMPTION
	REF*	TOTAL	BIS	CWC	LOM	MOR	RDP	POP	BASIS***
Ballwin	1	7.74			6.76	0.98		31283	
Bella Villa	2	0.13					0.13	687	Population
Bellefontaine Neighbors	3	4.36	4.36					11271	
Bellerive	4	0.34	0.34					254	Population
Bel-Nor	5	0.63	0.09				0.54	1598	
Bel-Ridge	6	0.78	0.78					3082	
Berkeley	7	4.96	1.73	3.23				10063	
Beverly Hills	8	0.10	0.10					603	Comb Sewer
Black Jack	9	2.61	0.75	1.86				6792	
Breckenridge Hills	10	0.80		0.80				4817	
Brentwood	11	1.95					1.95	7693	
Bridgeton	12	14.32		1.96		12.36		15550	
Calverton Park	13	0.42	0.15	0.27				1322	
Champ	14	0.80				0.80		12	Population
Charlack	15	0.27	0.27					1431	
Chesterfield	16	32.21			0.03	32.18		46802	
Clarkson Valley	17	2.73			0.02	2.71		2675	
Clayton	18	2.51					2.51	12825	
Cool Valley	19	0.46	0.46					1081	
Country Club Hills	20	0.17	0.17					1381	Comb Sew
Country Life Acres	21	0.12			0.02	0.03	0.07	81	Population
Crestwood	22	3.58					3.58	11863	
Creve Coeur	23	10.25				4.90	5.35	16500	
Crystal Lake Park	24	0.10					0.10	457	Population
Dellwood	25	1.03	1.03					5255	
Des Peres	26	4.29			2.75		1.54	8592	
Edmundson	27	0.27		0.27				840	Population
Ellisville	28	4.19			3.23	0.96		9104	
Fenton	30	6.35			6.35			4360	
Ferguson	31	6.17	6.03	0.14				22406	
Flordell Hills	32	0.12	0.12					931	Comb Sew
Florissant	33	11.42	0.20	10.39		0.83		50497	
Frontenac	34	2.89					2.89	3483	
Glendale	35	1.30					1.30	5767	
Glen Echo Park	36	0.03	0.03					166	Population
Grantwood Village	37	0.81					0.81	883	Population
Greendale	38	0.19					0.19	722	Population
Green Park	39	1.31					1.31	2666	
Hanley Hills	40	0.35					0.35	2124	
Hazelwood	41	15.04		5.71		9.33		26206	
Hillsdale	42	0.34	0.34					1477	Comb Sew
Huntleigh	43	0.98					0.98	323	Population
Jennings	44	3.77	3.77					15469	
Kinloch	45	0.72	0.61	0.11				449	Population
Kirkwood	46	9.19			5.43		3.76	27324	

\* In Figure 1.2 from St. Louis County Department of Planning, Research and Statics Division

\*\* Areas are in square miles

\*\*\* Municipalities exempt from Phase II requirements

Combined sewer systems, per 10 CSR 20-6.200(1)(C)16.C.

Populations less than 1000, per 10 CSR 20-6.200(1)(C)24A.

MUNICIPALITY	MAP	AREA**						2000	EXEMPTION
	REF*	TOTAL	BIS	CWC	LOM	MOR	RDP	POP	BASIS***
Ladue	47	8.55					8.55	8645	
Lakeshire	48	0.21					0.21	1375	
Mackenzie	49	0.02					0.02	137	Population
Manchester	50	5.00			5.00			19161	
Maplewood	51	1.56					1.56	9228	Comb Sew
Marlborough	52	0.24					0.24	2235	
Maryland Heights	53	22.09				22.09		25756	
Moline Acres	54	0.57	0.57					2662	
Normandy	55	1.86	1.52				0.34	5153	
Northwoods	56	0.67	0.67					4643	
Norwood Court	57	0.13	0.13					1061	
Oakland	58	0.61					0.61	1540	
Olivette	59	2.76					2.76	7438	
Overland	60	4.40	0.19	1.76		0.05	2.40	16838	
Pagedale	62	1.21	0.21				1.00	3616	
Pasadena Hills	63	0.21	0.21					1147	Comb Sew
Pasadena Park	64	0.30	0.30					489	Population
Pine Lawn	65	0.61	0.61					4204	Comb Sewer
Richmond Heights	66	2.29					2.29	9602	
Riverview	67	0.84	0.84					3146	
Rock Hill	68	1.10					1.10	4765	
St. Ann	69	3.15		2.73		0.42		13607	
St. George	70	0.18					0.18	1288	
St. John	71	1.43	1.03	0.39			0.01	6871	
Shrewsbury	72	1.44					1.44	6644	
Sunset Hills	73	9.04			7.83		1.21	8267	
Sycamore Hills	74	0.13	0.10	0.03				722	Population
Town & Country	75	11.55			3.45	6.63	1.47	10894	
Twin Oaks	76	0.26			0.26			362	Population
University City	77	5.88					5.88	37428	Comb Sew
Uplands Park	78	0.07	0.07					460	Comb Sew
Valley Park	79	3.16			3.16			6518	
Velda city	80	0.17	0.17					1616	Comb Sew
Velda Village Hills	81	0.12	0.12					1090	Comb Sew
Vinita Park	82	0.73	0.06				0.67	1924	
Vinita Terrace	83	0.06					0.06	292	Population
Warson Woods	84	0.57					0.57	1983	
Webster Groves	85	5.89					5.89	23230	
Wellston	86	0.93	0.31				0.62	2640	Comb Sew
Westwood	87	0.62					0.62	284	Population
Wilbur Park	88	0.06					0.06	475	Population
Wildwood	89	25.02			3.87	21.15		32884	
Winchester	90	0.25			0.25			1651	
Woodson Terrace	91	0.78		0.78				4189	
St. Louis County, Uninc	NA	158.54	26.43	26.08	71.01	9.99	25.03	326000	
<b>TOTALS</b>		<b>446.50</b>	<b>54.87</b>	<b>56.51</b>	<b>117.56</b>	<b>125.41</b>	<b>92.15</b>		

\* In Figure 1.2 from St. Louis County Department of Planning, Research and Statics Division

\*\* Areas are in square miles

\*\*\* Municipalities exempt from Phase II requirements

Combined sewer systems, per 10 CSR 20-6.200(1)(C)16.C.

Populations less than 1000, per 10 CSR 20-6.200(1)(C)24A.

## **G. Keeping the Community Informed**

To keep the community informed of Planning Committee activities and progress being made on developing this Plan, a monthly newsletter entitled the "Cloud Burst" was published by the Metropolitan St. Louis Sewer District's Division of Environmental Compliance. The newsletter was mailed to municipal officials and provided to other interested parties such as members of the East West Gateway Regional Water Resources Advisory Council. The newsletters were also posted to MSD's Phase II Storm Water internet page.

The East-West Gateway Coordinating Council has established a Regional Water Resources Advisory Council. The members of this Council represent a wide array of experience and commitment to solving environmental problems in the St. Louis Region, e.g. environmental advocacy groups, public officials, regulators, and community planners. With representative members of the Council on the Planning Committee and with two Phase II presentations provided, public input and participation was enabled in the development of a Phase II Storm Water Management Plan for the Plan Area.

Also, public presentations and distribution of forms for public comment were provided at the Earth Day symposium entitled, "Meeting of the Waters". Presentations were provided to two environmental groups that routinely participate in the activities of the Phase II Storm Water program, the River des Peres Watershed Coalition and the Open Space Council.

## **H. Plan Revisions**

This Phase II Storm Water Management Plan is written for submittal with the co-permittees' MS4 permit application in September 2007. Regulatory circumstances may change prior to the completion of this Plan in 2013. For example, if the Missouri 303(d) list of impaired streams is revised, Special Conditions in permit section 3.1 would become applicable. Also, once the 2010 census is taken, additional cities may need to be permitted and some cities may elect to terminate permit coverage. The new cities would need to be included in the Plan and goals established for them to implement the storm water management program. In both cases, MSD as the coordinating authority would need to consult with the MDNR, and revise the Phase II Storm Water Management Plan accordingly.

## CHAPTER 2

### Demographics of the St. Louis Area

A new tool is now available from the East West Gateway Council of Governments regarding demographics in the St. Louis Area that was not presented in the first Storm Water Management Plan. The Gateway Blueprint Model was developed in a partnership between the East-West Gateway Council of Governments and researchers at the University of Illinois Urbana-Champaign. The model makes use of land use forecasting methodology known as the Land Use Evolution and Assessment Model (LEAM). LEAM forecasts the probability of land use change for each quarter-acre patch of land in the region. There are about 20 million of these quarter-acre "cells" in the St. Louis region.

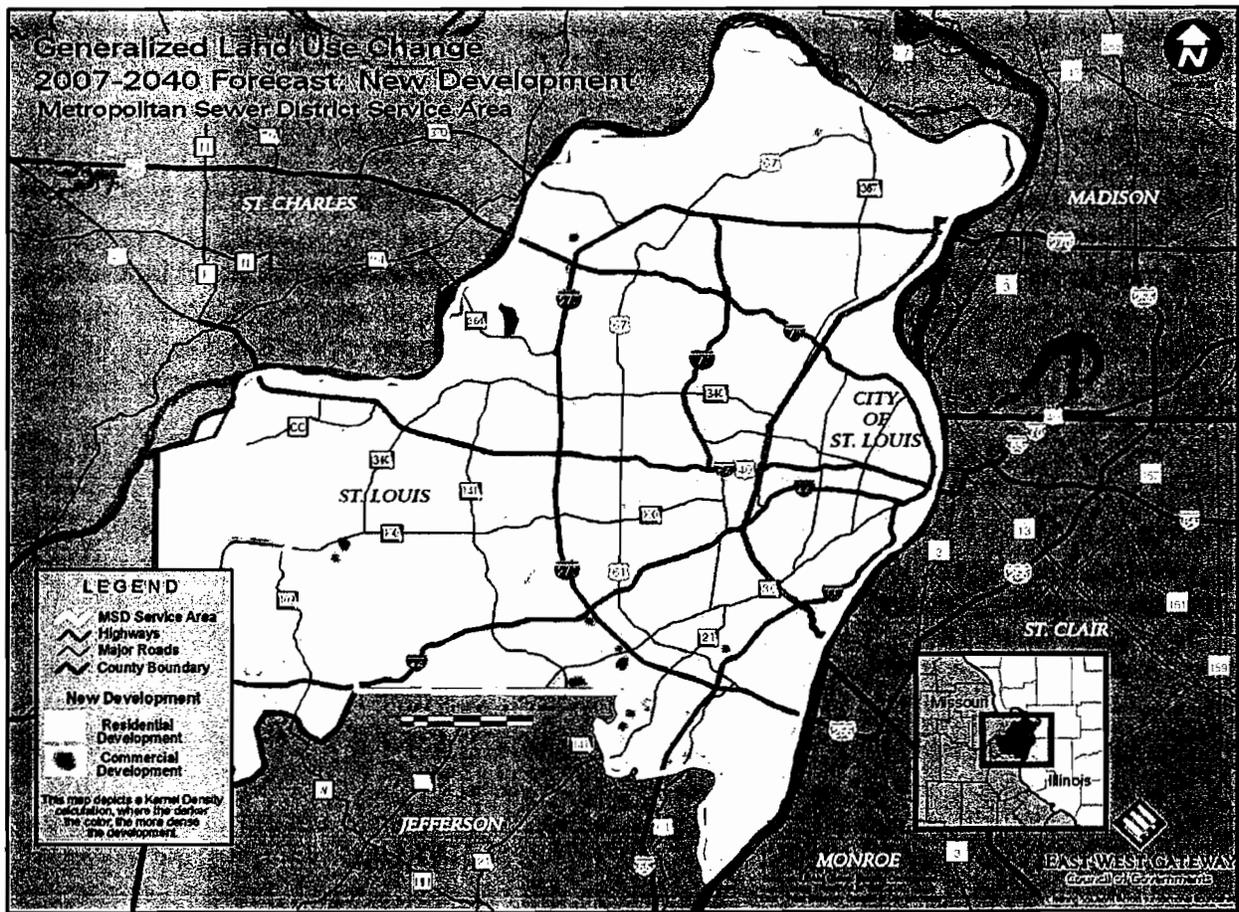
In LEAM, the probability of land use change for a given cell is a function of a variety of factors such as the availability of developable land, proximity to an interstate interchange, proximity to major intersections and proximity to employment centers. The Gateway Blueprint Model was developed by empirically deriving the statistical relationships between the "drivers" of land use change and observed patterns of development in the St. Louis region.

It is important to note that the Blueprint Model forecast is not a prediction of the future. Rather, the model shows likely outcomes associated with current policies relevant to land use, including foreseeable changes in the transportation system. The forecast information from this model will be relevant for co-permittees' planning and zoning authorities as they evaluate changes in their ordinances and policies, and consider the potential impact on water quality from land use changes.

Figure 2.1 shows areas of new residential and commercial development between 2007 and 2040, as forecast by the Gateway Blueprint Model. Red patches indicate new commercial development, while yellow shows new residential development. The areas most likely to see new development are in various areas throughout the plan area, but mainly in the west and southern portions of the area.

This forecast is broadly consistent with population forecasts prepared independently by the East-West Gateway Council of Governments. Figure 2.2 shows areas expected to experience increases in population between 2007 and 2040. As with the Gateway Blueprint forecast, high growth rates are expected in: Ballwin, Chesterfield, Creve Coeur, Ellisville, Fenton, Hazelwood, Manchester, Norwood Court, Sunset Hills, and Valley Park.

Figure 2.1 New Residential and Commercial Development Forecast



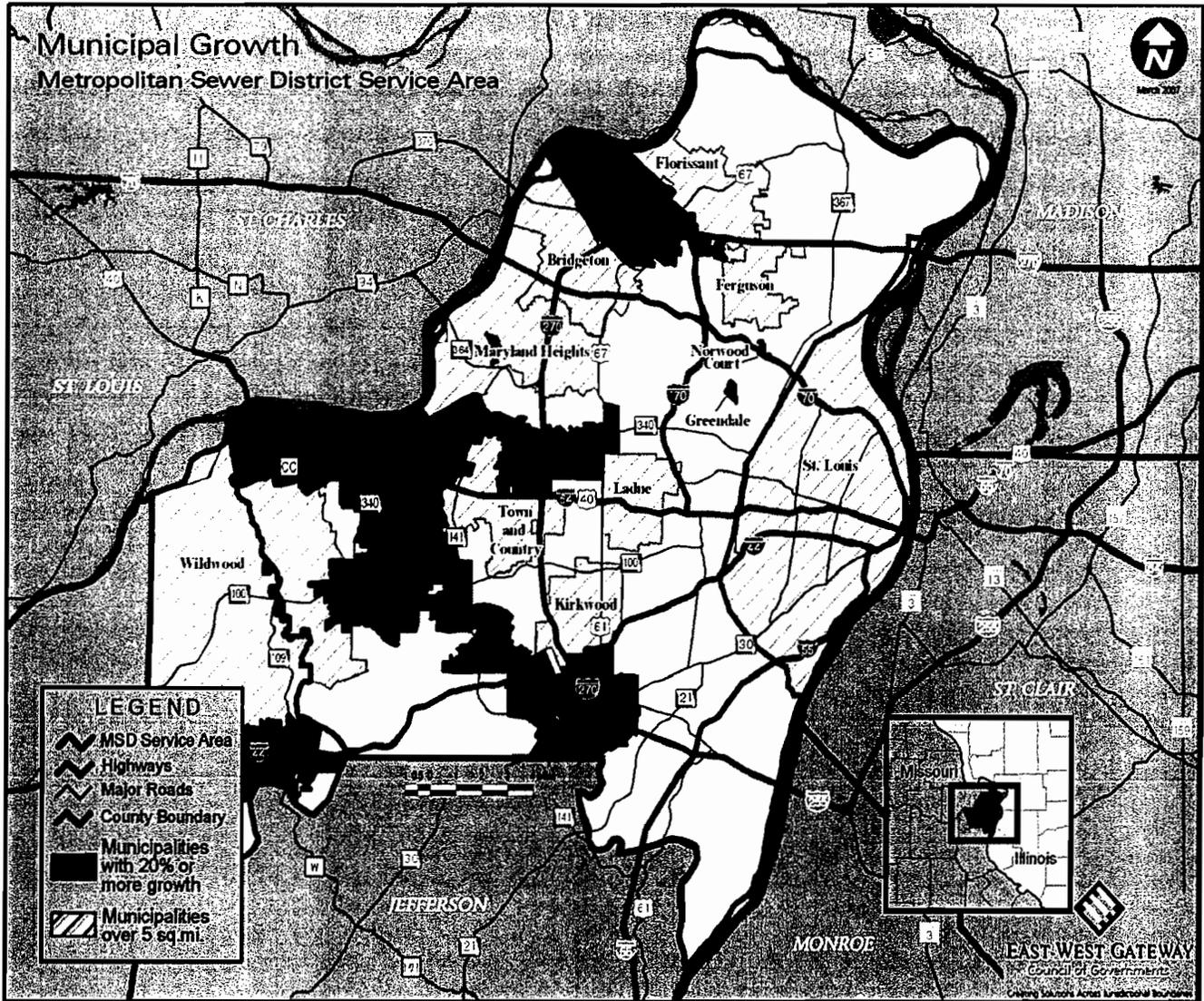
The new development forecasts from the Gateway Blueprint Model were overlaid with current parcels of undeveloped, commercial and vacant land to show areas likely to experience loss of open space in coming decades. Table 2.1 shows the acres of undeveloped land considered to be likely sites for residential and commercial development:

Table 2.1: Population and Land Use Change Forecasts, 2007-2035

Growth Area	Population Growth	New Residential	New Commercial
Wildwood	10,000	1,848 acres	137 acres
Chesterfield	<500*	953 acres	53 acres
Sunset Hills	2,700	683 acres	138 acres
South St. Louis Co.	13,000	2,037 acres	219 acres
North St. Louis Co.	12,000	966 acres	64 acres

\* The Model predicts new development in the western portion of the city, which is offset by population loss in the southeast portion of the city.

Source: East-West Gateway Council of Governments, Gateway Blueprint Model  
 Figure 2.2 Municipal Population Growth Forecast



The region's urban form is changing as the population sprawls outward from the urban core. The map in figure 2.3 shows how the urbanized area has expanded since 1950. The rate of land consumption has far outpaced the rate of population growth. According to US Census Bureau data compiled by East West Gateway, the urbanized area has grown by 286 percent between 1950 and 2000, while the population grew by only 40%. This has resulted in much lower density in recent development than in established urbanized areas previously developed. Despite the lower density development, the Plan Area is largely built out, and water quality has still been impacted, as discussed in the next chapter.



## CHAPTER 3

### Water Quality in St. Louis County Streams

#### A. Missouri Water Quality Standards

The water quality standards for Missouri waters are set forth in Missouri regulation 10 CSR 20-7.031. This regulation identifies various general categories of waters; establishes classifications and designates beneficial uses for some waters; establishes general water quality standards that must be met for all waters; and establishes specific water quality criteria that must be met for classified waters. The general categories of waters identified in the regulation include:

- Metropolitan No-Discharge
- Outstanding National Resource Waters
- Outstanding State Resource Waters
- Losing Streams
- Classified Streams and Classified Lakes
- Unclassified Streams and Unclassified Lakes
- Groundwater

There is overlap among these categories with some water bodies falling into more than one category. Except for Outstanding National and State Resource Waters, all of these categories are represented within the St. Louis County Plan Area. Unclassified lakes and streams make up the majority of water bodies in the Plan Area. Table 3.1 lists streams and lakes in the Plan Area and identifies the applicable category and classification information from the Missouri Water Quality Standards.

Section (3) of the regulation lists general criteria, which apply to all waters of the state at all times. These general criteria are referenced in Section 4.1.1.1 of Missouri's Small-MS4 permit as follows:

*The discharge of storm water shall not cause a violation of the state water quality standards, 10 CSR 20-7.031, which states, in part, that no water contaminant, by itself or in combination with other substances, shall prevent the waters of the state from meeting the following conditions:*

- a. Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses;*
- b. Waters shall be free from oil, scum and floating debris in sufficient amounts to be unsightly or prevent full maintenance of beneficial uses;*

- c. Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses;*
- d. Waters shall be free from substances or conditions in sufficient amounts to result in toxicity to human, animal or aquatic life;*
- e. There shall be no significant human health hazard from incidental contact with the water;*
- f. There shall be no acute toxicity to livestock or wildlife watering;*
- g. Waters shall be free from physical, chemical or hydrologic changes that would impair the natural biological community;*
- h. Waters shall be free from used tires, car bodies, appliances, demolition debris, used vehicles or equipment and solid waste as defined in Missouri's Solid waste Law, section 260.200, RSMo, except as the use of such materials is specifically permitted pursuant to section 260.200-260.247.*

Section (4) of the regulation establishes specific criteria for all classified waters of the state based on the designated uses for those waters.

Storm water permittee compliance with the Missouri Water Quality Standards is mandated in Section (5)(A) of Missouri's storm water regulation (10 CSR 20-6.200). This section states, in part:

*Applicants for permits for discharges from small MS4s must develop and submit descriptions of storm water management programs designed to reduce pollutants in storm water runoff to protect water quality of receiving waters.*

Subsequent sections of this Plan describe how the co-permittees will protect the quality of storm water runoff within the Plan Area.

Table 3.1 Water Bodies in the St. Louis County Phase II Plan Area  
That are Listed in the Missouri Water Quality Standards (10 CSR 20-7.031 as amended 12/31/05)

Water Body <sup>1</sup>	Location	Classification <sup>2</sup>		Designated Beneficial Uses <sup>3</sup>								Metro ND <sup>4</sup>	Losing <sup>5</sup>	MSD SA
	Mouth or Start of Segment	Class	Length	IR	LW	AQ	CF	WB	BT	DW	IN	Length	Length	
Mississippi River	Ohio River	P	195.5	°	°	°			°	°	°			6
Mississippi River	Dam #27	P	5.0	°	°	°		B	°	°	°			6
Meramec River	SW,NW,10,42N,6E	P	22.0		°	°		A	°	°	°			LOM
Meramec River	Hwy 141	P	26.0		°	°	°	A	°	°	°			LOM
Bee Tree Lake	NW,NE,3,42N,6E	L3	9 ac		°	°		B	°					LOM
Mattese Creek	NE,NW,22,43N,6E	P	0.9		°	°		B						LOM
Fenton Creek	35,43N,05E	P	0.5		°	°		B						LOM
Grand Glaize Creek	SW,NE,16,44N,5E	C	4.0		°	°		B				All		LOM
Fishpot Creek	SE,SE,18,44N,5E	P	2.0		°	°		B				All		LOM
Fishpot Creek	13,44N,4E												5.0	LOM
Un-named Tributary	NW,NW,NW,13,44N,4E												2.0	LOM
Williams Creek	SE,SE,13,44N,4E	P	1.0		°	°		B						LOM
Kiefer Creek	SE,SE,14,44N,4E	P	0.5		°	°		B						LOM
Kiefer Creek	NW,SE,SE,14,44N,4E												3.0	LOM
Un-named Tributary	NW,SW,NE,9,44N,4E												1.0	LOM
Hamilton Creek <sup>7</sup>	14,44N,3E												0.5	LOM
Un-named Tributary <sup>7</sup>	SE,SE,NE,14,44N,3E												1.0	LOM
Antire Creek	SE,SE,32,44N,4E	P	1.5		°	°		B					0.2	LOM
Un-named Tributary	NW,NW,SE,24,43N,6E													LOM
River des Peres	NE,SW,20,44N,7E	P	1.5		°	°								RDP
River des Peres	NW,SE,17,44N,6E	C	1.0		°	°								RDP
Gravois Creek	NW,SE,17,44N,6E	P	2.0		°	°		B				All		RDP
Gravois Creek	24,44N,6E	C	4.0		°	°		B						RDP
Maline Creek	SE,NW,15,46N,7E	C	1.0		°	°								BIS
Watkins Creek	SW,NE,36,47N,7E	C	3.5		°	°		B						BIS
Missouri River	47N,8E	P	100	°	°	°		B	°	°	°			6
Sunfish Lake	23,47N,7E	L3	34		°	°		B	°					BIS
Coldwater Creek	SW,NW,10,47N,7E	C	5.5		°	°		B			°	All		CWC
Fee Fee Creek (old)	SE,SE,29,46N,5E	P	1.0		°	°		B						MOR
Creve Coeur Creek (Below lake)	NE,NE,7,46N,5E	P	3.0		°	°		B						MOR
Fee Fee Creek (new)	SW,SW,8,46N,5E	P	1.5		°	°		B				All		MOR
-Creve Coeur Lake	20,46N,5E	L3	300 ac		°	°		B	°			All		MOR
-Creve Coeur Creek (Above lake)	SW,SW,20,46N,5E	C	2.0		°	°		B				All		MOR
Bonhomme Creek	NW,NE,4,45N,4E	C	2.0		°	°		B						MOR
Bonhomme Creek <sup>8</sup>	SE,SW,NE,2,44N,3E												0.7	MOR
Caulks Creek	NE,NE,SW,31,45N,4E												0.5	MOR
Caulks Creek	NE,SE,SE,13,45N,3E												3.0	MOR
Un-named Tributary	NW,SE,SW,30,45N,4E												1.0	MOR

<sup>1</sup> Water Bodies are arranged in ascending order from the lowest point in the Plan Area. An indented water body is tributary to the one above it. All stream lengths are in miles.

<sup>2</sup> Classified Waters Classifications:

L3 Private and public lakes other than major reservoirs and other than lakes used primarily for water supply.

P Streams that maintain permanent flow even in drought periods.

C Streams that may cease flow in dry periods but maintain permanent pools that support aquatic life.

<sup>3</sup> Beneficial Uses:

IR = Irrigation; LW = Livestock & wildlife watering; AQ = Protection of warm water aquatic life and human health--fish consumption;

CF = Cool water fishery; WB = Whole body contact recreation (class A or B); BT = Boating & canoeing; DW = Drinking water supply;

IN = Industry.

<sup>4</sup> Metropolitan No-Discharge Streams:

These streams may only receive uncontaminated cooling water, permitted storm water discharges and wet weather bypasses that do not interfere with beneficial uses. The no-discharge condition applies to the entire watershed of the stream, including all tributaries.

<sup>5</sup> Losing Streams: Streams that lose a significant portion of their flow during low-flow conditions via permeable geologic materials into aquifers.

<sup>6</sup> Parts of the Mississippi River are included in the BIS, RDP and LOM service areas. Parts of the Missouri River, in the BIS, CWC and MOR.

<sup>7</sup> The main stem of Hamilton Creek is outside the Plan Area. However, the upper reach of the losing tributary is within the Plan Area.

<sup>8</sup> The losing upper reach of Bonhomme Creek is outside the Plan Area. However, parts of the Plan Area drain to this reach.

## **B. Impaired Waters**

Section 303(d) of the federal Clean Water Act requires states to identify water bodies that cannot meet water quality standards after applying the existing regulations. For waters on this list (impaired waters), a plan must be developed to fix the problem. Such plans will include a Total Maximum Daily Load (TMDL) calculation of the maximum amount of a pollutant a water body can absorb without being impaired.

Section 3.1 of Missouri's Small-MS4 permit imposes additional requirements on permittees who have discharges which "significantly" contribute to 303(d) water bodies. This section requires a permittee, having storm water discharges upstream from an impaired water body, to determine whether those discharges are significantly contributing directly or indirectly to the impaired water body and to further identify any TMDL approved for that water body. If the permittee determines that it is significantly contributing to the impaired water body, the permittee must include, within its storm water management plan, steps to control the pollutants of concern and to ensure that the permittee's discharges do not cause or contribute to instream exceedances of the water quality standards. If a TMDL has been approved the permittee must include provisions within its program to ensure that all requirements of the TMDL will be met.

Grand Glaize Creek is the only stream, located within the Plan Area, that is listed on Missouri's 2002 303(d) list. It is listed based on the levels of mercury in fish tissue. As a result of this listing and the Missouri fish consumption advisories, mercury is a pollutant of concern under this Plan. The main source of the mercury has been identified as atmospheric deposition. It should be noted that Grand Glaize Creek is not unique in exhibiting a mercury problem. Increasing mercury levels have been found in fish statewide and the Missouri Department of Health and Senior Services currently has an advisory against consumption of certain fish from all Missouri waters due to mercury contamination. In Missouri's 2004/2006 proposed 303(d) list, the mercury impairment on Grand Glaize Creek is proposed to be removed.

Early in 2007, MDNR's 2004/2006 Proposed Missouri 303(d) list contained seven streams listed as impaired for chloride and/or bacteria. As discussed in the Permit Year 3 Annual Report and regardless of final actions on the list, the proposed listing was deemed significant enough to identify chloride as an additional pollutant of particular concern under this Plan. Bacteria was previously identified as a pollutant of concern in the 2002 Plan. To date, no TMDLs have been developed for any pollutants in the Plan Area.

## **C. USGS Water Quality Monitoring**

Since 1996, the MSD has had a joint funding agreement with the U.S. Department of the Interior U.S. Geological Survey (USGS) for water resources investigations in St. Louis County. Under past agreements, the USGS monitored 35 stream gauging stations of which 20 were also water quality stations within the county portion of the MSD service area. The locations of these stations are shown in Figure 3.1. Flow data are retrieved monthly from the gauging stations. Since 2005, only five water quality

stations have been funded by MSD to represent each of MSD's five watershed service areas. The streams (and USGS site number) are: Coldwater Creek (06936475), Creve Coeur Creek (06935890), Grand Glaize Creek (07019185), Maline Creek (07005000), and River des Peres (07010022). Water quality samples are collected four times per year from the water quality stations during base flow conditions and twice per year for rainfall events occurring in the spring and fall. Only wet weather samples were evaluated in the data comparison to represent water quality and identify pollutants in storm water runoff, rather than including dry weather samples that represent ambient stream water quality. Rainfall event sampling occurs during the first flush flow condition in the stream. Data, for the period 1997 through 2005, are available for storm event sampling at 17 of these stations, and recent data are shown in Appendix A3-1. The intent of this sampling was to gather baseline data to be used for a variety of purposes, one of which was to evaluate progress under the Phase II Storm Water Regulations. Evaluation of the data for this purpose will be discussed below.

#### **D. Identification of Area Storm Water Pollution Problems/Sources**

The data resulting from the USGS sampling efforts and MDNR's 303(d) listing process described above were reviewed to identify specific concerns that would need to be addressed in the implementation of the Phase II Storm Water Management Plan. Table 3.2 provides a simple comparison of the pollutant levels detected during wet weather sampling events versus the level listed for the pollutant in the water quality standards. The analysis does not attempt to duplicate the detailed methodology and 303(d) listing process conducted by MDNR under the water quality regulations.

Figure 3.1 Sampling Stations

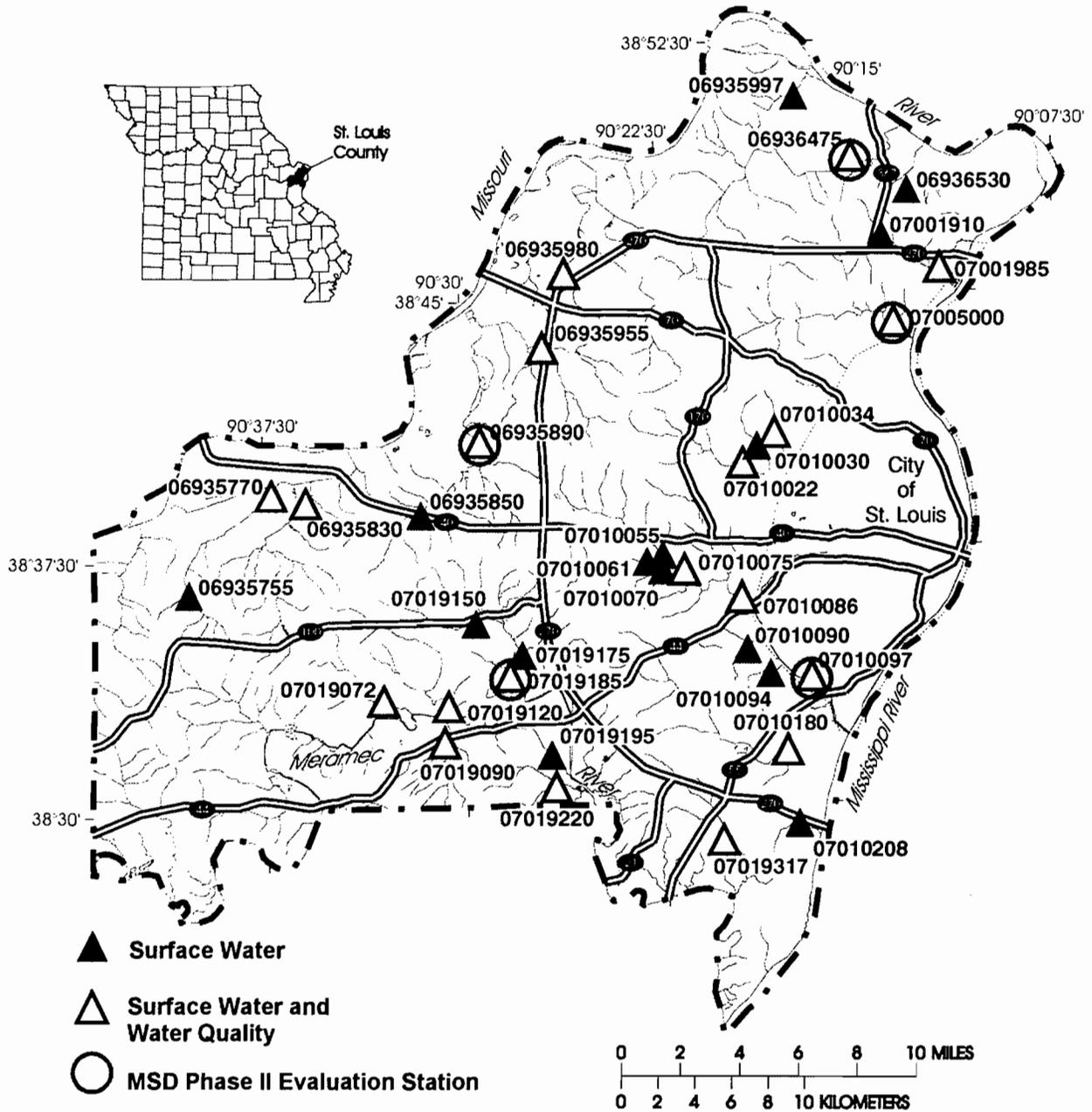


Table 3.2 Water Quality Analysis for the St. Louis County Phase II Plan Area During Storm Events

PARAMETER	USGS Sampling Results (All Samples)					USGS Sampling Results (Since 2003)				
	Total Samples	Exceeds Level in WQS				Total Samples	Exceeds Level in WQS			
		Acute		Chronic			Acute		Chronic	
		No.	%	No.	%	No.	%	No.	%	
pH	*					*				
Temperature	*					*				
Dissolved Oxygen	235			7	3.0	63			0	0.0
Fecal Coliform	183			183	100.0	52			52	100.0
Fecal Streptococci	*									
Total Nitrogen as N	*									
Total Kjeldahl Nitrogen as N	*									
Ammonia as N	230	0	0.0	2	0.9	64			0	0.0
Total Phosphorous as P	*									
Total Phosphate as PO <sub>4</sub>	*									
Hardness as CaCO <sub>3</sub>	*									
Chemical Oxygen Demand	*									
Total Dissolved Solids	*									
Total Suspended Solids	*									
Oil and Grease	154			5	3.2	54			3	5.6
Chloride	1	0	0.0	0	0.0					
Aluminum, dissolved	233	22	9.4			64	2	3.1		
Arsenic, dissolved	234			0	0.0	64			0	0.0
Beryllium, dissolved	233			0	0.0	64			0	0.0
Cadmium, dissolved	234	0	0.0	12	5.1	64	0	0.0	0	0.0
Chromium, dissolved	234	0	0.0	0	0.0	64	0	0.0	0	0.0
Copper, dissolved	234	1	0.4	10	4.2	64	0	0.0	0	0.0
Iron, dissolved	234			14	6.0	64			2	3.1
Lead, dissolved	234	1	0.4	28	12.0	64	0	0.0	2	3.1
Manganese, dissolved	*					*				
Mercury, total recoverable	234	0	0.0	1	0.4	64	0	0.0	0	0.0
Nickel, dissolved	234	0	0.0	0	0.0	64	0	0.0	0	0.0
Selenium, dissolved	234			0	0.0	64			0	0.0
Silver, dissolved	234	0	0.0			64	0	0.0		
Zinc, dissolved	234	9	3.8	15	6.4	64	0	0.0	0	0.0

KEY: USGS Results are for samples collected during the first-flush flow condition in the stream.

\* - Samples are typically also analyzed for these parameters. If the acute or chronic columns are empty for a parameter, for which samples have been collected, it means Missouri has no relevant acute and/or chronic Water Quality Standard for that parameter.

Individual sample results are contained in [Appendix A3-1](#).

The compliance status for some key pollutants is discussed in the following paragraphs.

### 1. Wet Weather Flow Water Quality

The water quality analysis of data in Table 3.2 shows the number of samples from wet weather stream sampling that contain levels of pollutants above the comparable level listed in the water quality standards. With the exception of lead and fecal coliform, all the parameters analyzed were less than the level in the water quality criteria over 90% of the time. The exceedances occurred at widely scattered locations and times, indicating that they are isolated events unrelated to a specific source. However, lead and fecal coliform exceeded the level in the water quality criteria 12 percent and 100 percent of the time, respectively.

Twenty-eight of the samples contained lead over the criterion in the water quality standards. However, seventy-five percent of these samples came from Fishpot, Kiefer, and River des Peres watersheds during the period of 1999 through 2001. These watersheds were compared to more stringent criteria than the other streams since they have lower average hardness than other streams in the area. Water quality criteria for lead are hardness dependent, therefore, the low hardness results in a lower numeric criteria. Since 2002, only two of the samples contained elevated lead, therefore, specifically targeting lead as a pollutant of concern under this Plan is not deemed warranted at this time.

Fecal coliform exceeded the criterion in the water quality standards one hundred percent of the time. The level of fecal coliform bacteria is elevated in all twenty of the sampled watersheds and during all periods of wet weather sampling. Therefore, fecal coliform is identified as a pollutant of particular concern under this Plan.

While the bulk of the data, described above, shows a high level of compliance with the water quality standards during storm events, the previous discussion as well as visual observations of streams and land areas indicate there is a need for emphasis on addressing certain water quality concerns in the Plan Area. These concerns include:

- Elevated levels of Suspended Solids;
- Elevated levels of Fecal Coliform;
- Elevated levels of Chloride;
- Floating Debris/Trash;
- Mercury in Fish Tissue;

This plan includes Best Management Practices (BMPs) to address all potential sources of pollutants in storm water as required by the federal and state regulations. Additional emphasis was placed on identifying BMPs which address the major problems identified above. Following is a discussion of each of the major pollutants of concern.

## **2. Suspended Solids**

The Missouri Water Quality Standards do not contain numerical criterion for suspended solids. However, the general criteria, as enumerated above, require that waters be free from substances that cause unsightly or harmful bottom deposits, unsightly color or turbidity or prevent full maintenance of uses. Suspended solids in excessive amounts can contribute to all of these water quality problems. A particular cause is sediment discharged from land areas disturbed by construction activities including but not limited to subdivisions, shopping centers, and road projects. Excessive stream velocities influenced by impervious areas can erode stream banks and beds adding to suspended solids.

The USGS storm event sampling data includes results of Total Suspended Solids (TSS) analyses. As previously noted, the USGS sampling effort involves base flow sampling as well as storm event sampling. Base flow TSS levels are generally in the single to low double digit figures while storm event (first flush) results range from ten to two-hundred

times the base flow levels. The results show considerable variation in TSS levels from storm to storm at the same station. There is no apparent, direct correlation based on stream flows or storm intensity at the time of sampling.

Field observations of streams after storm events have noted deposition of sediments downstream from land disturbance sites. Runoff from the highly developed, and therefore more impervious county areas, coupled with stream channelization in those areas also promotes greater erosion of stream banks, which contributes to elevated solids levels.

Land disturbance site problems have been addressed through enactment of appropriate ordinances in implementing MCM 4 requirements as described in the 2002 Plan with adequate enforcement and through increased public education as discussed in other sections of this Plan. In comparing overall average TSS concentrations at the 17 water quality stations with data since 2003, the area streams recently had lower TSS levels overall as 12 of the streams had lower concentrations, two about the same and three had higher TSS concentrations. However, ten of the streams with lower concentrations of TSS also had lower average stream flow, which may broadly account for the reduction in TSS.

### **3. Fecal Coliform**

The Missouri Water Quality Standards currently set a fecal coliform criterion of 200 colonies/100 mL during the recreational season (April - October) for streams and lakes designated for class A whole body contact recreational use. The Water Quality Standards also recently added *E. coli* bacteria criteria of 126 colonies/100 mL for class A whole body contact recreational use and 548 colonies/100 mL for class B whole body contact recreational use. Since the *E. coli* criteria are new, past data analysis did not evaluate this pollutant. Except for the Meramec River, no water bodies in St. Louis County currently are classified for class A whole body contact recreation. Nearly all the other water bodies are classified for class B whole body contact recreation, for which a fecal coliform standard does not exist.

EPA's Nationwide Urban Runoff Program (NURP) study found high levels of fecal coliform in urban runoff and concluded that levels can be expected to exceed water quality criteria during and immediately after storm events in many surface waters, even those providing high degrees of dilution. As shown in Appendices A3-1, fecal coliform levels, at the St. Louis County sampling stations, during periods of storm water runoff typically exceed the recreational-use standard by several orders of magnitude. Other studies have reported that primary sources of pathogens in urban storm water runoff are animal wastes (including pets), failing septic systems, illicit sewage connections and marine wastes. In recent years, the increasing use of DNA technology to identify specific sources appears to be strengthening the case for animal wastes being a more significant source of fecal coliform than previously thought. A review of the data indicates that a significant source of fecal coliform in the Plan Area streams is animal wastes.

As stated in EPA's BMP guidance information on pet waste collection for municipal operations, "According to recent research, nonhuman waste represents a significant source of bacterial contamination in urban watersheds. Genetic studies by Alderiso et al. (1996) and Trial et al. (1993) both concluded that 95% of fecal coliform found in urban storm water were of nonhuman origin."

The increasing evidence that wild and domestic animals are significant contributors to high levels of fecal coliform in storm water runoff adds to the difficulty of reducing this pollutant in water bodies. Fecal coliform from wild animals is somewhat beyond local governments' ability to control. On the other hand, BMPs that can be effective in reducing fecal coliform from domesticated animals, particularly household pets, can be instituted. Such BMPs typically include appropriate enforceable ordinances such as those listed in the model Operation and Maintenance program document (available on the MSD website) to comply with MCM 6 and public education as discussed in other sections of this Plan. With regard to reducing fecal coliform from human sources, MSD is working on a multiple decade, multiple billion dollar capital improvement program to improve the area's sanitary collection system in addition to implementing BMPs to address illicit discharges.

#### **4. Chloride**

The Missouri Water Quality Standards currently set a chloride chronic criterion of 230 mg/L for streams and lakes designated for protection of aquatic life. MDNR's analysis of the chloride concentrations for the 2004/2006 Proposed Missouri 303(d) list provided evidence for some level of concern regarding this nonpoint source pollutant.

Significant contributions of chloride to the water bodies is expected to be from snow and ice removal through the use of salt application on roads, parking lots and driveways. The higher chloride values observed during the winter months supports this conclusion. BMPs implemented under this Plan in Chapters 4 and 9 will increase awareness among co-permittees and the public about this problem.

#### **5. Trash**

One of the general criteria in the Missouri Water Quality Standards requires waters to be free from floating debris in sufficient amounts to be unsightly or prevent full maintenance of beneficial uses. Items discarded in or near streams can consist of anything from simple waste paper and plastics to used oil filters and toxic chemicals. Trash, discarded in a stream, can contribute to violations of any of the general criteria enumerated earlier.

Trash has been identified as a significant problem based on direct observations of streams, roadsides, and other areas including: residential, industrial, and commercial sites. Roadside litter and overflowing trash containers have been observed in many areas of the county. Trash containers at industrial and commercial sites are often either undersized or are not emptied frequently enough. Employees of such establishments, when faced with this situation, typically leave the lids open and stack additional trash well above the sides of the container or simply pile it on the ground next to the full

container. Much of this material ends up scattered about the landscape and is eventually blown or washed into nearby streams. It is not uncommon to see debris, from these and other sources, caught up in the branches of stream bank vegetation, carried in storm-swollen streams, or heaped in stream channels after storm-induced flows have subsided. These problems are being addressed through enactment of appropriate ordinances such as those listed in the model Operation and Maintenance program document to comply with MCM 6, with adequate enforcement and through increased public education and involvement as discussed in Chapter 4 and 5 of this Plan.

## **6. Mercury**

Mercury has been identified as a pollutant of concern under the Plan due to Missouri health advisories on fish consumption as a result of the high levels of mercury found in fish tissue. Despite the main source of mercury in fish tissue identified as resulting from atmospheric deposition, other sources of mercury in the environment result from mercury containing products that are improperly disposed. These products include household hazardous waste and electronic devices, which will be addressed along with the public education and public participation efforts related to trash.



## CHAPTER 4

### Public Education and Outreach (MCM 1)

#### **A. MS4 Permit Requirements**

Section 4.2.1.1 of the general MS4 permit requires the permittee to implement a public education program to distribute educational materials to the community or conduct equivalent outreach activities about the impacts of storm water discharges on water bodies and the steps that the public can take to reduce pollutants in storm water runoff.

Section 4.2.1.2 of the permit requires inclusion of the following elements in this program:

***Plans to inform individuals and households about the steps they can take to reduce storm water pollution;***

***Plans to inform individuals and groups on how to become involved in the storm water program (with activities such as local stream and beach restoration activities);***

***Identification of target audiences who are likely to have significant storm water impacts (including commercial, industrial and institutional entities);***

***Identification of the target pollutant sources the program is designed to address; and***

***An outreach strategy, including the mechanisms (e.g., printed brochures, newspapers, media, workshops, etc.) that will be used to reach the target audiences and the number of people this strategy is expected to reach.***

#### **B. General Pollution Prevention Compliance Activities**

The Metropolitan St. Louis Sewer District will have the overall responsibility for coordinating the public education and outreach efforts described in this Plan. Programs will include, but are not limited to, the distribution of educational materials and promotion of outreach activities. Programs will be implemented throughout the Plan Area to the maximum extent practicable using a variety of approaches, and will consider the various needs of the community.

Depending on the type of pollution contained in storm water runoff, the impact on natural watercourses can be cumulatively severe. It is readily recognized that runoff pollution is the major cause of water quality problems in most urban watersheds. It must also be recognized that each individual is personally responsible for the pollutants

in the runoff from his or her occupied land area. It is obvious that we can never meet our water quality goals for streams and lakes until we convince owners and land users to change behaviors and become better watershed stewards. Ordinary citizens must also be conscious of their responsibility for proper handling of trash, pet wastes, and other sources of pollution wherever they are located.

The basic implementation approach will be to seek out and form partnerships with municipalities, civic organizations, educational institutions and businesses to assure the water quality needs of the community are met. Education and information will address general pollution prevention goals plus specific pollution problems identified through previous field investigations as having a significant impact on Plan Area water quality, i.e., trash, animal waste, soil solids, chloride, and mercury. Where possible, the program design will utilize and promote the use of educational materials found to be effective previously or by other metropolitan areas, states, or organizations. Educational materials will offer options and alternatives for prevention and proper disposal of pollutants that could be discharged in storm water. Emphasis will be given to the economic importance and community benefits of pollution prevention, proper waste disposal, and resource management activities.

### **C. Compliance Activities using Printed Material**

MSD has developed, printed, and distributed nine different brochures dealing with various topics, and continues to distribute various brochures, fact sheets and booklets on an ongoing basis using established outlets.

### **D. Compliance Activities using Presentations**

MSD presents storm water quality educational information to grade school classrooms, plus various industry and community groups. Most of the classroom presentations involve the presentation of a nonpoint source pollution model. Booths at public events are another method MSD uses to present information to the public.

### **E. Compliance Activities using Other Media**

MSD continues to support the airing of the pollution prevention videos developed under the first plan on Charter cable. Video media will continue to be developed and aired. MSD will continue to maintain its internet Phase II web page.

The programs' distribution process will utilize several approaches to reach target audiences. A variety of mechanisms will continue to be used to deliver programs throughout the Plan Area, including websites, fact sheets, newsletters, utility bill inserts, speakers bureaus, brochures, school curricula, and seminars.

## **F. Rationale for New Goals**

Annual progress reports will be provided to document compliance with established goals and, for new initiatives, the specific activities associated with each year have been defined along with selected measurements as defined below. A successful outreach effort has been implemented as described in the 2002 Plan. MSD intends to continue the effective program efforts. Note that in addition to the efforts listed under MCM 1, MSD will undertake many educational efforts as part of the other control measures, as described elsewhere in this Plan.

MSD's experience and public comments indicate that MSD's efforts alone will not be the most effective at educating the public. MSD must use community and agency partnerships more effectively. In addition, to take advantage of the large amount of existing communication by the co-permittees and partners on various topics, a consistent message is needed to provide the connection of various waste issues with water quality impacts. A committee approach will be used to further improve the public education program.

### Annually

MSD will report the number of brochures and other educational materials distributed.

MSD will report the number of presentations given.

MSD will report the number of Phase II web page visits.

### Year 1

MSD will form a local or regional committee to develop an outreach strategy and implement a communication plan for water quality public education. The committee will include involvement from a number of co-permittees and partners from agencies, community groups, and others. A consistent message will be promoted over a variety of formats, such as municipal newsletters, partner newsletters, web pages, listserves, and media contacts. One product could be to write example newsletter articles to promote its publication by co-permittees and partners.

### Year 2

MSD will develop a radio public service announcement and distribute to radio stations for Phase II messages; for example, salt use on driveways and parking lots, pet waste, yard waste, or watershed awareness.

Year 3

MSD will distribute educational materials on a relevant topic throughout the District using bill inserts (distributed to all customers) or cable (distributed to all subscribing households) or other mass media.

Year 4

MSD will distribute educational materials on a relevant topic throughout the District using bill inserts (distributed to all customers) or cable (distributed to all subscribing households) or other mass media.

Year 5

MSD will distribute educational materials on a relevant topic throughout the District using bill inserts (distributed to all customers) or cable (distributed to all subscribing households) or other mass media.

To test the public's knowledge of storm water issues a questionnaire will be developed and a telephone survey conducted. The information will be used to analyze the impact of MSD's educational activities on making the public more aware of storm water quality issues and needs. Effective actions will be continued but subject matter may be revised and expanded.

## CHAPTER 5

### Public Involvement and Participation (MCM 2)

#### **A. MS4 Permit Requirements**

Section 4.2.2.1 of the general MS4 permit requires the permittee to implement a public involvement/participation program that complies with State and local public notice requirements.

Section 4.2.2.2 of the permit requires inclusion of the following elements in this program:

***Involvement of the public in the development and submittal of the permit application and storm water management program;***

***Plans to actively involve the public in the development and implementation of the public involvement/participation program;***

***Identification of the target audiences, including the types of ethnic and economic groups engaged;***

***Identification of the types of public involvement activities to be included with the following mandatory (where appropriate):***

- ***Citizen representatives on a storm water management panel***
- ***Public hearings***
- ***Working with citizen volunteers willing to educate others about the program***
- ***Volunteer monitoring or stream/beach clean-up activities***

#### **B. Public Involvement in Storm Water Plan Development**

As part of the Phase II Storm Water Management Planning process, MSD, on behalf of the Planning Committee, presented, on several occasions at public venues, the accomplishments of the Plan implementation and the proposed goals for the 2007 plan. Requests were made for comments and discussion. Many comments were considered and the proposed plans improved as a result.

For ongoing public involvement, the Metropolitan St. Louis Sewer District has the overall responsibility for coordination of the public participation and involvement activities described in this Plan. The St. Louis Metropolitan area benefits from a number of different environmental groups, stream teams, and other organizations concerned with various aspects of environmental protection. Under the 2002 Plan, efforts to

consolidate these groups into a new organization were not successful in serving the diverse interests of the many groups. Rather than duplicating and competing with existing membership organizations, MSD participates in a number of public environmental initiatives, involving watershed coalitions, partnerships, etc., upon request. These groups assist in promoting public awareness and serve as volunteers to participate in activities to reduce the impact of storm water pollution in the Plan Area.

As part of managing the storm water system, MSD utilizes a Rate Commission for addressing issues involving rates, and holds a number of public meetings, and through strategic planning initiatives, implements a Community Outreach program and builds relationships with stakeholders.

### **C. Public Participation Programs**

Citizens are encouraged to partner with MSD on a number of programs to educate the community or participate in clean-up projects to remove trash from area streams. The programs include:

Storm Drain Marking Program – This educational program involves working with groups to install four inch diameter plastic markers on storm drain inlets with the message, “No Dumping, Drains to Stream”. This is an ongoing communication at the source of discharge informing the public not to use storm drains for dumping waste. Educational outreach extends further when the groups use door hangers, as instructed, explaining the purpose of the markers to the community.

Stream Clean-ups – MSD partners with community groups in being an enabler to help them accomplish a successful stream clean-up effort. Depending on the group involved and the need, MSD has provided: trash disposal, glove and bag supplies, flyer printing, press release, volunteer labor, paid labor, and heavy equipment, such as trucks and tractors.

Nonpoint Source Pollution Education – A network of teachers and community group leaders help MSD educate the public on nonpoint source pollution. The main vehicle used is a nonpoint source pollution model with script provided by MSD.

Household Hazardous Waste Collection – St. Louis County Department of Health is responsible for engaging the public in participating in household hazardous waste & recyclables collection days. St. Louis County is developing a permanent dropoff program for household hazardous waste, evolving the program from periodic one-day events to permanent, fixed dropoff locations.

### **D. Pet Owner Responsibilities**

Fecal coliform levels in Plan Area watercourses have been found to be elevated, and animal sources contribute significantly. Groups that include pet owners, pet stores, veterinarians, humane societies, and members of the community were asked to help

address pet waste management, and continue ongoing distribution of public educational materials. Communities have addressed pet owner responsibilities in the development of ordinances or other enforcement mechanisms and means to ensure proper pet waste disposal.

### **E. Rationale for New Goals**

MSD has a storm water rate proposal that was supported by the Rate Commission to establish a storm water fee to fund basic and enhanced storm water services. Enhanced services are those that go beyond MSD's basic services in maintaining the public storm sewer system. If implemented as planned, up to five watershed advisory committees will be formed to provide public input on the enhanced services that will be provided by MSD. To support watershed management planning concepts, MSD will present information to these committees to address water quality related issues.

Based on MSD's experience in working with various groups on community and stream clean-up events, public participation activities will be enhanced through an intentional, coordinated clean-up effort involving all co-permittees.

Based on recommendations from the public, a rain garden, or rain barrel or similar program will be pursued to involve the public in reducing storm water runoff. Knowledgeable partners, good guidance and local expertise will be required. Partnerships will be pursued to make this program successful.

Specific goals for each year of the permit are presented as follows:

#### **Annually**

MSD will report on the number of volunteer presentations supported.

MSD will report on the number of storm drain marking projects supported.

MSD will report on the number of volunteer neighborhood and stream clean-ups supported.

St. Louis County will report on the amount of household hazardous waste collected.

#### **Year 1**

No new events planned.

Year 2

MSD will organize with partner organizations an annual Plan Area stream clean-up event. Each co-permittee will participate with the planned event, or participate in their own clean-up activity in the community. With success and commitment from partners, the event will become an annual event.

Year 3

If MSD's storm water rate proposal is adopted by the Board and the watershed advisory committees formed as proposed, MSD will present water quality related issues and activities to the watershed advisory committees for their consideration.

Year 4

MSD will develop a plan for implementation of a storm water management public involvement program to reduce the volume and/or rate of discharge of storm water generated from households, for example, a rain garden or rain barrel program.

Year 5

The storm water management public involvement program promotional and/or educational information will be developed and distributed to the public.

MSD, supported by citizen volunteers, will publish a report of their activities, including outcomes and recommendations for future volunteer activities.

## CHAPTER 6

### Illicit Discharge Detection and Elimination (MCM 3)

#### **A. MS4 Permit Requirements**

Section 4.2.3.1.1 of the general MS4 permit requires the permittee to develop, implement and enforce a program to detect and eliminate illicit discharges (as defined in 10 CSR 20-6.200) into the permittee's small MS4.

10 CSR 20-6.200(1)(C)7 defines an illicit discharge as "any discharge to a municipal separate storm sewer that is not composed entirely of storm water, except discharges pursuant to a state operating permit, other than storm water discharge permits and discharges from fire fighting activities."

The program must include development and implementation of, at a minimum:

***A storm sewer system map showing the locations of all outlets and the names and location of all waters of the State that receive discharges from those outlets;***

***An ordinance or other regulatory mechanism to effectively prohibit non-storm water discharges into the permittee's storm sewer system, with appropriate enforcement procedures and actions;***

***A plan to detect and address non-storm water discharges, including illegal dumping, to the permittee's system;***

***Methods to inform public employees, businesses and the general public of hazards associated with illegal discharges and improper disposal of waste;***

***Plans to address the thirteen categories of non-storm water discharges or flows, identified in Section 4.2.3.1.6 of the permit, only if the permittee identifies any of them as significant contributors of pollutants to the permittee's small MS4; and***

***A list, subject to the conditions in Section 4.2.3.1.7 of the permit, of other similar occasional incidental non-storm water discharges that the permittee has determined will not be addressed as illicit discharges.***

The Planning Committee has not identified any listed category of non-storm water discharge in Section 4.2.3.1.6 of the permit which significantly contributes pollutants to

St. Louis County water bodies. Should any of the listed categories or other similar occasional non-storm water discharges be found to contribute significant pollutants, action will be initiated to effectively prohibit or control such discharges using existing ordinance provisions and enforcement actions. The Planning Committee does not believe there is a need to develop a list of allowable incidental non-storm water discharges at this time. Under the existing program implementation, any incidental non-storm water discharge that is identified as a potential source of significant pollutants, appropriate local controls or conditions will be placed on such discharges.

## **B. Identification of Storm System Components**

For many years MSD has utilized "facilities maps" which show the location, size, depth, material of construction, and other useful information to identify sanitary sewers, combined sewers, storm sewers and their appurtenances. These maps are used by MSD staff engineers, maintenance personnel, private contractors, and others to "locate and tie into" for collection and transport of wastewater and/or storm water from commercial, industrial and residential properties.

Originally these facilities maps were sepia drawings that were copied and provided to users in an indexed paper format. All maps have now been digitized and are accessible in the office or field by computer. All MSD collection system maintenance personnel have lap top computers that contain the most up-to-date versions of these maps.

MSD uses Intergraph Corporation's Microstation GIS (graphical interface system) Environment (MGE) as the mapping software of choice. There are several advantages associated with this system.

MSD has facilitated the use of Windows NT 4.0 operating systems throughout its business offices because of its known reliability and security. Intergraph's MGE was the first to move to the Windows NT environment in 1994. Intergraph also had their developers work with other GIS vendors to encourage adoption of non-proprietary standards for use and exchange of spatial data formats. MSD also had much useful information spread through different areas that would be useful to share. Intergraph's MGE was a perfect choice because the tremendous amount of information could be combined and shared utilizing a single GIS. As an initial starting point MSD's GIS/Mapping department has the sole responsibility to maintain and update the future mapping layers onto a single server. Other departments needing this information can use Intergraph's GeoMedia software to capture, integrate, and maintain data from supported data sources into specific departmental key projects.

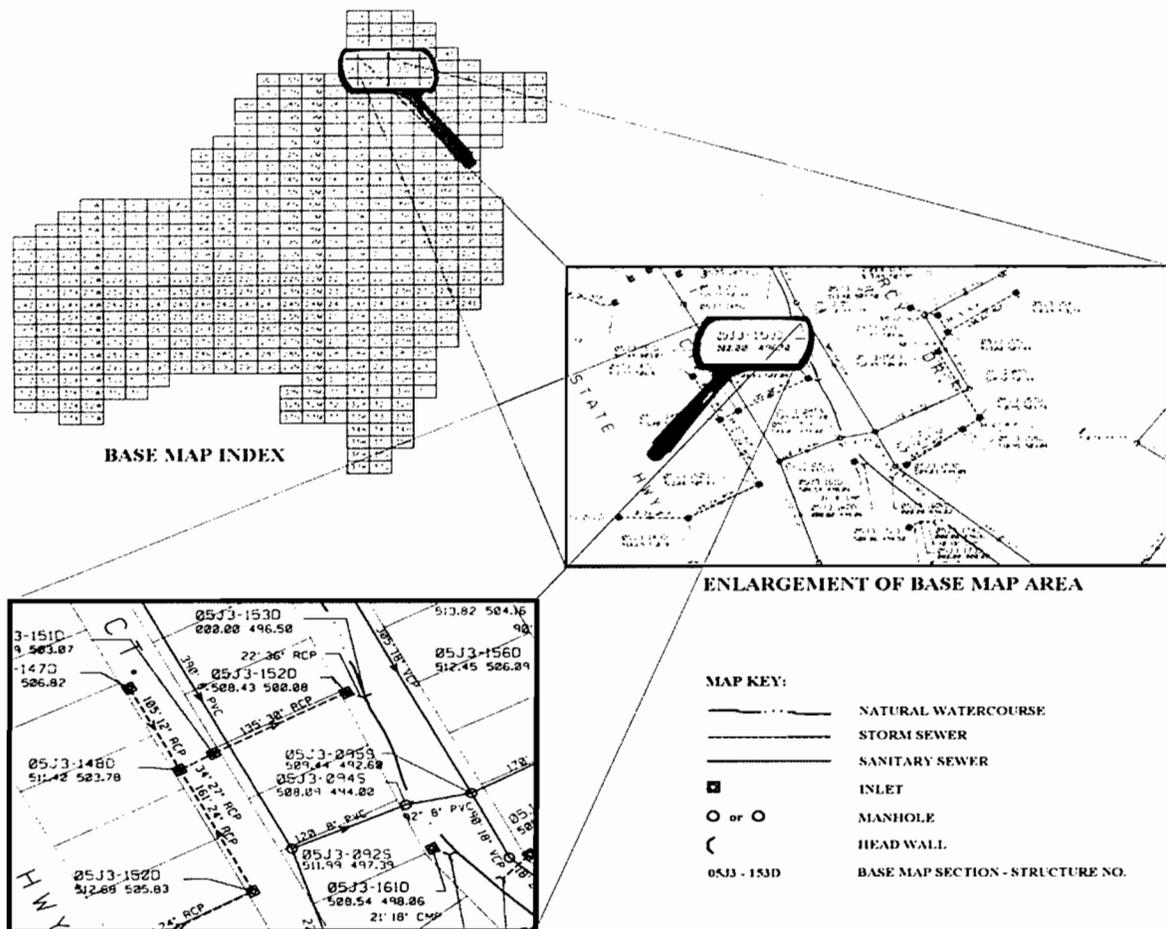
The coordinate system used in the MGE environment at MSD incorporates the following:

- Primary Coordinate System - State Plane 1927
- Zone - Missouri East
- Geodetic Datum - North American 1927
- Ellipsoid - Clarke 1866

Spatial analysis is performed using Intergraph's Geomedia software and the same coordinate system.

A schematic diagram depicting the process of locating and identifying sewers and structures is presented in Figure 6.1 along with an abbreviated key of symbols and numbering system utilized for structure identification.

Figure 6.1 Schematic of Sewer and Structure Location Procedure



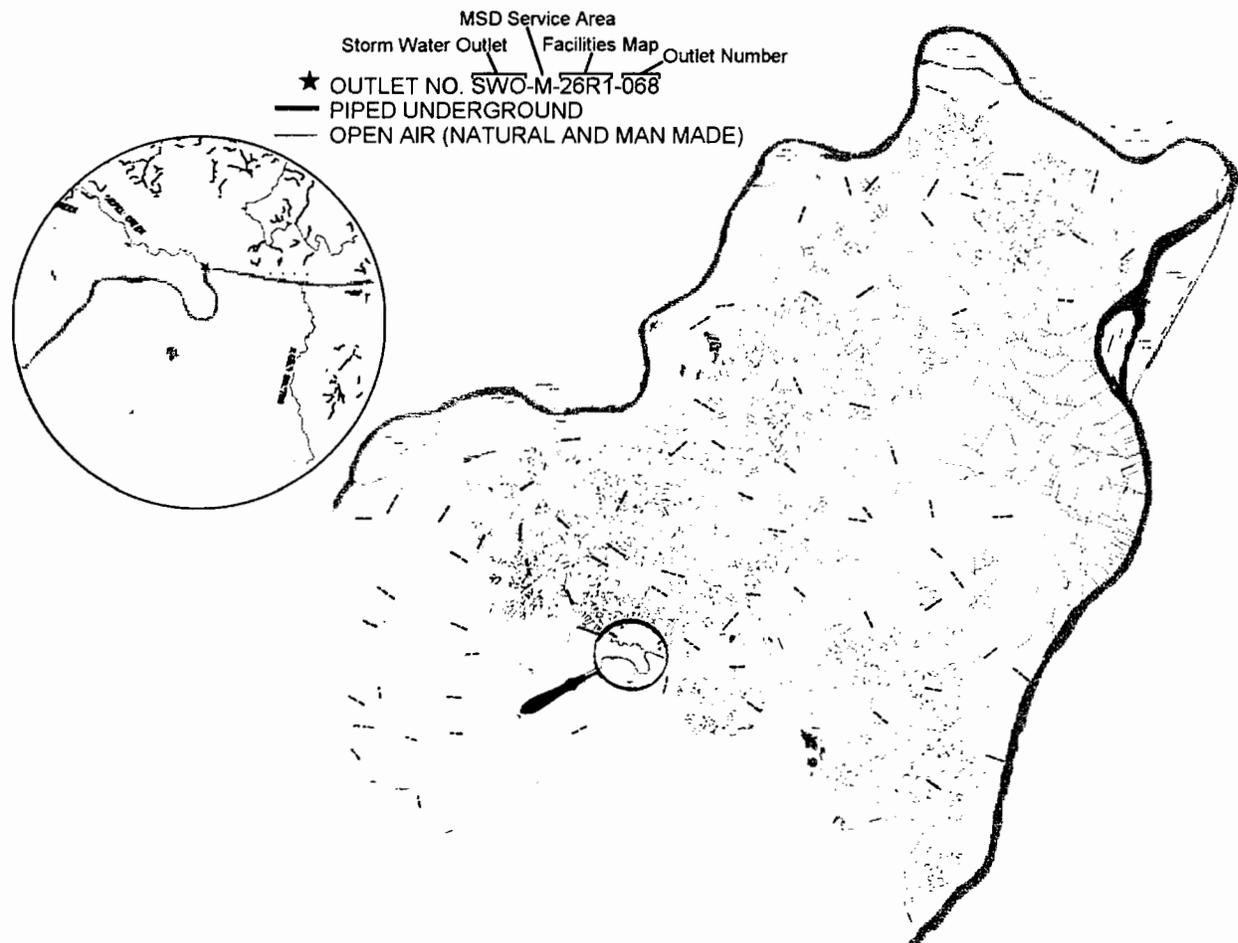
There are an estimated 10,750 storm sewer outfall structures of various sizes and configurations in St. Louis County. They may discharge drainage from a single lot or from several city blocks. They often discharge storm water from one political jurisdiction into another. Designation of these outfalls and other storm water conveyances for permitting purposes would create a heavy administrative burden with little increase in

pollution control. When the number of outfall structures increases from construction in undeveloped areas of St. Louis County, or when changes are made to existing systems, MSD's maps are updated. Because of MSD's GIS mapping capabilities, updating the separate storm sewer system is a continuing and routine task.

Since St. Louis County and its numerous incorporated municipalities were included in a single storm water management plan, it was determined that only the storm water outlets discharging storm water into the Mississippi, Missouri and Meramec Rivers need to be identified for possible monitoring purposes.

Figure 6.2 shows the multitude of storm water outlets which discharge storm water from the boundaries of the Plan Area. The insert enlargement on the figure below focuses on one such outlet denoted by the "red star." The map legend shows the outlet identification number assigned to it. "SWO" is an acronym for "storm water outlet," the following single letter denotes the MSD service area, the next four characters indicate on which facilities map the outlet appears, and the last three digits denote the outlet number assigned to it. As noted in "red," many of the drainage channels upstream of the outlets have been enclosed.

Figure 6.2 Storm Water Outlets from Land Areas in St. Louis County



MSD has identified 202 storm water outlets exiting the Plan Area. These outlets have been identified by designated numbers as explained above, the MSD service area, the municipality where located and the major natural watercourse receiving the discharge. The location of each specific point of discharge has been identified by state coordinates, longitude and latitude and by Township, Range and Section. A complete listing of all identified storm water outlets from the Plan Area is presented in Appendix A6-1. Since the selected discharge points are natural drainage topography, updating of these outlet's locations and physical configurations will not be a major task.

For inclusion in this Plan, the MSD has also prepared maps to visually associate each listed outlet with roadways and receiving streams. These maps are presented in Appendix A6-2 with the first map serving as the Plan Area index for the more detailed outlet maps.

### **C. Illicit Discharge Enforcement Mechanism**

Since the late 1960s, MSD has utilized provisions in its sewer use ordinances to prohibit illicit discharges into the separate storm sewer system. Currently, MSD Ordinance No. 8472 adopted August 14, 1991, is used as the legal enforcement tool to control such discharges. Article IV of this Ordinance, "Control of Pollutant Discharges to Separate Storm Sewers and Watercourses," contains the following statement:

*"Discharges to the District's separate storm sewers enter waters of the State directly or after conveyance through the District's system and are subject to NPDES permit regulations."*

It is further stated in the ordinance that:

*"All users shall comply with the provisions of this article to ensure that discharges from the District's separate storm sewers do not violate conditions of any of the District's NPDES permits or of any NPDES permit regulations, including storm water discharge regulations, or cause any violations of State or Federal water quality standards."*

A specific provision (Article IV, Section One, Paragraph A) requires NPDES permits for discharges to separate storm sewers:

*"No person shall discharge any wastewater, treatment plant effluent, cooling water, storm water or unpolluted water into any separate storm sewer or watercourse unless such discharge is authorized by an NPDES permit or is exempt from NPDES permit regulations and is not otherwise prohibited by this Ordinance."*

Storm water associated with industrial activity is prohibited unless certain criteria are met as described in Article IV, Section One, Paragraph B:

*“No person shall discharge or cause to be discharged into any separate storm sewer any storm water associated with industrial activity as defined in 40 CFR 122.26(b) unless the discharge is in compliance with all applicable provisions of the NPDES storm water regulations in 40 CFR 122.26 and any applicable State regulations and is in compliance with the terms and conditions of any system-wide storm water discharge permit issued to the District pursuant to those regulations.”*

As noted in Chapter 7, the St. Louis County area has a trash and litter problem that will require greater attention under Phase II Regulations. Provisions are contained in Article IV, Section Two, Paragraph B that can be cited to prohibit trash discharges into area watercourses:

*“No person shall place or deposit into any outfall, drainage facility, storm sewer or watercourse within the District any garbage, trash, yard waste, soil, rock or similar material, or any other substance which obstructs flow in the system or damages the system or interferes with the proper operation of the system or which constitutes a nuisance or a hazard to the public.”*

Appropriate enforcement procedures and actions are contained in the ordinance to deal with violators and to mitigate the effects of illegal discharges. Article IX - Enforcement, lists various enforcement actions that can be initiated against a violator such as:

- Section One - Notification of Violation (verbal and written)
- Section Two - Administrative Orders (to include cease and desist order, compliance order, show cause order and consent order)
- Section Three - Emergency Action (mitigative action taken by MSD)
- Section Four - Legal Action and Penalties (to include injunctive relief, consent decree, and fines and imprisonment)
- Section Five - Liability Due to Violations (violator liable for expenses and damages)
- Section Six - Recovery of Costs (MSD's costs are reimbursable)

Depending on the severity of the violation, the response of the violator, and other incident specific conditions, any and all of these enforcement tools are available to the MSD.

Also available to the MSD is the authority to prohibit or regulate discharges by means presented in Article VI, Section One under the heading “control alternatives.” In order to ensure compliance, the MSD may take one or more of the following actions:

1. Prohibit the discharge;
2. Require pretreatment or treatment to a condition acceptable for discharge;
3. Require controls on the quantities and rates of discharge;

4. Require payment to cover added costs of handling and treating;
5. Require the development of compliance schedules;
6. Require the submission of reports necessary to assure compliance;
7. Require discharge permits;
8. Conduct inspections, surveillance and monitoring;
9. Require submission of management plans;
10. Require sampling and analysis of discharges;
11. Terminate service.

MSD has the necessary legal authority already in place to enforce provisions of the Phase II Regulations at the local level in its role as coordinating authority. No additional legal authority is considered necessary. Because of MSD's existing legal authority and experience in enforcing ordinance provisions, enforcement of Phase II regulatory requirements was simply an expansion of normal business activities.

#### **D. Illicit Discharge Detection/Elimination**

Within St. Louis County, the MSD has 2,993 miles of separate storm sewers and over 10,750 identified outfalls. There are also an estimated 1,575 miles of surface streams, which includes open natural and constructed drainage ditches and channels. MSD's program to detect and address illicit discharges to the storm water system, including illegal dumping, involves a detection team of two people that will inspect the streams during dry weather conditions. The primary focus is to look for potentially illicit discharges, such as dry weather flows, and evidence of pollution in the stream from illicit discharges. The capability for field screening exists through a pH, dissolved oxygen and conductivity meter, plus sampling containers are carried for collecting samples for laboratory analysis. Illicit discharges are also identified through various engineering studies of the collection system, and illegal connections are reported to MSD's pollution control unit for investigation of responsible parties and to initiate enforcement action.

As potentially illicit discharges are identified, a referral is made to investigate the finding. The referral is made to MSD's pretreatment unit to investigate regulated industrial sources, the MSD pollution control unit to investigate all other discharges, and/or to MDNR for non-compliant discharges from NPDES permitted facilities. As appropriate after source confirmation, illegal discharges are referred to St. Louis County Department of Health regarding solid waste issues and private laterals. The MSD investigation procedure involves sewer map review, identification of possible sources of the pollutant in the area, site inspections of probable facilities, covert sampling activities if needed, and confirmation dye studies. Once the source or sources of the pollutants have been identified, then the ordinance enforcement tools described earlier will be utilized to mitigate the situation.

The team's mission is to identify and document, not only illicit discharges to MSD storm sewer systems, but also illegal dumping and infrastructure needs; such as, sanitary sewer structures exposed by stream erosion. Such visual documentation and corrective

actions will help prevent spills of wastewater from sanitary sewers that are structurally threatened. Problems are identified that also impact others, such as stream crossings, erosion, or problems with debris buildup. The information obtained is shared with municipalities and highway departments concerned with bridge protection; with sewer district maintenance personnel concerned with collection system integrity and stream blockages that could cause flooding; with engineering design staff concerned with prioritizing capital projects involving sanitary and storm sewer systems; and others assigned responsibility for erosion control.

MSD's inspection schedule will ensure the entire Plan Area's 1,575 miles of streams will be inspected within a 5-year permit period. MSD's stream mileage was calculated from a hydrograph drawn from orthographic maps, and includes all open channels, streams, creeks and observable ditches to any depth. The inspection mileage reported annually is tabulated daily, based on inspections looking for outfalls and other concerns identified above. Recording the findings from the inspections involves the use of a pocket PC and GPS unit that records the findings with the GPS coordinates. In the office, the data is downloaded into an Access database and is plotted on the MSD mapping software. The MSD Engineering Department, Division of Environmental Compliance administers the stream survey program.

#### **E. Publicizing Hazards Associated With Illicit Discharges**

Storm water runoff pollution is the major cause of water quality problems in most urban watersheds. It must also be recognized that each individual is personally responsible for the pollutants in the runoff from his or her occupied land area. The public education measures of this Plan have addressed this issue from the public's perspective by informing individuals and households on the proper application of lawn fertilizers and pesticides, pet waste control, car washing, waste management, and automotive fluid changing plus others. The educational programs developed for illicit discharge hazards will continue to be promoted with brochures and public service announcements under MCM 1. MSD's Phase II web page lists MSD's 24 hour customer service line for reporting illegal discharges, plus other agency contact information for spills, dumping, and other environmental reporting.

Education can also raise awareness of water quality needs and pollution prevention techniques for industry. Through the MSD Industrial Pretreatment Program and associated facility inspections, industrial customers are given brochures explaining the best practices for material handling and storage, fleet maintenance, and general waste control practices. Where discharges are found to violate MSD's ordinance or NPDES permit regulations, the pretreatment enforcement response plan and procedures will be followed. The MSD Division of Environmental Compliance will be responsible for such information dissemination.

## **F. Rationale for New Goals**

With the implementation of the existing illicit discharge detection and elimination program, ongoing program implementation goals will continue to be measured and reported. For improving these programs, the new goals reflect the recognition of the broad problem with solid waste, particularly trash and litter.

The Planning Committee determined that commercial and industrial sites represent significant sources of trash and litter that enter the public storm drainage system. Observations throughout the Plan Area indicated this is often the result of such sites having inadequately sized waste storage units (dumpsters) and/or the insufficient frequency of emptying those units. MSD's fat, oil and grease program results in thousands of food service and restaurant inspections annually to reduce grease blockages in the sanitary sewer system. With minimal additional effort, this program will be expanded to incorporate waste collection areas to address the trash problem. Also, the planning committee recognizes the significance of septic tanks on water quality, and the economic concerns dealing with related problems. A number of resources and agencies address this topic, and a better informed, coordinated effort is desired to address system maintenance and improper connections caused by outdated codes. Therefore, a goal to address this topic has been included in this chapter.

The following is a listing of the illicit discharge detection and elimination components to be implemented for each year of the permit period.

### **Annually**

A goal will be established to reach at least 20% of MSD's industrial customers each year with an illicit storm water discharges brochure as measured by number of brochures produced and distributed.

Illicit discharge detection surveys of all area streams will continue with 1400 miles of open channel inspection reported during the permit term, averaging 280 miles of streams surveyed per year over 5 years. MSD will report stream miles inspected, the findings of the inspection, and the actions taken.

MSD will inspect outdoor waste handling areas at restaurants as part of the interceptor/grease trap inspections, and report the number of inspections and violations.

### **Year 1**

No new goals.

### **Year 2**

No new goals.

Year 3

MSD and St. Louis County will form a work group to identify current activities, applicable regulations and available resources concerning septic tanks, and develop a strategic plan for addressing septic systems to minimize their impact on water quality, coordinating between agencies.

Year 4

The strategic plan for addressing septic systems developed by the work group will be distributed among involved agencies for implementation.

Year 5

No new goals.

## CHAPTER 7

### Construction Site Storm Water Runoff Control (MCM 4)

#### **A. MS4 Permit Requirements**

Section 4.2.4.1 of the general MS4 permit requires the permittee to develop, implement and enforce a program to reduce pollutants in storm water runoff from construction activities that result in a land disturbance of greater than or equal to one acre. Reduction of storm water discharges from construction activity disturbing less than one acre shall be included in the program if that construction activity is part of a larger common plan of development or sale that would disturb one acre or more. The program must include development and implementation of, at a minimum:

***An ordinance or other regulatory mechanism to require erosion and sediment controls, as well as sanctions to ensure compliance, to the extent allowable under State or local law;***

***Requirements for construction site operators to implement appropriate erosion and sediment control best management practices;***

***Requirements for construction site operators to control waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality;***

***Procedures for site plan review which incorporate consideration of potential water quality impacts;***

***Procedures for receipt and consideration of information submitted by the public; and***

***Procedures for site inspection and enforcement of control measures.***

#### **B. Land Disturbance Requirements**

Within the Plan Area, construction and land disturbance activities are performed by private entities, as well as by MSD, St. Louis County, and many of the municipal co-permittees. Land disturbance activities conducted by the co-permittees are handled in-house or with the use of a contractor. These activities fall under the land disturbance permitting requirements of the MDNR's Water Protection Program for projects disturbing one acre or more of land.

As a result of the first Phase II permit, each Plan Area co-permittee has amended its existing construction and land disturbance program or developed a new program, which

includes adoption of appropriate Phase II compliant policies, procedures, and ordinances to reduce pollutants from construction activities that result in a land disturbance of equal to or greater than 1 acre in size. Activities conducted by private entities are subject to the land disturbance permitting requirements of the co-permittee, depending upon the governmental jurisdiction within which the site is located. In addition to any local approvals, every construction site operator must also obtain a separate state permit for any land disturbance activities affecting an area of one acre or more. Regardless of the status of local approvals, land disturbance activities on such sites may not commence prior to the issuance of a state land disturbance permit.

### **C. Land Disturbance Activities**

The co-permittees and their areas of responsibility include:

#### **1. Metropolitan St. Louis Sewer District**

MSD has primary responsibility and authority to review and approve plans and specifications for sewerage and drainage works within the Plan Area. Any public or private sewerage or drainage works proposed to be constructed, altered or reconstructed by any person or corporation, public or private, within the District boundaries, must be reviewed by MSD. This review incorporates the post-construction storm water management controls required by MCM 5, as discussed in the next chapter. MSD does not review and approve land disturbance projects, except when the District performs or contracts for its own land disturbance activities.

#### **2. St. Louis County**

Two departments within St. Louis County government are involved in the authorization and inspection of construction and land disturbance activities:

##### **Department of Public Works (DPW)**

As per Section 4.310 of the St Louis County Charter, effective November 6, 1979, the DPW issues permits and performs inspections of all construction activities on private property within the unincorporated areas of Saint Louis County. In addition, the DPW issues permits and provides inspection services on all county government owned projects and also provides inspection services for grading permits issued by the St. Louis County Department of Highways and Traffic on private property. The DPW also provides, by contract, permitting and inspection services to most of the municipal governments in the county. As per Section 1101 of the St. Louis County Revised Code, the DPW serves as the coordinator of major development projects, acting as the central control on permit issuance. The DPW holds issuance of any permit until all other government jurisdictions have signed off on the project: Zoning, Highways, Health and MSD.

Department of Highways and Traffic

As per Section 1105 of the St Louis County Revised Code, the H&T Department issues permits and performs inspections of all projects in county right-of-ways. The H&T Department also performs land disturbance storm water pollution prevention plan reviews and issues permits for all projects within the flood plains of the unincorporated area of the county. The H&T Department also issues permits for grading required on subdivision developments. In addition, the H&T Department also performs or contracts for its own land disturbance activities while performing maintenance, repair, or construction of county roadways.

Two other county government departments own and operate facilities in the Plan Area and may be involved in land disturbance activities.

Aviation Department

The Spirit of St. Louis Airport in Chesterfield is wholly owned by the St. Louis County government. The Airport serves as the landlord for a major industrial park, out-leasing buildings and land to business activities both associated with flight operations at the airport and activities completely independent of flight operations.

Parks Department

This department owns and operates 78 county parks throughout St. Louis County both in the unincorporated areas and in the municipal areas. The Parks Department may perform land disturbance activities within these facilities either with in-house personnel or by contract.

**D. MDNR Land Disturbance Permit Requirements**

The Missouri Department of Natural Resources has developed a number of general land disturbance NPDES permits to cover varying situations throughout the state. Two of these have particular applicability to the St. Louis County Plan Area.

General permit MO-R100000 covers land disturbance activities conducted by a city, county or other governmental jurisdiction having a state approved land disturbance program.

General permit MO-R109000 covers land disturbance activities conducted by any entity, where discharges from the activity will discharge to water bodies identified by the state as "Valuable Resource Waters." The previously listed general permit can also cover these activities if the city, county or other governmental jurisdiction has provided for discharges to such waters within their approved programs.

Each of these general land disturbance permits apply specifically to land disturbance conducted by or under contract by the co-permittees, and contain additional requirements not specifically identified within the MS4 permit requirements. Since some of the co-permittees subject to this Plan currently utilize these general permits and since any co-permittees may utilize them, the additional requirements of these permits are addressed in this Plan. The MDNR requirements contained in the Requirements and Guidelines sections of these permits are:

Site operators must develop Storm Water Pollution Prevention Plans (SWPPP) specific to each site and must amend the plans whenever certain conditions occur. The required contents of a SWPPP and the conditions which would trigger SWPPP amendments are identified in the permit Requirements section.

Good housekeeping practices shall be maintained to keep solid waste from entering waters of the state.

All fueling facilities on site must adhere to applicable federal and state regulations concerning storage (underground and above ground) and dispensers;

Substances regulated under the Resource Conservation and Recovery Act (RCRA) that are transported, stored or used on site must be managed as per the provisions of this Act;

Site operators must designate individuals with overall responsibility for environmental matters;

Paint, solvents, petroleum products and petroleum waste products and the containers for these materials, must be stored according to BMPs and be inspected for leaks and spills weekly;

Quarterly reporting of the list of active land disturbance sites to MDNR;

Site operators must inspect outfalls and any structures or BMPs at the site provided to prevent pollution of storm water or to remove pollutants from storm water to ensure all BMPs are continually implemented and are effective. Inspections must be scheduled at least weekly and no later than 48 hours after a rainfall causes runoff, and the observed conditions noted in weekly reports. Deficiencies must be corrected within seven days of the report;

Site operators must post a copy of a public notification sign, as required by MDNR.

## **E. Plan Area Land Disturbance Programs**

As required by the Phase II permit, co-permittees have implemented programs that require erosion and sediment controls for construction site operators. Activities conducted by private entities are subject to these land disturbance permitting requirements of the applicable co-permittee, depending upon the governmental jurisdiction within which the site is located.

### **1. St. Louis County**

St. Louis County adopted a Land Disturbance Code (LDC) in October of 2003 and modified the Administrative provisions of that Code in September of 2005. This was accomplished under County Ordinances 21,578 and 22,468. The technical provisions of the County's LDC are virtually identical to the provisions contained in the Model Ordinance in Appendix A12-1 of the 2002 Plan. St. Louis County enforces the LDC in unincorporated St. Louis County and in many municipalities in the County that have contracted for the enforcement of the LDC.

The LDC separates land disturbances into two basic categories: Major Land Disturbances for land disturbance activities involving 1 acre or more of land or a site involving less than 1 acre as part of a proposed development that will ultimately disturb 1 acre or more; and Ordinary Land Disturbances for land disturbance activity involving less than 1 acre of land. The County currently issues approximately 30 major land disturbance permits annually for residential developments and approximately 50 major land disturbance permits for commercial developments.

The County's system of enforcement is outlined in the provisions of the Model Ordinance contained in Appendix A12-1 of the 2002 Plan. For Major Land Disturbances, this involves the following primary elements:

- Submission of land disturbance plans and SWPPP for review, approval and permit issuance by the County.
- Assignment of a Special Inspector who is supplied by the permittee and approved by St. Louis County. The Special Inspector is required to inspect the site weekly, after heavy rains and inspect related to complaints. This Inspector is required to report on each inspection to the Department of Public Works. If the Special Inspector finds deficiencies, he is required to call for the deficiencies to be corrected and to reinspect the site to confirm that the deficiencies have been corrected. In the event they are not corrected, the Special Inspector is to request the assistance of the County in causing the deficiencies to be corrected.
- The inspectors in the residential and commercial inspection sections of the County's Code Enforcement Division also inspect Major Land Disturbance sites for compliance with the LDC including BMP's. This is done in conjunction with permits to construct facilities on these sites.

- The residential & commercial inspection sections of the County's Code Enforcement Division also have Senior Site Development Specialists who assist inspectors in these sections in resolving major issues or concerns. These Senior Site Development Specialists also review the reports of the Special Inspectors for discrepancies and other problems and inspects Major Land Disturbance Sites, as necessary to assure that discrepancies are corrected and problems resolved.
- The County also supplements, as necessary, Code Enforcement Division inspections with inspections performed by inspectors from other Departments.

The County Code Enforcement Division maintains records of weekly inspections by Special Inspectors, complaints investigations by Special Inspectors and Code Enforcement Division Inspectors, inspections after heavy rains, escrow release inspections, and formal written violation notices as well as further deficiency correction action.

The St. Louis County LDC contains monetary penalties for not obtaining required permits and for other violations of the Code to include possible imprisonment. The LDC contains provisions that allows the code official to stop the work, when deemed necessary.

## **2. Municipalities**

Each incorporated municipality has the authority and responsibility to perform construction permitting and inspection services as a basic element of the police powers afforded municipal governments in Missouri, and under the 2002 Plan, has implemented a Phase II compliance land disturbance program to regulate construction within their jurisdiction. Some municipalities provide full permitting and inspection services with their own resources. These municipalities have adopted the model procedural guidance manual and ordinance as is or with such enhancements as it deems appropriate to meet its specific community needs. These municipalities have implemented the project reviews, permitting, inspection, complaint response, and other activities needed to implement the Phase II land disturbance program.

A second option many municipalities have taken is to adopt St. Louis County's ordinance and contract with St. Louis County for Code Enforcement. The County contracts for permitting (including plan review and construction authorization documents) and code enforcement, including periodic and critical event inspections. The County contract requires the construction site operator to gain zoning approval from the municipality for a project before a county permit is issued. In addition, the municipality issues its final occupancy permits only after the Department of Public Works has completed all construction inspections. In all cases the ordinance authority and any penalties for non-compliance are the responsibility and authority of the individual municipal governments.

Finally, a third option implemented for those cities that are built out and have little potential for land disturbance over one acre, was passing a resolution of no need, prohibiting land disturbance over one acre, without a Phase II program in place.

### **3. Other Entities**

In addition to the above local entities, the Missouri Department of Transportation also engages in land disturbance activities within the Plan Area. As previously noted, MoDOT's activities, within the Plan Area, will be covered under a separate statewide MS4 permit issued by MDNR to MoDOT, and the applicable storm water land disturbance permit.

### **F. Rationale for New Goals**

With the implementation of Phase II compliant land disturbance programs throughout the Plan Area by co-permittees for all public and private construction projects, goals for the next permit term will be focused on ensuring effective implementation of the programs. Ongoing implementation measures will be reported, and shared among co-permittees and the MDNR to ensure the regulated community's compliance with the program. Education of the construction community will be emphasized to ensure requirements are understood, and to address common problem areas. The education of program administrators will also be addressed to share tools and to ensure consistent, effective implementation by the co-permittees.

#### Annually

Municipalities and St. Louis County will report permits issued by name and area disturbed. This information was requested by MDNR for coordination to ensure land disturbance program compliance.

Annually report the number of formal, written notices of violation and further enforcement actions taken, and the companies they were taken against.

#### Year 1

St. Louis County and MSD with partners will develop a training program for developers and construction company employees on sediment and erosion control BMPs. Training will be tailored appropriately for experienced employees and those new to the land disturbance regulations.

#### Year 2

St. Louis County and MSD with partners will provide training for developers and construction company employees on sediment and erosion control BMPs. The effectiveness of this land disturbance training will be evaluated.

Year 3

St. Louis County and MSD will identify the top list of ordinance or BMP categories in frequent noncompliance, and prepare and deliver a presentation or other educational materials to present to construction companies and developers.

Year 4

St. Louis County and MSD will identify the tools and resources for municipalities to improve implementation of the Phase II land disturbance program

Year 5

St. Louis County and MSD will hold a training workshop for municipal staff to cover storm water pollution prevention plans, compliance inspections and program enhancements identified in year 4. The municipal implementation of the suggested tools and resources presented will be tracked.

## CHAPTER 8

### Post-Construction Storm Water Management in New Development and Redevelopment (MCM 5)

#### A. MS4 Permit Requirements

Section 4.2.5.1 of the general MS4 permit requires the permittee to develop, implement and enforce a program to address storm water runoff from new development and redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale, that discharge into the permittee's small MS4. The program must ensure that controls are in place that will prevent or minimize water quality impacts. Subsequent permit subsections require that this program include the following:

***Development and implementation of strategies which include a combination of structural and/or non-structural BMPs appropriate for the permittee's community;***

***Use of an ordinance or other regulatory mechanism to address post-construction runoff from new development and redevelopment projects to the extent allowable under State or local law; and***

***Means to ensure adequate long-term operation and maintenance of BMPs.***

***Policies and ordinances that provide requirements and standards to direct growth to identified areas, protect sensitive areas such as wetlands and riparian areas, maintain and/or increase open space (including a dedicated funding source for open space acquisition), provide buffers along sensitive water bodies, minimize impervious surfaces, and minimize disturbance of soils and vegetation;***

***Policies or ordinances that encourage infill development in higher density urban areas and areas with existing storm sewer infrastructure;***

***Education programs for developers and the public about project designs that minimize water quality impacts; and***

***Other measures such as minimization of the percentage of impervious area after development, use of measures to minimize directly connected impervious areas and source control measures often thought of as good housekeeping, preventive maintenance and spill prevention.***

## **B. Program Intent**

In the previous chapter, procedures to control the quality of storm water runoff during land disturbance activities throughout the Plan Area were discussed. In this chapter, the post-construction storm water management program, after land disturbances and development or redevelopment of the property is complete, is discussed and the individual BMPs, measurable goals, and responsible entities are identified.

Before actual construction begins, a great deal of planning is necessary to ensure the final project design complies with regulatory requirements and incorporates proven BMPs for water quality protection to the maximum extent practicable. Many of the natural watercourses within the Plan Area are affected by the intense urbanization characterized by imperviousness exceeding 25%. Most streams within the Plan Area are used as conduits for conveying storm water flows from these impervious areas, and as a result, their ability to support a diversity of aquatic life has been compromised, and they have experienced and continue to experience severe widening, down cutting and stream bank erosion. The storm water management plan should give adequate attention to means to prevent increases in imperviousness, attempt to reduce the imperviousness already present when practicable, and address stream stability and degradation.

Defining and describing specific priority areas within the Plan Area for more intense post-construction BMP implementation was not considered appropriate since the impacts of intensive urbanization are felt throughout the Plan Area. There are, however, locations within the Plan Area, which could be considered for infill development because of existing utility service and adequate sanitary and storm sewer infrastructure. These “vacant property” sites could be redeveloped to protect what few “green fields” remain within the Plan Area. Urban redevelopment and infill projects are a means of helping rejuvenate aging cities and provide opportunities for more environmentally friendly growth. The primary intent of Minimum Control Measure No. 5, is to:

- channel development towards areas which can support that growth with existing infrastructure,
- maintain the integrity of open spaces existing within the Plan Area, and
- incorporate appropriate watershed protection criteria in construction project design.

## **C. Best Management Practice Implementation**

The BMPs for post-construction storm water management in new development and redevelopment are categorized under the permit as structural and non-structural. Implementation of these BMPs in the Plan Area involves two different aspects due to the political jurisdictions in the Plan Area and the differing responsibilities of these authorities. One aspect is implemented by MSD through enforcement of design requirements for storm water management facilities, and the other is through land use

controlled through the planning and zoning authorities of the city and county governments.

### **1. Metropolitan St. Louis Sewer District (MSD)**

In the Plan Area all storm water facilities and controls must be reviewed and approved by the MSD. Currently, the MSD requires all such facilities to be provided and designed in accordance with provisions contained in the *“Rules and Regulations and Engineering Design Requirements for Sanitary Sewer and Stormwater Drainage Facilities”*, dated February 2006, as amended. To comply with the mandatory requirement under MCM 5 to “develop and implement strategies which include a combination of structural and/or non-structural BMPs appropriate for the locale,” MSD has revised these Rules and Regulations to include requirements for BMPs for storm water control and watershed protection to be incorporated into the project design. These rules and regulations are implemented under the authority of MSD Ordinance 9030, and the Rules and Regulations implementing the Phase II BMPs were adopted by the MSD Board of Trustees in Resolution 2630.

The Rules and Regulations include storm water design criteria for: flood protection using the 2 year and 100 year 24-hour events, water quality treatment using runoff from 90% of daily events, and channel protection storage using the one-year 24-hour event. To meet the water quality criteria, storm water management facilities must treat the water quality volume using an acceptable Urban BMP, as defined in the the Rules and Regulations, which adopts the Maryland Stormwater Design Manual. The five general categories of Urban BMPs include:

- Storm water ponds,
- Storm water wetlands,
- Infiltration practices,
- Filtering practices, and
- Open channel practices

Non-structural BMPs are recognized as beneficial storm water BMPs, particularly as a critical feature of better site designs. Non-structural BMPs are beneficial by reducing the generation of storm water from the site, and preserving environmentally sensitive areas. To promote the use of non-structural BMPs, a series of credits are provided for developments that use these BMPs in their site planning:

- Natural area conservation,
- Disconnection of rooftop runoff,
- Disconnection of non-rooftop runoff,
- Reserved buffers,
- Open channel use,
- Environmentally sensitive development, and
- Impervious cover reduction

The Rules and Regulations require site designers to submit a Stormwater Management Facilities Report. The Report will contain the operation and maintenance requirements specific to the design, and is approved by MSD prior to installation. Upon installation, MSD inspects facilities to ensure they were constructed according to the approved design. All BMPs will be maintained by the property owner(s), and MSD will enforce the maintenance through a Maintenance Agreement recorded with the property records. An enforcement program will be used to ensure property owners maintain the BMPs.

To promote a reduction in imperviousness both in new development and redevelopment projects, MSD has proposed to the Board of Trustees and the Rate Commission the adoption of a storm water user charge system based on a property's degree of imperviousness to cover basic storm water services to cover the operation and repair of the existing public storm water system. A storm water charge is proposed for enhanced services to cover additional services, as approved by MSD's Board.

## **2. Planning and Zoning Authorities**

Watershed protection is directly related to urban development and growth characteristics within the watershed. There are many planning and zoning strategies that can be developed by municipal governments to encourage growth in areas that can best support the type of growth desired while maintaining overall integrity of the watershed. Working in cooperation with St. Louis County government and the municipal governments in the County, the MSD has developed and distributed educational materials on planned growth and watershed protection to the co-permittees in the Plan Area. An educational booklet, "*Planning and Zoning Strategies for Water Quality Protection*", March 2006 was disseminated to all co-permittees, engineers and developers to promote water quality protection in planning and zoning regulations.

The Planning and Zoning booklet identifies eight land use strategies that can be used to protect water quality. Plan effectiveness will be measured by tracking the number of municipal ordinances adopted during each year of the permit that have incorporated planned growth BMPs into their planning and zoning regulations. In May 2007, all co-permittees were instructed to pass one of the appropriate strategies or use another option to address the post-construction storm water management requirements by the end of the first permit term. The eight strategies in the Planning and Zoning booklet include:

- Stream buffer,
- Planned unit development (PUD) performance criteria,
- Overlay zoning,
- Conservation subdivision ordinance,
- Infill redevelopment,
- Tree preservation,
- Flood plain protection, and
- Conservation easement

The intent of post-construction ordinances is to require better site designs up front in the planning and zoning review and approval process to accommodate a menu of non-structural best management practices for post-construction runoff. From the eight strategies identified in the Planning and Zoning Strategies booklet, three types of post-construction ordinances clearly meet this goal: planned urban development (PUD) ordinances with water quality based criteria (with standards for stream buffers, open space, and impervious surfaces), overlay zoning requiring better site designs to protect environmentally sensitive areas (like streams, wetlands and flood plains), and stream setbacks with vegetated buffers. It is believed that three additional strategies may also satisfy the permit requirement: the conservation subdivision ordinance, the infill redevelopment strategy (when the focus and effect protects green space), and the conservation easement strategy (when a dedicated funding source exists and acquired property protects streams, wetlands and flood plain areas). MDNR identified one of the eight strategies that will not satisfy the permit requirement alone, the tree preservation strategy. MSD also believes that the flood plain protection strategy will not satisfy this permit requirement, unless the ordinance greatly exceeds the minimum standards of the National Flood Insurance Program.

### **3. Missouri Department of Transportation**

The Missouri Department of Transportation (MDOT) is subject to a MS4 General Operating Permit issued by the Missouri Department of Natural Resources, Water Pollution Control Program. The MDOT's permit contains the same Phase II storm water requirements for post-construction storm water management as the St. Louis MS4. Therefore, MDOT projects will not be subject to the St. Louis County Phase II Storm Water Management Plan.

### **D. Flood Control**

The MSD has been involved with flood control since its inception. The MSD has constructed numerous channel improvement projects to alleviate flooding and erosion, and also constructed many storm sewer projects to alleviate localized street and backyard flooding. These projects are located within the original boundaries of the District where capital improvement projects are supported by ad valorem taxes. Outside the original boundaries, St. Louis County and the municipalities have also constructed channel improvement projects and storm sewer projects. Inadequate culverts and bridges have been replaced by the agencies that are responsible for the road and highway maintenance.

In 2000 the MSD completed a Stormwater System Master Improvement Plan (SSMIP) to provide a comprehensive and coordinated plan for resolving storm water problems throughout the District. Many flood control projects were identified in the SSMIP, of which a number contained non-structural solutions. Because structural solutions to flooding and erosion problems are often very costly, acquisition of the affected

properties is sometimes a more cost-efficient approach. The MSD recently purchased several flood prone houses in the River Des Peres watershed. The SSMIP also identified numerous locations where flood proofing could be a viable alternative to traditional structural flood control methods that may not be suitable or cost effective. The MSD has developed a flood proofing program, and flood proofing is one of the options considered when evaluating storm water solutions on projects.

The Plan Area has several flood control levee districts along the Missouri River. These include the Monarch – Chesterfield Levee District, the Howard Bend Levee District, Riverport, and the Earth City Levee District.

The local municipalities and St. Louis County have primarily managed floodplain requirements because it is an issue closely related to zoning and land use restrictions. A list of flood prone communities is provided in Table 8.1 from the St. Louis County Flood Insurance Study. These local governments have ordinances that fulfill the minimum requirements of the National Flood Insurance Program administered by FEMA, and some include slightly more restrictive requirements. Most of the municipalities listed are co-permittees and are involved in this Plan. Only ten municipalities on this list are exempted from Phase II compliance due to combined sewers or population served.

Floodplain studies are required for new development to insure the new structures are protected from the 100-year flood. MSD requires a floodplain study for any development that is to be in the 100-year floodplain. In addition, a 100-year hydraulic study is required if any watercourse cannot be contained in a 60-inch pipe for the 15-year event. MSD Rules and Regulations require the lowest floor of any structure to be at least one foot above the 100-year flood elevation, and the low sill must be two feet above the 100-year flood elevation. Floodplain filling is subject to state or local government restrictions, and thus MSD has no requirements for compensatory storage when development takes place in the floodway fringe. St. Louis County requires compensatory storage except in the floodplains of the Mississippi, Missouri and Meramec Rivers.

Since the early 1970's, storm water detention has been required for new development to control flooding of downstream properties. The MSD currently requires storm water detention for new developments that have a differential runoff of two cubic feet per second or greater between pre- and post-development flow. Detention is also required when special conditions or problems exist downstream of a new development. The post-developed peak flows are limited so that downstream peak flows and stages are not increased above pre-development conditions for the 2-year and 100-year, 24-hour events.

Table 8.1 Flood-Prone Communities

<b>FLOOD-PRONE COMMUNITIES</b>		
Ballwin	Florissant	Olivette
Bella Villa*	Frontenac	Overland
Bellefontaine Neighbors	Grantwood Village*	Pagedale
Bel-Ridge	Green Park	Richmond Heights
Berkeley	Hanley Hills	Riverview
Black Jack, City of	Hazelwood	Rock Hill
Breckenridge Hills	Huntleigh*	Shrewsbury
Brentwood	Jennings	St. Ann
Bridgeton	Kinloch*	St. John
Charlack	Kirkwood	Sunset Hills
Chesterfield	Ladue	Town and Country
Clarkson Valley	Lakeshire	University City*
Clayton	Mackenzie*	Valley Park
Cool Valley	Manchester	Velda Village Hills*
Crestwood	Maplewood*	Webster Groves
Creve Coeur	Maryland Heights	Wellston*
Des Peres	Moline Acres	Westwood*
Ellisville	Northwoods	Wildwood
Fenton	Norwood Court	Winchester
Ferguson	Oakland	St Louis County, Unincorporated Area

\* Exempt from Phase II Regulations

**E. Rationale for New Goals**

Previous sections of this chapter have dealt with activities carried out by co-permittees in the implementation of a post-construction storm water program. The goals for this Plan involve ongoing reporting of program measures and significant educational efforts to enhance compliance with these new programs.

With the new Rules and Regulations implemented by MSD, a strong partnership and working relationship with each of the municipalities and St. Louis County is desirable. The cities can help ensure that all applicable development plans are submitted to MSD for approval, and that site designs will successfully incorporate both structural and non-structural best management practices. Cities must not only be aware of the BMPs required by MSD, but when knowledgeable, can assist site developers early in planning

and zoning review by ensuring site designs allow the appropriate space for BMPs to be used. Also, cities can play an important role in ensuring the proper maintenance of BMPs through ordinances regulating management of properties, to ensure nuisances are not created by property owners not maintaining the BMPs. Implementation of non-structural BMPs can further be encouraged through various planning and zoning strategies that require preservation of water resources and open space. MSD offers a conceptual review service that can address storm water management under MSD's rules early in the design phase of a project, and ensure acceptability of the design under MSD's Rules and Regulations.

In addition to the co-permittees working effectively toward the same goals, public education will be another key element in implementing and maintaining effective post-construction BMPs. In the development community, educational efforts will encourage the use of a combination of the post-construction BMPs, particularly the non-structural BMPs. To ensure the proper operation and maintenance of BMPs, education of the public will be key, focusing on the responsibilities of homeowners and subdivision trustees and the required maintenance of BMPs. The public understanding of the important role BMPs perform to protect water quality, as well as the expectations of how they perform in managing storm water, will be key to ensuring the public acceptance of BMPs and ensuring they are well maintained and continue to function properly.

In summary, the activities to be undertaken to comply with MCM 5 requirements are listed by year of implementation as follows:

#### Annually

MSD will report the number of BMPs approved/installed, and the number of BMPs inspected to ensure proper operation and maintenance.

MSD will report the number of developments utilizing the conceptual review service.

#### Year 1

MSD and partners will develop educational material for municipal public works, developers and engineers on MSD's urban BMPs, and to promote the use of non-structural credits and the benefits of site storm water management planning prior to land disturbance.

MSD will provide storm water management BMP considerations and guidelines to municipalities' public works and planning and zoning reviewers to ensure the setbacks, open space, and real estate needed for the installation of structural and non-structural BMPs are allotted in the concept review of site plans.

Co-permittees will implement procedures to ensure all applicable private and public projects involving storm water management are reviewed and approved by MSD.

## Year 2

MSD and partners will begin distributing educational materials to municipalities, developers and design engineers on MSD's urban BMPs, and to promote the use of non-structural credits and the benefits of storm water management planning prior to land disturbance.

A work group will be formed of stakeholders to identify and evaluate legal impediments to the design, installation, operation and/or maintenance of non-structural BMPs allowed under MSD's Stormwater Design Rules and Regulations. The evaluation may include roadway design criteria, subdivision standards, zoning ordinances, property maintenance codes or others, as applicable. Findings, recommendations and models will be established.

Municipalities and St. Louis County will adopt and implement at least one additional directed growth planning and zoning strategy to protect water quality, such as green space and buffer criteria in overlay zoning and PUDs, or stream buffers from the P&Z booklet or equivalent conservation method. Cities that have previously implemented ordinances or procedures that require better site design, such as stream buffers or minimum open space requirements or maximum impervious surface requirements utilizing at least two strategies throughout their community will have satisfied this goal.

## Year 3

The findings, recommendations and models of the legal impediments to the design, installation, operation and/or maintenance of non-structural BMPs will be distributed appropriately.

MSD and partners will develop an educational reference library (toolbox) for BMP engineering design requirements.

## Year 4

Municipalities will be asked by MSD to pass ordinances under their property maintenance or other codes to require owners of structural and non-structural BMPs to maintain them, as practical and allowed by the city's legal authority.

Speaking engagements by MSD or partners at LEED green building venues or other low impact development programs will be used to gain awareness of the BMP toolbox and to promote better site designs for storm water management.

Develop educational materials for homeowners and subdivision trustees to explain the purpose and function of structural and non-structural BMPs with the goal of gaining acceptance of the BMPs in the community and to explain the property owners' responsibility and the BMP maintenance requirements to ensure these BMPs function properly.

Year 5

Distribute educational materials to the public for subdivision trustees and homeowners, distributing directly or via outlets such as title companies, etc., utilizing an O&M manual, pamphlet or other appropriate method.

## CHAPTER 9

### Pollution Prevention/Good Housekeeping for Municipal Operations (MCM 6)

#### **A. MS4 Permit Requirements**

Section 4.2.6.1 of the general MS4 permit requires the permittee to develop and implement an operations and maintenance program that includes a training component and has the ultimate goal of preventing or reducing pollutant runoff from municipal operations. The program is required to specifically address the following areas:

***Maintenance activities, maintenance schedules and long term inspection procedures for controls to reduce floatables and other pollutants to the permittee's MS4;***

***Controls for reducing or eliminating the discharge of pollutants from streets, roads, highways, municipal parking lots, maintenance and storage yards, waste transfer stations, fleet or maintenance shops with outdoor storage areas and salt/sand storage locations and snow disposal areas the permittee operates;***

***Procedures for the proper disposal of waste removed from the permittee's MS4 and area of jurisdiction, including dredged materials, accumulated sediments, floatables and other debris;***

***Procedures to ensure that new flood management projects are assessed for incorporation of additional water quality protection devices or practices; and***

***Identification of the person(s) responsible for overall management and implementation of the permittee's pollution prevention/good housekeeping program.***

Section 4.2.6.1.2 of the general MS4 permit requires the permittee, using training materials that are available from EPA, State, or other organizations, to develop employee training to prevent and reduce storm water pollution from activities such as park and open space maintenance, fleet and building maintenance, new construction and land disturbances and storm water system maintenance.

Section 4.2.6.2.1 of the general MS4 permit requires the permittee to specifically list all of its municipal operations which are impacted by the above listed requirements.

## **B. Storm Water Discharges Associated with Industrial Activity**

Section (2)(B)3.F of the Missouri Storm Water Regulations (10 CSR 20-6.200) requires that municipalities obtain separate state NPDES permits for storm water discharges from certain “industrial” facilities that are municipally owned or operated if the storm water discharges from those facilities are not already covered under other NPDES permits. Section (1)(B)16 of the regulations provides for a certification of “no exposure” in lieu of a permit if the “industrial” activities are protected from rain, snow, snowmelt and/or runoff and the operator meets certain other requirements.

Section 4.2.6.2.1 of the MS4 permit requires the permittee to include a list of such “industrial” facilities, along with the NPDES storm water permit number for each facility or a copy of the current NPDES storm water permit application. The regulations contain an extensive listing of “industrial” facilities subject to this requirement. From that extensive listing, only the following few are typically under municipal ownership and/or operation:

Transportation, including Airports	Solid Waste Transfer Facilities
Landfills	Wastewater Treatment Facilities
Hazardous Waste Treatment/Storage/Disposal	Recycling Facilities
Vehicle Maintenance Facilities	Yard Waste Compost/Mulch Facilities
Vehicle Washing Facilities	Warehousing and Storage Facilities

A separate municipal storm water permit is only required if storm water from any of these “industrial” facilities discharges directly to waters of the state and the storm water discharge is not already covered under another NPDES permit. Each co-permittee will supply the required information for any “industrial” facilities they own or operate as part of their individual MS4 permit applications.

## **C. Storm Water Conveyance Construction and O&M**

The MSD charter authorizes MSD to construct or reconstruct (by contracts or otherwise) any improvements, extensions or additions to provide adequate storm water drainage. Capital improvements are the structural solutions to alleviate specific drainage problems or to prevent them from occurring in the first place. Typical examples include replacing an undersized culvert to pass greater flows or repairing a channel reach that is suffering from extreme erosion. The MSD presently undertakes a very limited amount of storm water capital improvement projects that fall into three categories:

- Operation, Maintenance and Construction Improvement (OMCI) Fund Projects
- Replacement/Renewal Projects
- Emergency Projects

## **1. Operation, Maintenance and Construction Improvement (OMCI) Fund Projects**

Certain watersheds have a specially assessed ad valorem tax used for capital projects that benefit the particular area. These capital improvements are only done in watersheds that requested an OMCI tax. A storm water rate proposal has been developed by MSD that would establish a storm water rate which would cover the maintenance and capital improvement needs of the entire Plan Area. These projects are generally designed and managed by the MSD Engineering Department with private contractors performing the construction.

## **2. Replacement/Renewal Projects**

Over time, drainage infrastructure may become degraded to the point of needing replacement or substantial repair. Typical Replacement/Renewal activities include: routine inlet repair/reconstruction, sewer replacement/rehabilitation, culvert improvements, and improved stream bank repairs. These projects are currently only done within the original boundaries of the District, and they are completed by the MSD Operations Department or private contractors when deemed more efficient. Various municipalities also have capital improvement programs that include storm water projects. Some have a sales tax that is dedicated for storm water improvements. Under MSD's rate proposal, these projects would be funded as basic services by an impervious charge.

## **3. Emergency Projects**

The MSD charter explicitly gives MSD maintenance authority over all drainage facilities. Operations and Maintenance (O&M) includes those activities required to run the District storm water facilities on a daily basis and to keep the drainage system functioning as designed. Storm water O&M includes the following services: operation of flood gate and floodwall pump stations, emergency response to major rainfall or flooding events, inlet cleaning, sewer cleaning, debris removal from culverts and open channels, erosion repair, and complaint response.

## **4. Detention Basins**

The responsibility for maintenance of detention basins is currently placed on the property owner or homeowners association who have been required by covenant to sign a maintenance agreement.

## **5. Roadway Culverts**

Roadway culverts are currently maintained by the agency or individual responsible for the road. The MSD will provide emergency services to remove significant blockages.

## **6. Storm Sewers, Inlets, and Catch Basins**

Storm sewers within the original boundaries of the District are routinely maintained by the MSD. In the annexed area, the MSD will only provide emergency service, and the routine maintenance is either done by the municipality or is not done at all. The MSD does not maintain Missouri Department of Transportation storm sewers.

## **7. Improved Channels**

The MSD will remove significant obstructions to flow and also undertake measures to assure the structural integrity of the channel sides and bottom. This maintenance includes any fences installed by the MSD that are integral to the improvements.

## **8. Natural Channels**

Natural Channels are not routinely maintained by the MSD, but significant obstructions to flow will be removed. Priority is given to blockages that cause major flooding. The MSD will also undertake emergency control measures when there is a significant threat from flooding or erosion, or to protect its sanitary facilities.

## **9. Trench Drains, Swales, Roadside Ditches, and Gutters**

The MSD does not maintain any of these drainage components. Instead, these items are the responsibility of the property owners or public entity with jurisdiction.

MoDOT has received a statewide MS4 permit, and will be solely responsible for meeting all of the requirements of MCM 6 for its facilities and activities within the Plan Area. These facilities include state and federal roads and highways, including storm water conveyances located on the right of ways, parking and maintenance facilities for vehicles and equipment, and storage facilities for salt and other materials.

## **D. Operation and Maintenance Program**

The scope of municipal operations varies widely among the 61 entities involved in this Plan. Municipal operations range from very small municipalities, having no municipal facilities other than a few blocks of local streets, to the county government, having responsibility for regional highways, parks, high rise municipal buildings, major construction activities, fleet maintenance operations, airport and all the other various and sundry operations of a major county government. Because of this broad variation in activities, selection of appropriate BMPs to satisfy the permit requirements to the maximum extent practicable will vary considerably among the co-permittees. Training programs will be similarly varied. Each co-permittee has identified and listed their operations that are impacted by the MS4 permit requirements referenced in Section A above and have supplied the required information as part of their MS4 permit application. Under the 2002 Plan, implementation of an Operation and Maintenance

Program by each co-permittee was addressed in the first permit term. Table 9.1 lists a summary of the commonly implemented BMPs applicable to municipal pollution prevention.

The MSD organized a municipal work group and developed a model operation and maintenance program to cover the operations identified in the permit application. Since storm water runoff pays no attention to co-permittee jurisdictional boundaries it is considered beneficial to have uniform minimum procedures for the Plan Area as a whole. Development of this model program was completed in February 2005, and is titled "Operation and Maintenance Program for the Prevention and Reduction of Pollution in Storm Water Runoff from Municipal Operations within the City of [Municipality Name], St. Louis County, Missouri". The model program was submitted to all co-permittees in a letter dated February 28, 2005. Since not all co-permittees have identical facilities, services and operations, they were instructed to adopt only the applicable chapters and elements of the 102 page model program, editing the model to reflect the operations of the implementing organization. Co-permittees were instructed to add measures, beyond those in the model, as it deems appropriate to meet its specific community needs. As reported in St. Louis Metropolitan Small MS4 Annual Reports, MSD and MDNR held several workshops to assist program managers in implementing the operation and maintenance program, and training their employees. As this Plan is being written prior to the end of the first permit term, it is expected that each co-permittee will have implemented an adequate program by the end of the first permit term.

In implementing the model program, co-permittees have identified the activities, locations and responsible parties for management and implementation of the best management practices for nine major activity areas. These major activity areas are discussed below to cover all of the operations/activities engaged in by the 61 co-permittees under this plan.

Table 9.1 Summary of BMPs Currently Used for Pollution Prevention/Good Housekeeping

<b>BEST MANAGEMENT PRACTICES</b>
<b>Pet Waste Controls</b> Pooper scooper ordinance Ordinances addressing pet wastes on owner's property Provide pet waste signs and stations in public parks, etc
<b>Vehicle/Equipment Maintenance &amp; Parking</b> Minimize solvent use Use safer alternatives & recycled products Clean up spills promptly & w/minimal use of water Practice good housekeeping Properly store & dispose of hazardous wastes Recycle used oil, antifreeze, batteries, solvents, etc Provide & maintain traps for drips from parked equip
<b>Vehicle Washing</b> Use commercial facilities On-site, capture, treat & dispose washwater to san sew
<b>Illegal Dumping Control</b> Public Education Programs Ordinance & enforcement against illegal dumping Install/maintain structural controls for trash at outfalls
<b>Recycling Facilities</b> Control & properly dispose runoff Practice good housekeeping
<b>Landscaping &amp; Lawn Care</b> Employ planning & design using natural property conditions Utilize soil analyses Select plants appropriate to the region Use non-turf plantings wherever possible Irrigate efficiently Use mulches & compost effectively Minimize use of fertilizers, herbicides & pesticides
<b>Pest Control</b> Employ integrated pest mgt program for muni facilities
<b>Perform Street/Parking Lot Cleaning</b>
<b>Road &amp; Bridge Maintenance</b> Calibrate deicer applicators to prevent over-application Minimize maintenance activities during wet weather Capture paint/rust particles during cleaning/painting
<b>Perform Storm Drain System Cleaning</b>
<b>Properly Manage Muni Swim Pool Backwash/Drainage</b>
<b>Materials Management</b> Use Alternatives to Toxic Substance Properly Store Hazardous Substances Safely Store Road Salt & Other Deicing Materials Have a Spill Prevention & Control Program
<b>Maintain Regular Material Inventories</b> Identify hazardous & non-hazardous substances Properly label all containers Note materials requiring special handling/storage/disp
<b>Employee Education/Training</b> Provide Edu/Train in Pollution Prevention, Environmental Technology, etc

## **1. General Housekeeping and Operation and Maintenance**

This is the largest category since it incorporates general practices that can apply to most municipal operations, from custodial activities in municipal offices to operation and maintenance activities in shops, on streets and at satellite facilities. BMPs, under this category include those dealing with materials management and storage, e.g. salt, compost, etc., safe material substitutions, spill plans, establishment of standard O&M procedures, scheduling, community regulation, record keeping and housekeeping practices in general. Under community regulation, model ordinance language to address various solid waste issues such as trash, litter, and pet waste was also included in the model program. Some of the BMPs in this category will apply to every co-permittee.

## **2. Vehicle/Equipment Repair and Maintenance Operations**

In addition to the applicable practices from general category #1, BMPs under this category address such things as preventative maintenance and drainage from fleet parking areas. Many of the small municipal co-permittees do not engage in these operations and will not need to address them within their programs. The BMPs in this category will apply to MSD, St. Louis County and those municipal co-permittees that engage in such activities.

## **3. Vehicle/Equipment Washing**

BMPs under this category address drainage from washing areas and use of commercial facilities. As in category #2, many of the small municipal co-permittees do not engage in these operations and will not need to address them within their programs. The BMPs in this category will apply to MSD, St. Louis County and those municipal co-permittees that have vehicles/equipment that is washed.

## **4. Facility Repair, Remodeling and Construction**

Repair, remodeling, and construction activities at municipal facilities can generate wastes similar to those identified in MCM 4 for construction and land disturbance activities. BMPs under this category address erosion and sediment control, minimization of impervious areas and the applicable general practices from housekeeping and O&M practices. MSD, St. Louis County, and several of the larger municipal co-permittees routinely engage in such activities. Even the smallest co-permittee has the potential to engage in such activity. The BMPs in this category can apply to every co-permittee.

## **5. Cleaning and Maintenance of Roadways, Highways, Bridges, and Parking Facilities**

Each of the co-permittees has some responsibility for roadway maintenance. Only St. Louis County is involved with highway maintenance. The responsibilities of the other co-permittees vary considerably, depending on their size and the extent of their infrastructure. BMPs under this category address such things as pavement cleaning, deicing material storage and use, erosion, and sediment control and capture of pollutants during maintenance work. Some of the BMPs in this category will apply to every co-permittee.

## **6. Maintenance of Parks, Green Spaces, Trails, and Landscaping**

Except for some of the smaller municipalities all of the co-permittees have responsibilities under this category. These responsibilities vary greatly from maintaining only a small green space around a village hall to maintenance of regional parks and public recreation areas. BMPs under this category address such things as good planning and design, integrated pest management, effective irrigation and smart usage of fertilizers, herbicides and pesticides. The BMPs in this category will apply to MSD, St. Louis County and those municipal co-permittees that have such land areas to maintain.

## **7. Cleaning and Maintenance of Drainage Channels, Storm Sewers, and Inlet Structures.**

The MSD has the major responsibility for this activity within the Plan Area. MSD cleaning operations for enclosed conveyances typically involve flushing to a point of collection and use of a Vactor truck to remove the materials for proper disposal. Other co-permittees are responsible only for public storm water conveyances that have not been dedicated to MSD. These include conveyances that do not meet MSD standards for acceptance, conveyances that are contained entirely within a municipal complex or facility area and crossroad culverts under municipal roadways. Such conveyances remain the responsibility of the owning co-permittee. BMPs under this category address such things as proper scheduling and employment of non-polluting cleaning methods. The BMPs in this category will apply primarily to MSD but will also apply to a lesser extent to many of the co-permittees.

## **8. Operation and Maintenance of Recycling Facilities**

Only a small number of the co-permittees currently operate permanent recycling facilities where citizens can drop off recyclable materials such as glass, plastic, paper and similar items. A greater number of co-permittees operate facilities for recycling of landscape wastes (leaves, clippings, tree trimmings, etc), from municipal operations or collections. These facilities process such materials into mulch and/or compost which is then used for municipal operations as well as made available to the community's citizens. BMPs under this category address such things as proper physical siting to minimize storm water contact and routing of any runoff to proper disposal. The BMPs in

this category will only apply to those co-permittees that operate recycling or composting facilities.

## **9. Water Quality Impact Assessment of Flood Management Projects**

Responsibilities for this activity fall most heavily upon MSD, St. Louis County and those municipal co-permittees bordering the major rivers or located in the lower reaches of major watersheds. However, even the smaller municipal co-permittees can be involved in managing localized flooding situations. BMPs under this category address procedures to review new and existing flood management programs/facilities to minimize impacts on water quality. The BMPs in this category will apply, to a greater or lesser extent, to many of the co-permittees.

### **E. Municipal Employee Training Program**

The MS4 permit requires that the operation and maintenance program include a training component. The education and training of municipal employees is necessary to effectively implement this program. The training of municipal employees was employed early in the Phase II process under the previous plan to accomplish immediate benefits through municipal good housekeeping. Initially, nine workshops were held by MSD and MDNR's Environmental Assistance Office on the operation and maintenance program, covering an overview of the program plus best management practices for general housekeeping, vehicle and equipment maintenance, and facilities and parks management. MSD continues to provide annual refresher training on best management practices for the operation and maintenance program. MSD also makes other information available to co-permittees, including a training DVD and a "Working Together to Manage Stormwater Pollution" brochure available for employees and the public summarizing the best management practices implemented under the program.

Many of the larger co-permittees have developed in-house training geared to their specific needs and activities. Co-permittees are required to keep records and track their training activities to document and ensure that all current employees received initial training applicable to their job responsibilities and that new or re-assigned employees receive training applicable to their new job responsibilities within a specified period of time after employment. Provisions will be included for refresher training or training in new procedures to ensure employee knowledge and skills are maintained and updated.

Materials produced for distribution to the public under MCM 1 are also provided to municipal employees engaged in the types of activities to which those materials apply. Municipal employees are encouraged to actively participate in the public education efforts and public involvement activities discussed under MCM 1 and 2.

## **F. Trash and Pet Waste Ordinances**

Under the first plan, traditional municipal functions dealing with trash, litter and pet waste were addressed through a specific initial effort, and then included as part of the operation and maintenance program. In Year 1 of the 2002 Plan, co-permittees evaluated their trash and pet waste control ordinances, and the need to modify or pass new ordinances. Model ordinance language was developed and submitted to co-permittees for implementation to address the need. The model ordinance language has also been incorporated into the good housekeeping provisions of the operation and maintenance program. Those co-permittees that lacked adequate ordinances amended existing ordinances or adopted new ones under the first permit term.

## **G. Rationale for New Goals**

Previous sections of this chapter have dealt with activities carried out by co-permittee staff in implementation of the operation and maintenance program under the first MS4 permit term. Under the second permit term, the co-permittees will maintain their operation and maintenance programs and continue to provide refresher training to their employees on best management practices. Additionally, several new goals will be implemented to further the implementation of these programs and improve the best management practices implemented. Successful implementation of various best management practices will be identified and shared among all co-permittees to encourage the implementation of as many of the best practices as possible in the Plan Area. To accomplish this, case studies or educational information will be developed and shared among co-permittees. Effective tools, such as a model checklist, will be provided for municipal facility inspections. Due to the addition of chloride to the list of priority pollutants under the Plan, an emphasis on related best management practices has been given during training. However, the co-permittees will begin to report and track the actual usage of de-icers annually.

Trash and litter in our communities and the storm water system is still a priority pollutant under this plan. Under the 2002 Plan, the appropriate legal mechanisms for dealing with trash were put in place through evaluation and passage of trash and pet waste ordinances. Enforcement of ordinances is generally thought to be characterized in the Plan Area as complaint driven. Depending on the various, numerous residential and commercial sources of litter and solid waste, problems are thought to exist in identifying the sources, obtaining legally defensible evidence, and enforcing the ordinances. Therefore, goals will be included for the co-permittees to identify specific priority areas in the communities, and develop and implement a plan to address the specified areas. A focused combination of efforts will be used to include: public education, public involvement activities, and enforcing ordinances to address these problem areas.

The specific, reportable pollution prevention and good housekeeping activities to be performed by co-permittees identified in this Plan are listed by permit year as follows:

## Annually

Training in BMPs will continue as refresher seminars and workshops, and as BMP introduction for new employees as co-permittees implement their ongoing employee training programs. MSD will provide BMP refresher workshops for the co-permittees. Co-permittees will report on the number of employees trained.

All co-permittees will inspect their facilities to ensure implementation of best management practices and report the number of inspections annually. Inspection findings will be incorporated into the co-permittee's program review and employee training program.

St. Louis County and municipalities will report salt usage per lane mile (as actual or estimated), the application equipment and method used, and application rate(s) selected and the selection methodology used in snow and ice removal from roadways.

## Year 1

MSD will develop and distribute a municipal facility inspection template checklist based on the model Operation and Maintenance Program.

A municipal work group will be organized to develop a guidance document that will include a menu of approaches to address problem areas for illegal solid waste disposal and the plan's trash and bacteria water quality goals.

St. Louis County and MSD will develop a reporting form and guidance for tracking snow and ice removal methodologies from roadways: such as product (i.e., salt) usage per lane mile, the application equipment and method used, and the application rate(s) selected and the selection methodology used.

## Year 2

Municipalities and St. Louis County will identify specific solid waste (trash and pet waste) problem areas in their community, make a priority list of sites to address, and develop a plan of action in Year 2 to address these areas by March 2013.

All municipalities with parks will post pet waste signs in the parks.

## Year 3

MSD and partners will identify and develop educational information or a case study, and distribute to co-permittees to encourage implementation of a best management practice regarding a calibrated spreader for road salt application, or similar practice.

Each co-permittee will continue to implement specific action plans with the goal to address all solid waste (trash and pet waste) problem areas in the community by March 2013.

#### Year 4

MSD and partners will identify and develop educational information or a case study, and distribute to co-permittees to encourage implementation of another best management practice.

Each co-permittee will continue to implement specific action plans with the goal to address all solid waste (trash and pet waste) problem areas in the community by March 2013.

MSD and St. Louis County will evaluate data on salt usage per lane mile, application equipment and method, and application rate goals used in snow and ice removal from roadways, and distribute a report of the evaluation that makes recommendations for best practices.

#### Year 5

Each co-permittee will complete implementation of specific action plans to address all solid waste (trash and pet waste) problem areas in the community by March 2013.

## CHAPTER 10

### Record Keeping and Reporting

#### **A. MS4 Permit Requirements**

Several sections of the general MS4 permit contain requirements pertaining to permittee record keeping and reporting. These requirements, as listed below, apply to each of the 61 co-permittees in the St. Louis County Plan Area.

Section 4.1.2.3 requires the permittee to designate individuals responsible for environmental matters. This section also requires the permittee to inspect any structures that function to prevent pollution of storm water or to remove pollutants from storm water and of the permittee's area of jurisdiction in general to ensure that any BMPs are continually implemented and effective.

Section 4.4 requires the permittee to do an annual review of the permittee's storm water management program (SWMP) in conjunction with preparation of the annual report required under section 5.3. The permittee may update the program subject to the following procedures as specified in the permit:

Changes adding (but not subtracting or replacing) components, controls or requirements to the SWMP may be made at any time upon written notification to the MDNR.

Changes replacing an ineffective or infeasible BMP specifically identified in the SWMP with an alternate BMP may be requested at any time with the following information to be supplied to the MDNR:

1. An analysis of why the BMP is ineffective or infeasible (including cost prohibitive),
2. Expectations on the effectiveness of the replacement BMP, and
3. An analysis of why the replacement BMP is expected to achieve the goals of the BMP to be replaced.

Section 5.1.1 requires the permittee to evaluate program compliance, the appropriateness of identified BMPs, and progress toward achieving identified measurable goals.

Section 5.2 requires the permittee to retain records of all activities requiring record keeping by this Plan.

Section 5.3 requires the permittee to submit annual reports to the MDNR by April 10 of each year of the permit term. The reports must include:

The status of the permittee's compliance with permit conditions, an assessment of the appropriateness of the identified BMPs, progress towards achieving the statutory goal of reducing the discharge of pollutants to the maximum extent practicable and the measurable goals for each of the minimum control measures;

Results of information collected and analyzed, if any, during the reporting period, including monitoring data used to assess the success of the program at reducing the discharge of pollutants to the maximum extent practicable;

A summary of the storm water activities the permittee plans to undertake during the next reporting cycle (including an implementation schedule);

Proposed changes to the permittee's SWMP, including changes to any BMPs or any identified measurable goals that apply to the program elements; and

Notice that the permittee is relying on another government entity to satisfy some of the permittee's permit obligations (if applicable).

## **B. Record Keeping**

Each co-permittee will designate, on the co-permittee's individual permit application, an individual in overall charge of storm water management activities within the co-permittee's area of jurisdiction. That individual will be responsible for ensuring that:

- All elements of this Plan, pertaining to the identified co-permittee, are effectively implemented;
- Required inspections are made;
- Required records are kept; and
- Information required for inclusion in reports to MDNR is provided to the coordinating authority (MSD) upon request or as scheduled.

The permit specifies certain actions, such as inspections, which each co-permittee must perform. In addition, this Plan identifies actions that the co-permittees are committed to take in order to comply with the requirements of the Phase II Storm Water Regulations and the terms and conditions of the MS4 permit. Measurable goals and time frames for achieving those goals have been established. Accurate and timely record keeping by each co-permittee is essential in order to document the timeliness and effectiveness of committed actions, to demonstrate compliance with the permit requirements and to provide the basis for the annual reports. Co-permittees must maintain documentation regarding the implementation of programs and the maintenance of the programs under the MS4 permit. Records are required to be maintained by the co-permittee for a minimum of three years.

Following are examples of the types of actions for which records should be kept. This listing is not all inclusive:

- Inspections as required by Section 4.1.2.3 of the permit (Record dates, areas inspected, personnel involved, findings, follow-up actions, etc.). Each co-permittee must conduct inspections within its area of jurisdiction for the activities for which it is responsible under this Plan.
- Annual program evaluations as required by Section 4.4 of the permit (Record evaluation method and results. If changes are proposed in the Plan, record the reasoning behind the changes).
- Public information efforts under MCM 1 (Record dates, activity such as brochure distribution, speaking event, etc.; type and number of people reached, milestones in web site development, web site hits, results of public knowledge surveys; etc.).
- Public involvement efforts under MCM 2 (Record milestones in public involvement activity dates, nature of activities; applicable statistics such as numbers of volunteers, numbers of people reached, quantities of waste collected or removed, miles of stream or road cleaned, number of inlets marked, pet pledge cards signed; etc.).
- Illicit discharge detection and elimination efforts under MCM 3 (Record statistics such as miles of streams surveyed, number of illicit discharge investigations initiated, number of stream problems identified; results of investigations and problem identification; etc.)
- Construction site storm water control efforts under MCM 4 (Record milestones in co-permittee program development, program modifications/adoptions; statistics such as the number of permits issued; etc.).
- Post-construction storm water management in new development and redevelopment efforts under MCM 5 (Record milestones in review and modification of existing regulations, and MSD approval of BMPs; ensuring the operation and maintenance responsibilities for residential structural BMPs; etc.).
- Pollution prevention/good housekeeping for municipal operations efforts under MCM 6 (Record milestones in review and modification of existing ordinances, development and adoption of a model O&M program, development of a training program, dates, locations and subject matter of training sessions; statistics such as numbers of training sessions held, numbers of employees trained/refreshed; etc.).

### **C. Reporting**

As the coordinating authority for the Plan Area, the Metropolitan St. Louis Sewer District will compile the information provided by the individual co-permittees to satisfy the

permit's annual review, program evaluation and annual report requirements. The District's Division of Environmental Compliance (DEC) will be responsible for coordinating this activity and preparing and submitting the reports to MDNR.

The MSD DEC will develop appropriate standardized forms that co-permittees can use to supply required information.

The MSD DEC will develop schedules for submittal of information required for reporting purposes, including the annual reports.

## CHAPTER 11

### BMP Goals, Measurements, and Responsibilities

#### A. Purpose

The purpose of this chapter is to summarize in one convenient location within this Plan the various BMPs and goals selected each year of the permit period to comply with requirements of the six Minimum Control Measures. The entity within the Plan Area responsible for implementation is also included. BMPs that are implemented as ongoing programs list the permit year as “all” indicating the goal will be implemented in each year of the permit. The information contained in this chapter summarizes what has been presented in narrative format in each of the Chapters on MCMs for the convenience of readers.

#### B. BMP Implementation Information

##### **MCM 1: PUBLIC EDUCATION AND OUTREACH**

<b>Permit Year</b>	<b>BMP Goal Selected</b>	<b>Measurement Method</b>	<b>Responsibility</b>
All	a. Brochures and other educational materials will be distributed to improve water quality.	Number distributed	MSD
	b. Presentations on water quality and nonpoint source pollution education will be provided.	Number presentations	MSD
	c. Phase II web page visits.	Number page visits	MSD
1	a. A communication committee with partners will be formed to develop/implement an outreach strategy.	Committee formed, outreach products	MSD
2	a. Develop a radio public service announcement and distribute to radio stations.	Radio PSA developed and distributed	MSD
3	a. Distribute educational information on a relevant topic District-wide using bill inserts, cable TV, or other mass media.	Message delivered	MSD
4	a. Distribute educational information on a relevant topic District-wide using bill inserts, cable TV, or other mass media.	Message delivered	MSD
5	a. Distribute educational information on a relevant topic District-wide using bill inserts, cable TV, or other mass media.	Message delivered	MSD
	b. Conduct a survey to evaluate public awareness and program effectiveness.	Number of responses	MSD

**MCM 2: PUBLIC INVOLVEMENT AND PARTICIPATION**

Permit Year	BMP Goal Selected	Measurement Method	Responsibility
All	a. Volunteer presentations	Number supported	MSD
	b. Storm drain marker projects	Number supported	MSD
	c. Neighborhood and stream clean-ups	Number supported	MSD
	d. Household hazardous waste collection	Waste volume	St. Louis County
1	a. No new programs planned	---	---
2	a. MSD and co-permittees will organize an annual Plan Area stream clean-up event.	Participation and waste volume	All co-permittees
3	a. If established by the Board, MSD will present water quality related issues and activities to the storm water watershed advisory committees.	Meetings and presentations	MSD
4	a. Develop a plan for implementation of a storm water management public involvement program to reduce the volume and/or rate of discharge of storm water.	Program plan developed	MSD
5	a. Develop and distribute the storm water management public involvement program promotional and/or educational information to the public.	Program implemented	MSD
	b. MSD, supported by citizen volunteers, will publish a report of their activities, including outcomes and recommendations for future volunteer activities.	Report prepared and published	MSD

**MCM 3: ILLICIT DISCHARGE DETECTION AND ELIMINATION**

Permit Year	BMP Goal Selected	Measurement Method	Responsibility
All	a. Survey 1400 miles of area streams for illicit discharge over permit term, averaging 280 miles per year over 5 years.	Miles surveyed	MSD
	b. Distribute an illicit storm water discharges brochure to 20% of MSD's industrial customers each year.	Brochures distributed	MSD
	c. Inspect outdoor waste handling areas at restaurants and other facilities as part of the interceptor/grease trap inspections.	Inspections performed	MSD
1	a. No new programs planned.	---	---
2	a. No new programs planned.	---	---

**Continue MCM 3**

Permit Year	BMP Goal Selected	Measurement Method	Responsibility
3	a. A work group will be formed to develop a strategic plan for septic systems to minimize their impact on water quality.	Work group formed	MSD and St. Louis County
4	a. The strategic plan for addressing septic systems developed will be distributed among involved agencies for implementation.	Strategic plan distributed	MSD and St. Louis County
5	a. No new programs planned	---	---

**MCM 4 CONSTRUCTION SITE STORM WATER RUNOFF CONTROL**

Permit Year	BMP Goal Selected	Measurement Method	Responsibility
All	a. Land disturbance permits issued will be reported by name and area disturbed.	Annual Report	Municipalities & St. Louis Co.
	b. Land disturbance program formal NOVs and further enforcement actions will be reported, listing the violating organizations.	Annual Report	Municipalities & St. Louis Co.
1	a. Develop a training program for developers and construction company employees on sediment and erosion control BMPs.	Program developed	St. Louis County and MSD
2	a. Provide training for developers and construction company employees on sediment and erosion control BMPs, and evaluate training effectiveness.	Training sessions	St. Louis County and MSD
3	a. Develop list of top ordinance or BMP categories in frequent noncompliance, and deliver a presentation or distribute educational materials to construction companies and developers.	Presentations or material distributed	MSD and St. Louis County
4	a. Identify the tools and resources for municipalities to improve implementation of their Phase II land disturbance programs.	Resources identified	MSD and St. Louis County
5	a. Hold a training workshop for municipal staff to cover storm water pollution prevention plans, compliance inspections and program enhancements identified in year 4, and track the implementation of the tools presented.	Workshop sessions	MSD and St. Louis County

**MCM 5: POST-CONSTRUCTION STORM WATER MANAGEMENT**

<b>Permit Year</b>	<b>BMP Goal Selected</b>	<b>Measurement Method</b>	<b>Responsibility</b>
All	a. BMPs approved/installed, and BMPs inspected to ensure proper operation and maintenance.	Number of BMPs installed and inspected	MSD
	b. Developments utilizing the MSD conceptual review service will be reported.	Number of reviews	MSD
1	a. Develop educational material on BMPs and to promote the use of non-structural credits and the benefits of site storm water management planning prior to land disturbance.	Material developed	MSD
	b. Provide storm water management BMP guidelines to public works and planning and zoning reviewers to assist in the concept review of site plans.	Material distributed	MSD
	c. Implement procedures to ensure all applicable private and public projects involving storm water management are reviewed and approved by MSD.	Procedures implemented	Municipalities and St. Louis Co
2	a. Distribute educational materials to municipal public works, developers and engineers on BMPs and to promote the use of non-structural credits and the benefits of site storm water management planning prior to land disturbance.	Material distributed	MSD
	b. Evaluate legal impediments to the design, installation, operation and/or maintenance of non-structural BMPs allowed under MSD's Stormwater Design Rules and Regulations.	Evaluation performed	MSD
	c. Adopt and implement one additional directed growth planning and zoning strategy to protect water quality, as necessary, to have two strategies in place.	Ordinance or strategy adopted	Municipalities and St. Louis Co
3	a. Distribute a report on the legal impediments to the design, installation, operation and/or maintenance of non-structural BMPs.	Reports distributed	MSD
	b. Develop an educational reference library (toolbox) for BMP engineering design requirements.	Library developed	MSD

**Continue MCM 5**

Permit Year	BMP Goal Selected	Measurement Method	Responsibility
4	a. Adopt ordinances under property maintenance or other codes to require property owners to maintain structural and non-structural BMPs, where practical.	Ordinance adopted	Municipalities and St. Louis Co
	b. Present at green building or other low impact development venues to gain awareness of the BMP library (toolbox) and to promote better site designs for storm water management.	Presentation given	MSD
	c. Develop educational materials to explain the purpose and function of structural and non-structural BMPs in the community, and the property owners' responsibility for BMP maintenance.	Educational material developed	MSD
5	a. Distribute educational materials explaining the purpose and function of structural and non-structural BMPs in the community to the public, utilizing an O&M manual, pamphlet or other appropriate method.	Material distributed	MSD

**MCM 6 POLLUTION PREVENTION/GOOD HOUSEKEEPING FOR MUNICIPAL OPERATIONS**

Permit Year	BMP Goal Selected	Measurement Method	Responsibility
All	a. Training on BMPs will continue as refresher seminars and workshops.	Workshops held	MSD
	b. Continue to implement O&M training program for employees.	Employees trained	All co-permittees
	c. Inspect facilities to ensure implementation of best management practices.	Inspections performed	All co-permittees
	d. Track and report salt usage per lane mile, application equipment and method, and application rate goal.	Quantity used	Municipalities and St. Louis Co
1	a. Develop and distribute a municipal facility inspection template checklist based on the model Operation and Maintenance Program.	Checklist distributed	MSD
	b. Develop a guidance document with a menu of approaches to address problem areas for illegal solid waste disposal.	Guidance developed	MSD
	c. Develop a reporting form and guidance for tracking salt usage and application.	Form developed	St. Louis County and MSD

**Continue MCM 6**

<b>Permit Year</b>	<b>BMP Goal Selected</b>	<b>Measurement Method</b>	<b>Responsibility</b>
2	a. Develop a priority list of solid waste (trash and pet waste) problem areas, a plan of action to address these areas by March 2013.	Action plan developed	Municipalities and St. Louis Co
	b. All co-permittees with parks will post pet waste signs in the parks.	Signs posted	Municipalities and St. Louis Co
3	a. Develop educational information or a case study, and distribute to co-permittees to encourage implementation of a best management practice.	Information distributed	MSD
	b. Continue to implement action plans to address solid waste (trash and pet waste) problem areas by 2013.	Actions taken	Municipalities and St. Louis Co
4	a. Develop educational information or a second case study, and distribute to co-permittees to encourage implementation of a best management practice.	Information distributed	MSD
	b. Continue to implement action plans to address solid waste (trash and pet waste) problem areas by 2013.	Actions taken	Municipalities and St. Louis Co
	c. Distribute a report evaluating data on salt usage per lane mile, application equipment and method, and application rate goals used in snow and ice removal, and recommend best practices.	Report distributed	St. Louis County and MSD
5	a. Complete implementation of action plans to address solid waste (trash and pet waste) problem areas.	Actions taken	Municipalities and St. Louis Co

**C. Effectiveness of BMPs**

It is considered by the Planning Committee that the BMP goals and measurements identified in this chapter comply with the requirements of the Phase II Regulations and that when implemented the pollution of storm water in the Plan Area will be prevented to the maximum extent practicable.

# Appendices



APPENDIX A3-1  
WATER QUALITY ANALYSIS

CREVE COEUR CREEK NEAR CREVE COEUR - WATER QUALITY ANALYSIS  
USGS SITE 06935890 WET WEATHER (FIRST FLUSH) RESULTS

PARAMETER (units)	10/10/01	3/20/02	10/2/02	3/19/03	10/9/03	3/4/04	10/12/04	3/22/05	WQ STANDARD*				
	05:44	19:19	23:30	11:44	11:43	10:12	10:03	14:04	MIN	MAX	MEAN	ACUTE	CHRONIC
Discharge (CFS)	42	56	113	117	353	104	64	249	42	353	137.25		
pH (units)	7.5	7.9	7.4	8	7.2	7.7	7.8	7.8	7.2	8	7.66		
Temperature (deg. C)	16.5	9	21.9	13.8	17.5	9.1	14.9	7.1	7.1	21.9	13.73		
Dissolved Oxygen (mg/l)	7.9	9.6	6.2	9.1	6.7	8.7	8	10	6.2	10	8.28		5
Fecal Coliform (col/100ml)	42000	680	12700	917	36,000		8,000	2,200k	680	42000	16716.17		200
Fecal Streptococci (col/100ml)	47000	860	24000	1440	55,000				860	55000	25660.00		
Ratio (Fec Coli/Fec Strep)	0.89	0.79	0.53	0.64	0.65				0.53	0.89	0.70		
Total Nitrogen as N (mg/l)	2.31	1.34	3.41	2.56	2.46	2.48	1.87	1.71	1.34	3.41	2.27		
Ammonia as N (mg/l)	0.08	0.08	0.13	0.2	0.05	0.11	0.05	0.24	0.05	0.24	0.12		
Total Phosphorus as P (mg/l)	0.58	0.15	1.1	0.42	0.72	0.54	0.28	0.34	0.15	1.1	0.52		1.08
Hardness as CaCO3 (mg/l)	64	240	98	250	150	170	260	300	64	300	191.50		
Total Suspended Solids (mg/l)	338	66	944	495	654	1020	93	265	66	1020	484.38		
Oil and Grease (mg/l)	<7	<7	<7	<7	7	<7	<7	1.17	0	7	1.17		10
Aluminum, dissolved (ug/l)	506	180	<3	3	3	6	<2	2	0	506	87.88		750
Arsenic, dissolved (ug/l)	2	2	2	2	2	1	2.3	1.2	1	2.3	1.81		20
Beryllium, dissolved (ug/l)	<1	<1	<1	<1	<1	<1	<0.06	<0.06	0	0	0.00		5
Cadmium, dissolved (ug/l)	1	<1	1.5	<1.0	<1	<1	0.11	0.17	0	1.5	0.35		0.3
Chromium, dissolved (ug/l)	1	4.6	1.3	1.1	3.1	<1	<1	0.9	0	4.6	1.50		103
Copper, dissolved (ug/l)	2	2.2	2.3	2.4	2.6	1.9	2.5	3.5	1.9	3.5	2.43		20
Iron, dissolved (ug/l)	545	188	15	8	17	16	21	8	8	545	102.25		1000
Lead, dissolved (ug/l)	<1	<1	<1	<1	<1	<1	<0.08	<0.08	0	0	0.00		4
Manganese, dissolved (ug/l)	54	232	133	265	100	125	95.5	345	54	345	168.69		
Mercury, total recoverable (ug/l)	0.1	<1	<1	<0.1	<0.1	<0.1	<1	0.02	0	0.1	0.02		2.4
Nickel, dissolved (ug/l)	1.3	2.9	3.1	3.2	2.8	1.6	2.48	5.47	1.3	5.47	2.86		660
Selenium, dissolved (ug/l)	<1	<1	<1	1	<1	2	1	1	0	2	0.62		5
Silver, dissolved (ug/l)	<1	<1	<1	<1.0	<1.0	<1.0	<2	<2	0	0	0.00		6.5
Zinc, dissolved (ug/l)	37	49	2	<2	4	5	2	2.5	0	49	12.69		165

Note: To determine Water Quality Standards:

A pH of 8.0 and Temperature of 20 degrees C was used for Ammonia

A Hardness range of 150 mg/l to 174 mg/l was used for the metals.

The Dissolved Oxygen WQ Standard is the minimum acceptable value.

APPENDIX A3-1  
WATER QUALITY ANALYSIS

**COLDWATER CREEK NEAR BLACK JACK - WATER QUALITY ANALYSIS  
USGS SITE 06936475 WET WEATHER (FIRST FLUSH) RESULTS**

PARAMETER (units)	10/10/01	3/9/02	10/29/03	3/19/03	10/6/03	3/4/04	10/12/04	3/22/05	WQ STANDARD*				
	09:24	04:42	07:14	12:47	16:12	13:31	20:02	14:52	MIN	MAX	MEAN	ACUTE	CHRONIC
Discharge (CFS)	1640	189	641	761	1,510	1,420	339	1,150	189	1640	956.25		
pH (units)	7.8	7.4	7.7	7.7	7.5	7.4	7.7	7.8	7.4	7.8	7.63		
Temperature (deg. C)	17.1	11.8	11.4	13.1	18.6	9.4	15.3	6.9	6.9	18.6	12.95		
Dissolved Oxygen (mg/l)	7.1	1.1	7.6	5	6.4	10.7	6.1	11.7	1.1	11.7	6.96		5
Fecal Coliform (col/100ml)	21500	38,000	10,500	10,500	22,000	2,700k	5,200	5,200	5200	38000	19440.00		200
Fecal Streptococci (col/100ml)	20000	7,600	10,100	10,100	4,400	8,330			4400	20000	10086.00		
Ratio (Fec Coli/Fec Strep)	1.08	5.00	1.00	1.00	2.64				1	5	2.43		
Total Nitrogen as N (mg/l)	2.84	3.12	2.2	3.64	3.54	5.03	2.11	4.31	2.11	5.03	3.35		
Ammonia as N (mg/l)	0.05	0.25	0.01	0.26	0.08	0.4	0.06	0.24	0.01	0.4	0.17		
Total Phosphorus as P (mg/l)	1	0.2	0.54	0.68	1.2	2.2	0.4	1.69	0.2	2.2	0.99		1.08
Hardness as CaCO3 (mg/l)	45	370	130	120	64	71	220	160	45	370	147.50		
Total Suspended Solids (mg/l)	861	134	409	611	1,290	1,930	182	1280d	134	1930	773.86		
Oil and Grease (mg/l)	<7	<7	<7	<7	E3n	<7			0	0	0.00		10
Aluminum, dissolved (ug/l)	452	15	5	4	5	6	<2	3	0	452	61.25		750
Arsenic, dissolved (ug/l)	2	4	<1	2	2	2	2.6	1.5	0	4	2.01		20
Beryllium, dissolved (ug/l)	<1	<1	<1	<1	<1	<1	<0.6	<0.6	0	0	0.00		5
Cadmium, dissolved (ug/l)	1	<1	<1.0	<1.0	<1	<1	0.21	0.23	0	1	0.18		0.4
Chromium, dissolved (ug/l)	1.1	6.4	<1.0	1.8	1.1	<1	<1	0.8	0	6.4	1.40		117
Copper, dissolved (ug/l)	6.5	1.5	1.5	1.8	1.6	1.4	3	1.7	1.4	6.5	2.38		12
Iron, dissolved (ug/l)	612	42	41	39	28	22	25	20	20	612	103.63		1000
Lead, dissolved (ug/l)	2	<1	<1	<1	<1	<1	0.1	0.09	0	2	0.27		5
Manganese, dissolved (ug/l)	67	1100	107	251	86	139	142	205	67	1100	262.13		
Mercury, total recoverable (ug/l)	0.1	<1	<0.1	<0.1	<0.1	<0.1	0.01	0.05	0	0.1	0.02		0.5
Nickel, dissolved (ug/l)	1.7	4.6	1.8	2.8	1.6	1.5	4.67	3.85	1.5	4.67	2.82		84
Selenium, dissolved (ug/l)	<1	3	4	1	<1	2	1.2	1.1	0	4	1.54		5
Silver, dissolved (ug/l)	<1	<1	<1.0	<1.0	<1.0	<1.0	<2	5.9	0	5.9	0.74		8.4
Zinc, dissolved (ug/l)	20	124	4	8	4	6	<2	4.5	0	124	21.31		172

Note: To determine Water Quality Standards:

A pH of 8.0 and Temperature of 20 degrees C was used for Ammonia

A Hardness range of 175 mg/l to 199 mg/l was used for the metals.

The Dissolved Oxygen WQ Standard is the minimum acceptable value.

APPENDIX A3-1  
WATER QUALITY ANALYSIS

GRAND GLAIZE CREEK NEAR VALLEY PARK - WATER QUALITY ANALYSIS  
USGS SITE 07019185 WET WEATHER (FIRST FLUSH) RESULTS

PARAMETER (units)	10/5/01	2/19/02	10/25/02	3/19/03	10/9/03	3/4/04	10/12/04	3/22/05	WQ STANDARD*
	08:56	15:54	07:24	09:47	12:02	08:59	17:15	11:27	
Discharge (CFS)	161	210	130	178	509	302	137	188	
pH (units)	7.6	8	8	8.4	7.5	7.2	7.7	7.7	
Temperature (deg. C)	16.1	8.4	11.6	13.5	17.3	9	15.2	7.9	
Dissolved Oxygen (mg/l)	7.1	10.6	10.6	9.9	7.3	9.6	8.2	12	5
Fecal Coliform (col/100ml)	29000		4,400	8,160	26,000	50,000	14,000k	1,200k	200
Fecal Streptococci (col/100ml)	13800	5800	1,500	9,170	22,500	5,600			
Ratio (Fec Coli/Fec Strep)	2.10		2.93	0.89	1.16	8.93			
Total Nitrogen as N (mg/l)	1.25	1.56	0.87	2.4	2.4	2.63	1.52	1.06	
Ammonia as N (mg/l)	0.07	0.21	0.05	0.13	0.1	0.23	<0.4	0.05	
Total Phosphorus as P (mg/l)	0.28	0.2	0.17	0.39	0.76	0.54	0.28	0.17	8.92
Hardness as CaCO3 (mg/l)	260	300	230	240	170	180	130	370	
Total Suspended Solids (mg/l)	190	307	114	596	1,400	741	92	122	
Oil and Grease (mg/l)	<7	3	<7	<7	<7	<1			10
Aluminum, dissolved (ug/l)	54	164	<3	<3	5	5	3	<1	750
Arsenic, dissolved (ug/l)	2	<1	2	2	2	1	1.4	0.9	20
Beryllium, dissolved (ug/l)	<1	<1	<1	<1	<1	<1	<0.6	<0.6	5
Cadmium, dissolved (ug/l)	1	<1	<1.0	<1.0	<1	<1	0.13	0.13	0.4
Chromium, dissolved (ug/l)	1	<1	2.1	2.2	2.9	<1	1.7	0.8	1005
Copper, dissolved (ug/l)	2	1.4	1.5	2.4	1.9	1.3	2.3	2.4	26
Iron, dissolved (ug/l)	57	118	11	14	7	16	24	20	13
Lead, dissolved (ug/l)	<1	<1	<1	<1	<1	<1	<0.8	<1	1000
Manganese, dissolved (ug/l)	84	186	64	253	33	183	45.4	287	136
Mercury, total recoverable (ug/l)	<1	<1	<0.1	<0.1	<0.1	<0.1	<1	<1	2.4
Nickel, dissolved (ug/l)	1.5	1.5	2.2	3.4	2.3	1.6	2.34	5.75	842
Selenium, dissolved (ug/l)	<1	<1	<1	1	<1	3	0.4	0.8	5
Silver, dissolved (ug/l)	<1	<1	<1.0	<1.0	<1	<1	<2	<2	10.6
Zinc, dissolved (ug/l)	67	97	3	<2	2	7	2.4	3.9	211

Note: To determine Water Quality Standards:

A pH of 8.0 and Temperature of 20 degrees C was used for Ammonia

A Hardness range of 200 mg/l to 224 mg/l was used for the metals.

The Dissolved Oxygen WQ Standard is the minimum acceptable value.

APPENDIX A3-1  
WATER QUALITY ANALYSIS

MALINE CREEK AT BELLEFONTAINE NEIGHBORS - WATER QUALITY ANALYSIS  
USGS SITE 07005000 WET WEATHER (FIRST FLUSH) RESULTS

PARAMETER (units)	10/24/01	3/9/02	10/29/02	4/16/03	10/9/03	3/4/04	10/26/04	3/22/05	WQ STANDARD*
	00:45	03:32	05:16	21:09	14:42	12:38	17:00	13:22	
Discharge (CFS)	61	171	180	416	541	709	127	398	
pH (units)	7.2	7.9	7.7	7.7	7.6	7.7	7.5	7.6	
Temperature (deg. C)	15.8	12.8	11.4	17.4	18.4	9.3	17.5	7.1	
Dissolved Oxygen (mg/l)	6	10.3	8.6	8.3	7.2	14.6	7.8	12.1	5
Fecal Coliform (col/100ml)	10600		12,800	14,500	22,000		8,400	27,000K	200
Fecal Streptococci (col/100ml)		4000	14,700	21,000	25,000	10,000			
Ratio (Fec Coli/Fec Strep)		0.87	0.69	0.88					
Total Nitrogen as N (mg/l)	1.31	2.34	1.5	5.4	3.3	4.08	2.04	3.84	
Ammonia as N (mg/l)	0.1	0.03	<0.01	0.18	0.07	0.14	<0.04	0.28	
Total Phosphorus as P (mg/l)	0.27	0.57	0.48	1.6	1.3	2.1	0.92	1.22	1.08
Hardness as CaCO3 (mg/l)	160	240	120	170	66	83	110	120	
Total Suspended Solids (mg/l)	69	575	305	2,300	1,300	2,190	465d	872d	
Oil and Grease (mg/l)	<7	<7	<7	<7	<1	<7			10
Aluminum, dissolved (ug/l)	206	185	4	<3	5	8	3	15	750
Arsenic, dissolved (ug/l)	2	2	1	2	2	2	1.8	1.3	20
Beryllium, dissolved (ug/l)	<1	<1	<1	<1	<1	<1	<0.06	<0.06	5
Cadmium, dissolved (ug/l)	0.3	<1	<1	<1	<1	<1	<1	<1	0.3
Chromium, dissolved (ug/l)	0.6	3.3	<1	2.8	1.4	<1	<0.8	0.9	7.1
Copper, dissolved (ug/l)	4.5	3.8	1.4	2.8	2	2.2	1.7	1.3	794
Iron, dissolved (ug/l)	312	163	20	21	21	18	47	38	20
Lead, dissolved (ug/l)	<1	<1	<1	<1	<1	<1	0.16	0.14	100
Manganese, dissolved (ug/l)	232	409	95	452	75	93	251	218	1000
Mercury, total recoverable (ug/l)	<1	<1	<0.1	0.1	<0.1	<0.1	0.04	0.04	4
Nickel, dissolved (ug/l)	3.2	3.2	1.5	4.2	1.6	1.8	2.42	3.01	2.4
Selenium, dissolved (ug/l)	<1	1	<1	<1	<1	2	0.5	0.6	660
Silver, dissolved (ug/l)	<1	<1	<1	<1	<1	<1	<2	<2	5
Zinc, dissolved (ug/l)	94	25	4	13	3	7	4.3	4.3	6.5
									165
									19.33
									151

Note: To determine Water Quality Standards:

A pH of 8.0 and Temperature of 20 degrees C was used for Ammonia

A Hardness range of 150 mg/l to 174 mg/l was used for the metals.

The Dissolved Oxygen WQ Standard is the minimum acceptable value.

APPENDIX A3-1  
WATER QUALITY ANALYSIS

RIVER DES PERES NEAR UNIVERSITY CITY - WATER QUALITY ANALYSIS  
USGS SITE 07010022 WET WEATHER (FIRST FLUSH) RESULTS

PARAMETER (units)	10/24/01	3/9/02	10/29/02	3/19/03	10/9/03	3/3/04	10/12/04	3/22/05	MIN	MAX	MEAN	WQ STANDARD*	
	13:22	02:17	01:56	08:52	13:37	20:21	16:14	09:49				ACUTE	CHRONIC
Discharge (CFS)	593	157	15	161	691	68	177	109	15	691	246.38		
pH (units)	7.5	7.6	7.3	7.8	7	7.6	7.3	7.8	7	7.8	7.49		
Temperature (deg. C)	13.6	14.2	12.3	14.3	18.8	9.9	15.8	6.4	6.4	18.8	13.16		
Dissolved Oxygen (mg/l)	8.9	7.7	7	9.4	8.6	9.2	7	12.3	7	12.3	8.76		5
Fecal Coliform (col/100ml)	56000	32,000	22,000	22,000	76,000	100,000	33,000		22000	100000	48600.00		200
Fecal Streptococci (col/100ml)	134000	27,000	14,000	14,000	76,000				14000	134000	62750.00		
Ratio (Fec Coli/Fec Strep)	2.23	5.43	4.40	5.40	2.93	8.7	5.13	7.12d	1.2	1.6	1.40		
Total Nitrogen as N (mg/l)	0.21	0.23	1.3	0.87	0.1	0.94	0.24	0.51	2.23	8.7	4.89		
Ammonia as N (mg/l)	0.86	0.93	0.79	0.76	0.8	1.6	1.24	1.24	0.1	1.3	0.55		8.92
Total Phosphorus as P (mg/l)	35	140	83	110	37	150	61	120	0.76	1.6	1.03		
Hardness as CaCO3 (mg/l)	633	380	159	322	784	721	383	375d	35	150	92.00		
Total Suspended Solids (mg/l)	18	5	<7	<7	<1	16			159	784	483.14		10
Oil and Grease (mg/l)	188	245	7	8	13	8	9	9	0	18	6.50		
Aluminum, dissolved (ug/l)	1	2	<1	2	2	2	1.4	0.9	7	245	60.88		750
Arsenic, dissolved (ug/l)	<1	<1	<1	<1	<1	<1	<0.06	<0.06	0	2	1.41		
Beryllium, dissolved (ug/l)	1	<1	<1	<1	<1	<1	<1	0.06	0	0	0.00		5
Cadmium, dissolved (ug/l)	1.3	3.1	<1	2.6	1.9	<1	<1	0.06	0	1	0.13		3.6
Chromium, dissolved (ug/l)	5.2	6.8	1.6	2.6	3.9	2	2.5	3.2	0	3.1	1.46		450
Copper, dissolved (ug/l)	330	252	78	32	25	60	88	31	1.6	6.8	3.48		10
Iron, dissolved (ug/l)	5	2	<1	<1	<1	<1	0.39	0.2	25	330	112.00		1000
Lead, dissolved (ug/l)	84	363	207	137	29	566	224	216	0	5	0.95		47
Manganese, dissolved (ug/l)	0.1	<1	<0.1	<0.1	<0.1	<0.1	0.37d	0.04	29	566	228.25		
Mercury, total recoverable (ug/l)	1.7	3.1	1.3	2.7	1.5	2.6	1.76	3.59	0	0.1	0.06		2.4
Nickel, dissolved (ug/l)	<1	1	1	1	<1	3	0.6	0.9	1.3	3.59	2.28		367
Selenium, dissolved (ug/l)	<1	<1	<1	<1	<1	<1	<2	<2	0	0	0.00		5
Silver, dissolved (ug/l)	91	137	11	28	8	13	6.9	9.5	0	0	0.00		2
Zinc, dissolved (ug/l)									6.9	137	38.05		92

Note: To determine Water Quality Standards:

A pH of 8.0 and Temperature of 20 degrees C was used for Ammonia

A Hardness range of 75 mg/l to 99 mg/l was used for the metals.

The Dissolved Oxygen WQ Standard is the minimum acceptable value.

APPENDIX A3-1  
WATER QUALITY ANALYSIS

BONHOMME CREEK NEAR CLARKSON VALLEY - WATER QUALITY ANALYSIS  
USGS SITE 06935770 WET WEATHER (FIRST FLUSH) RESULTS

PARAMETER (units)	10/10/01	3/25/02	10/2/02	3/13/03	10/17/03	3/4/04	WG STANDARD*
	06:30	05:42	23:30	04:14	00:53	10:59	
Discharge (CFS)	57	109	128	88	54	151	
pH (units)	7.8	7.7	7.1	21	7.7	7.7	
Temperature (deg. C)	14.9	5.7	21	10.6	13.7	9.2	
Dissolved Oxygen (mg/l)	8.1	10.8	7.1	8.9	8.4	9	5
Fecal Coliform (col/100ml)	4000	1100	27,600	667	26,000	8,170	200
Fecal Streptococci (col/100ml)	17000	4950	48,000	2,500		4,200	
Ratio (Fec Coli/Fec Strep)	0.24	0.22	0.57	0.27		1.94	
Total Nitrogen as N (mg/l)	1.97	2.99	4.8	2.1	1.83	1.51	
Ammonia as N (mg/l)	0.06	0.28	0.08	0.1	0.04	0.08	
Total Phosphorus as P (mg/l)	0.5	0.49	2.1	0.47	0.36	0.44	
Hardness as CaCO3 (mg/l)	180	120	100	130	190	160	
Total Suspended Solids (mg/l)	293	100	2,420	297	116	528	
Oil and Grease (mg/l)	<7	<7	<7	<7	<7	<7	10
Aluminum, dissolved (ug/l)	205	388	7	4	<3	8	750
Arsenic, dissolved (ug/l)	2	1	2	2	2	2	
Beryllium, dissolved (ug/l)	<1	<1	<1	<1	<1	<1	
Cadmium, dissolved (ug/l)	1	<1	<1.0	<1.0	<1	<1	
Chromium, dissolved (ug/l)	1	<1	1.4	<1.0	4.1	<1	
Copper, dissolved (ug/l)	1.7	2.4	2.9	1.8	2.5	1.2	
Iron, dissolved (ug/l)	241	352	5	30	22	17	1000
Lead, dissolved (ug/l)	<1	<1	<1	<1	<1	<1	4
Manganese, dissolved (ug/l)	78	106	9	97	95	139	
Mercury, total recoverable (ug/l)	<1	<1	<0.1	<0.1	<0.1	<0.1	
Nickel, dissolved (ug/l)	1.7	2	2.9	2.2	3.3	1.3	
Selenium, dissolved (ug/l)	<1	<1	<1	<1	<1	3	
Silver, dissolved (ug/l)	<1	<1	<1.0	<1.0	<1	<1	
Zinc, dissolved (ug/l)	42	102	<2	2	4	7	151

Note: To determine Water Quality Standards:

A pH of 8.0 and Temperature of 20 degrees C was used for Ammonia

A Hardness range of 150 mg/l to 174 mg/l was used for the metals.

The Dissolved Oxygen WQ Standard is the minimum acceptable value.

APPENDIX A3-1  
WATER QUALITY ANALYSIS

**COWMIRE CREEK AT BRIDGETONE - WATER QUALITY ANALYSIS  
USGS SITE 06935980 WET WEATHER (FIRST FLUSH) RESULTS**

PARAMETER (units)	10/5/01	3/25/02	10/18/02	3/28/03	10/9/03	3/4/04	WQ STANDARD*
	05:55	00:38	0.858333	0.5416667	10:19	08:50	
Discharge (CFS)	27	40	59	29	28	36	
pH (units)	7.6	7.9	7.7	8.1	7.6	7.5	
Temperature (deg. C)	14.7	4.3	15.5	10	18.6	9.6	
Dissolved Oxygen (mg/l)	8.3	11.5	8.6	10	7.1	10.5	5
Fecal Coliform (col/100ml)	32000	3200	86,000	10,800		12,000	200
Fecal Streptococci (col/100ml)	5600		12,400	4,600		15,000	
Ratio (Fec Coll/Fec Strep)	5.71		6.9	2.34		0.80	
Total Nitrogen as N (mg/l)	3.45	2.6	2.83	2.17	2.62	2.29	
Ammonia as N (mg/l)	0.2	0.27	0.11	0.06	0.02	0.09	
Total Phosphorus as P (mg/l)	0.55	0.18	0.72	0.24	0.38	0.57	
Hardness as CaCO3 (mg/l)	200	200	190	360	260	160	
Total Suspended Solids (mg/l)	170	74	579	147	207	605	
Oil and Grease (mg/l)	<7	<7	<7	<7	<7	8	10
Aluminum, dissolved (ug/l)	48	71	5	25	5	821	750
Arsenic, dissolved (ug/l)	2	2	1	2	2	1	20
Beryllium, dissolved (ug/l)	<1	<1	<1	<1	<1	<1	5
Cadmium, dissolved (ug/l)	1	<1	<1.0	<1.0	<1	<1	0.4
Chromium, dissolved (ug/l)	1.1	2.4	<1.0	8.4	3.9	4.9	131
Copper, dissolved (ug/l)	3.7	4	2.4	4.4	4.2	11	13
Iron, dissolved (ug/l)	116	87	13	20	14	1,310	1000
Lead, dissolved (ug/l)	<1	<1	<1	<1	<1	7	5
Manganese, dissolved (ug/l)	127	316	165	432	148	300	
Mercury, total recoverable (ug/l)	<1	<1	<0.1	<0.1	<0.1	<0.1	2.4
Nickel, dissolved (ug/l)	2.7	2.6	2.1	5.4	3.8	3.6	842
Selenium, dissolved (ug/l)	<1	<1	1	2	1	2	5
Silver, dissolved (ug/l)	<1	<1	<1.0	<1.0	<1	<1	10.6
Zinc, dissolved (ug/l)	76	87	8	14	15	45	211

Note: To determine Water Quality Standards:

A pH of 8.0 and Temperature of 20 degrees C was used for Ammonia

A Hardness range of 200 mg/l to 224 mg/l was used for the metals.

The Dissolved Oxygen WQ Standard is the minimum acceptable value.

APPENDIX A3-1  
WATER QUALITY ANALYSIS

DEER CREEK AT MAPLEWOOD - WATER QUALITY ANALYSIS  
USGS SITE 07010086 WET WEATHER (FIRST FLUSH) RESULTS

PARAMETER (units)	10/5/01 09:54	3/9/02 03:27	10/25/02 06:32	3/28/03 14:47	10/9/03 13:27	3/3/04 21:26
Discharge (CFS)	247	392	143	118	1,100	98
pH (units)	7.5	6.3	7.6	7.3	7.7	7.5
Temperature (deg. C)	15.8	14	13.1	11.4	18	10.5
Dissolved Oxygen (mg/l)	7.2	8.5	7.2	10.6	5.8	8.7
Fecal Coliform (col/100ml)	59000	49000	55,000	26,000	31,000k	4,400
Fecal Streptococci (col/100ml)	77000	16200	11,700	3,700	18,000	4,400
Ratio (Fec Coli/Fec Strep)	0.77	3.02	4.70	7.00	1.72	
Total Nitrogen as N (mg/l)	2.49	3.2	3.65	2.16	3.68	2.54
Ammonia as N (mg/l)	0.55	0.24	1.5	0.33	0.3	0.33
Total Phosphorus as P (mg/l)	0.37	0.65	0.41	0.22	0.82	0.26
Hardness as CaCO3 (mg/l)	64	150	140	170	91	240
Total Suspended Solids (mg/l)	133	337	114	27	378	135
Oil and Grease (mg/l)	<7	5	<7	<7	<1	<7
Aluminum, dissolved (ug/l)	141	372	6	7	4	7
Arsenic, dissolved (ug/l)	2	3	2	2	2	2
Beryllium, dissolved (ug/l)	<1	<1	<1	<1	<1	<1
Cadmium, dissolved (ug/l)	1	<1	<1.0	<1.0	<1	<1
Chromium, dissolved (ug/l)	1.4	2.6	1.2	5.5	2.5	1.7
Copper, dissolved (ug/l)	5.7	5.4	3.4	5.4	3.7	3.7
Iron, dissolved (ug/l)	201	265	58	42	25	21
Lead, dissolved (ug/l)	1	2	<1	<1	<1	<1
Manganese, dissolved (ug/l)	69	191	165	222	81	384
Mercury, total recoverable (ug/l)	<1	<1	<0.1	<0.1	<0.1	<0.1
Nickel, dissolved (ug/l)	1.2	2.9	2.6	3.6	2	2.2
Selenium, dissolved (ug/l)	<1	<1	<1	1	<1	4
Silver, dissolved (ug/l)	<1	<1	<1.0	<1.0	<1	<1
Zinc, dissolved (ug/l)	30	134	23	27	5	15

Note: To determine Water Quality Standards:

A pH of 8.0 and Temperature of 20 degrees C was used for Ammonia

A Hardness range of 125 mg/l to 149 mg/l was used for the metals.

The Dissolved Oxygen WQ Standard is the minimum acceptable value.

	MIN	MAX	MEAN	WQ STANDARD*	
				ACUTE	CHRONIC
	98	1100	349.67		
	6.3	7.7	7.32		
	10.5	18	13.80		
	5.8	10.6	8.00		5
	26000	59000	47250.00		200
	3700	77000	21833.33		
	0.77	7	3.44		
	2.16	3.68	2.95		
	0.24	1.5	0.54		
	0.22	0.82	0.46		
	64	240	142.50		
	27	378	187.33		
	0	5	0.83		10
	4	372	89.50		750
	2	3	2.17		20
	0	0	0.00		5
	0	1	0.17		0.3
	1.2	5.5	2.48		684
	3.4	5.7	4.55		17
	21	265	102.00		1000
	0	2	0.50		3
	69	384	185.33		
	0	0	0.00		2.4
	1.2	3.6	2.42		566
	0	4	0.83		5
	0	0	0.00		4.7
	5	134	39.00		142

APPENDIX A3-1  
WATER QUALITY ANALYSIS

ENGLEHOLM CREEK NEAR WELLSTON - WATER QUALITY ANALYSIS  
USGS SITE 07010035 WET WEATHER (FIRST FLUSH) RESULTS

PARAMETER (units)	10/24/01	4/8/02	10/25/02	4/20/03	10/9/03	3/4/04	WQ STANDARD*
	13:20	07:11	07:25	04:15	11:47	09:16	
Discharge (CFS)	44	22	11	20	34	45	
pH (units)	7.5	7.7	7.8	7.2	8.3	7.9	
Temperature (deg. C)	15.1	10.8	12.3	15.1	18	14.5	
Dissolved Oxygen (mg/l)	8.1	8.5	9.1	8.4	7.5	8.9	5
Fecal Coliform (col/100ml)	17000	9200	8,200	12,000	22,000	8,800	200
Fecal Streptococci (col/100ml)	20500	7200	28,000	14,000	32,000	4,800	
Ratio (Fec Coli/Fec Strep)	0.83	1.28	0.29	0.86	0.69	1.83	
Total Nitrogen as N (mg/l)	1.97	1.72	2.03	2.94	3.02	6.94	
Ammonia as N (mg/l)	0.03	0.16	0.03	0.04	0.12	0.14	
Total Phosphorus as P (mg/l)	0.77	0.27	0.51	0.64	0.74	1.7	8.92
Hardness as CaCO3 (mg/l)	54	92	64	130	58	59	
Total Suspended Solids (mg/l)	825	169	213	255	697	1,990	
Oil and Grease (mg/l)	3	<7	<7	<7	<7	<7	10
Aluminum, dissolved (ug/l)	285	425	6	5	36	8	750
Arsenic, dissolved (ug/l)	1	1	1	<1	1	1	20
Beryllium, dissolved (ug/l)	<1	<1	<1	<1	<1	<1	5
Cadmium, dissolved (ug/l)	1	<1	<1.0	<1.0	<1	<1	0.2
Chromium, dissolved (ug/l)	1.3	1.4	<1.0	<1.0	1.8	<1	450
Copper, dissolved (ug/l)	6.6	4.8	3.8	5	3.7	4.7	10
Iron, dissolved (ug/l)	483	327	38	26	20	15	1000
Lead, dissolved (ug/l)	10	2	<1	<1	<1	<1	47
Manganese, dissolved (ug/l)	94	98	45	88	28	73	
Mercury, total recoverable (ug/l)	0.1	<1	<0.1	<0.1	<0.1	<0.1	2.4
Nickel, dissolved (ug/l)	3	1.5	1.7	2.5	1.6	1.2	367
Selenium, dissolved (ug/l)	<1	<1	<1	<1	<1	<1	41
Silver, dissolved (ug/l)	<1	<1	<1.0	<1.0	<1	<1	2
Zinc, dissolved (ug/l)	32	159	9	12	5	4	92

Note: To determine Water Quality Standards:

A pH of 8.0 and Temperature of 20 degrees C was used for Ammonia

A Hardness range of 75 mg/l to 99 mg/l was used for the metals.

The Dissolved Oxygen WQ Standard is the minimum acceptable value.



APPENDIX A3-1  
WATER QUALITY ANALYSIS

FENTON CREEK NEAR FENTON - WATER QUALITY ANALYSIS  
USGS SITE 07019220 WET WEATHER (FIRST FLUSH) RESULTS

PARAMETER (units)	10/15/01	2/19/02	10/25/02	3/13/03	10/9/03	3/26/04	WQ STANDARD*				
	20:30	15:22	08:30	02:57	13:47	11:22	ACUTE	CHRONIC			
Discharge (CFS)	92	97	160	138	94	125					
pH (units)	6.7	7.7	7.8	7.8	7.5	7.7					
Temperature (deg. C)	12.2	9.9	12.6	11.9	18.2	14.6					
Dissolved Oxygen (mg/l)	8.4	9.9	8.7	10.1	7	8.9		5			
Fecal Coliform (col/100ml)			15,800	2,670		38,500		200			
Fecal Streptococci (col/100ml)		29,000	24,000	6,200	6,800	8,000					
Ratio (Fec Coli/Fec Strep)		0.66	0.43			4.81					
Total Nitrogen as N (mg/l)	<.72	1.78	2.74	2.81	2.08	2.39					
Ammonia as N (mg/l)	0.03	0.05	0.08	0.13	0.06	0.12					
Total Phosphorus as P (mg/l)	0.3	0.26	0.57	0.49	0.35	0.34		1.08			
Hardness as CaCO3 (mg/l)	140	150	92	150	130	170					
Total Suspended Solids (mg/l)	336	336	1,070	385	288	307					
Oil and Grease (mg/l)	<.7	4	<.7	<.7	<.7	<.7		10			
Aluminum, dissolved (ug/l)	350	1210	11	5	<3	5		750			
Arsenic, dissolved (ug/l)	1	<.1	1	1	2	<.1		20			
Beryllium, dissolved (ug/l)	<.1	<.1	<.1	<.1	<.1	<.1		5			
Cadmium, dissolved (ug/l)	<.1	<.1	<.1	<.1	<.1	<.1		7.1			
Chromium, dissolved (ug/l)	1.1	1.1	<.1	1.7	2.7	1.6		794			
Copper, dissolved (ug/l)	2.7	1.8	2	2.3	2.5	2.1		20			
Iron, dissolved (ug/l)	365	761	22	23	11	9		1000			
Lead, dissolved (ug/l)	1	<.1	<.1	<.1	<.1	<.1		100			
Manganese, dissolved (ug/l)	108	103	21	56	11	109		4			
Mercury, total recoverable (ug/l)	<.1	<.1	<.1	<.1	<.1	<.1		2.4			
Nickel, dissolved (ug/l)	2.2	1.3	2.3	2.4	2.5	1.4		660			
Selenium, dissolved (ug/l)	<.1	<.1	<.1	<.1	<.1	<.1		5			
Silver, dissolved (ug/l)	<.1	<.1	<.1	<.1	<.1	<.1		6.5			
Zinc, dissolved (ug/l)	109	52	2	6	3	5		165			
							MIN	MAX	MEAN	ACUTE	CHRONIC
							92	160	117.67		
							6.7	7.8	7.53		
							9.9	18.2	13.23		
							7	10.1	8.83		5
							2670	38500	18990.00		200
							6200	29000	14800.00		
							0.43	4.81	1.97		
							0	2.81	1.97		
							0.03	0.13	0.08		
							0.26	0.57	0.39		1.08
							92	170	138.67		
							288	1070	453.67		
							0	4	0.67		10
							0	1210	263.50		750
							0	2	0.83		20
							0	0	0.00		5
							0	0	0.00		7.1
							0	0	0.00		103
							1.8	2.7	1.37		20
							9	761	198.50		1000
							0	1	0.17		4
							11	109	68.00		
							0	0	0.00		2.4
							1.3	2.5	2.02		660
							0	0	0.00		5
							0	0	0.00		6.5
							2	109	29.50		165

Note: To determine Water Quality Standards:

A pH of 8.0 and Temperature of 20 degrees C was used for Ammonia

A Hardness range of 150 mg/l to 174 mg/l was used for the metals.

The Dissolved Oxygen WQ Standard is the minimum acceptable value.

APPENDIX A3-1  
WATER QUALITY ANALYSIS

FISHPOT CREEK AT VALLEY PARK - WATER QUALITY ANALYSIS  
USGS SITE 07019120 WET WEATHER (FIRST FLUSH) RESULTS

PARAMETER (units)	10/10/01	3/9/02	10/25/02	3/19/03	10/9/03	3/4/04	WO STANDARD*	
	07:15	04:26	08:55	11:12	13:29	09:06		ACUTE
Discharge (CFS)	808	89	6.1	54	e	41		
pH (units)	8	7.6	7.8	7.8	7.2	7.5		
Temperature (deg. C)	16.9	12.1	12.5	12.9	18	8.6		
Dissolved Oxygen (mg/l)	7.5	9.25	8.9	10.7	7.7	10.5		5
Fecal Coliform (col/100ml)	60000	9000	39,000	6,200	28,500	39,500		200
Fecal Streptococci (col/100ml)	39200	11600	20,800	12,000	22,500			
Ratio (Fec Coll/Fec Strep)	1.53	0.78	1.90	0.52	1.27			
Total Nitrogen as N (mg/l)	4.18	2.74	2.07	2.85	2.26	2.8		
Ammonia as N (mg/l)	0.04	0.11	0.05	0.15	0.06	0.16		
Total Phosphorus as P (mg/l)	1.2	0.6	0.51	0.4	0.94	0.55		
Hardness as CaCO3 (mg/l)	45	150	66	87	60	100		
Total Suspended Solids (mg/l)	2160	594	459	228	958	667		
Oil and Grease (mg/l)	<7	<7	<7	<7	<1	<7		10
Aluminum, dissolved (ug/l)	1060	274	5	5	4	509		750
Arsenic, dissolved (ug/l)	2	2	<1	2	1	2		20
Beryllium, dissolved (ug/l)	<1	<1	<1	<1	<1	<1		5
Cadmium, dissolved (ug/l)	1	<1	<1	<1	<1	<1		3.6
Chromium, dissolved (ug/l)	1	2.6	<1.0	2.7	2	1.3		450
Copper, dissolved (ug/l)	2.5	2.3	2	3.9	2.9	3.2		10
Iron, dissolved (ug/l)	997	170	16	20	10	506		1000
Lead, dissolved (ug/l)	2	<1	<1	<1	<1	2		47
Manganese, dissolved (ug/l)	52	50	24	86	5	61		2
Mercury, total recoverable (ug/l)	0.1	<1	<0.1	<0.1	<0.1	<0.1		2.4
Nickel, dissolved (ug/l)	1.5	2.4	1.1	1.9	1.6	2.7		367
Selenium, dissolved (ug/l)	<1	<1	<1	<1	<1	2		5
Silver, dissolved (ug/l)	<1	<1	<1	<1	<1.0	<1.0		2
Zinc, dissolved (ug/l)	34	95	3	3	2	7		92

Note: To determine Water Quality Standards:

A pH of 8.0 and Temperature of 20 degrees C was used for Ammonia

A Hardness range of 75 mg/l to 99 mg/l was used for the metals.

The Dissolved Oxygen WQ Standard is the minimum acceptable value.

APPENDIX A3-1  
WATER QUALITY ANALYSIS

GRAVOIS CREEK NEAR MEHLVILLE - WATER QUALITY ANALYSIS  
USGS SITE 07010180 WET WEATHER (FIRST FLUSH) RESULTS

PARAMETER (units)	10/15/01		3/9/02		10/3/02		4/4/03		10/9/03		3/3/04	
	20:25	03:16	03:30	16:28	03:30	16:28	13:08	21:22				
Discharge (CFS)	115	297	191	133	278	85						
pH (units)	7.5	7.7	7.5	7.5	7.6	7.8						
Temperature (deg. C)	11.7	13.6	22.4	17.6	18.5	9.5						
Dissolved Oxygen (mg/l)	10.1	9.1	5.8	7.6	8.4	8.1						
Fecal Coliform (col/100ml)	38000	7800	7,430	6,600	46,000	25,000						
Fecal Streptococci (col/100ml)	34000	5800	5,800	2,600	49,000							
Ratio (Fec Colif/Fec Strep)	1.12	1.34	1.28	2.54	0.94							
Total Nitrogen as N (mg/l)	<.72	2.79	2.54	3.15	2.1	1.69						
Ammonia as N (mg/l)	0.02	0.07	0.13	0.19	0.13	0.06						
Total Phosphorus as P (mg/l)	0.29	0.68	0.51	0.44	0.32	0.22						
Hardness as CaCO3 (mg/l)	91	190	210	170	210	200						
Total Suspended Solids (mg/l)	118	982	778	325	790	231						
Oil and Grease (mg/l)	<.7	<.7	<.7	<.7	<.7	<.1						
Aluminum, dissolved (ug/l)	252	671	<.3	5	<.3	5						
Arsenic, dissolved (ug/l)	1	3	1	7	2	1						
Beryllium, dissolved (ug/l)	<.1	<.1	<.1	<.1	<.1	<.1						
Cadmium, dissolved (ug/l)	<.1	<.1	<.1	<.1	<.1	<.1						
Chromium, dissolved (ug/l)	1.2	3.6	2.2	4.5	3.8	1.4						
Copper, dissolved (ug/l)	2.9	2.8	2.3	4.5	3.3	3.1						
Iron, dissolved (ug/l)	285	463	6	28	8	16						
Lead, dissolved (ug/l)	2	1	<.1	<.1	<.1	<.1						
Manganese, dissolved (ug/l)	72	148	49	211	100	125						
Mercury, total recoverable (ug/l)	<.1	<.1	<.1	<.1	<.1	<.1						
Nickel, dissolved (ug/l)	1.5	2.9	2.3	4.2	3.5	1.5						
Selenium, dissolved (ug/l)	<.1	1	<.1	1	1	4						
Silver, dissolved (ug/l)	<.1	<.1	<.1	<.1	<.1	<.1						
Zinc, dissolved (ug/l)	32	103	4	13	7	10						

PARAMETER (units)	MIN	MAX	MEAN	WQ STANDARD*	
				ACUTE	CHRONIC
Discharge (CFS)	85	297	183.17		
pH (units)	7.5	7.8	7.60		
Temperature (deg. C)	9.5	22.4	15.55		
Dissolved Oxygen (mg/l)	5.8	10.1	8.18		5
Fecal Coliform (col/100ml)	6600	46000	21805.00		200
Fecal Streptococci (col/100ml)	2600	49000	19440.00		
Ratio (Fec Colif/Fec Strep)	0.94	2.54	1.44		
Total Nitrogen as N (mg/l)	0	3.15	2.05		
Ammonia as N (mg/l)	0.02	0.19	0.10		1.08
Total Phosphorus as P (mg/l)	0.22	0.68	0.41		
Hardness as CaCO3 (mg/l)	91	210	178.50		
Total Suspended Solids (mg/l)	118	982	537.33		
Oil and Grease (mg/l)	0	0	0.00		10
Aluminum, dissolved (ug/l)	0	671	155.50	750	
Arsenic, dissolved (ug/l)	1	7	2.50		20
Beryllium, dissolved (ug/l)	0	0	0.00		5
Cadmium, dissolved (ug/l)	0	0	0.00		0.3
Chromium, dissolved (ug/l)	1.2	4.5	2.78	794	103
Copper, dissolved (ug/l)	2.3	4.5	3.15	20	10
Iron, dissolved (ug/l)	6	463	134.33	1000	
Lead, dissolved (ug/l)	0	2	0.50	100	4
Manganese, dissolved (ug/l)	49	211	117.50		
Mercury, total recoverable (ug/l)	0	0	0.00	2.4	0.5
Nickel, dissolved (ug/l)	1.5	4.2	2.65	660	73
Selenium, dissolved (ug/l)	0	4	1.17	6.5	5
Silver, dissolved (ug/l)	0	0	0.00	165	
Zinc, dissolved (ug/l)	4	103	28.17		151

Note: To determine Water Quality Standards:

A pH of 8.0 and Temperature of 20 degrees C was used for Ammonia

A Hardness range of 150 mg/l to 174 mg/l was used for the metals.

The Dissolved Oxygen WQ Standard is the minimum acceptable value.

APPENDIX A3-1  
WATER QUALITY ANALYSIS

KIEFER CREEK NEAR BALLWIN - WATER QUALITY ANALYSIS  
USGS SITE 07019072 WET WEATHER (FIRST FLUSH) RESULTS

PARAMETER (units)	10/10/01	10/25/02	3/19/03	10/9/03	3/4/04
	07:44	08:27	10:52	12:42	10:07
Discharge (CFS)	108	62	46	86	27
pH (units)	7.4	7.2	7.4	7.3	7.2
Temperature (deg. C)	16.5	12.9	13	17.4	10
Dissolved Oxygen (mg/l)	9	10.5	10.7	8.5	10
Fecal Coliform (col/100ml)	34000	28,000	18,300	44,000	
Fecal Streptococci (col/100ml)	24800	6,800	14,000	49,000	
Ratio (Fec Coll/Fec Strep)	1.37	4.12	1.31	0.90	
Total Nitrogen as N (mg/l)	2.47	2.24	1.8	3.82	2.00
Ammonia as N (mg/l)	0.14	0.07	0.1	0.09	0.03
Total Phosphorus as P (mg/l)	0.56	0.45	0.42	0.9	0.23
Hardness as CaCO3 (mg/l)	85	110	140	65	180
Total Suspended Solids (mg/l)	315	225	334	1,250	279
Oil and Grease (mg/l)	5	<7	<7	<7	<7
Aluminum, dissolved (ug/l)	736	4	4	6	6
Arsenic, dissolved (ug/l)	2	<1	1	1	<1
Beryllium, dissolved (ug/l)	<1	<1	<1	<1	<1
Cadmium, dissolved (ug/l)	1	<1	<1	<1	<1
Chromium, dissolved (ug/l)	1	1.3	1.4	2	<1
Copper, dissolved (ug/l)	2.8	1.6	2.3	2.5	<1
Iron, dissolved (ug/l)	516	9	16	12	6
Lead, dissolved (ug/l)	<1	<1	<1	<1	<1
Manganese, dissolved (ug/l)	31	12	42	5	48
Mercury, total recoverable (ug/l)	0.1	<0.1	<0.1	<0.1	<0.1
Nickel, dissolved (ug/l)	1.5	1.3	1.7	1.5	1
Selenium, dissolved (ug/l)	<1	<1	<1	<1	3
Silver, dissolved (ug/l)	<1	<1	<1	<1	<1
Zinc, dissolved (ug/l)	55	2	3	2	5

	MIN	MAX	MEAN	WQ STANDARD*	
				ACUTE	CHRONIC
	27	108	65.80		
	7.2	7.4	7.30		
	10	17.4	13.96		
	8.5	10.7	9.74		5
	18300	44000	31075.00		200
	6800	49000	23650.00		
	0.9	4.12	1.93		
	1.8	3.82	2.47		
	0.03	0.14	0.09		8.92
	0.23	0.9	0.51		
	65	180	116.00		
	225	1250	480.60		
	0	5	1.00		10
	4	736	151.20		750
	0	2	0.80		20
	0	0	0.00		5
	0	1	0.20		0.3
	0	2	1.14		74
	0	2.8	1.84		13
	6	516	111.80		1000
	0	0	0.00		65
	5	48	27.60		3
	0	0.1	0.02		2.4
	1	1.7	1.40		469
	0	3	0.60		5
	0	0	0.00		3.2
	2	55	13.40		117

Note: To determine Water Quality Standards:

A pH of 8.0 and Temperature of 20 degrees C was used for Ammonia

A Hardness range of 100 mg/l to 124 mg/l was used for the metals.

The Dissolved Oxygen WQ Standard is the minimum acceptable value.

APPENDIX A3-1  
WATER QUALITY ANALYSIS

MATTESE CREEK NEAR MATTESE- WATER QUALITY ANALYSIS  
USGS SITE 07019317 WET WEATHER (FIRST FLUSH) RESULTS

PARAMETER (units)	10/15/01	3/9/02	10/19/02	4/16/03	10/9/2003	3/3/2004	MIN	MAX	MEAN	WQ STANDARD*	
	19:43	02:26	03:45	20:10	12:56	20:27				ACUTE	CHRONIC
Discharge (CFS)	121	107	121	236	709	110	107	709	234.00		
pH (units)	6.9	7.7	7.6	7.7	7.7	7.7	6.9	7.7	7.55		
Temperature (deg. C)	13.2	13.5	14.5	17.4	18.4	9.5	9.5	18.4	14.42		
Dissolved Oxygen (mg/l)	8.7	9.5	7.7	8.7	7.8	6.5	6.5	9.5	8.15		5
Fecal Coliform (col/100ml)		5400	13,800	4,400	58,000	4,800	4400	58000	17280.00		200
Fecal Streptococci (col/100ml)		7000	11,500	2,850	60,000	8,830	2850	60000	18036.00		
Ratio (Fec Coli/Fec Strep)		0.77	1.2	1.54	0.97	0.54	0.54	1.54	1.00		
Total Nitrogen as N (mg/l)	<.79	3.72	2.1	5.4	3.02	2.94	0	5.4	2.86		
Ammonia as N (mg/l)	0.01	0.13	0.03	0.15	0.13	0.08	0.01	0.15	0.09		1.08
Total Phosphorus as P (mg/l)	0.22	0.72	0.44	0.89	0.71	0.5	0.22	0.89	0.58		
Hardness as CaCO3 (mg/l)	210	140	60	84	88	120	60	210	117.00		
Total Suspended Solids (mg/l)	121	803	421	1,420	829	584	121	1420	696.33		
Oil and Grease (mg/l)	<.7	<.7	<.7	<.7	<.7	<.7	0	0	0.00		10
Aluminum, dissolved (ug/l)	151	401	6	6	6	5	5	401	95.83		750
Arsenic, dissolved (ug/l)	1	2	<.1	1	2	<.1	0	2	1.00		20
Beryllium, dissolved (ug/l)	<.1	<.1	<.1	<.1	<.1	<.1	0	0	0.00		5
Cadmium, dissolved (ug/l)	<.1	<.1	<.1	<.1	<.1	<.1	0	0	0.00		0.3
Chromium, dissolved (ug/l)	<.1	3.2	<.1	3.9	3.4	2.5	0	3.9	2.17		89
Copper, dissolved (ug/l)	2.6	3.3	1.6	2.8	4.3	2	1.6	4.3	2.77		17
Iron, dissolved (ug/l)	164	244	15	28	13	8	8	244	78.67		1000
Lead, dissolved (ug/l)	<.1	1	<.1	<.1	<.1	<.1	0	1	0.17		82
Manganese, dissolved (ug/l)	55	82	6	119	16	67	6	119	57.50		3
Mercury, total recoverable (ug/l)	<.1	<.1	0.1	0.1	<.1	<.1	0	0.1	0.03		2.4
Nickel, dissolved (ug/l)	1.7	2.4	<.1	2.4	2	1.4	0	2.4	1.65		560
Selenium, dissolved (ug/l)	2	<.1	<.1	<.1	1	3	0	3	1.00		5
Silver, dissolved (ug/l)	<.1	<.1	<.1	<.1	<.1	<.1	0	0	0.00		4.7
Zinc, dissolved (ug/l)	140	108	3	11	4	9	3	140	45.83		142

Note: To determine Water Quality Standards:

A pH of 8.0 and Temperature of 20 degrees C was used for Ammonia

A Hardness range of 125 mg/l to 149 mg/l was used for the metals.

The Dissolved Oxygen WQ Standard is the minimum acceptable value.

APPENDIX A3-1  
WATER QUALITY ANALYSIS

WATKINS CREEK NEAR BELLEFONTAINE NEIGHBORS - WATER QUALITY ANALYSIS  
USGS SITE 07001985 WET WEATHER (FIRST FLUSH) RESULTS

PARAMETER (units)	10/23/01	3/9/02	10/29/02	3/28/03	10/14/03	10/14/03	3/26/04	3/26/04	WQ STANDARD*
	23:57	06:17	06:16	14:33	04:42	04:43	09:54	09:55	
Discharge (CFS)	12	158	54	34	30		57		
pH (units)	7.8	7.5	7.5	7.9	7.5		7.5	7.7	
Temperature (deg. C)	16.2	12.7	11.3	10.3	15.8		14.5	14.5	
Dissolved Oxygen (mg/l)	6.3	9.8	8.8	10.3	6.6		9.2	9.2	5
Fecal Coliform (col/100ml)	42000	16500	48,000	14,500	3,700		14,000	20,000	200
Fecal Streptococci (col/100ml)	5600		14,200	4,600	6,200		15,000	6,000	
Ratio (Fec Coll/Fec Strep)	7.50	3.38	3.38	3.15	0.59		0.93	3.33	
Total Nitrogen as N (mg/l)	1.4	3.16	1.19	1.3	1.67		5.75	7.34	
Ammonia as N (mg/l)	0.13	0.13	<0.01	0.11	0.01	0.02	0.3	0.32	8.92
Total Phosphorus as P (mg/l)	0.29	1	0.39	0.22	0.54	0.56	1.9	2.5	
Hardness as CaCO3 (mg/l)	260	110	75	270	200	200	99	99	
Total Suspended Solids (mg/l)	37	937	131	131	166	159	1990	3670	
Oil and Grease (mg/l)	<7	<7	<7	<7	13	<7	11	<7	10
Aluminum, dissolved (ug/l)	42	355	4	<3	<3	<3	7	<3	750
Arsenic, dissolved (ug/l)	2	2	<1	2	3	2	1	2	20
Beryllium, dissolved (ug/l)	<1	<1	<1	<1	<1	<1	<1	<1	5
Cadmium, dissolved (ug/l)	1	<1	<1	<1	<1	<1	<1	<1	8.2
Chromium, dissolved (ug/l)	1	2.1	<1	2.5	3	<1	<1	<1	901
Copper, dissolved (ug/l)	3.7	3	1.5	2.9	2.5	2.5	2.7	2.6	23
Iron, dissolved (ug/l)	109	332	42	15	26	27	13	9	1000
Lead, dissolved (ug/l)	<1	2	<1	<1	<1	<1	<1	<1	118
Manganese, dissolved (ug/l)	238	248	103	328	209	207	87	86	
Mercury, total recoverable (ug/l)	<1	<1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	2.4
Nickel, dissolved (ug/l)	3.9	2.5	1	4.7	3.8	3.7	2.3	1.7	752
Selenium, dissolved (ug/l)	<1	<1	2	1	<1	<1	<1	<1	5
Silver, dissolved (ug/l)	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	8.4
Zinc, dissolved (ug/l)	54	49	7	8	7	6	4	3	188

Note: To determine Water Quality Standards:

A pH of 8.0 and Temperature of 20 degrees C was used for Ammonia

A Hardness range of 175 mg/l to 199 mg/l was used for the metals.

The Dissolved Oxygen WQ Standard is the minimum acceptable value.

APPENDIX A3-1  
WATER QUALITY ANALYSIS

WILLIAMS CREEK NEAR PEERLESS PARK - WATER QUALITY ANALYSIS  
USGS SITE 07019090 WET WEATHER (FIRST FLUSH) RESULTS

PARAMETER (units)	10/24/01	10/29/02	3/20/03	11/17/03	3/4/04	MIN	MAX	MEAN	WQ STANDARD*	
	14:03	00:29	00:29	21:34	11:08				ACUTE	CHRONIC
Discharge (CFS)	25	91	30	41	28	7.1	91	43.00		
pH (units)	7.4	7.5	7.1	7.2	7.5	7.1	7.5	7.34		
Temperature (deg. C)	13.8	11.2	12.2	16.1	140	0.61	140	38.66		
Dissolved Oxygen (mg/l)	7.6	7.8	9.6	8.8	9.7	0.61	9.7	8.70		5
Fecal Coliform (col/100ml)	30000	28,000	2,800	12,000		0.04	30000	18200.00		200
Fecal Streptococci (col/100ml)	11400	12,500	4,560	8,600		0.04	12500	9265.00		
Ratio (Fec Coli/Fec Strep)	2.63	2.24	0.61	1.4		0.04	2.63	1.72		
Total Nitrogen as N (mg/l)	2.15	1.73	2.6	5.1	4	0.04	5.1	3.12		
Ammonia as N (mg/l)	0.08	<0.01	0.04	0.04	0.25	0	0.25	0.08	8.92	1.08
Total Phosphorus as P (mg/l)	0.49	0.3	0.25	1	0.8	0.25	1	0.57		
Hardness as CaCO3 (mg/l)	83	84	170	1,770	1,260	1	1770	673.40		
Total Suspended Solids (mg/l)	244	83	69	1,770	1,260	1	1770	685.20		
Oil and Grease (mg/l)	<7	<7	<7	<7	<7	0	0	0.00		10
Aluminum, dissolved (ug/l)	256	4	<3	9	1,140	0	1140	281.80	750	
Arsenic, dissolved (ug/l)	<1	<1	1	<1	2	0	2	0.60		20
Beryllium, dissolved (ug/l)	<1	<1	<1	<1	<1	0	0	0.00		5
Cadmium, dissolved (ug/l)	1	<1	<1	<1	<1	0	1	0.20	11.6	0.5
Chromium, dissolved (ug/l)	1	<1	2.1	<1	1.5	0	2.1	0.92	1207	157
Copper, dissolved (ug/l)	2.9	1.9	3	2.9	4.5	0.1	4.5	3.04	32	16
Iron, dissolved (ug/l)	262	11	13	25	1,210	0.1	1210	304.20		1000
Lead, dissolved (ug/l)	2	<1	<1	<1	8	0	8	2.00	172	7
Manganese, dissolved (ug/l)	95	19	10	26	219	0.1	219	73.80		
Mercury, total recoverable (ug/l)	<1	0.1	<0.1	<0.1	<0.1	0	0.1	0.02	2.4	0.5
Nickel, dissolved (ug/l)	1.6	1.2	2.2	5	20	1.2	20	6.00	1017	113
Selenium, dissolved (ug/l)	<1	3	<1	<1	2	0	3	1.00		5
Silver, dissolved (ug/l)	<1	<1	<1	<1	<1	0	0	0.00	15.6	
Zinc, dissolved (ug/l)	70	3	6	5	20	3	70	20.80	255	233

Note: To determine Water Quality Standards:

A pH of 8.0 and Temperature of 20 degrees C was used for Ammonia

A Hardness range of over 250 mg/l .

The Dissolved Oxygen WQ Standard is the minimum acceptable value.



### Stormwater Outlets August 2007

SWO ID Number	Longitude	Latitude	1/4		Section	Township/ Range	Creek Name	Receiving Water	Municipality
			SE	NW					
1 SWO-B-13E2-001	-90:12:52.220	38:43:36.726	SE	NW	15	* T46NR7E	Maline	Mississippi River	St. Louis
2 SWO-B-10D2-002	-90:10:39.472	38:46:07.217	NE	SW	36	* T47NR7E		Mississippi River	St. Louis
3 SWO-B-09C4-003	-90:10:29.592	38:46:24.598	SW	NE	36	* T47NR7E	Watkins	Mississippi River	St. Louis County
4 SWO-B-09C4-004	-90:10:12.275	38:46:37.091	SE	SE	25	* T47NR7E		Mississippi River	St. Louis County
5 SWO-B-08B2-005	-90:07:54.941	38:47:39.523	NW	SE	20	* T47NR8E		Mississippi River	St. Louis County
6 SWO-B-06D4-010	-90:11:26.986	38:49:01.752	SW	NE	14	* T47NR7E		Missouri River	St. Louis County
7 SWO-B-06E2-011	-90:12:16.268	38:49:24.542	SE	SE	10	* T47NR7E	Spanish Lake	Missouri River	St. Louis County
8 SWO-C-06E2-001	-90:12:33.340	38:49:34.479	NW	SE	10	* T47NR7E		Missouri River	St. Louis County
9 SWO-C-05E4-002	-90:13:06.023	38:49:54.049	SW	NW	10	* T47NR7E	Coldwater	Missouri River	St. Louis County
10 SWO-C-04G2-008	-90:15:55.088	38:51:14.436	SW	SE	31	* T48NR7E	Mill	Missouri River	St. Louis County
11 SWO-C-03H2-009	-90:17:09.784	38:51:45.190	SW	NE	36	* T48NR6E		Missouri River	St. Louis County
12 SWO-C-03H2-010	-90:17:10.890	38:51:46.358	SE	NW	36	* T48NR6E		Missouri River	St. Louis County
13 SWO-C-02H4-011	-90:18:09.701	38:52:06.139	SW	SE	26	* T48NR6E		Missouri River	St. Louis County
14 SWO-C-02J3-012	-90:18:27.101	38:52:05.846	SE	SW	26	* T48NR6E		Missouri River	St. Louis County
15 SWO-C-02J3-013	-90:18:29.049	38:52:05.991	SE	SW	26	* T48NR6E		Missouri River	St. Louis County
16 SWO-C-02J3-014	-90:18:32.485	38:52:06.160	SE	SW	26	* T48NR6E		Missouri River	St. Louis County
17 SWO-C-02J3-015	-90:18:51.183	38:52:07.898	SW	SW	26	* T48NR6E		Missouri River	St. Louis County
18 SWO-C-02J3-016	-90:18:55.989	38:52:08.602	SE	SE	27	* T48NR6E		Missouri River	St. Louis County

### Stormwater Outlets August 2007

	SWO ID Number	Longitude	Latitude	1/4	1/4	Section	Township/ Range	Creek Name	Receiving Water	Municipality
19	SWO-C-02J3-017	-90:19:05.966	38:52:10.817	SE	SE	27	* T48NR6E		Missouri River	St. Louis County
20	SWO-C-02J4-018	-90:19:18.559	38:52:12.879	SW	SE	27	* T48NR6E		Missouri River	St. Louis County
21	SWO-C-02J4-019	-90:19:34.161	38:52:14.876	NE	SW	27	* T48NR6E		Missouri River	St. Louis County
22	SWO-C-02K3-020	-90:20:19.611	38:52:14.101	SW	SE	28	* T48NR6E		Missouri River	St. Louis County
23	SWO-C-03K2-021	-90:20:21.950	38:51:41.643	SW	NE	33	* T48NR6E		Missouri River	St. Louis County
24	SWO-C-03K3-022	-90:20:19.835	38:51:27.751	NW	SE	33	* T48NR6E	Betty Jane	Missouri River	St. Louis County
25	SWO-C-04K3-023	-90:20:38.622	38:50:37.008	SE	SW	4	* T47NR6E		Missouri River	St. Louis County
26	SWO-C-04K3-024	-90:20:43.397	38:50:30.708	SE	SW	4	* T47NR6E		Missouri River	St. Louis County
27	SWO-C-05K1-025	-90:20:57.309	38:50:15.390	NW	NW	9	* T47NR6E		Missouri River	St. Louis County
28	SWO-C-05K1-026	-90:21:02.203	38:50:09.008	SW	NW	9	* T47NR6E		Missouri River	St. Louis County
29	SWO-C-05K4-027	-90:21:08.782	38:49:59.780	SW	NW	9	* T47NR6E		Missouri River	St. Louis County
30	SWO-C-05K4-028	-90:21:12.364	38:49:55.794	NE	SE	8	* T47NR6E		Missouri River	Florissant
31	SWO-C-05K4-029	-90:21:18.430	38:49:50.120	NW	NE	8	* T47NR6E		Missouri River	Florissant
32	SWO-R-06K1-001	-90:21:32.704	38:49:37.275	SW	SE	8	* T47NR6E		Missouri River	Florissant
33	SWO-R-06L2-002	-90:21:34.722	38:49:33.653	SW	SE	8	* T47NR6E		Missouri River	Florissant
34	SWO-R-06L2-003	-90:21:38.883	38:49:30.203	NW	NE	17	* T47NR6E		Missouri River	Florissant
35	SWO-R-06L2-004	-90:21:42.131	38:49:27.757	NW	NE	17	* T47NR6E		Missouri River	Florissant
36	SWO-R-06L2-005	-90:21:46.968	38:49:25.729	NE	NW	17	* T47NR6E		Missouri River	St. Louis County

### Stormwater Outlets August 2007

SWO ID Number	Longitude	Latitude	1/4	1/4	Section	Township/ Range	Creek Name	Receiving Water	Municipality
37 SWO-R-06L2-006	-90:21:56.908	38:49:22.037	NE	NW	17	* T47NR6E		Missouri River	St. Louis County
38 SWO-R-06L2-007	-90:22:02.077	38:49:19.969	NE	NW	17	* T47NR6E		Missouri River	St. Louis County
39 SWO-R-06L2-008	-90:22:11.348	38:49:16.280	SW	NW	17	* T47NR6E		Missouri River	St. Louis County
40 SWO-R-06L1-009	-90:22:26.159	38:49:12.848	SE	NE	18	* T47NR6E		Missouri River	St. Louis County
41 SWO-R-06L4-010	-90:22:36.976	38:49:12.421	SE	NE	18	* T47NR6E		Missouri River	St. Louis County
42 SWO-R-06L4-011	-90:22:52.033	38:49:10.657	SW	NE	18	* T47NR6E		Missouri River	St. Louis County
43 SWO-R-06L4-012	-90:22:56.625	38:49:10.517	SE	NW	18	* T47NR6E		Missouri River	St. Louis County
44 SWO-R-06L4-013	-90:22:59.145	38:49:10.720	SE	NW	18	* T47NR6E		Missouri River	St. Louis County
45 SWO-R-06L4-014	-90:23:07.813	38:49:10.852	SE	NW	18	* T47NR6E		Missouri River	St. Louis County
46 SWO-R-06M3-015	-90:23:19.252	38:49:06.818	SW	NW	18	* T47NR6E	Cowmire	Missouri River	Hazelwood
47 SWO-R-06M4-016	-90:24:43.454	38:49:08.439	SE	NE	14	* T47NR5E		Missouri River	Hazelwood
48 SWO-R-09P2-017	-90:28:24.065	38:46:55.242	SW	SE	29	* T47NR5E		Missouri River	Bridgeton
49 SWO-R-10P2-018	-90:28:40.704	38:46:10.566	SW	SE	32	* T47NR5E		Missouri River	St. Louis County
50 SWO-R-11P1-019	-90:29:04.376	38:45:23.492	NW	SW	5	* T46NR5E		Missouri River	Maryland Heights
51 SWO-R-11Q3-020	-90:29:30.541	38:44:56.638	NE	NE	7	* T46NR5E	Creve Coeur	Missouri River	Maryland Heights
52 SWO-R-15R2-021	-90:31:43.186	38:42:04.657	SE	NE	26	* T46NR4E		Missouri River	Maryland Heights
53 SWO-R-15R3-022	-90:31:50.232	38:41:36.584	SE	SE	26	* T46NR4E		Missouri River	Maryland Heights
54 SWO-R-16R1-023	-90:32:14.423	38:41:07.666	NE	SW	35	* T46NR4E		Missouri River	Maryland Heights

### Stormwater Outlets August 2007

SWO ID Number	Longitude	Latitude	1/4	1/4	Section	Township/ Range	Creek Name	Receiving Water	Municipality
55 SWO-R-16S4-025	-90:33:30.871	38:40:46.246	SE	SW	34	* T46NR4E		Missouri River	Chesterfield
56 SWO-R-16T3-026	-90:34:14.101	38:40:41.369	NW	NE	4	* T45NR4E	Bonhomme	Missouri River	Chesterfield
57 SWO-R-16T4-027	-90:35:02.970	38:40:45.292	SW	SW	33	* T46NR4E		Missouri River	Chesterfield
58 SWO-R-16U4-028	-90:36:56.970	38:40:54.707	SW	SW	31	* T46NR4E		Missouri River	Chesterfield
59 SWO-R-16W2-030	-90:39:30.432	38:41:09.550	NE	SE	34	* T46NR3E		Missouri River	Chesterfield
60 SWO-R-18W4-031	-90:40:20.634	38:38:56.127	NE	NW	15	* T45NR3E		Missouri River via Unamed Tributary	Wildwood
61 SWO-R-20W2-032	-90:39:40.122	38:37:48.053	SE	NE	22	* T45NR3E		Missouri River via Bonhomme Creek	Wildwood
62 SWO-R-20W3-033	-90:39:36.419	38:37:39.477	NE	SE	22	T45NR3E		Missouri River via Bonhomme Creek	Wildwood
63 SWO-R-20W3-034	-90:39:35.146	38:37:35.988	NE	SE	22	T45NR3E		Missouri River via Bonhomme Creek	Wildwood
64 SWO-R-20W3-035	-90:39:33.001	38:37:28.172	NE	SE	22	T45NR3E		Missouri River via Bonhomme Creek	Wildwood
65 SWO-R-20W3-036	-90:39:26.420	38:37:22.679	SW	SW	23	T45NR3E		Missouri River via Bonhomme Creek	Wildwood
66 SWO-R-21W2-037	-90:39:20.217	38:37:13.464	SW	SW	23	T45NR3E		Missouri River via Bonhomme Creek	Wildwood
67 SWO-R-22W2-038	-90:39:01.194	38:36:10.917	NE	NW	35	T45NR3E		Missouri River via Bonhomme Creek	Wildwood
68 SWO-R-22W2-039	-90:39:01.306	38:36:05.197	SE	NW	35	T45NR3E		Missouri River via Bonhomme Creek	Wildwood
69 SWO-R-22W3-040	-90:39:01.456	38:35:53.631	SE	NW	35	T45NR3E		Missouri River via Bonhomme Creek	Wildwood
70 SWO-R-22V4-041	-90:38:52.333	38:35:53.388	NW	SE	35	T45NR3E		Missouri River via Bonhomme Creek	Wildwood
71 SWO-R-22V4-042	-90:38:44.499	38:35:50.781	NW	SE	35	T45NR3E		Missouri River via Bonhomme Creek	Wildwood
72 SWO-R-22V4-043	-90:38:38.621	38:35:47.167	NE	SE	35	T45NR3E		Missouri River via Bonhomme Creek	Wildwood

### Stormwater Outlets August 2007

SWO ID Number	Longitude	Latitude	1/4	1/4	Section	Township/ Range	Creek Name	Receiving Water	Municipality
73	-90:38:32.221	38:35:44.204	NE	SE	35	T45NR3E		Missouri River via Bonhomme Creek	Wildwood
74	-90:38:45.382	38:35:24.234	NW	NE	2	T44NR3E		Missouri River via Bonhomme Creek	Wildwood
75	-90:38:46.026	38:35:08.792	SW	NE	2	T44NR3E		Missouri River via Bonhomme Creek	Wildwood
76	-90:38:25.840	38:34:07.531	SW	NW	12	T44NR3E		Meramec River via Hamilton and Carr	Wildwood
77	-90:38:17.216	38:34:07.353	SW	NW	12	T44NR3E		Meramec River via Hamilton and Carr	Wildwood
78	-90:38:11.570	38:34:07.237	NE	SW	12	T44NR3E		Meramec River via Hamilton and Carr	Wildwood
79	-90:38:09.688	38:34:16.384	SE	NW	12	T44NR3E		Meramec River via Hamilton and Carr	Wildwood
80	-90:37:56.127	38:34:19.564	SE	NW	12	T44NR3E		Meramec River via Hamilton and Carr	Wildwood
81	-90:37:56.208	38:34:16.836	SE	NW	12	T44NR3E		Meramec River via Hamilton and Carr	Wildwood
82	-90:38:08.542	38:34:00.919	NE	SW	12	T44NR3E		Meramec River via Hamilton and Carr	Wildwood
83	-90:38:09.078	38:33:53.448	NE	SW	12	T44NR3E		Meramec River via Hamilton and Carr	Wildwood
84	-90:37:57.024	38:33:52.585	SE	SW	12	T44NR3E		Meramec River via Hamilton and Carr	Wildwood
85	-90:37:48.867	38:33:49.866	SW	SE	12	T44NR3E		Meramec River via Carr Creek	Wildwood
86	-90:37:47.226	38:33:52.128	SW	SE	12	T44NR3E		Meramec River via Carr Creek	Wildwood
87	-90:33:00.822	38:40:47.887	SE	SE	34	* T46NR4E		Missouri River	Chesterfield
88	-90:37:30.684	38:40:52.764	SE	SE	36	* T46NR3E		Missouri River	Chesterfield
89	-90:37:46.816	38:40:55.924	SW	SE	36	* T44NR3E		Missouri River	Chesterfield
90	-90:38:58.613	38:34:08.027	SE	SW	13	T46NR4E		Meramec River via Hamilton and Carr	Wildwood

### Stormwater Outlets August 2007

SWO ID Number	Longitude	Latitude	1/4	1/4	Section	Township/ Range	Creek Name	Receiving Water	Municipality
91 SWO-R-24V4-068	-90:38:50.396	38:34:07.935	NE	SE	14	T44NR4E		Meramec River via Hamilton and Carr	Wildwood
92 SWO-R-24V4-069	-90:38:34.411	38:34:07.776	SW	SE	14	T44NR4E		Meramec River via Hamilton and Carr	Wildwood
93 SWO-R-24V3-070	-90:38:06.293	38:34:20.213	NE	SE	12	T44NR3E		Meramec River via Hamilton and Carr	Wildwood
94 SWO-R-25U1-071	-90:37:18.636	38:33:52.032	NW	SW	7	T44NR4E		Meramec River via Hamilton and Carr	Wildwood
95 SWO-R-25V2-072	-90:37:17.193	38:33:52.016	NW	SW	7	T44NR4E		Meramec River via Hamilton and Carr	Wildwood
96 SWO-R-25U1-073	-90:37:07.881	38:33:51.905	NW	SW	7	T44NR4E		Meramec River via Hamilton and Carr	Wildwood
97 SWO-M-37K3-001	-90:20:39.161	38:23:24.814	SW	NW	10	* T42NR6E	Meramec River	Mississippi River	St. Louis County
98 SWO-M-36J4-002	-90:19:25.369	38:24:27.634	NW	NW	2	* T42NR6E		Mississippi River	St. Louis County
99 SWO-M-36J2-003	-90:19:10.249	38:24:44.198	SE	SW	35	* T43NR6E		Mississippi River	St. Louis County
100 SWO-M-35J3-004	-90:18:52.785	38:24:59.346	NW	SE	35	* T43NR6E		Mississippi River	St. Louis County
101 SWO-M-36K4-006	-90:20:51.832	38:24:22.791	SE	NE	4	* T42NR6E		Meramec River	St. Louis County
102 SWO-M-36K1-007	-90:20:52.250	38:24:31.038	NE	NE	4	* T42NR6E		Meramec River	St. Louis County
103 SWO-M-36K2-008	-90:20:48.439	38:24:45.541	SE	SE	33	* T43NR6E		Meramec River	St. Louis County
104 SWO-M-35K4-009	-90:20:45.545	38:25:08.438	SE	NE	33	* T43NR6E		Meramec River	St. Louis County
105 SWO-M-35K4-010	-90:20:47.871	38:25:18.847	SE	NE	33	* T43NR6E		Meramec River	St. Louis County
106 SWO-M-34K4-011	-90:20:51.398	38:25:57.633	NE	SE	28	* T43NR6E		Meramec River	St. Louis County
107 SWO-M-34K2-012	-90:20:34.435	38:26:17.819	NW	NW	27	* T43NR6E		Meramec River	St. Louis County
108 SWO-M-33K3-014	-90:20:17.894	38:26:35.764	SE	SW	22	* T43NR6E		Meramec River	St. Louis County

**Stormwater Outlets  
August 2007**

SWO ID Number	Longitude	Latitude	1/4	1/4	Section	Township/ Range	Creek Name	Receiving Water	Municipality
109 SWO-M-33K3-015	-90:20:16.950	38:26:37.394	SE	SW	22	* T43NR6E		Meramec River	St. Louis County
110 SWO-M-33K3-016	-90:20:06.985	38:26:51.308	NE	SW	22	T43NR6E		Meramec River	St. Louis County
111 SWO-M-33K3-017	-90:20:05.773	38:26:54.109	SE	NW	22	T43NR6E		Meramec River	St. Louis County
112 SWO-M-33K2-018	-90:20:10.775	38:27:18.699	NE	NW	22	* T43NR6E		Meramec River	St. Louis County
113 SWO-M-32K4-019	-90:21:02.995	38:27:30.887	SW	SE	16	* T43NR6E		Meramec River	St. Louis County
114 SWO-M-32L3-020	-90:21:43.323	38:27:24.589	SW	SW	16	* T43NR6E		Meramec River	St. Louis County
115 SWO-M-33L2-021	-90:22:13.869	38:27:16.908	NW	NE	20	* T43NR6E		Meramec River	St. Louis County
116 SWO-M-32M3-022	-90:23:24.774	38:27:23.679	SW	SE	18	* T43NR6E		Meramec River	St. Louis County
117 SWO-M-32M3-023	-90:23:40.439	38:27:31.568	SE	SW	18	* T43NR6E		Meramec River	St. Louis County
118 SWO-M-30M4-024	-90:24:21.976	38:29:04.838	NW	NE	12	* T43NR5E		Meramec River	St. Louis County
119 SWO-M-30M4-025	-90:24:16.516	38:29:17.562	SW	SE	1	* T43NR5E		Meramec River	St. Louis County
120 SWO-M-30M4-026	-90:24:19.614	38:29:23.572	NW	SE	1	* T43NR5E		Meramec River	St. Louis County
121 SWO-M-30M1-027	-90:24:14.904	38:29:41.522	SW	NE	1	* T43NR5E		Meramec River	St. Louis County
122 SWO-M-29M4-028	-90:24:17.132	38:29:52.436	NW	NE	1	* T43NR5E		Meramec River	St. Louis County
123 SWO-M-29M4-029	-90:24:19.076	38:30:10.487	SW	SE	36	* T44NR5E		Meramec River	St. Louis County
124 SWO-M-29M1-031	-90:24:31.340	38:30:18.318	NE	SW	36	* T44NR5E		Meramec River	Sunset Hills
125 SWO-M-29N2-032	-90:24:50.751	38:30:17.081	NW	SW	36	* T44NR5E		Meramec River	Sunset Hills
126 SWO-M-29N2-033	-90:25:25.774	38:30:25.541	NW	SE	35	* T44NR5E	Fenton	Meramec River	St. Louis County

### Stormwater Outlets August 2007

	SWO ID Number	Longitude	Latitude	1/4	1/4	Section	Township/ Range	Creek Name	Receiving Water	Municipality
127	SWO-M-29N1-034	-90:25:39.472	38:30:40.561	SE	NW	35	* T44NR5E		Meramec River	Sunset Hills
128	SWO-M-28N4-035	-90:26:10.075	38:30:59.632	SW	SW	26	* T44NR5E	Yarnell	Meramec River	Fenton
129	SWO-M-27N4-036	-90:26:07.156	38:31:54.211	SW	SW	23	* T44NR5E		Meramec River	Fenton
130	SWO-M-27N1-037	-90:26:04.104	38:31:56.709	SW	SW	23	* T44NR5E		Meramec River	Sunset Hills
131	SWO-M-27N1-038	-90:26:03.371	38:32:09.679	NW	SW	23	* T44NR5E		Meramec River	Sunset Hills
132	SWO-M-26N4-039	-90:26:00.505	38:32:33.106	NW	NW	23	* T44NR5E		Meramec River	Sunset Hills
133	SWO-M-26N4-040	-90:26:02.901	38:32:34.306	NW	NW	23	* T44NR5E		Meramec River	Fenton
134	SWO-M-26N4-041	-90:26:00.723	38:32:39.100	NW	NW	23	* T44NR5E		Meramec River	Sunset Hills
135	SWO-M-26N4-042	-90:26:03.812	38:32:38.537	NW	NW	23	* T44NR5E		Meramec River	Sunset Hills
136	SWO-M-26N1-043	-90:26:04.664	38:32:48.010	SW	SW	14	T44NR5E		Meramec River	Sunset Hills
137	SWO-M-26N1-044	-90:26:11.851	38:32:55.471	NE	SE	15	T44NR5E		Meramec River	St. Louis County
138	SWO-M-25O3-045	-90:26:22.763	38:33:21.983	NE	NE	15	T44NR5E		Meramec River	Kirkwood
139	SWO-M-25O3-046	-90:26:25.110	38:33:26.467	NW	NE	15	T44NR5E		Meramec River	Kirkwood
140	SWO-M-25O3-047	-90:26:31.781	38:33:32.416	NW	NE	15	T44NR5E		Meramec River	Kirkwood
141	SWO-M-25O2-048	-90:26:35.919	38:33:34.608	NW	NE	15	T44NR5E		Meramec River	Kirkwood
142	SWO-M-25O2-049	-90:26:42.534	38:33:33.904	NE	NW	15	T44NR5E		Meramec River	Kirkwood
143	SWO-M-25O3-050	-90:26:54.312	38:33:26.918	NE	NW	15	T44NR5E		Meramec River	Fenton
144	SWO-M-25O4-051	-90:27:15.272	38:33:16.850	SE	NE	16	* T44NR5E		Meramec River	Fenton

### Stormwater Outlets August 2007

SWO ID Number	Longitude	Latitude	1/4	1/4	Section	Township/ Range	Creek Name	Receiving Water	Municipality
145 SWO-M-25O4-052	-90:27:21.929	38:33:14.954	SE	NE	16	* T44NR5E	Meramec River	Fenton	
146 SWO-M-25O4-053	-90:27:26.425	38:33:13.677	SE	NE	16	* T44NR5E	Meramec River	Fenton	
147 SWO-M-25O4-054	-90:27:47.384	38:33:10.581	SW	NE	16	Grand Glaize	Meramec River	Valley Park	
148 SWO-M-26O1-055	-90:27:49.177	38:33:07.058	NW	SE	16	* T44NR5E	Meramec River	Fenton	
149 SWO-M-26P2-056	-90:28:35.093	38:32:44.521	SE	SE	17	* T44NR5E	Meramec River	St. Louis County	
150 SWO-M-26Q2-057	-90:29:38.378	38:32:45.711	SE	SE	18	* T44NR5E	Meramec River	St. Louis County	
151 SWO-M-26Q2-058	-90:29:46.496	38:32:48.057	SE	SE	18	* T44NR5E	Fishpot	Valley Park	
152 SWO-M-26Q2-059	-90:29:59.909	38:32:48.423	SW	SE	18	* T44NR5E	Meramec River	Valley Park	
153 SWO-M-26Q1-061	-90:30:20.605	38:32:46.464	SE	SW	18	* T44NR5E	Meramec River	Valley Park	
154 SWO-M-26Q1-062	-90:30:46.008	38:32:47.206	SE	SE	13	* T44NR4E	Meramec River	Valley Park	
155 SWO-M-26Q1-063	-90:30:49.189	38:32:44.750	SE	SE	13	* T44NR4E	Williams	St. Louis County	
156 SWO-M-26Q1-064	-90:30:54.661	38:32:47.930	SE	SE	13	* T44NR4E	Meramec River	Valley Park	
157 SWO-M-26R2-065	-90:31:03.113	38:32:48.857	SW	SE	13	* T44NR4E	Meramec River	Valley Park	
158 SWO-M-26R2-066	-90:31:13.034	38:32:49.952	SE	SW	13	* T44NR4E	Meramec River	Valley Park	
159 SWO-M-26R2-067	-90:31:24.726	38:32:51.676	SE	SW	13	* T44NR4E	Meramec River	St. Louis County	
160 SWO-M-26R1-068	-90:31:50.801	38:32:55.165	SE	SE	14	* T44NR4E	Meramec River	St. Louis County	
161 SWO-M-26R1-069	-90:32:02.777	38:32:54.314	SE	SE	14	* T44NR4E	Kiefer	St. Louis County	
162 SWO-M-26R4-070	-90:31:52.263	38:32:37.415	NE	NE	23	* T44NR4E	Meramec River	St. Louis County	

### Stormwater Outlets August 2007

	SWO ID Number	Longitude	Latitude	1/4	1/4	Section	Township/ Range	Creek Name	Receiving Water	Municipality
163	SWO-M-26R4-071	-90:31:55.377	38:32:26.165	SE	NE	23	* T44NR4E		Meramec River	St. Louis County
164	SWO-M-26R4-072	-90:32:10.092	38:32:24.356	SW	NE	23	* T44NR4E		Meramec River	St. Louis County
165	SWO-M-26R4-073	-90:32:15.010	38:32:27.142	SW	NE	23	* T44NR4E		Meramec River	St. Louis County
166	SWO-M-26S1-074	-90:33:27.408	38:32:46.596	SW	SE	15	* T44NR4E		Meramec River	St. Louis County
167	SWO-M-26S4-075	-90:33:29.452	38:32:34.739	NE	NW	22	* T44NR4E		Meramec River	St. Louis County
168	SWO-M-26S4-076	-90:33:43.477	38:32:23.564	SE	NW	22	T44NR4E		Meramec River	St. Louis County
169	SWO-M-27S1-077	-90:33:54.486	38:32:13.043	NW	SW	22	T44NR4E		Meramec River	St. Louis County
170	SWO-M-27S1-078	-90:34:02.892	38:32:10.756	NE	SE	21	* T44NR4E		Meramec River	St. Louis County
171	SWO-M-27S1-079	-90:34:03.832	38:32:06.757	NE	SE	21	* T44NR4E		Meramec River	St. Louis County
172	SWO-M-27T2-080	-90:34:17.343	38:31:57.323	SE	SE	21	* T44NR4E		Meramec River	St. Louis County
173	SWO-M-27T2-081	-90:34:15.736	38:31:55.482	SE	SE	21	T44NR4E		Meramec River	St. Louis County
174	SWO-M-27T2-082	-90:34:46.261	38:32:02.836	SE	SW	21	* T44NR4E		Meramec River	St. Louis County
175	SWO-M-27T1-084	-90:35:01.189	38:31:58.946	SW	SW	21	* T44NR4E		Meramec River	St. Louis County
176	SWO-M-27T1-085	-90:35:38.111	38:32:16.667	NW	SE	20	T44NR4E		Meramec River	St. Louis County
177	SWO-M-27T1-086	-90:35:41.619	38:32:12.441	NW	SE	20	T44NR4E		Meramec River	St. Louis County
178	SWO-M-26U3-087	-90:36:14.127	38:32:27.496	SW	NW	20	T44NR4E		Meramec River	Wildwood
179	SWO-M-26U3-088	-90:36:15.680	38:32:27.652	SW	NW	20	T44NR4E		Meramec River	Wildwood
180	SWO-M-26U3-089	-90:36:18.271	38:32:27.800	SW	NW	20	T44NR4E		Meramec River	Wildwood

### Stormwater Outlets August 2007

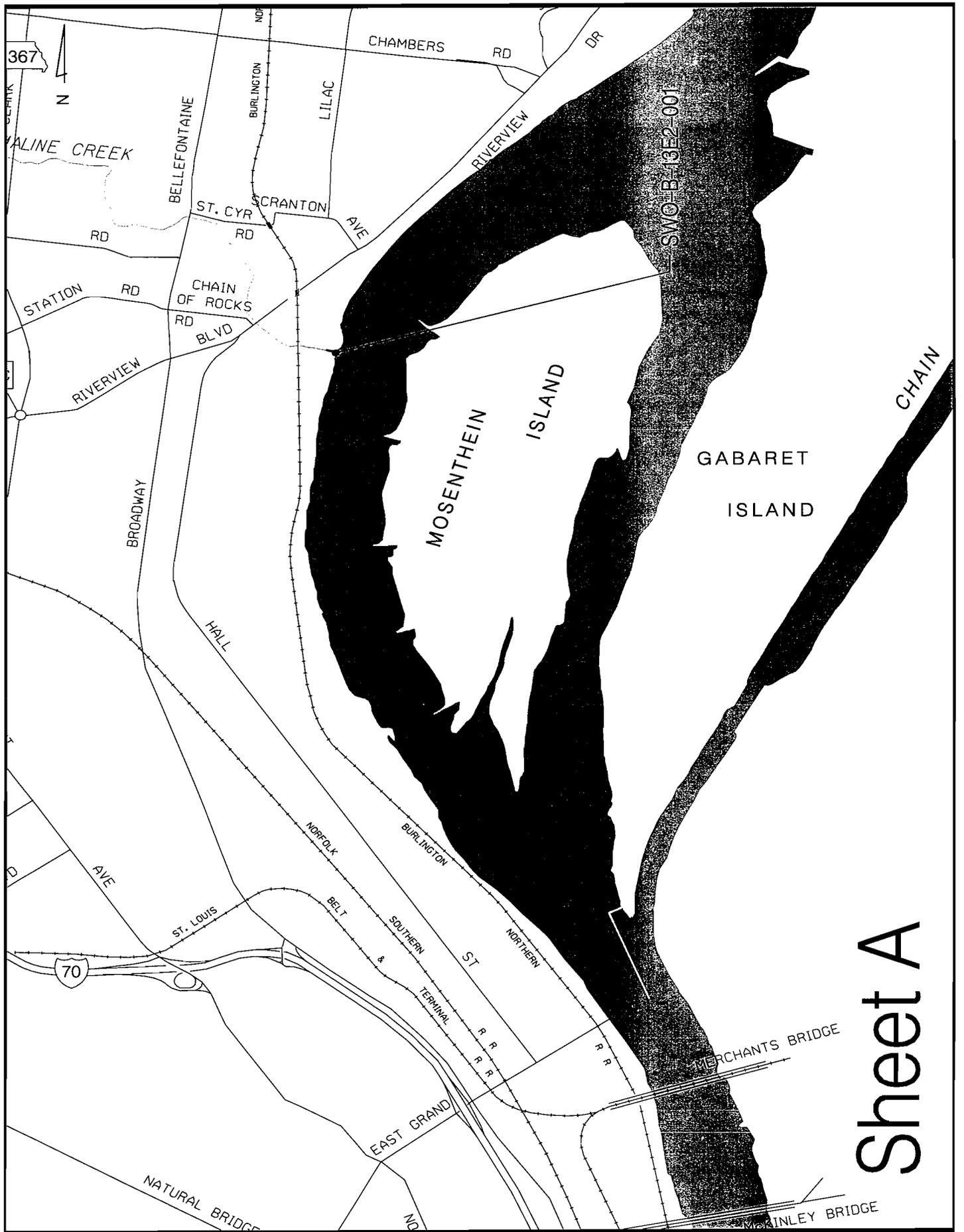
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181	SWO-M-26U3-090	-90:36:24.149	38:32:29.178	SE	NE	19	T44NR4E		Meramec River	Wildwood
182	SWO-M-26U4-091	-90:37:00.589	38:32:36.315	NE	NW	19	T44NR4E		Meramec River	Wildwood
183	SWO-M-27V2-092	-90:37:33.739	38:32:00.265	SE	SE	24	T44NR3E		Meramec River	St. Louis County
184	SWO-M-28U1-093	-90:36:59.881	38:31:15.369	NE	SW	30	T44NR4E		Meramec River	St. Louis County
185	SWO-M-28U1-094	-90:36:54.108	38:31:11.095	SE	SW	30	T44NR4E		Meramec River	St. Louis County
186	SWO-M-28U3-095	-90:36:25.052	38:31:00.654	SE	SE	30	T44NR4E		Meramec River	St. Louis County
187	SWO-M-29T1-096	-90:35:43.729	38:30:36.288	SW	NE	32	T44NR4E		Meramec River	St. Louis County
188	SWO-M-29T4-097	-90:35:25.252	38:30:12.901	SE	SE	32	T44NR4E	Antire	Meramec River	St. Louis County
189	SWO-M-26U1-100	-90:37:02.280	38:32:58.598	SE	SW	18	T44NR4E		Meramec R. via unnamed Tributary	Wildwood
190	SWO-M-26U1-101	-90:37:03.581	38:32:58.595	SE	SW	18	T44NR4E		Meramec R. via unnamed Tributary	Wildwood
191	SWO-M-32K4-102	-90:21:12.876	38:27:31.712	SE	NW	4	* T43NR6E		Meramec River	St. Louis County
192	SWO-M-32K4-103	-90:21:26.509	38:27:29.579	SW	NW	4	* T43NR6E		Meramec River	St. Louis County
193	SWO-M-33M1-104	-90:24:36.824	38:27:09.405	NE	SW	25	T43NR5E		Meramec River	St. Louis County
194	SWO-M-32N3-105	-90:24:51.732	38:27:26.834	SW	NW	25	T43NR5E		Meramec River	St. Louis County
195	SWO-M-25O3-106	-90:26:21.630	38:33:16.417	SE	SE	9	T44NR5E		Meramec River	St. Louis County
196	SWO-M-29N2-107	-90:25:32.131	38:30:35.772	SW	NE	9	T44NR5E		Meramec River	Sunset Hills

**Stormwater Outlets  
August 2007**

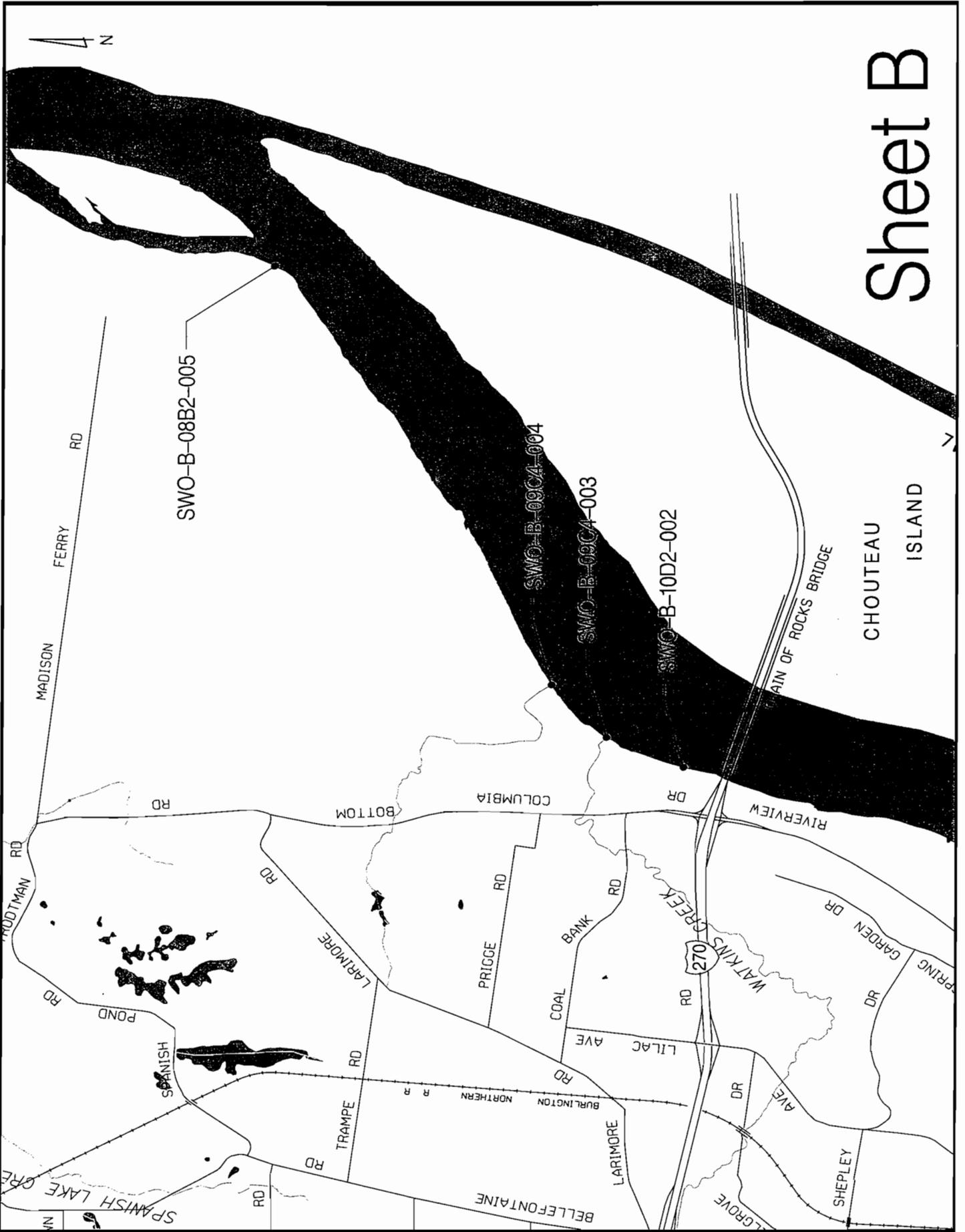
	<b>SWO ID Number</b>	<b>Longitude</b>	<b>Latitude</b>	<b>1/4</b>	<b>1/4</b>	<b>Section</b>	<b>Township/ Range</b>	<b>Creek Name</b>	<b>Receiving Water</b>	<b>Municipality</b>
197	SWO-M-29N1-108	-90:25:35.427	38:30:38.226	SW	NE	35	* T44NR5E		Meramec River	Sunset Hills
198	SWO-L-31G4-001	-90:16:53.747	38:28:36.443	NE	SW	7	* T43NR7E		Mississippi River	St. Louis County
199	SWO-L-30G4-002	-90:16:47.526	38:29:02.747	NE	NW	7	* T43NR7E	Martigney	Mississippi River	St. Louis County
200	SWO-L-29G1-003	-90:16:25.302	38:30:19.223	SW	NE	31	* T44NR7E		Mississippi River	St. Louis County
201	SWO-L-29G1-004	-90:16:19.573	38:30:31.604	SE	NE	31	* T44NR7E		Mississippi River	St. Louis County
202	SWO-L-27G2-005	-90:15:38.094	38:31:58.397	NE	SW	20	* T44NR7E	R. Des Peres	Mississippi River	St. Louis County
	*Interpolated section number									



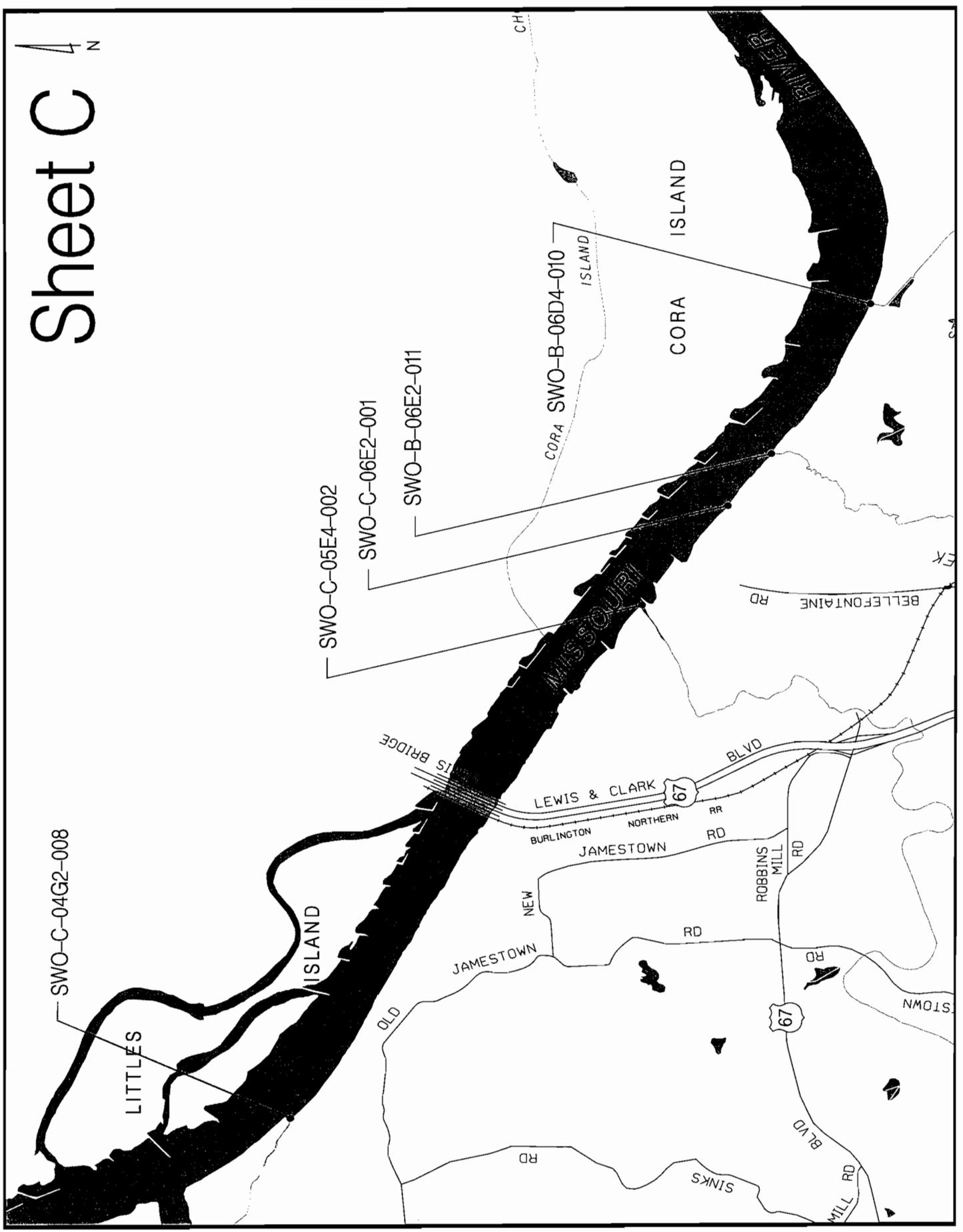




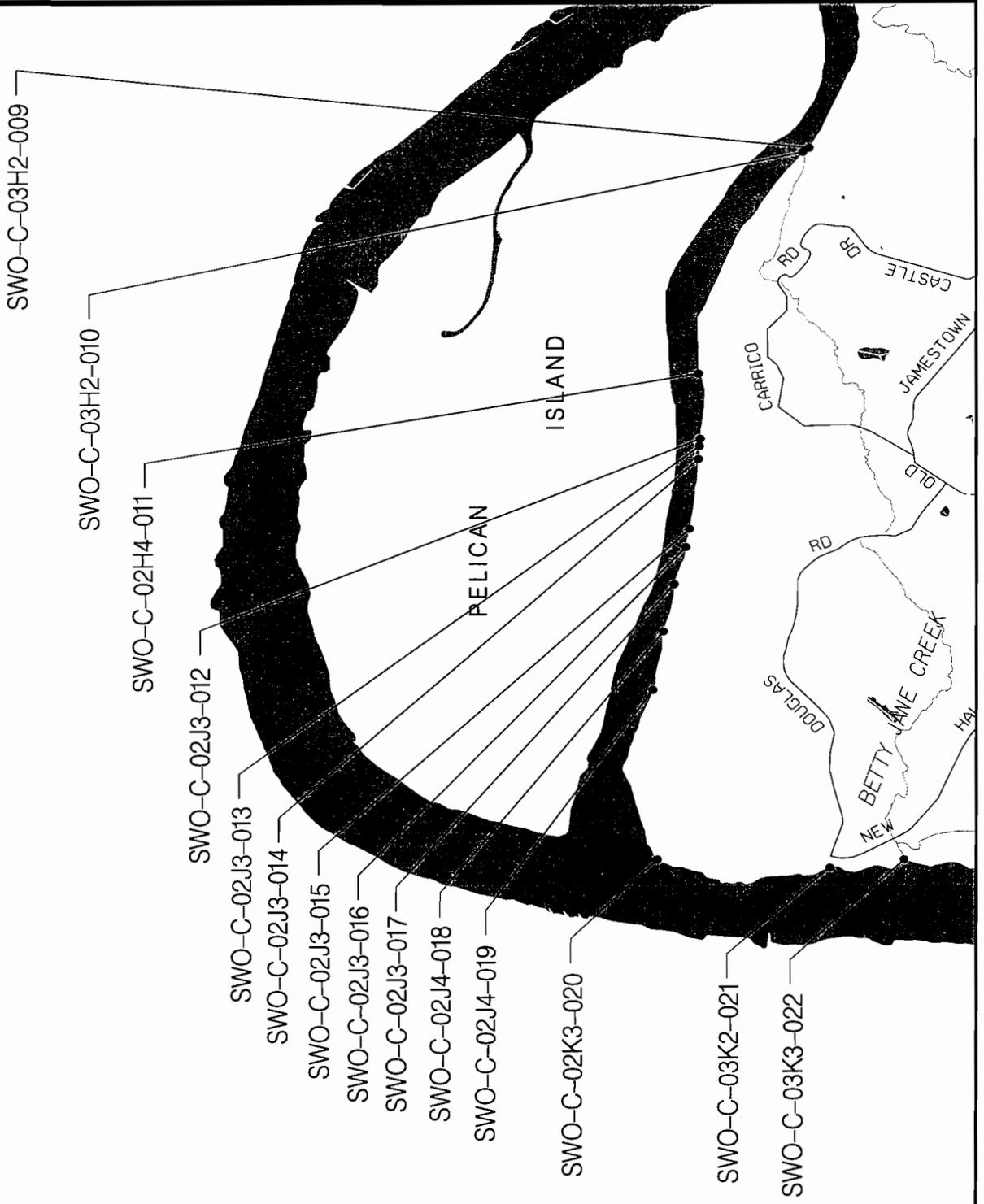
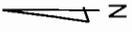
Sheet A



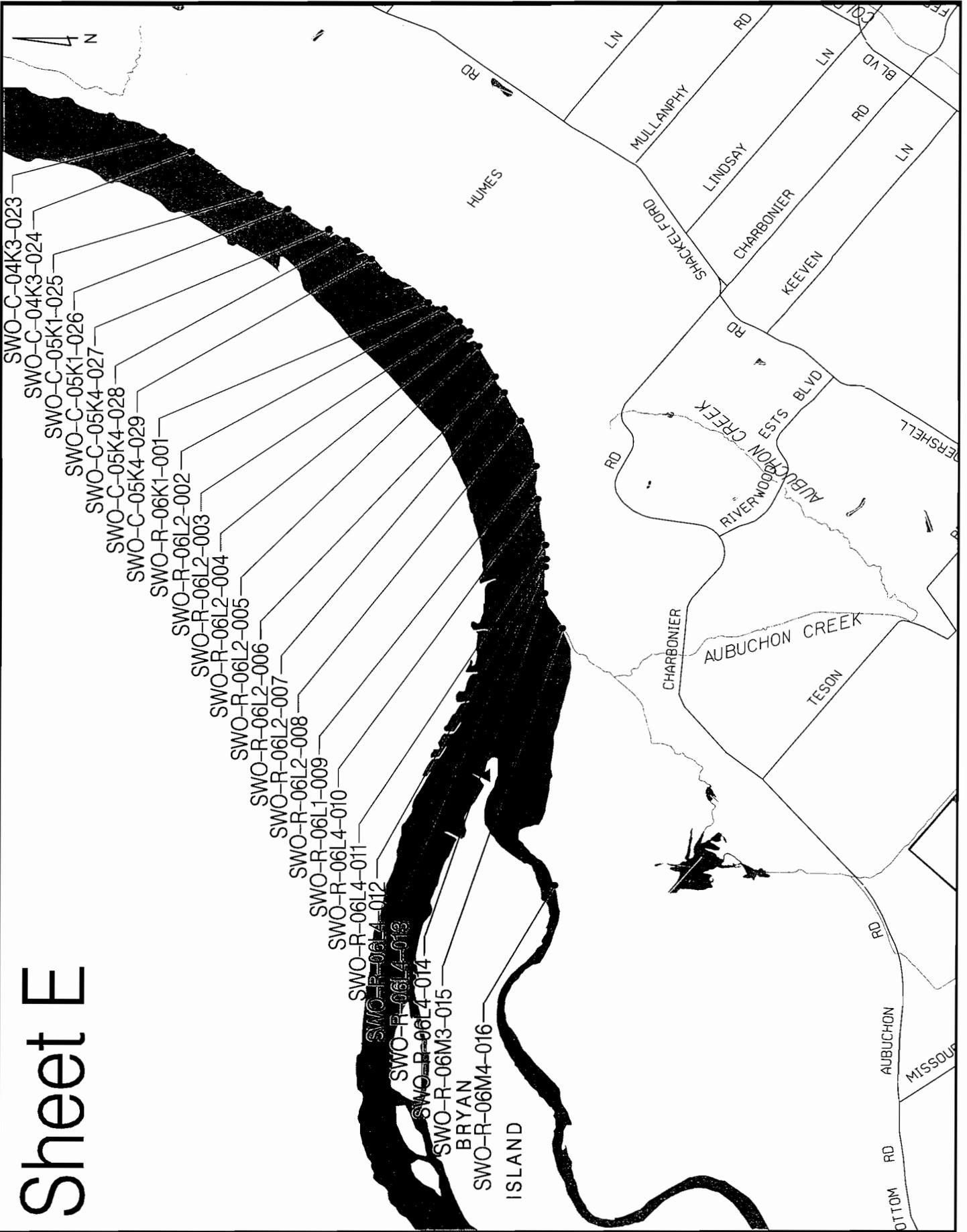
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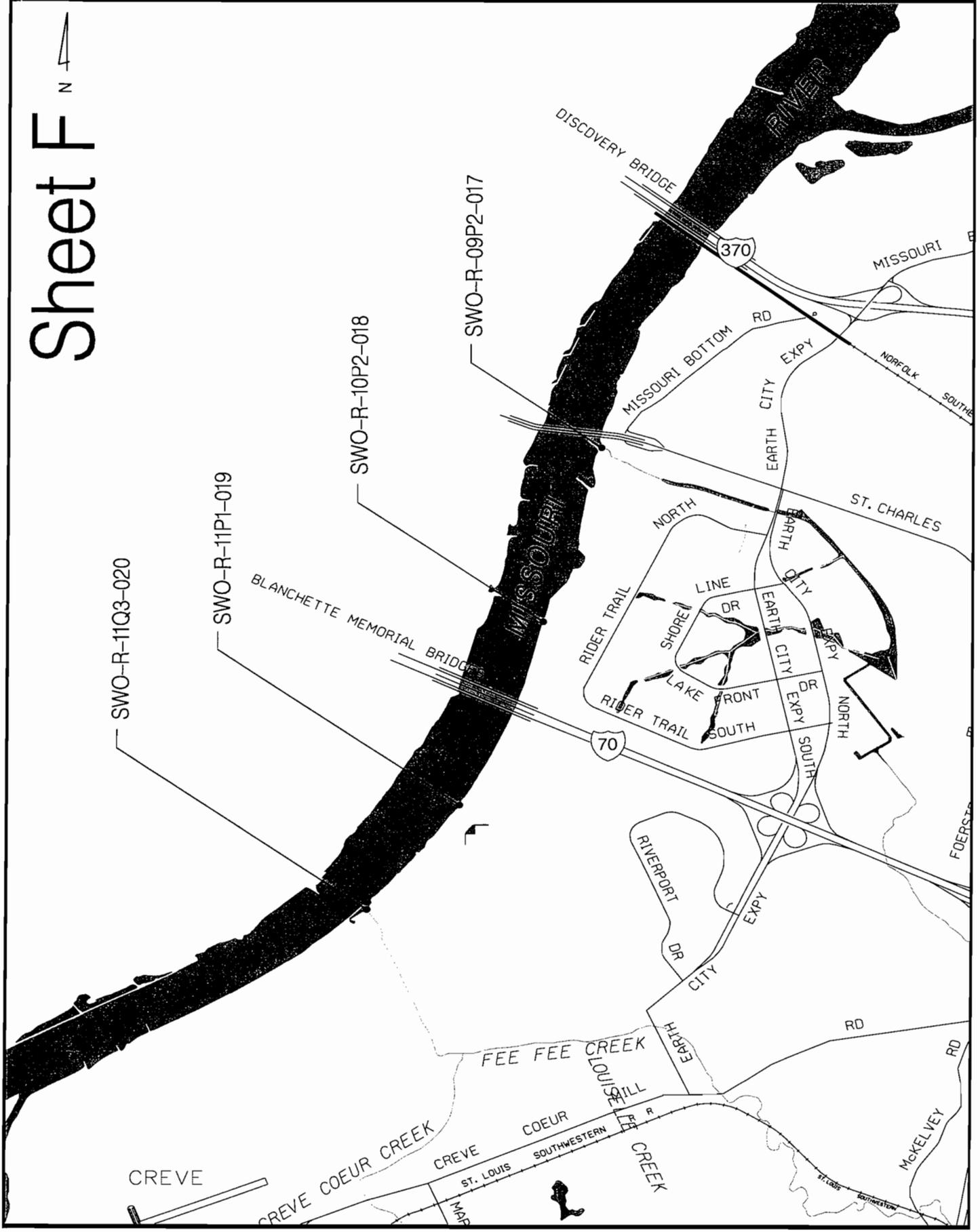
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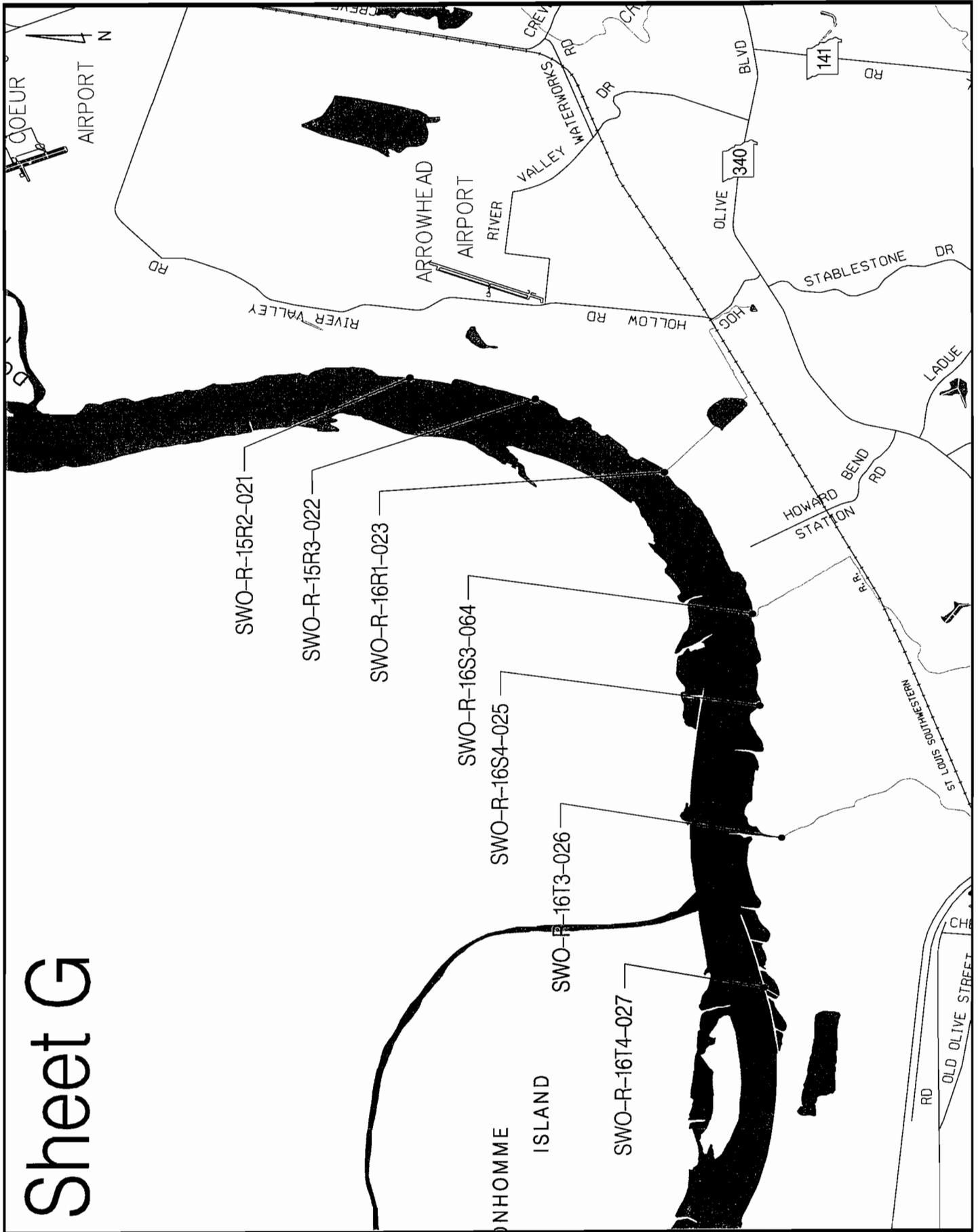
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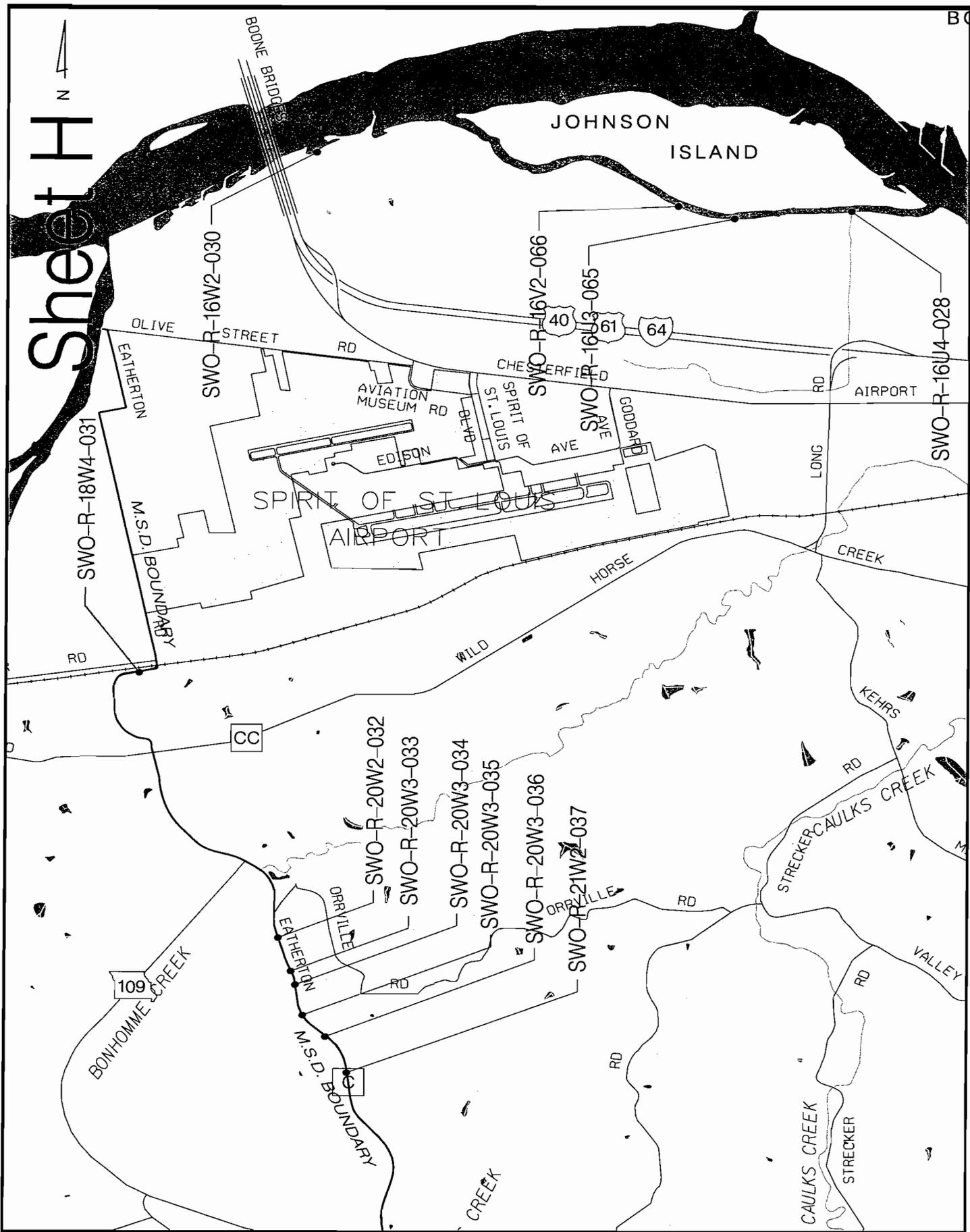


# Sheet F

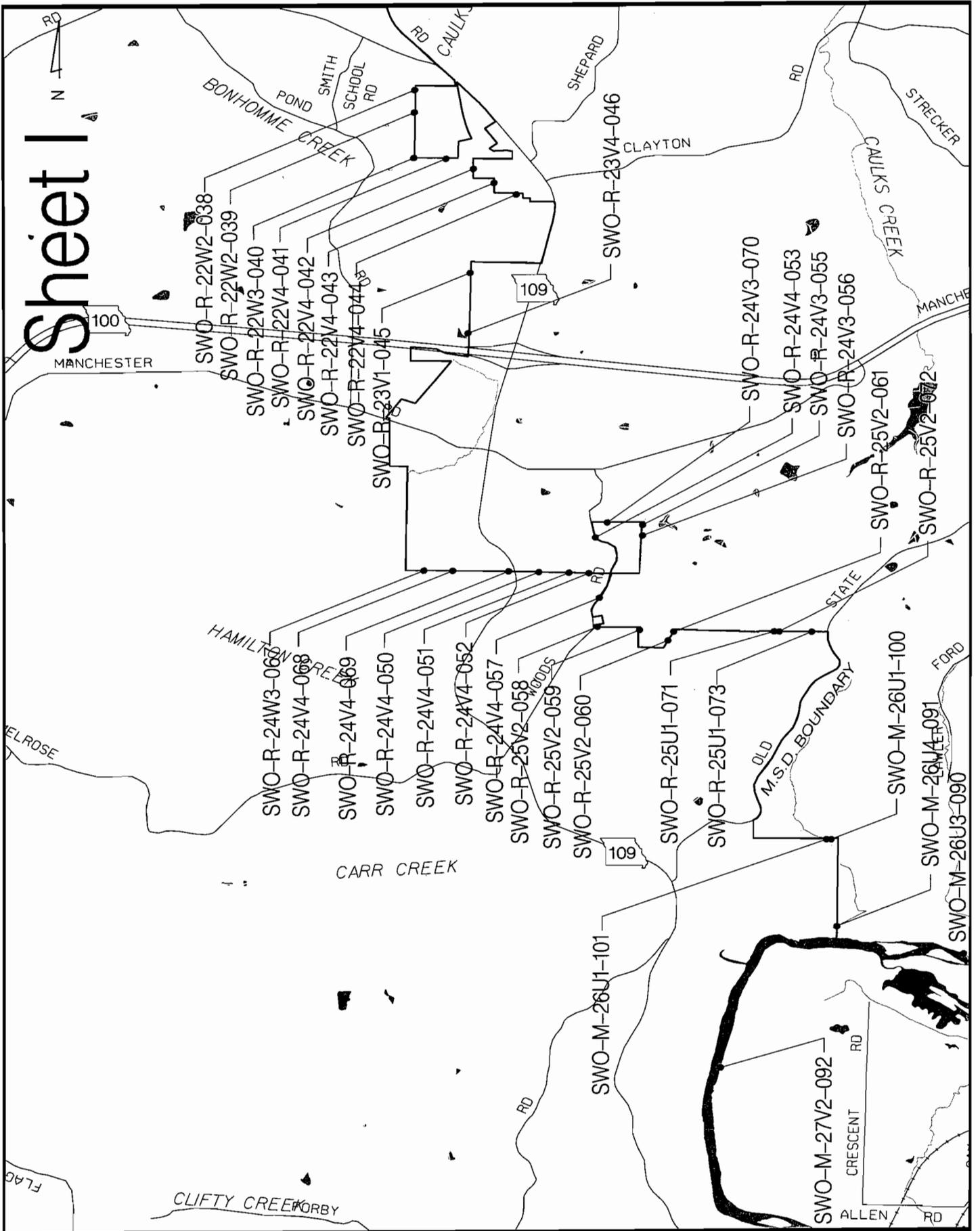


# Sheet G

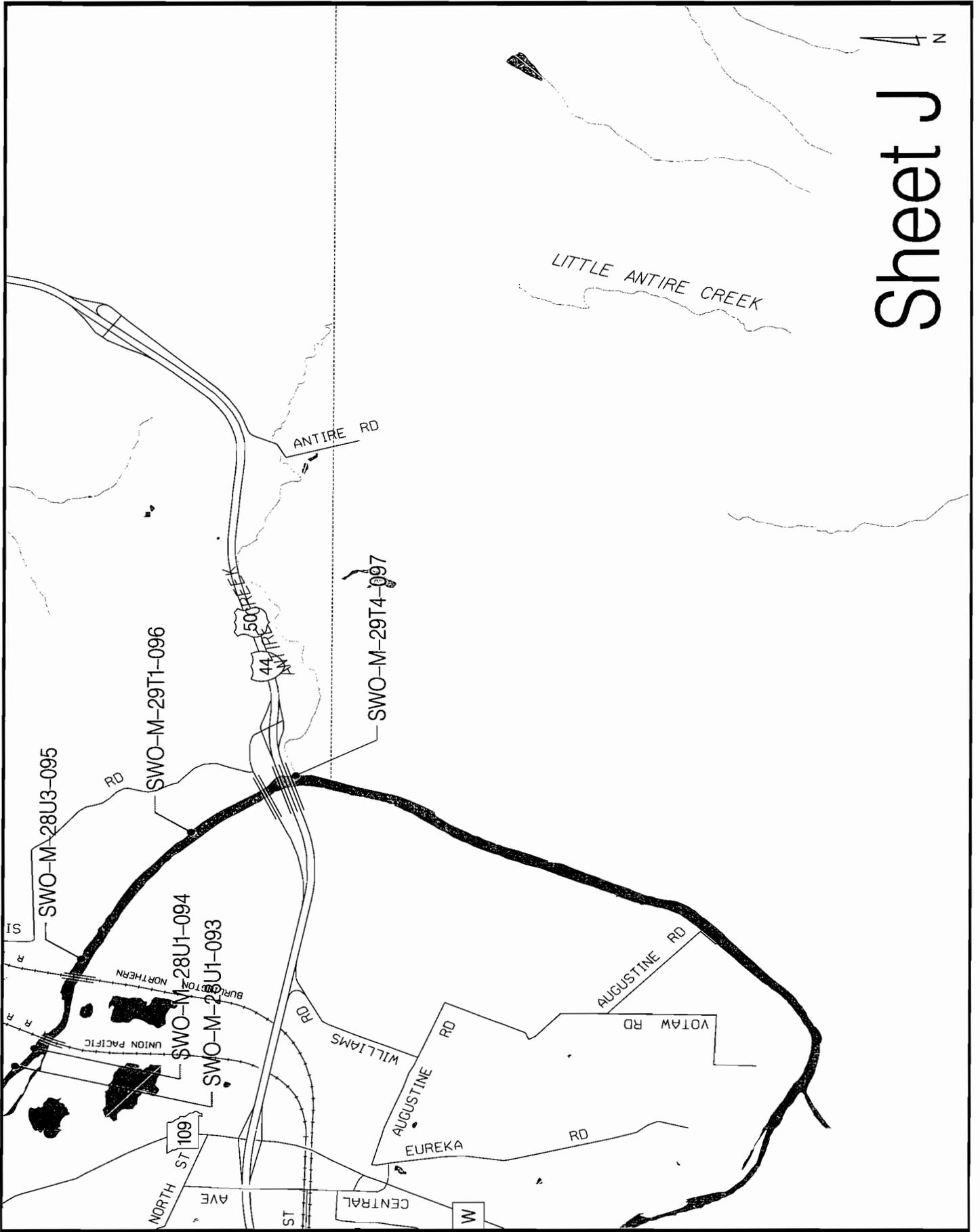




# Sheet I



# Sheet J



# Sheet K

