



KANSAS CITY, MISSOURI

National Pollutant Discharge Elimination System (NPDES)

Municipal Separate Storm Sewer System (MS4) Permit MO-0130516

Ninth Year Report, May 1, 2013 – April 30, 2014

Submitted by:
**Kansas City, Missouri
Water Services Department
4800 E 63rd Street
Kansas City, MO 64130
December 2014**

CERTIFICATION

Authority

As required in Part VI, Sections D and E, of Missouri State Operating Permit No. MO-0130516,

All reports required by the permit and other information requested by the Director shall be signed by:

1. For a municipality, State, or other public agency: either a principal executive officer or ranking elected official.

Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Terry Leeds, P.E.
Director, Water Services Department

Date

WRITTEN NOTICE OF COMPLIANCE

Part IV.B of the Missouri State Operating Permit MO-0130516 requires that the City of Kansas City, Missouri provide written notice of compliance or non-compliance with the schedule for permit implementation. The City has, so far, submitted nine reports covering the period from September 3, 2004 to April 30, 2013, to Missouri Department of Natural Resources. This current report covers the period of May 1, 2013 – April 30, 2014. It documents the status of implementing, to the maximum extent practicable, the components of the stormwater management programs that are established as permit conditions, and addresses the progress of programs that were required to be implemented in this period. As detailed in the report, the City is in compliance with the schedule for all interim milestones and final deadlines as identified in the permit schedule (Permit Part IV.A).

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1. INTRODUCTION

This report is submitted to Missouri Department of Natural Resources (MDNR) by the City of Kansas City, Missouri (hereafter referred to as the City) pursuant to the conditions of the National Pollutant Discharge Elimination System (NPDES) Missouri State Operating Permit MO-0130516 for discharges from its municipal separate storm sewer system. The five-year permit was issued on September 3, 2004 and expired on September 3, 2009. Since the expiration of the first permit term, the City has continued to operate its separate storm sewer system under the expired permit conditions. This annual report provides an update on the permit implementation activities conducted between May 1, 2013 and April 30, 2014.

This report consists of six sections:

1. Stormwater Management Program Components: Elements of the City's stormwater management program are summarized in this section. Objectives, program development, implementation status, and major achievements are discussed here.
2. Public Education Program: Public education is required in multiple stormwater management programs in the City's MS4 permit. This section discusses education activities, currently conducted or planned pursuant to Permit requirements.
3. Watershed Monitoring Program: Monitoring water quality is a critical component in evaluating the effectiveness of the MS4 permit implementation. This section presents a summary of ongoing monitoring efforts performed in accordance with Part VI of the Permit.
4. Other Permit Reporting Requirements: The City's MS4 Permit mandates reporting elements that allow for the evaluation of Permit implementation but are not specifically included in any of the previous sections. These elements include proposed changes to permit conditions, enforcement actions, identification of water quality improvement or degradation, and a fiscal analysis.
5. Future Implementation: This section discusses the future direction of stormwater management in the City.
6. Attachments: This section (Attachments 1, 2 and 3) includes detailed supporting documents that have been developed in compliance with the permit requirements and/or that are not required by the permit but show the City's effort on stormwater pollution prevention and mitigation.

2. CONTACT LIST

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3. STORMWATER MANAGEMENT PROGRAM COMPONENTS

3.1 Address Post-Construction Discharge from Areas of New Development and Significant Redevelopment

1. Water quality considerations for areas of new development and significant redevelopment

Permit Ref. III.A-1.a.
Status: Ongoing

The activities that have been performed under this program included:

- **Revising the new Kansas City Zoning and Development Code:**
No change was made during the reporting period.

- **New area plan addressing stormwater and sustainability**

Table 1 provides the new area plans that the City Planning and Development Department completed that directly and specifically address stormwater and environmental sustainability.

2. Procedures for addressing water quality issues as part of the permitting process

Permit Ref.: III.A-1.a.i.
Status: Ongoing

The Land Development Division of the City Planning and Development Department continued to require developments' adherence to the adopted APWA standards and supplements including the **Manual of Best Management Practices (BMPs) for Stormwater Quality**, and compliance with Stream Buffer Regulations during the initial planning stages of new development and redevelopment, and during the construction of the projects. These standards require developments to mitigate their impacts for post-construction above pre-development conditions by including permanent water quality BMP's, buffers, and maintenance instruments for all sites within the MS4. In addition, the WSD also provides BMP guidance during the plan review and approval process.

3. A description of review standards and a description of the site development review process for internal and external educational purposes

Permit Ref.: III.A-1.a.ii.
Status: Ongoing

See Table 2 for details.

4. Operation and maintenance of post-construction BMPs

Permit Ref.: III.A-1.b.
Status: Ongoing

- **Regional BMPs:** No change was made during the reporting period.

- **Public BMPs:** The Stormwater Maintenance Group at WSD inspected and maintained the public detention basins at 8801 James A Reed Rd., 3913 N. Kensington Rd., 6013 N. Strathbury Rd., 300 Chestnut Trafficway, 17th/Manchester Trafficway, and Gardner Avenue. The basin at 1200 E Linwood Rd. is owned by the City and maintained by the City's Board of Police Commissioners.

Table 1. The new area plan addressing stormwater and sustainability

Area plan	Completion/ adoption date	Low-impact development (or re-development), stormwater-related vision/principle/recommendation
Swope Park Area Plan*	2013	<p><u><i>Vision for Sustainability:</i></u> Create a sustainable community that is economically, environmentally, and socially healthy and resilient.</p> <ul style="list-style-type: none"> Promote a land use pattern that is consistent with the carrying capacity of natural resources. Promote green infrastructure: <ul style="list-style-type: none"> ✓ Implement green and sustainable stormwater solutions in streetscape improvements and in City-owned facilities. ✓ Implement urban gardening and opportunities for green storm water mitigation in area vacant lots. Promote sustainable development. <ul style="list-style-type: none"> ✓ Integrate sustainable approaches to storm water management, energy efficiency, alternative energy production, and sustainable building techniques (e.g. low embodied energy) in new development. <p><u><i>Guiding principle to address land use and development:</i></u></p> <ul style="list-style-type: none"> Promote a land use development pattern that is consistent with the carrying capacity of natural resources. The land use plan incorporates the proposed open space system and recommends areas where conservation or clustered development should occur to minimize impacts to sensitive environmental areas. Furthermore, inclusion of connected open spaces will be encouraged in new development plans. Promote “green” solutions and implement sustainable infrastructure solutions and achieve multiple benefits. Coordinate Wet Weather Improvements with other neighborhood improvement initiatives, encourage green solutions and adhere to the city’s Wet Weather Solutions Program Guiding Principles. Through strong creative leadership and a stewardship ethic, the Wet Weather Solutions Program will take action to manage the City’s water resources in a sustainable way. <p><u><i>Stormwater management, flood mitigation, and sewer strategies:</i></u></p> <ul style="list-style-type: none"> Implement stormwater improvements as recommended in the KC-One Plan, the Overflow Control Plan and the three watershed plans in the Swope Area: Town Fork Creek, Middle Blue and Brush Creek. Implement Best Management Practices (Green Solutions)

*<https://data.kcmo.org/Area-Plans/SWOPE-AREA-PLAN-06-30-2014/pd8z-g6zb>

In addition, the WSD has started to maintain City-owned green solution sites allowing them to function at an optimal level. Currently the department maintains a total of 10.5 acres which include, but not limited to, rain gardens, bio-retention cells, and detention basins.

-Private Water Quality BMPs:

- ***The Detention Basin Credit program:*** The WSD maintains the program to encourage the use of detention basins. WSD conducted routine inspections for basins receiving the detention credit. See Table 2 for details. There were four new detention basins given credits.
- ***BMP evaluation for development plans and BMP easements:*** See Table 2 for details.

Table 2. A summary of tasks associated with addressing post-construction discharge from new development and significant re-development

Permit Ref.	Task	Activities
1a.	Incorporate water quality considerations for areas of new development and redevelopment: (1) in land use planning, subdivision approval, and site plan review and approval; and (2) in project review and approval for new development and significant redevelopment	- Review Process <ul style="list-style-type: none"> • 244 reviews of development applications • 1,031 reviews of construction projects • 39 BMP facilities installed. • 39 pre-application development assistance sessions with development stakeholders. • 58 BMP Easements reviewed • 65 Covenants for Maintenance reviewed
1a.i & ii	Improve procedures for incorporating water quality concerns as part of the permitting process	
1a.ii.	Upgrade the site development review standards	
1a.ii.	Internal and external education on review standards and process	
1a.iii.	Set up minimum design criteria for structural BMPs	
1b.	Inspect and maintain (I/M) post-construction BMPs	<ul style="list-style-type: none"> • 7 public detention basins inspected and maintained as needed • 52 private detention basins inspected • 10.5 acres of green solution sites maintained (new this year)

3.2 Control Discharge from Roadways

1. Store and cover deicing chemicals to minimize the discharge of deicing salts to the MS4

Permit Ref. III.A-2a.
Status: Ongoing

The City Public Works Department has deicing chemical and material storage facilities at each of its three districts and two outlying salt storage facilities. The facilities vary in size and their storage capacities range from 6 to 12 thousand tons of materials. Rock salt is stored in dome structures at three of the locations. The domes were constructed on asphalt slabs and consist of wooden and concrete structural materials, capable of containing deicing chemicals during periods of extended storage. The two additional salt storage facilities are “Cover-All” buildings with ten-foot high concrete walls constructed on an asphalt slab. Salt brine and calcium chloride solutions are also used as deicing agents for the public streets and both are stored in tanks. During the reporting period, the Public Works and Parks & Recreation departments used a total of 414,850 gallons of salt brine, 33,044 gallons of liquid calcium chloride and 28,131 tons of salt to keep City streets safe for cars and passengers.

2. Effectively maintain public streets while considering water quality and watershed goals and objectives

Permit Ref. III.A.2b.
Status: Ongoing

- **Street sweeping program:** The Stormwater Maintenance Division of the Water Services Department obtained eight new environmental-friendly and cost-efficient street sweepers to conduct the program. Figure 1 provides the performance measurements on a monthly basis for the fiscal year of 2013/14.

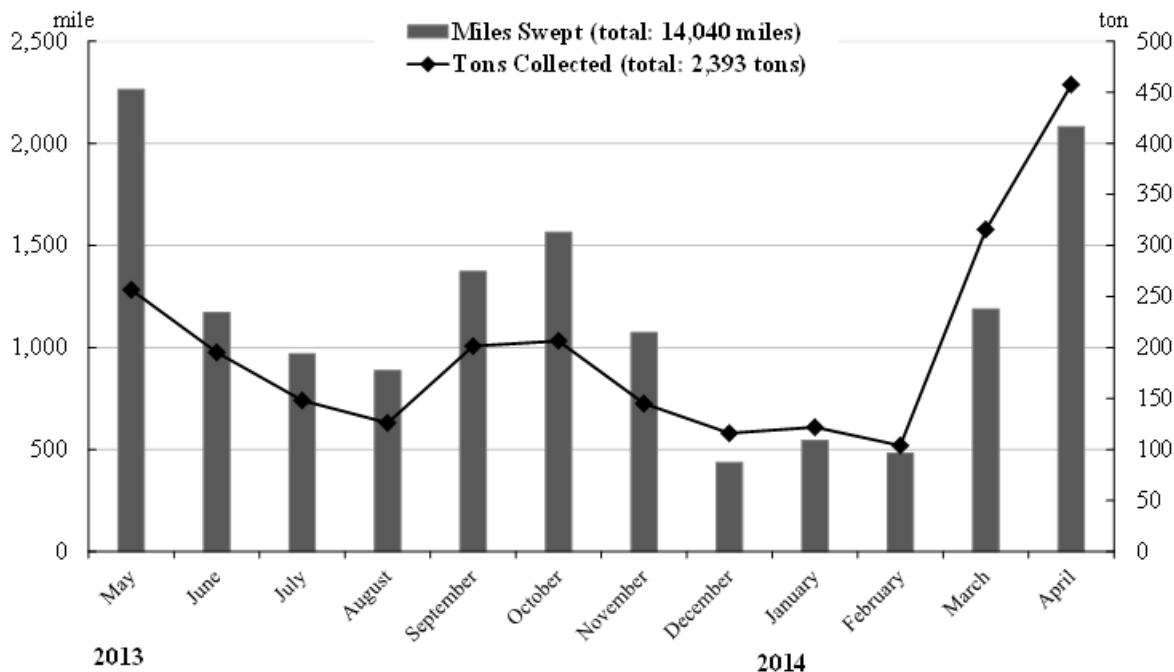


Figure 1. Monthly record of street sweeping for FY 2013/14

- **Other trafficway/right-of-way maintenance:** The City Parks & Recreation Department maintains 12,000 acres of parkland in 220 parks, 40-miles of interior roads, hundreds of parking lots, 129-miles of boulevards, parkways, and streets, and over 76 miles of trails and bikeways. Due to the isolation of much of the property in the Park system, it is a prime target for illegal dumping activities. The Department continued working with law enforcement personnel, neighborhood and community groups, other City departments, the City's Illegal Dumping Task Force and other stakeholders in multi-faceted effort to address the dumping problem. See Section 4.7 **Reduce Illicit Discharges, Spills, and Improper Disposal** for details.

- **Adopt-a-Street program:** The program currently has a total of 156 active volunteer organizations/groups throughout the City with 114 miles/blocks adopted. The program provides an opportunity for residents, business, and civic groups to partner with the City to help keep the City clean.

- **The Leaf and Brush Program:** During this reporting period a total of 13,035 tons of waste was collected at two drop-off centers and 4,780 tons of yard waste was collected during the seasonal curbside collections.



3. Storm sewer maintenance

Permit Ref. III.A.2c

Status: Ongoing

- **Stormwater Maintenance policy implementation:** The Stormwater Maintenance Division of WSD defines maintenance activities as cleaning, repair, and replacement of structures including stormwater inlets, ditches, streams, channels, fences for channels, and detention basins. Scheduled inspection of inlets is on a two-year frequency. Priority inlets are cleaned more frequently. Inlets are primarily cleaned by the use of vacuum trucks to remove debris that could otherwise find its way to streams.

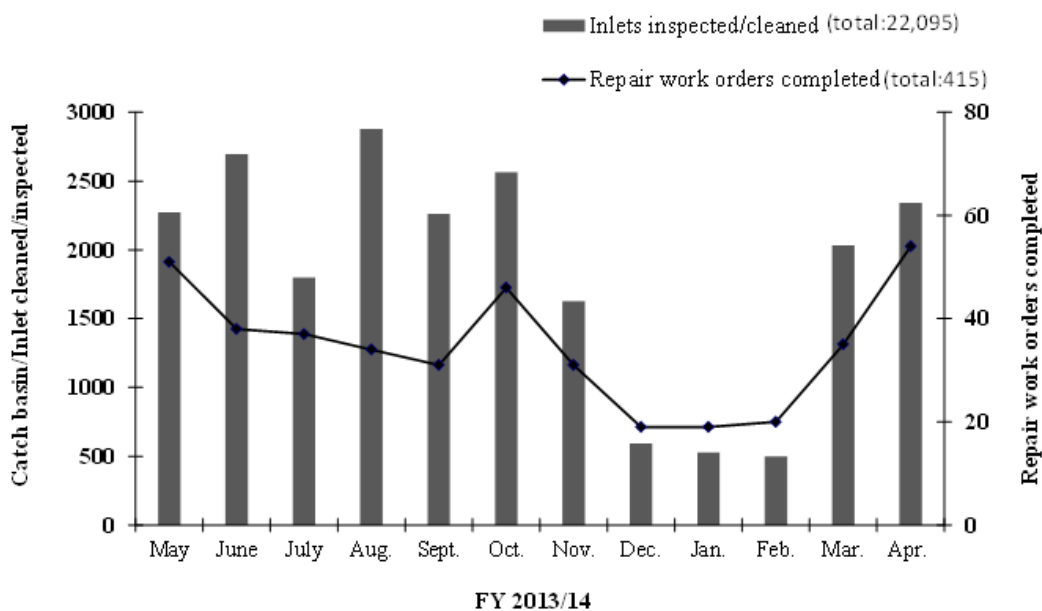


Figure 2. Monthly record of storm sewer structure maintenance for FY 2013/14

- **Stormwater Maintenance group accomplishments:** The group completed 22,095 cleanings of storm inlets, and 415 repair work orders (Figure 2). Note that this work is season-dependent. Additionally, the group strengthened its staffing resources and expertise to meet the maintenance demand related to the use of green infrastructure as an alternative to conventional stormwater concrete infrastructure.

- **Catch basin hotline:** The City's 3-1-1 Action Center serves as a central point of contact for City services including catchbasin or other stormwater concerns. During the reporting period, the City received 1,163 requests for service or maintenance of catch basins and other stormwater inlets (Figure 3).

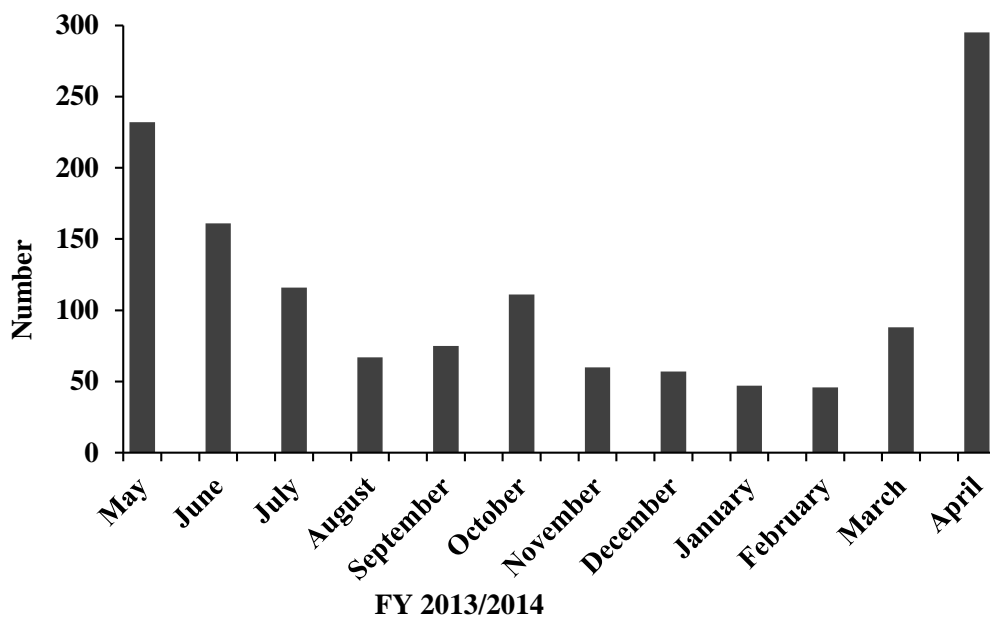


Figure 3. Record of requests for services on catch basins/inlets through the City's 3-1-1 Action Center

- **Catch Basin Replacement Program:** To maintain the proper function of stormwater inlets, the City has replaced 97 catch basins City-wide through its *Catch Basin Replacement Program* during this reporting period.

3.3 Assess Impact of Flood Risk Management Projects on Water Quality Conditions

1. Evaluate existing flood risk management projects for water quality retrofitting

Permit Ref. III.A-3b
Status: Complete

The original evaluation of existing flood management projects was completed in the early years of the permit term. Most of the projects in this category are large scale, long term projects involving the Corps of Engineers and federal funding. These projects are managed by the Department's Waterways Division and they do consider water quality impacts in the course of their work. The Department also regularly works with community groups and organizations interested in maintaining the riparian areas through clean-up efforts like the annual "Operation Blue River Rescue".

2. Evaluate new flood control projects

Permit Ref. III.A.3b
Status: Ongoing

No new large scale flood control projects have been initiated in the current reporting period.

As mentioned above, there are several ongoing projects in various stages of progress. Of note is the continuing planning and evaluation on a watershed basis of Brush Creek. This bi-state coalition of 18 different communities are continuing efforts to improve the condition of the entire Brush Creek watershed, certainly including water quality.

On a smaller scale, the Department does address localized flooding concerns, primarily through the Public Improvements Advisory Council (PIAC) funding process. Residents or groups can apply for funding to address various concerns, including flooding. Funded projects dealing with drainage and flooding are managed by the Department's Stormwater Division, Capital Projects Section. During the last reporting period, six projects were completed that included green infrastructure elements as a component of a larger project, totaling \$192,613 in green infrastructure investment.

The Department also manages capital improvement projects for stormwater. A larger project of note is the Universal Avenue Project that was designed during this permit period. The project consist of 3,200 linear feet of new 8' x 6' reinforced concrete box storm sewer with inlets, junction boxes, a control structure, and a large detention basin. The earthen basin will be planted with native species along the bottom and the sides to facilitate enhanced infiltration.

3.4 Control Pollutants in Runoff from Municipal Waste Management Facilities

1. Continue spot inspections

Permit Ref. III.A.4

Status: Ongoing

OEQ performed a walk-through inspection for 87th Street Landfill on April 7, 2014. Visual observations during this inspection showed that: (1) the cap was generally intact with substantial vegetation and minor to substantial amounts of tree growth; (2) minor water ponding was present on the cap surface of the landfill, and (3) fill material exposure, and active seepage was present at this landfill. The inspection results were documented and further investigations were undertaken (see the subsequent description).

2. Implementation of a sampling and analysis plan

Permit Ref. III.A.4

Status: Ongoing

The City contracted with SCS Engineers to perform sampling and analysis at the 87th Street, 97th Street, Heart and Round Grove Landfills three times per year. SCS Engineers generated a sampling and analysis plan. Sampling locations were marked with steel t-posts and were recorded with GPS data to facilitate repeatable sampling activities. Final sampling was performed at multiple sampling locations at each of the four landfills in May of 2013.

Several parameters were measured and recorded in the field including pH, conductivity, dissolved oxygen, and temperature. Samples were collected and analyzed for the following parameters: metals (arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, selenium, silver, and zinc); ammonia; total dissolved solids (TDS); total suspended solids (TSS); total Kjeldahl Nitrogen (TKN); total phosphorus; Chemical Oxygen Demand (COD); Biochemical Oxygen Demand (BOD); nitrate/nitrite; chloride; sulfate/sulfide; orthophosphate; hardness; and cyanide. Samples from the Round Grove Creek Landfill were also analyzed for Fecal Coliform and E. Coli. during each event. Additional samples may be collected and analyzed at each of the landfills on an annual basis for semi-volatile organic compounds (SVOCs), organochlorine pesticides, and Polychlorinated biphenyls (PCBs).

Missouri Water Quality Criteria for the protection of aquatic life, Missouri Lowest Default Target Levels for groundwater contamination, and US EPA Maximum Contaminant Levels for drinking water is used to evaluate the analytical results.

3. Investigative Study

Permit Ref. III.A.4

Status: Ongoing

The City contracted with SCS Engineers to perform an investigative study to determine the source of seepage identified at the 87th Street landfill, and to propose remedial options.

SCS Engineers conducted a video inspection of the storm sewer pipe associated with the leachate, and evaluated potential contamination sources in the area that may be contributing to the discharge. A fluorescent dye test and leachate sampling of above ground access points and the discharge point of the pipe was also performed.

4. Establish and Implement a Landfill Maintenance Program

Permit Ref. III.A.4

Status: Ongoing

All maintenance activities are geared toward maintaining the integrity of the landfill cap and minimizing the infiltration of water into the interred waste. Maintenance program activities may include the following activities: surface waste removal and cap maintenance:

-Surface Waste Removal:

- Annual removal of any waste materials that have been either illegally dumped onto the cap surface or were deposited by stormwater flowing from the adjacent stream onto the landfill property.
- These removed wastes will be documented and disposed of in an active, permitted landfill.

-Cap Maintenance:

- Annual maintenance activities to the cap surface will consist of the repair of any areas of erosion, cap damage, subsidence, or depressions that directly affect the infiltration of water into the interred waste areas or runoff into adjacent stream.
- All areas determined to be in need of repair will be recorded and documented through GPS coordinates, and will be visited the following year, during the annual inspection, to determine if the repairs were successful.
- Only clean fill material will be used for these maintenance activities.

3.5 Monitor and Control Pollutants from Industrial and High-Risk Runoff

1. Update the inventory of potentially significant dischargers

Permit Ref. III.A.5a
Status: Ongoing

At the end of this reporting period, the Inventory of high-risk runoff facilities lists 188 facilities: 69 municipal-owned or operated facilities and 119 non-municipal facilities. Attachment 1, extracted from the Inventory, provides a list of these facilities with their names, site addresses and the watersheds in which they are located.

2. Implement the Inspection Program

Permit Ref. III.A.5a-c
Status: Ongoing

See Table 3 for details on the progress of the inspections.

3. Evaluate the priority list of high-risk runoff facilities

Permit Ref. III.A.5d
Status: Ongoing

See Attachment 2 for a priority list of high-risk-runoff facilities. In comparison with the previous list, the current one has two facilities removed – Harley-Davidson Motor Group Company and U.S. Department of Energy (DOE) – Kansas City Plant. Re-inspection at Harley-Davidson has shown that most activities at this site occur inside the buildings and that the company has successfully been implementing an Integrated Contingency Plan, which includes stormwater pollution prevention. The DOE plant was removed due to its closure at the site. While the two sites were removed, the industrial area south of Worlds of Fun remains on the list and the stormwater runoff monitoring activities are conducted here.

4. Implement the Monitoring Plan for High-Risk Runoff Facilities

Permit Ref. III.A.5d
Status: Ongoing

The Stormwater Utility of the Water Services Department has made the following progress:

- *Continuing to collect monitoring data from the facilities that hold State permits and are on the Priority list.*

- *Continuing to conduct monitoring at the identified outfalls:* See Table 4 for results.

- *Implementing the Stormwater Self-assessment Program:* There are 11 facilities implementing the program.

5. Alternative Certification

Permit Ref. III.A.5e
Status: Ongoing

See Table 3 for details.

6. GIS mapping

Permit Ref. NA
Status: Ongoing

The City continues to maintain its GIS database for the facilities in the Inventory and Priority List.

7. Employee education and outreach

Permit Ref. NA
Status: Ongoing

Office of Environmental Quality, Parks & Recreation, Public Works, Water Services Departments and Law Department teamed to work on a guidance document and Best Management Practices for outdoor washing of vehicle and equipment at municipal sites during the reporting period.

Table 3. A summary of industrial and high-risk runoff facility program

Permit Ref.	Task	Sub-task	Activities	Status	Output
5a.	Update the inventory of potentially significant dischargers	Update the inventory	Inspections: 11 City-owned or operated facilities, 18 non-City-owned or operated facilities General inspection covering stormwater: ▪ 308 City owned/operated sites (note: some sites do not have outdoor operation) Monitoring: ▪ 1-3 events/ 4 sites* ▪ Facilities implementing self-assessment: 11 ▪ Facilities No-Exposure certified: 70 Employee education: ▪ Developing a BMP guidance document for municipal vehicle and equipment washing.	Completed	Attachment 1
5b.	Update and evaluate the priority list of high-risk runoff dischargers	(1) Update the list		Completed	Attachment 2
		(2) Conduct field verification or inspection			
	Maintain a GIS database of high-risk runoff dischargers	Update the GIS database		Completed	GIS layers/map
5c.	Continue the inspection program	(1) Inspect municipal facilities		Ongoing	Inspection records and reports
		(2) Inspect private facilities			
5d.	Implement the monitoring program	(1) Conduct the monitoring		Ongoing	Monitoring results
		(2) Develop a self-assessment program for municipal facilities		Completed and reported previously	
		(3) Implement a self-assessment program for municipal facilities		Ongoing	▪ Stormwater no-exposure certificates ▪ Stormwater pollution prevention plans
	Conduct outreach	Target municipal facilities		Ongoing	BMP guidance document for vehicle washing

Multiple sampling efforts were made during the reporting period and only successful efforts in providing sufficient samples were included.

Table 4. Data summary of stormwater monitoring at selected industrial areas

Parameter	Units	Total number	Detection	Minimum	Maximum	Median	Range in stormwater runoff*	Number of exceedence
alkalinity	mg/L	7	7	33	239	96	NA	NA
biochemical oxygen demand	mg/L	7	7	5	17	6.4	3-21	0
chemical oxygen deman	mg/L	7	7	42	145	77	7-803	0
hardness	mg/L	7	7	30	490	160	27-580	0
ammonia	mg/L	7	5	0.43	1.647	0.769	ND-1.4	1
oil & grease	mg/L	7	5	2	9	4	ND-22	0
phenols	mg/L	7	3	0.077	0.258	0.191	ND-0.08	3
total suspended solids	mg/L	7	7	24	930	80	8-879	1
total dissolved solids	mg/L	7	7	76	510	290	22-4,940	0
total solids	mg/L	7	7	130	1400	550	NA	NA
Ag-Dissolved	mg/L	7	0	ND	ND	NA	ND-0.0053	NA
Al-Dissolved	mg/L	7	7	0.004	0.364	0.049	NA	NA
Cd-Dissolved	mg/L	7	0	ND	ND	NA	ND-0.0017	0
Cr-Dissolved	mg/L	7	7	0.001	0.003	0.002	ND-0.020	0
Cu-Dissolved	mg/L	7	7	0.003	0.014	0.012	ND-0.025	0
Ni-Dissolved	mg/L	7	7	0.001	0.003	0.002	ND-0.019	0
Pb-Dissolved	mg/L	7	5	0.002	0.01	0.003	ND-0.064	0
Zn-Dissolved	mg/L	7	7	0.016	0.115	0.05	ND-0.272	0
Ag	mg/L	7	0	ND	ND	NA	NA	NA
Al	mg/L	7	7	0.258	11.4	1.22	NA	NA
As	mg/L	7	7	0.003	0.012	0.007	NA	NA
Cd	mg/L	7	1	0.001	0.001	0.001	ND-0.002	0
Cr	mg/L	7	7	0.003	0.023	0.005	ND-0.017	1
Cu	mg/L	7	7	0.008	0.044	0.016	ND-0.027	2
Fe	mg/L	7	7	0.331	16.3	1.35	NA	NA
Hg	mg/L	7	2	0.00003	0.00006	0.000045	ND-0.0002	0
Mg	mg/L	7	7	1.31	13.1	4.36	NA	NA
Mn	mg/L	7	7	0.05	1.26	0.079	NA	NA
Mo	mg/L	7	7	0.001	0.015	0.002	NA	NA
Ni	mg/L	7	7	0.002	0.022	0.004	ND-0.017	1
Pb	mg/L	7	7	0.002	0.15	0.01	ND-0.061	1
Zn	mg/L	7	7	0.065	0.416	0.123	0.01-0.448	0

* The ranges listed here were extracted from the ranges found for the stormwater runoff samples collected from representative residential, industrial, and commercial areas in the City from Yr. 2005 to Yr. 2008 per Part VI. Monitoring and Reporting Requirements in the MS4 Permit.

3.6 Reduce the Discharge of Pesticides, Herbicides, and Fertilizers

1. Continue the public education program to promote the proper use, handling, storage, and disposal of pesticides, herbicides, and fertilizers (PHFs)

Permit Ref.: III.A.6.a
Status: Ongoing

Activities that have occurred during this reporting period include:

- “**Waterline**” bill inserts: distributed bill inserts to over 170,000 customers in one issue with material titled “*Disposing of Hazardous Wastes Safely*”.
- **Nature First** Program: The City’s partners in restoration and management of natural areas include Bridging the Gap’s KC Wildlands (KCWL), Missouri Department of Conservation, GreenWorks, Blue River Watershed Association, and Missouri Department of Natural Resources, as well as numerous neighborhood associations, park support groups and private corporations. This year’s achievements included burning prairie and glade habitats in Swope and Jerry Smith Parks. *KC Wildlands* continued efforts to remove invasive honeysuckle in various locations and maintained a tool-lending shed for honeysuckle events led by community leaders on non-KCWL/Parks properties.

2. Implement BMPs to reduce the contribution of pollutants associated with the application, storage, and disposal of PHFs on City-owned property and right-of-ways

Permit Ref.: III.A.6.b
Status: Ongoing

Activities include:

- **City Environmental Management System (EMS) Program and employee training:** The City continues to implement the program and provide its employees with relevant training as presented in the previous reports.
- **City facility environmental inspections:** The City conducted environmental inspections for 308 sites that are either owned or operated by the City during the reporting period.
- **Conditionally Exempt Small Quantity Generator (CESQG) Waste Disposal Program:** The program is used to dispose of unused or off-spec PHFs from City facilities. Heritage Environmental Services, contracted with the City, visits facilities on a monthly basis to remove these materials, as needed. The program is part of the City’s overall Household Hazardous Waste Program, and has been in place for nearly ten years. The program has been overlooked in our previous annual reports as the City’s BMP effort regarding PHF management for City properties.
- **BMPs on City golf courses:** The City continues to use environmental Best Management Practices (BMPs) and procedures for its five golf courses: Hodge Park, Shoal Creek, Swope Memorial, Minor Park, and Heart of America.

The contracted management teams from Kemper Sports and Orion Management Solutions have made the following specific improvements to reduce pesticide and fertilizer usage at Swope Memorial, Minor Park, and Heart of America golf courses:

- Maintaining a native buffer near water bodies and sensitive areas wherever possible.
- Allowing the outer rough areas that were once mowed and irrigated (approximately 15 to 20 acres at each course) to return to their native habitats.

In addition, Shoal Creek Golf Course has received certification through the **Audubon Sanctuary Program**, a cooperative effort between the US Golf Association and Audubon International. This program "promotes ecologically sound land management and conservation of natural resources."

- **BMPs at City parks:** Parks and Recreation Dept crews continue to maintain, improve and protect thousands of acres of land which provide wildlife habitat and contribute to reducing stormwater runoff and water pollution throughout the city. These properties include over 6,500 acres protected as woodlands throughout the park system; over 150 acres in the reduced mowing program; over 290 acres of natural areas on 36 sites, consisting of restored and remnant prairies, glades, butterfly gardens, bioswales and rain gardens. In partnership with Bayer Crop Science and Bridging the Gap, a new Pollinator Patch Garden was planted at the Lakeside Nature Center in Swope Park, to support and raise awareness of the importance of bees and other pollinators. In all these areas, taller grasses, deep-rooted native plants and increased tree cover act to provide wildlife habitat, slow down and filter water runoff, and increase infiltration into the soils. Additionally, wetlands are protected near the Lake of the Woods, in Swope Park. The Cleaver Boulevard Streetscape Improvements included nine new stormwater planters to help filter runoff from the street before it reaches Brush Creek and at Little Blue Valley Park, 14 acres of impervious surfacing were removed and returned to un-mowed natural area.

- **BMPs on City lakes:** The Parks & Recreation Department continued to inspect and treat as necessary the City lakes following the same procedure as described previously.

- **BMPs for mosquito control on public properties:** The Health Department (HD) purchases larvicide (a 90-day briquette) each year for distribution on City-owned property. The Health Department does some larviciding on City-owned properties and this occurs only on a complaint basis.

- **BMPs on right-of-ways:** The Parks & Recreation Department maintains 40-miles of park roads, hundreds of parking lots, 2,008-acres and 129-miles of boulevards, parkways, and streets. Except in the effort to save the healthiest Ash trees from the Emerald Ash Borer, the department does not use pesticides in these rights-of-ways. Herbicides and fertilizers are used sparingly only on an as-needed basis.

3.7 Reduce Illicit Discharges, Spills, and Improper Disposal

1. Develop a City ordinance to prohibit illicit discharges to MS4

Permit Ref. III.A.7a.
Status: Completed

No substantive revisions were made to the ordinance during this reporting period.

2. Implement a procedure for illicit discharge investigation and enforcement

Permit Ref. III.A.7a & d
Status: Completed

During the reporting period, one incident of illicit discharge or illegal connection was reported. The Division investigated, the sources of the incidents were identified and corrective measures were required for the responsible offenders.

3. Identify priority areas and continue field screening program

Permit Ref. III.A.7b & c
Status: Ongoing

During this reporting period, the City was in the planning stage developing a new outfall inspection plan. The plan will include the inspection of a minimum of 500 major outfalls over the next permit cycle.

4. Prevent illicit discharge and improper disposal

Permit Ref. III.A.7d & f
Status: Ongoing

Table 5 provides a summary of several waste management programs that encourage proper disposal and prevent and address illegal dumping. In addition to this progress, the following program is of particular note:

- The ***Household Hazardous Waste (HHW) Management*** Program: managed by the Water Services Department, consists of three subprograms: Drop-off, Swap Shop, and Mobile Collection Events. The program services 41 communities from the five counties of the regional solid waste management district. During the reporting period, the program collected 1,113,957 pounds of materials from both its collection sites and 12 mobile events. See Figure 4, Figure 5, and Table 5 for program achievements in 2013.

5. Spill prevention, containment, and response

Permit Ref. III.A.7e
Status: Ongoing

The Fire Department's Hazardous Materials Division (HazMat 71) responded to 319 spill/leak incidents during the reporting period. One hundred and twelve incidents were attributable to flammable/natural gas conditions, 82 incidents were associated with gasoline or other flammable liquid spills, while 49 incidents were related to chemical spills or leaks, or other type of hazmat incident.

6. Public education

Permit Ref. III.A.7 f
Status: Ongoing

The Water Services Department distributed a bill insert titled ***Disposing of Hazardous Wastes Safely*** to over 170,000 customers. The insert provided residents with useful information on the City's Household Hazardous Waste Program.

7. The sanitary sewer maintenance program

Permit Ref. III.A.7g
Status: Ongoing

Table 6 summarizes sanitary sewer maintenance performed by the WSD.

8. GIS Mapping effort

Permit Ref. NA
Status: Ongoing

The WSD's GIS mapping group and Stormwater Services Division continue to maintain its GIS databases to assist in the program tracking repair/replacement and maintenance of storm sewer system assets, to support stormwater billing and to support the illicit discharge screening process (Table 7). The groups update the database with the information supplied by field inspection crews, engineering as-built drawings from construction projects, and latest orthophoto map product.

Table 5. Achievements through comprehensive waste management programs

KC Recycles (FY 13/14)					
Community(Drop-off Center) Recycling (ton): 733			Curbside Recycling (ton): 19,314		
E-waste Collection (ton): 12			Organics collection (ton): 14,387		
City Department Internal Recycling – Paper, plastics, cans & metals (FY 13/14)					
Aviation Department (ton): 39.1 + 47.7 (glass)			All other departments (ton): 92.8		
Appliance and Bulky Items Collection (FY 13/14)					
Number of appliances: 60			Bulky items (ton): 6,230		
Leaves and Brush Collection (FY 13/14)					
Drop-off site (ton): 13,035			Curbside (ton): 4,780		
Illegal Dumping Cleanup (FY 13/14)					
Material collected (ton): 4,265			Waste tire collected: 17,602		
Neighborhood Cleanup Assistance (FY 13/14)					
Participating home associations: 201		Cleanup waste (ton): 663		Dumpsters placed: 494	
Number of tires collected: 1,736			Number of “Blue Bags” delivered: 5,695		
Waste Tire Collection (FY 13/14)					
Number of clean-ups: 2			Number of tires collected: 627		
Household Hazardous Waste (2013)					
HHW Facility		Mobile outreach		Swap shop	
HHW received	Number of vehicles	HHW	Number of vehicles	Material	Cost saved
826,251	7,008	287,706	2,957	121,423	28,983
Blue River Rescue (April , 2014)					
Volunteers	Sites cleaned	Trash removed (tons)		Trees planted	
1,200	27	55		300	
Bridging the Gap (FY 13/14)					
Keep Kansas City Beautiful (KKCB) – Great America Cleanup(GAC)					
Events: 37+		Organizations/Communiti		Litter Removed (ton): 202.5+	
Green Events					
Venues: 25			Recycled(ton): 3.3		
Litter Cleanups					
Volunteer hours: 141			Trash removed (ton): 0.6		
Litter Cleanup Kits					
Events: 7			Trash removed (ton): 0.3		
Electronics Recycling					
Volunteer hours: 76			E-waste recycled (ton): 31		

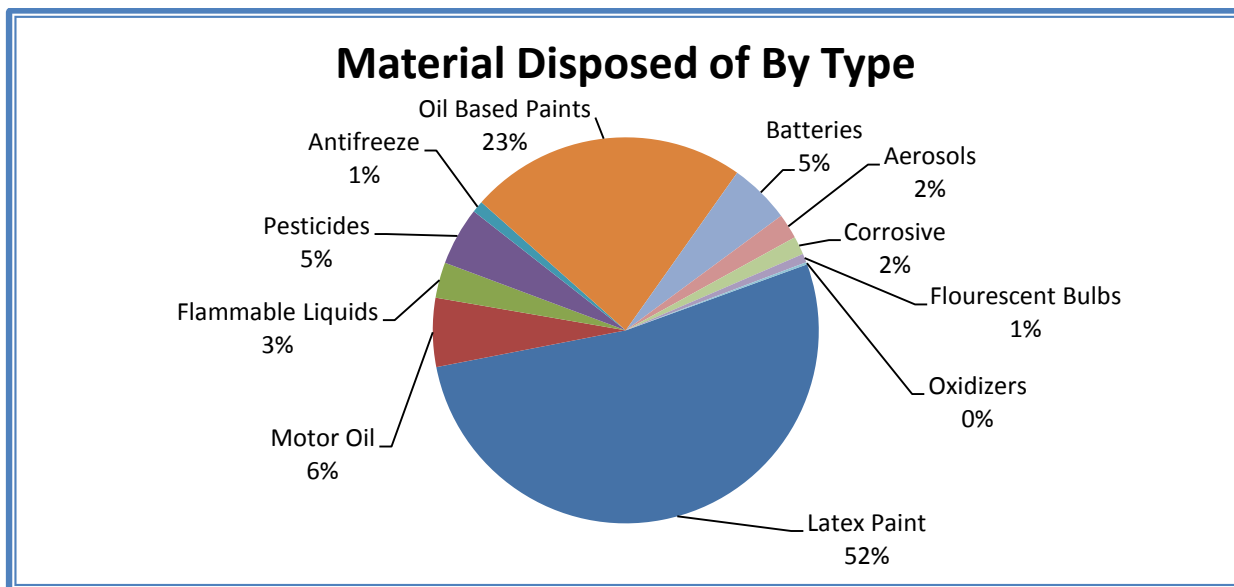


Figure 4. Material by type disposed of by the Household Hazardous Waste Facility in 2013
(Provided by R. Fort, KCMO HHW Program Manager. Total weight of the materials: 916,802 lbs; note the total weight counts only the materials that were disposed of and shipped out.)

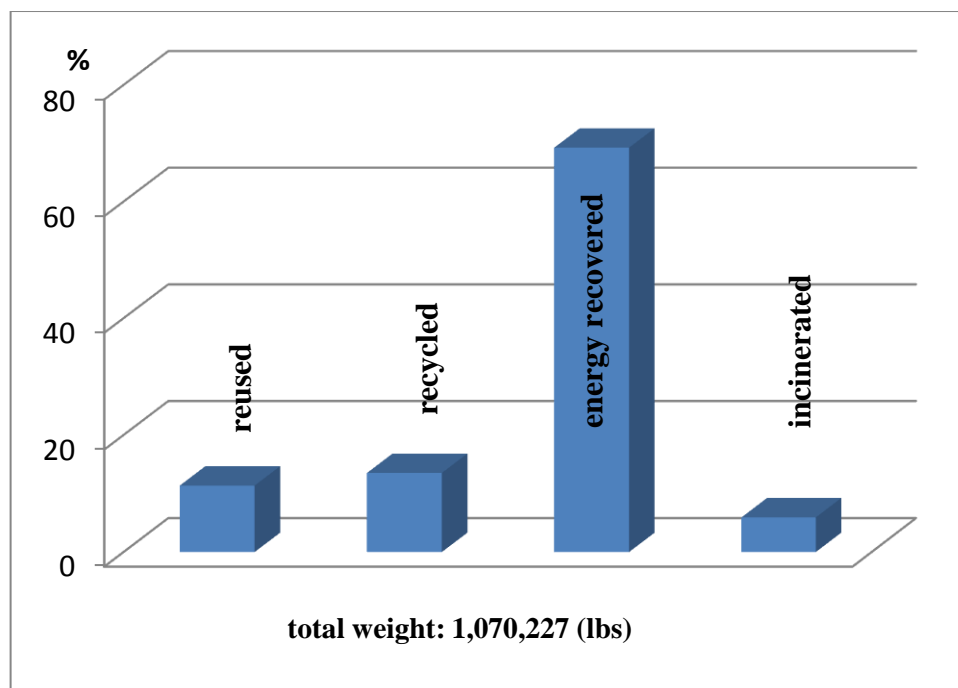


Figure 5. Distribution of material managed by Household Hazardous Waste Facility in 2013

Table 6. Sanitary sewers maintenance performance for FY 13/14

Engineering Division (estimated*)					
TV Sanitary sewer lines		Manholes rehabilitated		Sewer line rehabilitated/replaced	
198 miles		91		35 miles	
Wastewater Maintenance Division					
Sewer televised	Sewer cleaned	Public sewer repaired	Private sewer repaired	Manhole repaired	Stoppage opened
197 miles	452 miles	222	447	224	191

Table 7. Stormwater features in the Geographic Information System (GIS) database

Data as of 6/25/2014	Stormwater inlet*	Paved ditch	Detention basin	Swale
City owned or has easement	44,480	195	281	47
Privately owned	9,077	17	7	0
Ownership to be determined	74	0	0	0
Abandoned	7	0	0	0
Totals	53,638	212	288	47

* Stormwater inlets are further categorized into nine sub-types in the database. They are area side inlet, catch basin, curb and drop inlet, curb inlet, drop inlet, field inlet, setback curb inlet, trench drain, and others.

3.8 Reduce Pollutants in Construction Site Runoff

1. Erosion and Sediment Control Ordinance review and update

Permit Ref. III.A.8a
Status: Completed

No change has been made since last reporting period. However, the City did update its Administrative Regulation AR 1-12 dealing with erosion control and City projects to provide further clarity of roles of responsibilities. Follow the link below for the document.

<https://kcmo.sharepoint.com/Lists/Administrative%20Regulations/Attachments/77/1-12%20City%20Standard%20Erosion%20and%20Sediment%20Control%20Specification.pdf>

2. Maintaining an inventory of active construction sites

Permit Ref. III.A.8b
Status: Ongoing

- **Private development site (≥ 1 acre):** The City continued to use the KIVA system to track active private development construction sites. During this report period, there were 85 new site disturbance permits issued and 371 active site disturbance permits.

- **City construction projects (≥ 1 acre):** The Stormwater Services Division tracks projects (≥ 1 acre) that are constructed by City departments under the City's General Operating Permit. There were 34 projects recorded as less than 90% of completion during the reporting period.

3. Inspecting construction sites

Permit Ref. III.A.8c
Status: Ongoing

The City's inspections for sediment and erosion control-related issues are handled as follows:

- **Private construction projects (≥ 1 acre):** The Land Development Division (LDD) in the City Planning and Development Department is responsible for inspection of site disturbance activities. During this report period, the LDD inspection staff documented a full year of biweekly compliance monitoring and documentation was incorporated into the KIVA permit tracking system. Inspection comments in KIVA are available to the public through the KIVANET web site. There were more than 1,000 inspections of site disturbance activities on private development projects performed during this reporting period.

- **City-funded construction projects:** These projects are regulated under the State's General Operating Permit MO-R100006. The Office of Environmental Quality and the Stormwater Service Division conduct joint monthly inspections to ensure compliance with the sediment and erosion control requirements. The inspection review includes verification of an active, up-to-date SWPPP for each site, an updated site plan, weekly inspection reports including items noted for correction and the noted correction, and the inspection log. A total of 153 inspections were conducted.

4. Providing inspector training and outreach to the construction industry

Permit Ref. III.A.8d
Status: Ongoing

The City provided in-house trainings on sediment and erosion control to its construction field inspectors, project managers, environmental staff, and pertinent management personnel. Table 8 summarizes the training provided to the City employees and outside groups.

5. Enforcement of the City's construction site runoff program

Permit Ref. III.A.8e
Status: Ongoing

The City inspection staff follows established protocols for escalated enforcement actions or steps. For private construction projects (≥ 1 acre) managed by LDD, inspection results are placed in KIVA. Certified letters are sent to responsible parties stating deficiencies and performance requirements for compliance including days allowed for resolution. Citations are issued when compliance issues are not resolved in a timely manner.

During the reporting period, the LDD inspection staff notified contractors of more than 50 deficiencies, indicating modifications necessary for compliance, or providing orders to complete the work, or defaulting on the developer's bonds when necessary. For private-funded construction projects (< 1 acre), the Division of Investigations in the City Planning & Development Department conducted 15 investigations and sent six notices of violation. No prosecutions were made.

Table 8. A summary of education and outreach on erosion and sediment control

Employee Education				
Training Providers	Content	Dates	Attendees	Work background of attendees
Land Development Division (LDD)	KCMO Supplements to APWA Standards 2100, 2600, 5100, 5600, BMP Manual, Erosion Sediment Control Drawings, and the stream buffer ordinance.	Weekly throughout the year.	8	Plan reviewers and LDD inspectors
Water Services Department	Refresher course for sediment and erosion control policies, and practices	4/22 and 4/23/2014	41	Field construction inspectors, project managers from applicable departments

4. STORMWATER PUBLIC EDUCATION AND AWARENESS PROGRAM

Stormwater public education is a key element of many of the programs conducted by the City and is required under the MS4 Permit. To facilitate its implementation and to underscore its significance, the City has extracted the public education requirements from individual programs throughout the Permit, and has consolidated them into this *Stormwater Public Education and Awareness Program*. However, each Stormwater Management program required by the Permit still addresses its own technical training (such as construction inspector training), but is able to use this program as a resource for its outreach and educational requirements and needs.

Internal Education

See *Section 3.8 Reduce Pollutants in Construction Site Runoff* for more details. In addition, WSD hosted the following seminars or training sessions for its employees: Green Infrastructure and Integrated Solutions, An Introduction to Green Roofs, Safeguarding Rain Gardens Training to Pipeline crew supervisors, Prairie plant maintenance session, Middle Blue Pilot Project tour with Planning, Target Green - Green Infrastructure Key Findings and Lessons Learned, and State of Kansas City's Green Infrastructure Workshop.

Public Outreach

- KC Green:

- In September 2013, the City held its biannual green fair promoting sustainability to city employees, residents and businesses. During the fair, educational brochures were provided and four city neighborhoods were recognized as "Green Neighborhoods" for their effort to implement environmental sustainability practices.
- On Earth Day Cleanup "Trash Bash" – April 22, 2014, representatives from various city departments worked together with two City neighborhoods to clean up two sites. There were 91 volunteers, and approximately 19 tons of trash and a total of 275 tires were collected.

- Homeowners Reference Guide to Creating a Rain Garden: WSD created this booklet to educate the public on rain gardens' function related to stormwater and to provide ideas on the design, plant selection, and location. The booklets were provided at various public events.

- Water Quality Education through the Overflow Control Program: During the reporting period, WSD hosted two tours of green infrastructure, and made 23 presentations to neighborhoods and 20 presentations at conferences or to professional organizations.

- The Water Services Department continues to be a leading stakeholder for the Regional Water Quality Public Education Program: The water quality public education program, initiated by the MARC (Mid-America Regional Council), takes a comprehensive approach to raising public awareness about watershed issues and water quality in the Kansas City region. The City has historically been one of the major sponsors of the program. Accomplishments through the program in 2013 are presented in *Regional Water Quality Public Education Program – 2013 Annual Report* (Mid-America Regional Council). The report is available at the following link: http://www.marc.org/Environment/Water-resources/pdfs/WQEC_Annual_Rpts/FINAL_WQEC_2013_Annual-Report.aspx

Partnerships in Public Outreach

- *Bridging the Gap's Various Environmental Outreach Programs*

Bridging the Gap (www.bridgingthegap.org) is a not-for-profit organization that works to make the Kansas City region sustainable by connecting environment, economy and community. The organization seeks to educate citizens, businesses and government on the impacts of decisions and behaviors on our present and future community and world. The City continues to support its various programs through both direct funding and in-kind support. See Table 5 for achievements during the reporting period. In addition, the organization and WSD partnered to celebrate the 25th anniversary at the Water Services drinking water intake structure in June 2013. Over 300 attendees were educated on water issues about the Missouri River during the event.

- *Home Builders Association of Greater Kansas City's Home Show and Flower, Lawn, and Garden Show*

There were over 200 exhibits and many innovative products and services at the combined event for the Home Show and Flower, Lawn, and Garden Show in March 2014. The show was filled with environmentally friendly approaches and products. The City's Parks and Recreation Department continued to be one of the leading sponsors for the Garden Show. Other participating City departments included General Services, Water Services, and the Office of Environmental Quality. The City's exhibit booths promoted water quality protection, tree planting, native species/prairie protection, wetland conservation, rain garden planting, and other green solutions by illustrating City projects as examples.

- *Blue River Rescue Event*

The event is an outreach of the Friends of Lakeside Nature Center operated by the City's Parks & Recreation Department. The event is sponsored by the Missouri Department of Natural Resources and is supported by many governmental entities and businesses. The City's Parks & Recreation, Public Works and Water Services Departments continue to provide facilities, equipment, expertise, and funding to facilitate the event. See Table 5 for this year's achievement.



Figure 6. Blue River Rescue, April 2014

(photo from http://www.facebook.com/pages/Project-Blue-River-Rescue/189682744389036?sk=photos_stream)

- *Blue River Watershed Association*

The WSD continued to partner with and fund the Association to implement the following programs:

- **T. R.U. E Blue (Teaching Rivers in an Urban Environment):** City staff volunteered to assist student groups streamside at 5 events; City funding was provided to purchase new HACH water quality testing kits for the program.
- ***The Journey of Stormwater from KC to the Sea:*** Eight workshops were hosted and 28 teachers received the training to implement the curriculum in their classrooms. The curriculum was taught to 81 different classes, reaching a total of 1,976 students in five different school districts.

The program received an Environmental Achievement Award from the Kansas City Environmental Management Commission in 2013.

- Greenworks

WSD worked with five students with Greenworks, under a regional grant, to develop the script for “Water Pollution is Never the Solution”, a video on stormwater pollution in Kansas City. The video is available for viewing at the City’s website, WSD’s website, and Greenworks in KC website. The link is <https://www.youtube.com/watch?v=H9MOU-evdTQ>

- The City also participated in the following activities/events:

- Teacher Resource Day April 26, 2014: Water Services participated in this event hosted by Science Pioneers. The event allows K-12 teachers to learn about hands on learning opportunities for their students. WSD gave out information on the *KC to the Sea* curriculum and Dr. H2O talked about his water quality science program.
- The Kansas City Environmental Education Network (KCEEN): WSD participates in the network hosted by Mid America Regional Council. The mission of KCEEN is to improve environmental education for students throughout the Kansas City region by raising awareness, providing opportunities for action, and coordinating information and resources. KCEEN serves pre-K through 12 educators through professional development opportunities and events.
- Missouri Watershed Festival: WSD assisted with educational booths at the Festival at Lakeside Nature Center on Oct. 4, 2013. A total of 170 students participated in the event and were educated about the water cycle, watersheds, stormwater pollution, and aquatic invertebrates as indicators of water quality.
- State of Kansas City Green Infrastructure Workshop: Water Services convened the first State of Kansas City Green Infrastructure Workshop on March 27, 2014. The workshop allowed city departments to discuss current projects and lessons learned in using green infrastructure in stormwater management.
- Sixth Annual Marlborough Cleanup: City staff teamed up with residents and businesses in the Marlborough neighborhood to assist with their annual cleanup. There were 125 volunteers. Fifteen tons of trash was removed, and 180 tires were collected.

5. WATERSHED MONITORING PROGRAM

1. Implement a representative stormwater discharge monitoring plan

Permit Ref. VI.A.1
Status: Completed

The WSD's Laboratory continued to conduct the monitoring, which included field sampling, field measurements of basic water quality parameters, and laboratory testing for physicochemical and microbiological parameters. All field sampling/measurements, sample handling, laboratory analysis, and data validation, as well as quality assurance and quality control, follow the Standard Operating Procedures for the MS4 Stormwater Discharge Monitoring Program developed by the Department's Laboratory. Grab samples were collected using a stainless steel bucket, or by filling the containers directly from the outfall. Composite samples were collected using ISCO Avalanche Portable Refrigerated Samplers for the first three hours of the discharge (12 aliquots taken every 15 minutes).

The WSD maintains the following records of the sampling events:

- Description of Sampling

- ✓ Location and collection time
- ✓ Sample collection
- ✓ Field test results
- ✓ Staff who collected samples (Chain-of-Custody forms)

- Storm Event Data

- ✓ Date and duration of the storm events sampled
- ✓ Rainfall data
- ✓ Duration between storm event sampled and the end of the previous measurable storm event
- ✓ Estimate of the total volume of the discharge sampled

- QA/QC Review and Clarification: a single database containing field test results and laboratory results tables.

Sampling events occurred from June 2013 to April 2014. Table 9 includes the number of storm events sampled at each site as well as the ranges of rainfall at these sites. The precipitation for all sampling events ranged from 0.10 inch to more than 2.5 inches (Figure 7). Runoff from the sampled storm events at the sampling sites ranged from 10,300 to 313,800 cubic feet and was estimated based on the storm magnitude and the size and land use of the drainage areas.

Grab samples were collected during the first two hours of the discharge. These samples were used for the field testing of temperature, dissolved oxygen and pH, as well as the laboratory analysis of total phenols, oil & grease, fecal coliform, *E.coli*, total coliform, and turbidity. Time-based composite samples were used for the analysis of over 100 physico-chemical parameters which include more than 60 semi-volatile organic compounds, 25 pesticide-related compounds, 8 metals (dissolved, and total), 6 nutrients, 3 bacteria indicators, in addition to 15 conventional water quality parameters (e.g., oxygen-related or solid-related).

Table 9. A summary of sampled storm event characteristics

Site ID	Location	Number of Storms Sampled	Range of Rainfall (in) ^a	Range of Runoff (cubic feet, estimated) ^b
#801	SE 50th Terrace & Sterling	4	0.24 – 0.86	73,900–264,800
#802	SE Wyandotte & 135 Street	5	0.19 – 1.52	10,300 – 82,500
#803	NW 107 Terrace & Pomona	4	0.47 – 1.68	87,800 – 313,800
#804	NE 49 th Street & N. Highland	6	0.23 – 2.78	12,100 – 146,500
#805	133 rd Street & Inverness	5	0.21 – 1.09	11,800 – 61,000
#806	Barry Rd. & I-29	5	0.26 – 1.47	34,000 – 192,100

^a The rainfall data was obtained from the rain gauges installed at the individual sampling stations.

^b Runoff volume is estimated based on rainfall, drainage area, and runoff coefficient, i.e., Volume = Rainfall * Drainage Area * Runoff Coefficient. Runoff coefficients (land-use dependent) are cited from Civil Engineers Reference Manual 9th Edition, Page A-45.

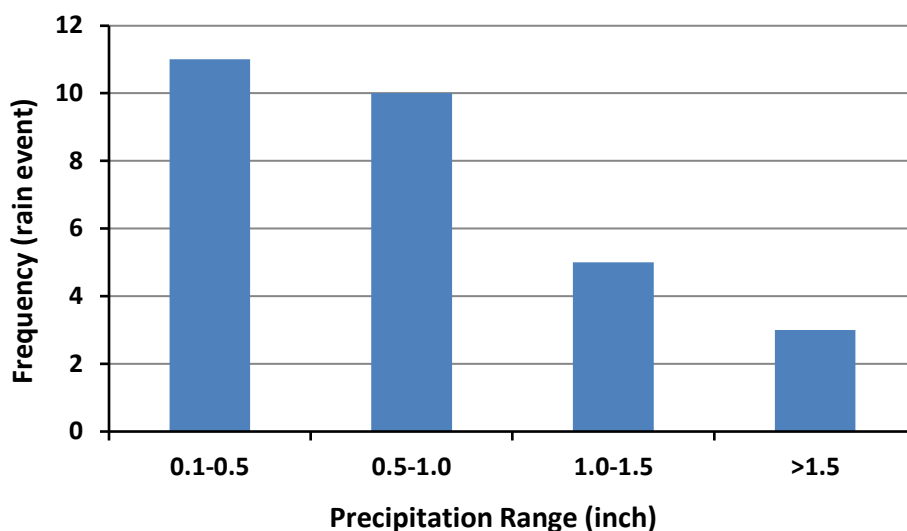


Figure 7. Precipitation range and distribution of frequency of sampled storm events

2. Summary of storm event data

Permit Ref. VI.A.1

Status: Completed

Table 10 and Table 11 present a summary of the data characterizing stormwater discharges for each land-use type. The range of event-mean concentration (EMC) is described as well as average EMC

according to the land-use category. For the purpose of this report, the concentration of a constituent in an individual grab or time-based composite sample is considered as an estimate of the EMC of this constituent in the runoff for a particular storm event tested. The land-use average EMC is the average of EMCs of a constituent in the runoff for all storm events sampled for a specific land-use category.

Table 12 presents the estimated loading results for the monitored storm events. The pollutant loading is defined as the mass of a constituent contained in stormwater runoff that is transported to the receiving water during a storm event. For the purpose of this reporting, it is estimated by multiplying the flow volume and the EMC of a parameter per event.

A preliminary analysis of the monitoring results shows the following:

- Of the four pesticides that were required to be monitored under the Permit (i.e., α -BHC, DDT, methoxychlor, and dieldrin), none was detected at any of the six designated sites.
- Of more than 60 semi-volatile organic compounds analyzed, thirteen were detected in one or more samples, and most detections were for commercial sites #805 and #806, as well as one industrial site #802:
 - √ 2-Nitrophenol: #801 (residential);
 - √ Anthracene: #806 (commercial);
 - √ Benzo(a)pyrene: #806 (commercial);
 - √ Benzo(b)fluoranthene: #806 (commercial);
 - √ Benzo(ghi)perylene: #802 (industrial) and #806 (commercial);
 - √ Benzo(k)fluoranthene: #805 (commercial);
 - √ Carbazole: #806 (commercial);
 - √ Chrysene: #802 (industrial), #805 and #806 (commercial);
 - √ Di(2-ethylhexyl)phthalate: at every site of each land use category, EXCEPT #804 (industrial).
 - √ Di-n-butyl phthalate: #805 (commercial);
 - √ Fluoranthene: at every site of each land use category, EXCEPT #801 (residential) and #803 (industrial).
 - √ Phenanthrene: #802 (industrial) and #806 (commercial);
 - √ Pyrene: #802 (industrial), #804 (residential), #805 and #806 (commercial).
- Of the metals, Chromium, Copper, Nickel, and Zinc, in both dissolved and total recoverable forms, were detected most frequently across all the three land uses. Lead in total recoverable form was also commonly detected. Mercury in total recoverable form and lead in dissolved form were occasionally detected at sites of different land use categories.
- No significant difference was identified among different land uses for phosphorus or nitrogen-related nutrient parameters, or solid-related parameters.
- The commercial runoff samples, in general, had lower EMCs for E. Coli. and fecal coliform than those residential and industrial runoff samples.
- The residential runoff samples, in general, had higher EMCs for chemical oxygen demand (COD) and biochemical oxygen demand (BOD).
- No significant difference in the runoff samples between the different land uses was observed for the parameters other than those mentioned above.

Table 10. A summary of stormwater discharge characterization by land use category – conventional, inorganic, and bacterial parameters

Constituent	Units	Residential		Commercial		Industrial		Result Count	Detect Count
		EMC Range	Average	EMC Range	Average	EMC Range	Average		
Ammonia	mg/L	ND – 4.83	1.04	ND – 2.53	0.62	ND – 4.72	1.34	28	20
Conductivity (Lab)	µS/cm	79 – 501	243	67 – 189	118	88 – 642	263	26	26
Dissolved oxygen	mg/L	5.2 – 10.1	7.6	5.4 – 10.9	8.1	6.4 – 12.1	8.7	26	26
pH	S.U.	7.1 – 9.8	7.9	6.9 – 9.2	7.8	7.3 – 8.7	7.7	26	26
Total Alkalinity	mg/L	28 – 116	72	29 – 56	41	40 – 173	73	27	27
Total Hardness	mg/L	82 – 150	109	46 – 132	87	70 – 184	129	27	27
Chemical Oxygen Demand	mg/L	41 – 149	86	14 – 111	40	31 – 122	67	27	27
Biochemical Oxygen Demand (5-day)	mg/L	5 – 29	16	4 – 12	8	4 – 15	9	27	27
Turbidity (Lab)	NTU	18 – 240	90	7 – 32	16	20 – 2529	384	26	26
Total Solids	mg/L	96 – 720	437	140 – 610	223	190 – 1000	384	27	27
Total Dissolved Solids	mg/L	96 - 300	210	70 – 210	122	150 – 340	208	27	27
Total Suspended Solids	mg/L	36 – 530	203	10 – 80	32	18 – 740	143	27	27
Volatile Suspended Solids	%	15 – 37	22	9 – 80	36	12 – 50	22	27	27
Nitrite	mg/L	0.069 – 0.124	0.093	0.022 – 0.126	0.074	0.040 – 0.150	0.083	28	28
Nitrate	mg/L	0.253 – 1.700	0.762	0.069 – 0.537	0.328	0.231 – 1.010	0.637	28	28
Nitrogen, total Kjeldahl	mg/L	2.31 – 8.570	5.71	1.54 – 5.04	2.74	0.33 – 10.42	4.07	27	27
Oil & Grease	mg/L	ND – 5	2.7	ND – 3	2.4	ND – 24	5.5	26	20
Phenols	mg/L	ND – 0.406	0.211	0.090 – 0.374	0.185	0.045 – 0.264	0.147	26	22
Phosphorus, total	mg/L	0.153 – 0.780	0.459	0.040 – 0.208	0.119	0.140 – 0.940	0.337	27	27
Phosphorus, dissolved	mg/L	0.075 – 0.490	0.237	ND – 0.133	0.095	0.078 – 0.180	0.114	27	25
Fecal Coliform	cfu/100 mL	<100 – 27,000	66626	1500 – 40,000	8,600	800 – 270,000	58,625	26	26
E. Coli	MPN/100 mL	<100 – 740,000	123,524	310 – 17,930	3,988	410 – 169,000	39,188	26	26
Cadmium, dissolved	mg/L	ND	NA	ND	NA	ND – 0.078	NA	27	1

Constituent	Units	Residential		Commercial		Industrial		Result Count	Detect Count
		EMC Range	Average	EMC Range	Average	EMC Range	Average		
Chromium, dissolved	mg/L	ND – 0.006	0.003	ND – 0.003	0.002	ND – 0.001	0.001	27	24
Copper, dissolved	mg/L	0.002 – 0.005	0.004	0.003 – 0.007	0.004	0.002 – 0.005	0.003	27	27
Lead, dissolved	mg/L	ND – 0.002	0.002	ND – 0.002	0.002	ND – 0.002	0.002	27	7
Ni, dissolved	mg/L	0.001 – 0.002	0.002	ND – 0.002	0.001	ND – 0.009	0.002	27	25
Silver, dissolved	mg/L	ND	NA	ND	NA	ND	NA	27	0
Zinc, dissolved	mg/L	0.007 – 0.023	0.016	0.011 – 0.027	0.021	0.007 – 0.048	0.028	27	27
Cadmium, total	mg/L	ND	NA	ND	NA	ND – 0.136	NA	27	1
Chromium, total	mg/L	0.001 – 0.015	0.007	0.001 – 0.005	0.002	0.002 – 0.008	0.004	27	27
Copper, total	mg/L	0.004 – 0.025	0.011	0.005 – 0.012	0.008	0.004 – 0.014	0.007	27	27
Mercury, total	mg/L	ND – 0.00004	NA	ND	NA	ND – 0.00008	0.0001	27	4
Lead, total	mg/L	0.002 – 0.020	0.0103	ND – 0.004	0.0027	ND – 0.01	0.004	27	19
Ni, total	mg/L	0.002 – 0.013	0.006	0.001 – 0.002	0.001	0.002 – 0.006	0.003	27	27
Silver, total	mg/L	ND	NA	ND	NA	ND	NA	27	0
Zinc, total	mg/L	0.026 – 0.127	0.062	0.035 – 0.088	0.051	0.054 – 0.156	0.102	27	27
Semi volatile organic compounds and pesticides (detected)									
Anthracene	µg/L	ND	NA	ND – 2.57	1.99	ND	NA	27	2
Benzo(b)fluoranthene	µg/L	ND	NA	ND – 3.29	ND	ND	NA	27	1
Benzo(ghi) perylene	µg/L	ND	NA	ND – 1.49	NA	ND – 1.49	NA	27	2
Benzo(a) pyrene	µg/L	ND	NA	ND-2.05	NA	ND	NA	29	1
Carbazole	µg/L	ND	NA	ND	NA	ND – 3.96	NA	27	1
Chrysene	µg/L	ND	NA	ND – 4.85	2.41	ND – 2.36	1.86	27	6
Di(2-ethylhexyl)phthalate	µg/L	ND – 9.49	8.13	ND – 39.63	18.19	ND – 17.10	9.57	27	16
Fluoranthene	µg/L	ND – 1.50	1.47	ND – 6.22	2.68	ND – 3.12	2.0	27	11
2-nitrophenol	µg/L	ND – 4.78	NA	ND	NA	ND	NA	27	1
Phenanthrene	µg/L	ND	NA	ND – 3.26	2.43	ND – 1.26	NA	27	3
Pyrene	µg/L	ND – 1.21	NA	ND – 4.55	2.26	ND – 2.29	1.82	27	7

ND: the concentration of the parameter is below the detection limit;

NA: data is not available due to the fact that no more than one sample has a level above the detection limit.

Table 11. A summary of stormwater discharge characterization– selected pesticides and semi-volatile organic compounds

Constituent	Result Count	Detect Count	Constituent	Result Count	Detect Count	Constituent	Result Count	Detect Count
a-BHC	27	0	4-Chloroaniline	27	0	Fluoranthene	27	11
4,4'-DDE	27	0	4-Chlorophenyl phenyl ether	27	0	Hexachlorobenzene	27	0
4,4'-DDT	27	0	4-Methylphenol	27	0	Hexachlorobutadiene	27	0
Methoxychlor	27	0	4-Nitrophenol	27	0	Hexachlorocyclopentadiene	27	0
Dieldrin	27	0	Acenaphthene	27	0	Hexachloroethane	27	0
1,2,4-Trichlorobenzene	27	0	Acenaphthylene	27	0	Indeno(1,2,3-cd) pyrene	27	0
1,2-Dichlorobenzene	27	0	Anthracene	27	2	Isophorone	27	0
1,2-Diphenylhydrazine	27	0	Benzo(a)anthracene	27	0	N-Nitrosodi-n-propylamine	27	0
1,3-Dichlorobenzene	27	0	Benzidine	27	0	Naphthalene	27	0
1,4-Dichlorobenzene	27	0	Benzo(a) pyrene	27	1	Nitrobenzene	27	0
2,4,5-Trichlorophenol	27	0	Benzo(b) fluoranthene	27	1	Pentachlorophenol	27	0
2,4,6-Trichlorophenol	27	0	Benzo(ghi) perylene	27	2	Phenanthrene	27	3
2,4-Dichlorophenol	27	0	Benzo(k) fluoranthene	27	0	Phenol	27	0
2,4-Dimethylphenol	27	0	Butyl benzyl phthalate	27	0	Pyrene	27	7
2,4-Dinitrophenol	27	0	Carbazole	27	1	bis(2-Chloroethoxy)methane	27	0
2,4-Dinitrotoluene	27	0	Chrysene	27	6	bis(2-Chloroisopropyl)ether	27	0
2,6-Dinitrotoluene	27	0	Di(2-ethylhexyl)phthalate	27	16			
2-Chloronaphthalene	27	0	Di-n-butyl phthalate	27	1			
2-Chlorophenol	27	0	Di-n-octyl phthalate	27	0			
2-Methylnaphthalene	27	0	Dibenz(a,h)anthracene	27	0			
2-Methylphenol(o-Cresol)	27	0	Diethyl phthalate	27	0			
2-Nitroaniline	27	0	Dimethyl phthalate	27	0			
2-Nitrophenol	27	1	Fluorene	27	0			

ND: the concentration of the parameter is below the detection limit;

NA: data is not available due to the fact that no more than one sample has a level above the detection limit.

Table 12. Estimated pollutant loadings per outfall per rain event by land use category – conventional, inorganic, and bacterial parameters

Constituent	Units	Residential		Commercial		Industrial	
		Range	Average	Range	Average	Range	Average
Ammonia	kg	ND-5.8	1.5	ND-13.7	2.7	ND-9.1	2.7
Total Hardness	kg	31-870	313	36-468	166	36-1333	352
Chemical Oxygen Demand	kg	35-727	216	8-337	99	10-560	179
Biochemical Oxygen Demand (5-day)	kg	4-120	45	2-44	16	1-71	24
Total Alkalinity	kg	23 – 667	208	11 – 230	86	14 – 404	175
Total Solids	kg	140 – 5397	1,388	47 – 1234	483	58 – 2132	540
Total Dissolved Solids	kg	103-1649	564	33-894	273	52-1688	1,002
Total Suspended Solids	kg	45-3973	760	5-243	75	7-1433	331
Volatile Suspended Solids	1E+04 kg	8-120	58	9-125	54	7-187	52
Nitrite	kg	0.03-0.72	0.3	0.02-0.69	0.2	0.02-0.7	0.2
Nitrate	kg	0.2-9.8	2.9	0.1-1.8	0.6	0.1-3.3	1.5
Nitrogen, total Kjeldahl	kg	3-52	17	1-21	7	1-39	11
Oil & Grease	kg	ND-23	7	ND-13	6	ND-75	18
Phenols	kg	ND	NA	ND	NA	ND	NA
Phosphorus, total	kg	0.12-3.47	1.13	0.03-0.89	0.29	0.06-2.34	0.86
Phosphorus, dissolved	kg	0.06-1.31	0.65	ND-0.56	0.26	0.03-0.69	0.28
Fecal Coliform	1E+06 cfu	685-15,531,998	3,392,890	7,389-1,213,933	230,981	15,491-6,306,052	1,489,948
E. Coli	1E+06 MPN	343-42,569,181	6,670,809	1,378-544,145	131,311	7,939-3,058,615	902,047
Cadmium, dissolved	g	ND	NA	ND	NA	ND-0.02	NA
Chromium, dissolved	g	ND-44.9	12.0	ND-9.1	3.7	ND-8.9	2.7
Copper, dissolved	g	1.7-30.0	10.2	1.0-21.2	8.6	0.6-26.7	8.9
Lead, dissolved	g	ND-11.5	5.6	ND-3.4	NA	ND-3.5	2.1
Nickel, dissolved	g	0.3-7.4	3.6	ND-5.4	2.5	ND-28.1	5.9
Silver, dissolved	g	ND	NA	ND	NA	ND	NA
Zinc, dissolved	g	6.2-52.5	32.5	8.7-114.9	43.9	4.7-248.7	72.0
Cadmium, total	g	ND	NA	ND	NA	ND-39.7	NA

Constituent	Units	Residential		Commercial		Industrial	
		Range	Average	Range	Average	Range	Average
Chromium, total	g	1.4-112.4	24.3	0.5-15.2	5.1	1.2-26.7	9.5
Copper, total	g	3.4-187	38.1	2.3-38.3	16.4	1.8-71.1	20.0
Mercury, total	g	ND-0.3	NA	ND	NA	ND-0.3	0.3
Lead, total	g	2.71-149.9	31.8	ND-12.1	5.5	ND-19.4	9.7
Nickel, total	g	1.7-97.5	19.1	0.3-8.5	3.2	0.8-26.7	9.0
Silver, total	g	ND	NA	ND	NA	ND	NA
Zinc, total	g	18-952	200	16-267	110	18-1,102	295
Semi volatile organic compounds and pesticides (detected)							
4,4'-DDE	g	ND	NA	ND	NA	ND	NA
4,4'-DDT	µg/L	ND	NA	ND	NA	ND	NA
Dieldrin	g	ND	NA	ND	NA	ND	NA
Benzo(a)anthracene	g	ND	NA	ND	NA	ND	NA
Benzo(a)pyrene	g	ND	NA	ND-3.49	NA	ND	NA
Benzo(b)fluoranthene	g	ND	NA	ND-5.59	NA	ND	NA
Benzo(ghi) perylene	g	ND	NA	ND-2.54	NA	ND-1.86	NA
Chrysene	g	ND	NA	ND-8.25	4.16	ND-2.94	1.74
Benzo(k)fluoranthene	g	ND	NA	ND	NA	ND	NA
Di(2-ethylhexyl)phthalate	g	ND-70.7	42.6	ND-120.3	33.3	ND-53.3	27.6
Fluoranthene	g	ND-1.5	1.0	ND-16.4	6.0	ND-3.9	1.6
Indeno(1,2,3cd)pyrene	g	ND	NA	ND	NA	ND	NA
Phenanthrene	g	ND	NA	ND-17.7	10.2	ND-1.6	NA
Pyrene	µg/L	ND-1.3	1.3	ND-11.1	5.8	ND-2.9	1.7

ND: the concentration of a specific parameter is below the detection limit and excluded for the purpose of calculating the average loading.

NA: data is not available due to the fact that no more than one sample has a level above the detection limit.

3. Implement an ambient monitoring action plan

Permit Ref. VI.B
Status: Completed

The following progress was made on this program during the reporting period:

- Completed field sampling and laboratory analysis

The Stormwater Services Division completed three sampling events during the reporting period. The first two events occurred in May and October 2013, respectively, and the streams evaluated include East Fork Shoal Creek, Line Creek, Upper Shoal Creek, Rock Creek, Round Grove Creek, North Brush Creek, Fishing River and First Creek. The third event occurred in April 2014. The streams evaluated include East Fork Shoal Creek, Line Creek, Round Grove Creek, North Brush Creek, Fishing River, Brush Creek, Hickman Mill Creek, Little Blue River, Searcy Creek, and Buckeye Creek. One stream outside of the City limits - Prairie Creek in Platte County MO was also sampled concurrent with the bio-assessment program required by the Permit to facilitate interpretation of the bio-assessment results. All sampling sites are shown in Figure 8, except Prairie Creek.

Sampling activity at each site usually consisted of both field (in-stream) measurements and grab sample collection, except that extra field data were also collected in the early summer of 2013. The following devices were utilized in field measurements: an YSI Field DO Meter Model 550A for dissolved oxygen, Oakton pH tester 30 for pH, and VWR Conductivity Meter for conductivity. Stream water samples were collected and handled in accordance with the ***Kansas City, MO In-stream Ambient Monitoring Program*** document (submitted in the MS4 First Year Report, 2006) and the ***Quality Assurance Project Plan*** (submitted in the MS4 Third Year Report, 2008). Samples were analyzed by the Water Services Department's Laboratory. Sample analysis included general water quality parameters (e.g., ammonia, alkalinity), 7 metals (total and dissolved forms) and mercury, and 3 bacteria indicators. Additionally, samples collected in the last two rounds were also analyzed for more than 50 semi-volatile organic compounds and 20 pesticide-related compounds.

- Data summary

To evaluate the water quality of the sampled streams, Table 13 provides a statistical summary of physico-chemical and microbial data and a comparison made between the analytic results and the Missouri State Water Quality criteria for Designated Uses. Since all the streams that are monitored in the program and that are within the City limits currently have the same use designation, which includes livestock and wildlife watering, protection of aquatic life and whole body contact recreation (B) (Both North Brush Creek and Little Blue River are also designated for secondary contact recreation), the available most stringent criteria among the designated uses were used to simplify the comparison.

For non-organic-chemical parameters, all of the results are within the criteria ranges, except the sample collected from North Brush Creek on 10/8/2013, of which the level of lead (0.005 mg/L) may have slightly exceeded the criterion (0.0045 mg/L). For microbial parameters, the geometric medians of the data are lower than the criteria. For every organic analyte (semi-volatile organic compounds and pesticide-related compounds), the levels of all of the samples were below individual detection limits and thus the data are not presented in the table.

Table 13. A summary of physico-chemical data for the streams monitored in dry weather

Parameter	Unit	Total number	Number of detection or valid measurement	Frequency of detection or valid measurement (%)	Minimum ¹	Maximum ¹	Median ¹	Criteria ²
Air Temperature	°C	38	38	100	6	33	24	
Water Temperature	°C	38	38	100	7	23	17	32
Conductivity	ms/cm	38	38	100	0.30	1.59	0.74	
Dissolved Oxygen	mg/L	38	38	100	5.7	16.4	10.8	5
pH	S.U.	38	38	100	7.3	8.4	7.9	
Turbidity	NTU(Lab)	29	29	100	1.5	70.0	3.5	
Alkalinity, total	mg/L	29	29	100	106	261	183	
Biochemical oxygen demand 5-day	mg/L	29	13	45	ND	6	2	
Cl	mg/L	29	29	100	12	232	82	
Chemical oxygen demand	mg/L	29	29	100	7	44	16	
<i>E. Coli.</i>	MPN/100mL	29	27	93	<100	1376	109	1134 ³
Fecal coliform	CFU/100mL	29	28	97	<100	970	70	1800 ³
Total coliform	MPN/100mL	29	29	100	932	24810	3360	
Na	mg/L	29	29	100	12	196	58	
Ammonia	mg/L	29	28	97	ND	1.44	0.33	3.8-26.2 ⁴ 0.7-2.7 ⁵
Hardness, total	mg/L	29	29	100	88	472	276	
Nitrite	mg/L	29	29	100	0.036	0.131	0.07	
Nitrate	mg/L	29	29	100	0.014	1.76	0.21	10 ⁶
Total Kjeldahl Nitrogen	mg/L	29	29	100	0.33	4.28	1.43	
Oil & Grease	mg/L	29	9	31	ND	2	2	10
Phenols	mg/L	29	15	52	ND	0.13	0.02	
Phosphorus, dissolved	mg/L	29	23	79	ND	0.23	0.11	
Phosphorus, total	mg/L	29	29	100	0.02	0.56	0.14	
Total dissolved solids	mg/L	29	29	100	250	1100	450	
Total solids	mg/L	29	29	100	270	1200	490	
Total suspended solids	mg/L	29	29	100	1	140	5	
Volatile suspended solids	%	29	29	100	9	100	38	
Ag-dissolved	mg/L	29	0	0	ND	ND	NA	0.002-0.0156
Cd-dissolved	mg/L	29	0	0	ND	ND	NA	0.0002-0.00005
Cr-dissolved	mg/L	29	28	97	ND	0.006	0.001	
Cu-dissolved	mg/L	29	29	100	0.001	0.005	0.002	0.007-0.020
Ni-dissolved	mg/L	29	19	66	ND	0.004	0.001	0.041-0.113
Pb-dissolved	mg/L	29	14	48	ND	0.005	0.002	0.004-0.007
Zn-dissolved	mg/L	29	28	97	ND	0.015	0.004	0.092-0.255
Ag	mg/L	29	0	0	ND	ND	NA	
Cd	mg/L	29	0	0	ND	ND	NA	
Cr	mg/L	29	29	100	0.001	0.009	0.001	
Cu	mg/L	29	29	100	0.002	0.011	0.003	
Hg	mg/L	29	2	7	ND	0.0001	0.0001	0.0024 ⁷
Ni	mg/L	29	26	90	ND	0.009	0.001	
Pb	mg/L	29	21	72	ND	0.009	0.002	
Zn	mg/L	29	29	100	0.002	0.044	0.005	

Note:

¹ For those parameters that were detected in one or more samples, the minimum refers to the minimum value of the detected results, and the median refers to the median value of the detected results, except geometric mean for bacterium criteria.

² Criteria listed here are cited from Missouri Department of Natural Resources' criteria for protection of aquatic life unless annotated otherwise. For metals, chronic criteria are used unless annotated otherwise. A blank space is used if the criterion is not available or applicable to ambient stream samples.

³ Criteria for whole body contact recreation-WBC(B).

⁴ Acute criteria for cool & warm-water fisheries for pH values between 7.3 and 8.4.

⁵ Chronic criteria for early life stages present for pH values between 7.3 and 8.4 and temperature between 7°C and 23°C.

⁶ Acute criteria.

4. Conduct biological assessment

Permit Ref. VI.C.1&2

Status: Ongoing

The following progress was made on this program during the reporting period:

- Completed field sampling and continuing to work on laboratory analysis

During the reporting period, one round of habitat assessment and one round of sampling were conducted with the support from Columbia Environmental Research Center (CERC) of U.S. Geological Survey: 10/22-10/25/2013 and 4/7-4/11/2014, respectively. In addition, samples collected during previous sampling events were being analyzed by the CERC lab, and data was compiled for an in-depth analysis.

Streams assessed for habitat condition were: five urban stream reaches - East Fork Shoal Creek, Line Creek, Upper Shoal Creek, Rock Creek, and Round Grove Creek; three control stream reaches - North Brush Creek, Fishing River and First Creek, as well as a reference stream reach (outside of the City limits) – Prairie Creek in Platte County, MO.

Streams used for macro-invertebrate collection were: five urban stream reaches - East Fork Shoal Creek, Line Creek, Round Grove Creek, Brush Creek, Hickman Mill Creek, Searcy Creek, and Buckeye Creek; three control stream reaches - North Brush Creek, Fishing River and Little Blue River, as well as a reference stream reach (outside of the City limits) – Prairie Creek in Platte County, MO.

Field work included: water quality testing, habitat assessment, and macro-invertebrate collection. Field measurement and sample collection for water quality were performed nearly concurrently (within days apart) with macro-invertebrate collection. The details of field methodology and laboratory results are presented in the section on stream ambient monitoring program. Habitat assessment and macro-invertebrate collection were performed in accordance with the Division's ***Kansas City, Missouri Biological Sampling Program*** plan (presented in the First Year report) and relevant State standard operating procedures by the Missouri Department of Natural Resources Air and Land Protection Division's Environmental Services Program [i.e., Semi-quantitative macroinvertebrate stream bioassessment project procedure (MDNR 2010); Stream Habitat Assessment Project Procedure (MDNR 2010)].

Benthic macroinvertebrates collected during previous events were being processed at the CERC laboratory, which included laboratory treatment, sorting, microscope slide mounting, and taxonomic identifications. Operations were conducted according to the State's Protocol Taxonomic Levels for Macroinvertebrate Identifications (MDNR 2010). Appropriate quality control procedures were implemented.

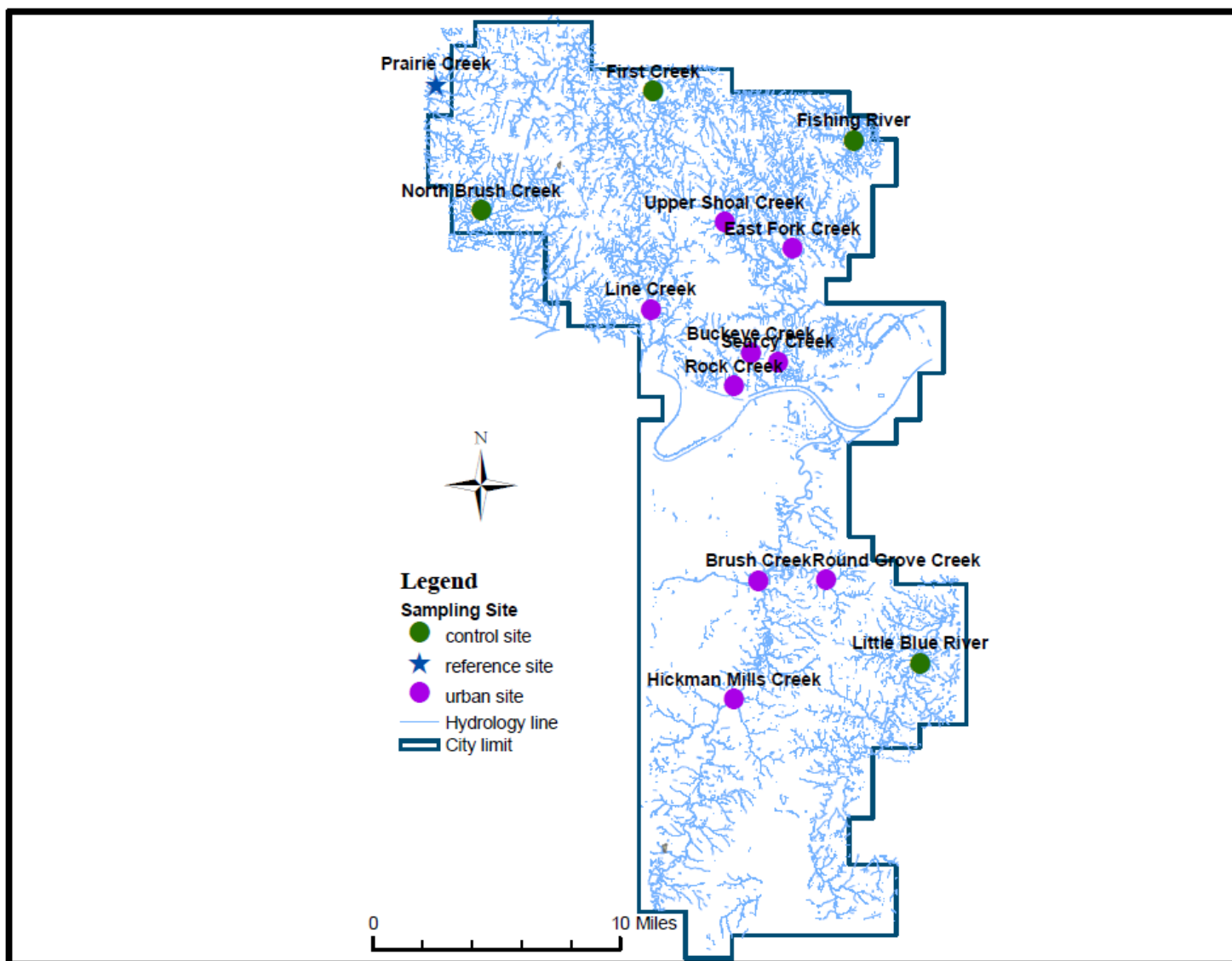


Figure 8. Sites for 2014 biological sampling

- Assessed data result collected over the years

The following presents a time trend assessment of biological condition for the streams monitored under this program over the years. The data compiled for this assessment cover the sampling events including spring 2007, fall 2008, spring 2009, spring 2010, fall 2011, spring 2012, spring 2013 and fall 2013. At the time of this report, spring 2014 samples are still being analyzed in the laboratory and are not included here. Since 2007, a total of fourteen streams have been surveyed under this program, but they were not necessarily surveyed on a continuous base and sampling events did not include a consistent set of sites each year. Currently, sites are sampled in spring and fall during odd-numbered years and spring only (including habitat assessment) during even-numbered years, but this monitoring schedule was not implemented until fall 2011. Streams that have been continuously sampled since the beginning of the

program include: North Brush Creek, East Fork Shoal Creek, Upper Shoal Creek, Line Creek, Round Grove Creek, and Rock Creek. In 2008, First Creek and Fishing River were added to the list of control stream sites, and a Little Blue River site (sampled only in 2007) was removed due to lack of comparable flow regime and habitat. In 2011, Prairie Creek was also added as an additional control site. In 2014 (data pending analysis), three sites were replaced with newly selected sites to increase geographic coverage of the region: Rock Creek, Upper Shoal Creek and First Creek were replaced with Hickman Mill (Hart Grove) Creek, Brush Creek, Searcy Creek, Buckeye Branch, and a newly selected site on the Little Blue River.

Several factors were considered for a better assessment of time trend analysis. Sampling had occurred in either spring or fall seasons in previous years. As a result, there are five sets of spring data and three sets of fall samples available. Only spring data are compared to eliminate the seasonal factor and to generate a statistically reliable trend analysis. Also sampling conducted between 2007 and 2010 only included coarse substrate habitat, while sampling done after 2010 expanded to cover three stream habitats (coarse substrate in riffles, non-flow in depositional zones, and rootmats along margins). Therefore, we report trends based on the most consistently available data, which is single-habitat results of spring data for all years, and 3-habitat results of spring and fall data for the 2011-2013 period only.

Table 14 shows a comparison of Missouri Stream Condition Index (MSCI) derived over the years. In general, the MSCI scores have not changed noticeably for most of the streams since the beginning of biological monitoring. However, Round Grove Creek appears to have improved from non-supporting to partially-supporting over the years; East Fork Shoal Creek had a brief decline from partially or full-supporting to non-supporting in the spring of 2013 and back to partially-supporting in the fall of 2013. Rock Creek was rated the lowest among all sites during most sampling periods and was non-supporting in both 2007 and 2013.

Table 14. Trend in Missouri Stream Condition Index (MSCI) scores for stream sites evaluated

Site	Spring 2007	Fall 2008	Spring 2009	Spring 2010	Fall 2011		Spring 2012		Spring 2013		Fall 2013	
					CO	All	CO	All	CO	All	CO	All
Line Cr	18	14	14	18	16	18	16	16	16	16	18	20
N. Brush Cr	18	16	14	18	20	18	16	16	16	16	14	18
Round Grove Cr	6	12	10	10	12	14	14	12	12	12	14	16
First Cr	*	14	10	12	16	18	16	10	12	10	12	12
Fishing R	*	14	14	14	16	18	14	16	14	12	10	14
Prairie Cr	*	*	*	*	18	20	16	14	14	14	16	18
Rock Cr	8	12	10	10	10	14	10	12	12	12	8	10
Upper Shoal Cr	16	14	12	12	16	16	16	12	12	14	12	14
E Fk Shoal Cr	18	16	12	14	*	*	14	12	8	12	14	16

Notes: Only scores for single-habitat (CO=coarse substrate only) are given for 2007-2010, and both single-habitat and three-habitat (All=coarse, non-flow, and rootmat) scores are given for years 2011-2013. Scores are based on site comparisons with reference data for streams with riffle-pool (RP) prevalence within the Central Plains Blackwater/Lamine drainage unit (CPBL). *= denotes samples not taken. Ranges in MSCI scores correspond with the following aquatic life impairment levels: 16-20 = Fully Supporting, 10-14 = Partially-Supporting, and 4-8 = Non-Supporting.

Figure 9 through Figure 12 present the four core macroinvertebrate indicators based on single-habitat (coarse substrate) community data collected between 2007 and 2013. Two urban sites (Round Grove Creek and Rock Creek) both show some improvement over the years as indicated by the increased values of Total Taxa Richness, EPT (Ephemeroptera, Plecoptera, and Trichoptera) Taxa Richness and Shannon Diversity Index and the decreased values of Missouri Biotic Index in 2012 and/or 2013. Another two urban sites (Upper Shoal Creek and East Fork Shoal Creek) show some decline as indicated by the decrease in values of EPT Taxa Richness. Results for the three control streams (North Brush Creek, Fishing River and First Creek) and one urban stream (Line Creek) do not show any distinct trends across years for the four indicators. Comparing the control streams (North Brush Creek, Fishing River, First Creek and Prairie Creek) with the streams subject to more urban influence (Line Creek, Round Grove Creek, Upper Shoal Creek, Rock Creek), no apparent differences are observed for any of the four indicator metrics. Even though Round Grove Creek and Rock Creek are noticeably the lowest in EPT Taxa Richness among the MS4 sites, both Line Creek and Upper Shoal Creek have values more comparable to those of the control sites. In most cases, values for each indicator metric at the control sites have varied across years with a similar magnitude as that of some of the urban MS4 sites.

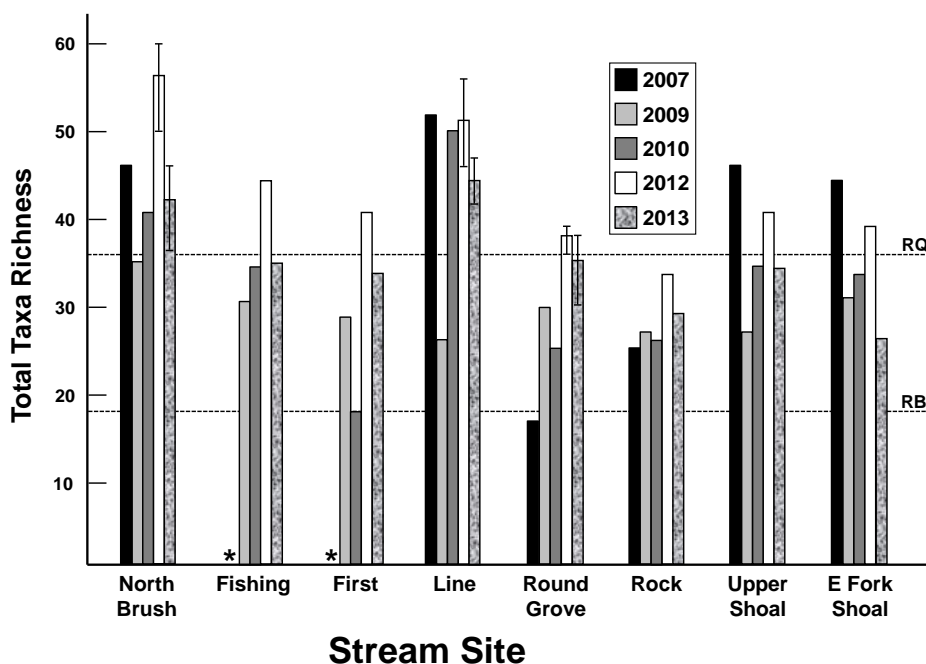


Figure 9. Total taxa richness (range for replicated sites) of macroinvertebrates based on single habitat (coarse substrate) estimates for stream sites sampled during spring 2007-2013 seasons
 Note: RQ=reference range quartile, RB=reference range bisection, *= samples not taken

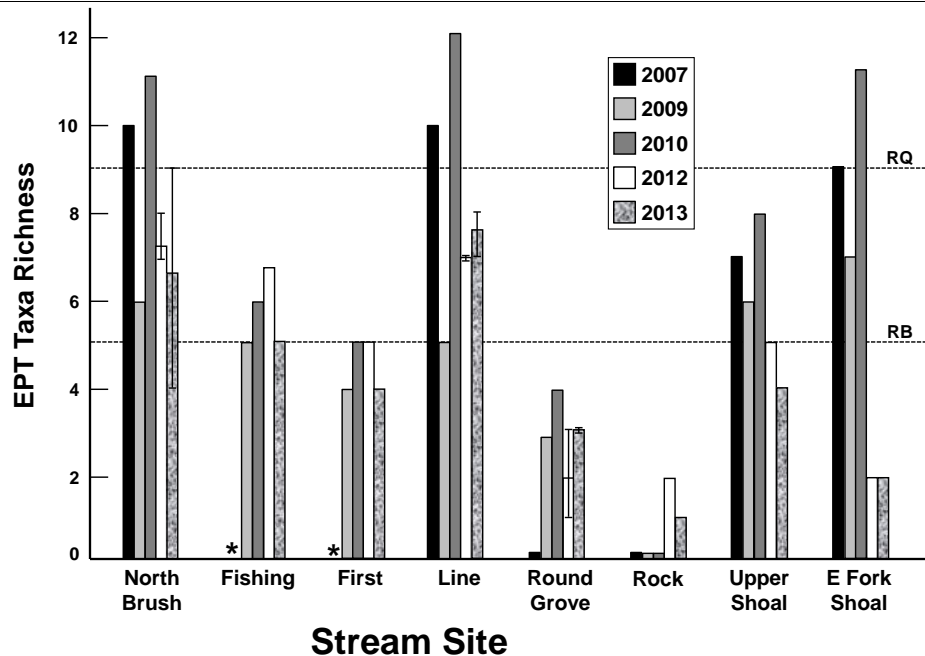


Figure 10. EPT taxa richness (range for replicated sites) of macroinvertebrates based on single habitat (coarse substrate) estimates for stream sites sampled during spring 2007-2013 seasons
 Note: RQ=reference range quartile, RB=reference range bisection, *= samples not taken

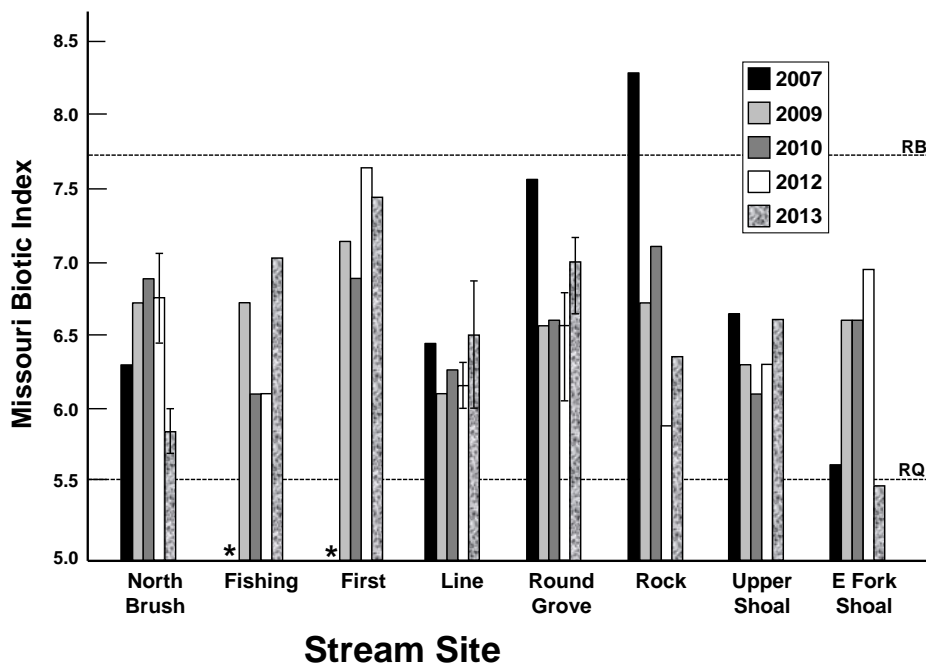


Figure 11. Missouri Biotic Index (range for replicated sites) of macroinvertebrates based on single habitat (coarse substrate) estimates at stream sites sampled during spring 2007-2013 seasons
 Note: RQ=reference range quartile, RB=reference range bisection, *= samples not taken

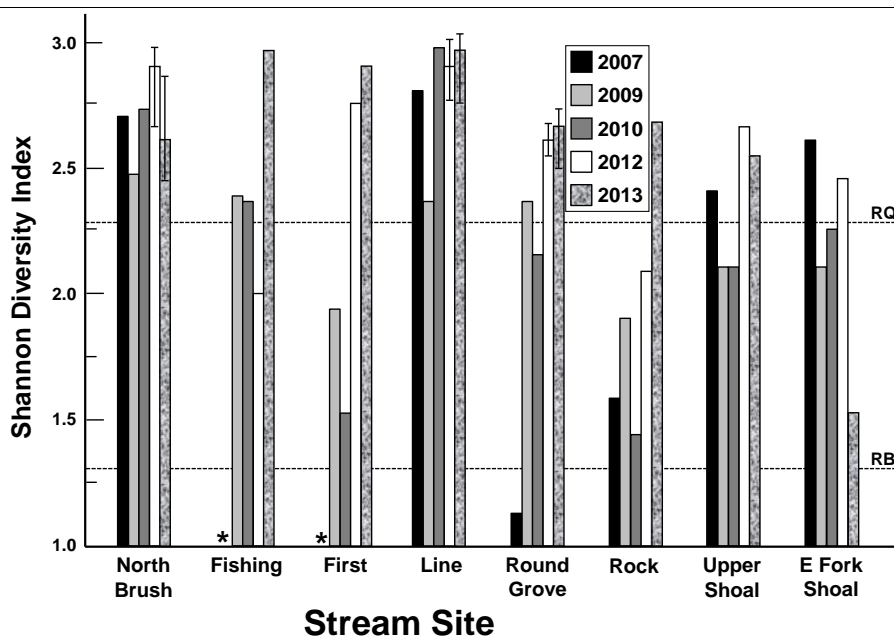


Figure 12. Shannon Diversity Biotic Index (range for replicated sites) of macroinvertebrates based on single habitat (coarse substrate) estimates at stream sites sampled during spring 2007-2013 seasons. RQ=reference range quartile, RB=reference range bisection, * = samples not taken

Figure 13 shows both the trend and a comparison of control sites and urban MS4 impacted sites of the 10-metric biotic condition score based on macroinvertebrate communities sampled at three habitats during 2011-2013. Both the 10-metric biotic condition scores and the previously observed trend in MSCI scores indicate that there is no statistical difference in macroinvertebrate community indicators or overall biotic condition between control sites and urban MS4 sites. This is due to specific sites that have biotic condition less similar to other sites within the same category. Specifically, the values of the MS4 site at Line Creek are more comparable with those of control streams, whereas control sites at Fishing River and First Creek have often been more similar in condition to other urban MS4 sites.

In summary, Line Creek and North Brush Creek have been among the best and most consistent streams in MSCI scores, and trends indicate that they have met fully supporting status in all sampling years except 2009 when none of the streams met fully-supporting status. Round Grove Creek and Rock Creek were among the lowest in MSCI scores, and these streams have not met fully-supporting status during any year or season of monitoring. Even though some variation between years is apparent, control sites and comparable urban MS4 sites that have good habitat quality have been rated among the best in biotic condition based on macroinvertebrate community indicators. Stormwater discharge associated with urban activities such as land development and transportation tends to be considered as posing a detrimental impact on the aquatic systems. Based on our habitat assessment, the most obvious and frequently observed problems with sites we evaluated are excessive bank erosion, lack of riparian protection, lack of intact buffer zones, and excessive sedimentation that causes increases in fine sediments and corresponding embeddedness in riffle areas. With stable and adequate riparian buffer zones, aquatic communities can be protected even with significant stormwater flow. This is supported by MSCI results at Line Creek; compared to other stream sites, this stream receives stormwater discharges from the largest number of major outfalls (over 60 of 36" or larger in diameter), and has been

subjected to very dynamic developmental activities in the upstream portions of the watershed during the years monitored. Since the monitoring site at Line Creek contains among the best in-stream habitat and intact buffer zones, it has scored among the best sites based on the MSCI. In contrast, the First Creek site is downstream of only about a dozen stormwater outfalls and is located in a less- developed part of the City, yet it has among the worst stream condition based on macroinvertebrate communities.

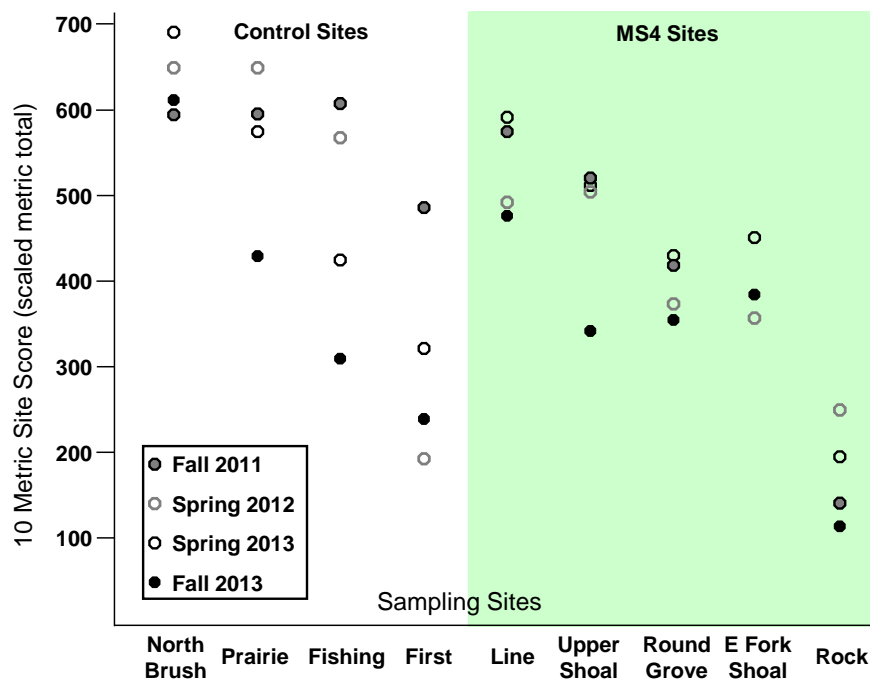


Figure 13. Trends in the 10-metric biotic condition score (mean for replicated sites) at nine stream sites in Kansas City, Missouri based on macroinvertebrate communities sampled during 2011-2013
Note: MS4 sites are located in the part of the City which is served by separate storm sewer system.

6. OTHER PERMIT REPORTING REQUIREMENTS

6.1 Summary of Implementation Status

The Stormwater Management Programs (SWMPs) are being implemented and the status of each program element has been described in each individual program section of this report. All the required components are proceeding in accordance with the City's Permit requirements.

6.2 Proposed Changes

During the past fiscal year's permit implementation, no significant change of permit conditions has been identified or anticipated. If any major changes are anticipated or occur in the future, the City will send written notification to the Water Pollution Control Program Permits Section for approval, following the procedures as described in Part III. G. in the Permit.

6.3 Program Effectiveness Evaluation Regarding Water Quality Improvement

The following presents an overall assessment of the City's Stormwater Management Programs, based on major outcomes of the relevant programs:

- The City is enforcing its new Zoning and Development Code in its planning and development processes

- The Code advances conservation principles by directing new development away from receiving waters.
- The enforcement of this Code will generate a profound environmental impact in preventing future stream degradation.

- Level of maintenance services for roadways and storm sewer systems remain:

- The City continues to operate and maintain these public infrastructure systems in a manner that is required by the Permit.
- The City continues to maintain and improve the ancillary functions, such as GIS mapping, to facilitate its maintenance services.
- The City has begun to maintain green solution sites (rain gardens, bio-retention cells, etc.) allowing them to function at optimal level.

- Water quality protection has been incorporated into flood damage reduction projects

- Water quality protection has become an increasingly important element in flood risk management projects. The City uses applicable green alternatives in designing and constructing the new projects with strategic water-quality improvement measures.

- Activities and programs aimed at promoting awareness of stormwater pollutants in industrial and commercial runoff:

- The City is implementing the *Stormwater Self-assessment* Program for high-risk-runoff facilities.
- Education and outreach continues to play an important role in the City's overall efforts to address stormwater issues among the industrial communities.

- Pesticide usage has been kept at a minimum level:

- The City's 220 parks are maintained free of insecticides.
- The City continues to maintain native prairies and wetlands.
- BMP efforts taken on or adjacent to the City-owned golf courses continue to enhance wildlife habitats, and reduce the need for watering and fertilizers.

- There continues to be a significant effort to reduce stormwater pollution:

- A number of programs hosted or supported by various City departments serve to reduce nonpoint source pollutants.
- The nature of these programs ranges from City-wide to localized hot spots and from routine maintenance to individually scheduled events.
- These programs address various pollutants, from daily household solid waste, hazardous waste, to sewage leaks and pharmaceutical products, which can all potentially end up in urban runoff or affect stormwater quality.

- Construction site runoff control has been recognized as an important practice

- The City continues to use standard procedures for land disturbance inspections and to provide a standard template of the Stormwater Pollution Prevention Plan for construction or grading projects disturbing one or more acres.

- Public education and outreach efforts continue to grow

- Continuing to operate a number of programs in which public education and outreach plays an important role: For example, The ***Adopt-a-Street*** program has a total of 151 volunteer organizations/groups throughout the City.
- Continuing to use a combination of conventional communication approaches and online methods. The City also supported and/or participated in the activities of various organizations to provide public education.
- Continuing to maintain an extensive partnership with different organizations on a number of programs for public educational purposes. These programs and their organizations include ***Keep Kansas City Beautiful*** and ***Community Recycling*** by Bridging the Gap; the Blue River Watershed Association, and the ***Water Quality Program*** by Mid-American Regional Council.
- Continuing to reach a larger audience: For example, bill inserts are used to reach each residence in the City, and the ***Wet Weather*** website provides information to those outside the geographic boundaries of the City.

The above-mentioned major outcomes can further be measured by some indirect indicators. Figure 14 shows the annual quantity of materials that the Regional Household Hazardous Waste Collection Program received and processed from 1998 to 2013. The program continues to divert household hazardous waste away from the landfills, streams, and storm sewers.

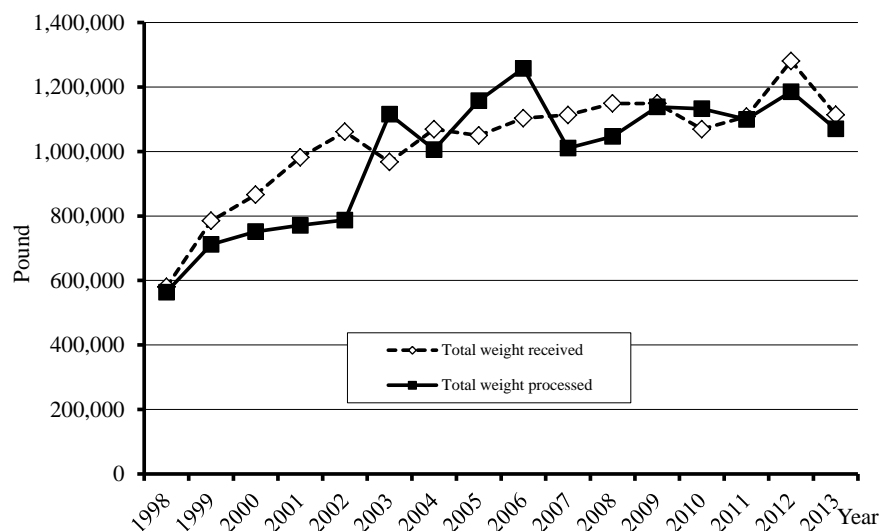


Figure 14. 1998 – 2013 Regional Household Hazardous Waste Collection Program – yearly comparison

In addition to routine street sweeping performed by the Water Services Department (**Figure 15**), the City's other departments/divisions utilize and enhance other existing programs or other methods to curb urban nonpoint source pollution to maintain a cleaner environment. Examples of these programs include, but are not limited to, City-wide curbside and community recycling – KC Recycles, Keep Kansas City Beautiful – Litter Abatement, Household Hazardous Waste Program, and Leaves and Brush Program. **Figure 16** and **Figure 17** illustrate some of the achievements made by the Solid Waste Division with the Public Works Department from Yr. 2004 to 2013.

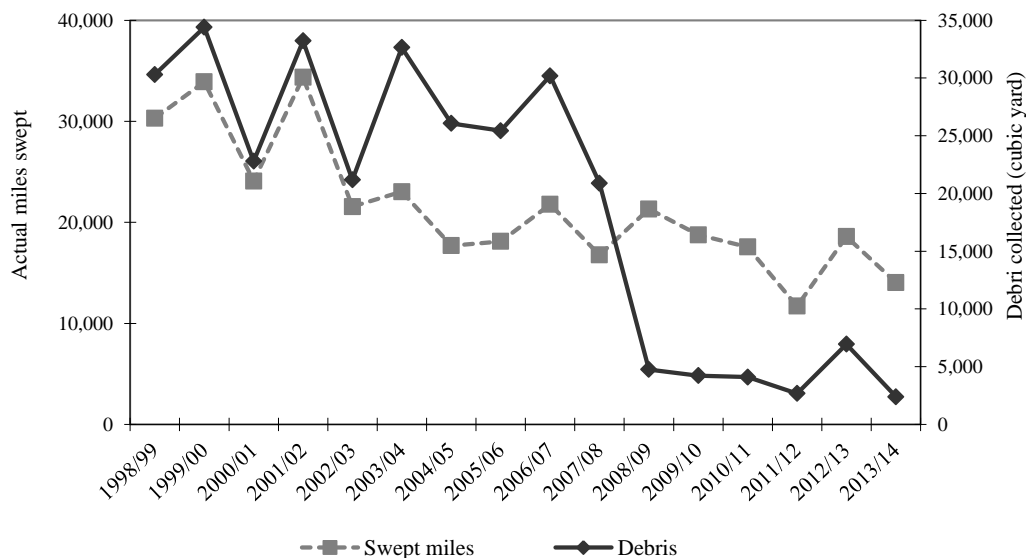


Figure 15. 1998-2014 Street Sweeping Program record

Note for the figure of Street Sweeping Program: Prior to 2008, the program used to cover residential, arterial/boulevards, and downtown streets; and the debris collected was tracked by cubic yard. Since 2008, cleaning downtown streets has been supplemented with Kansas City Downtown Council's cleanup efforts. Additionally, the program has shifted from the Public Works Department to the Water Services Department in 2008, and actual waste weight is tracked by tonnage instead of by cubic yard used previously. A conversion factor of 1.67 was used to convert tonnage to cubic yards for data comparison.

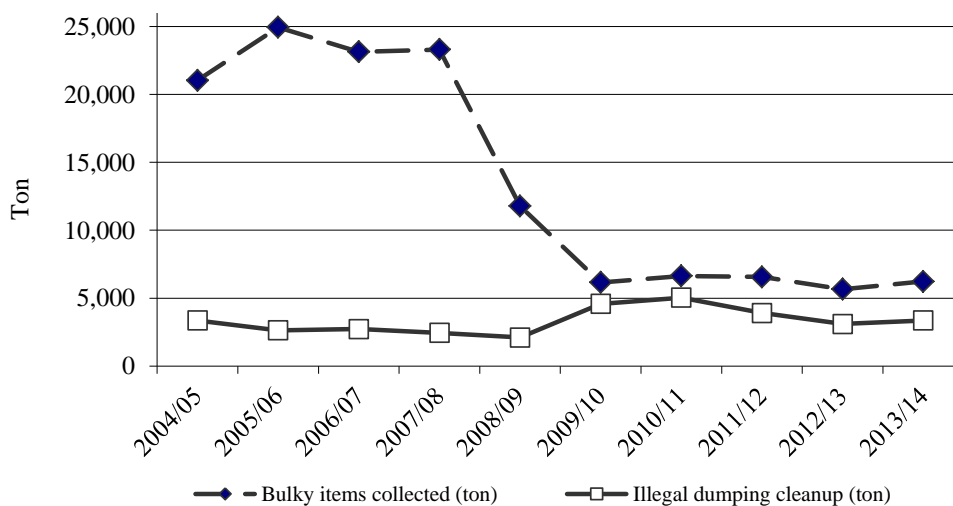


Figure 16. 2004 – 2014 Bulky items collection and illegal dumping cleanup

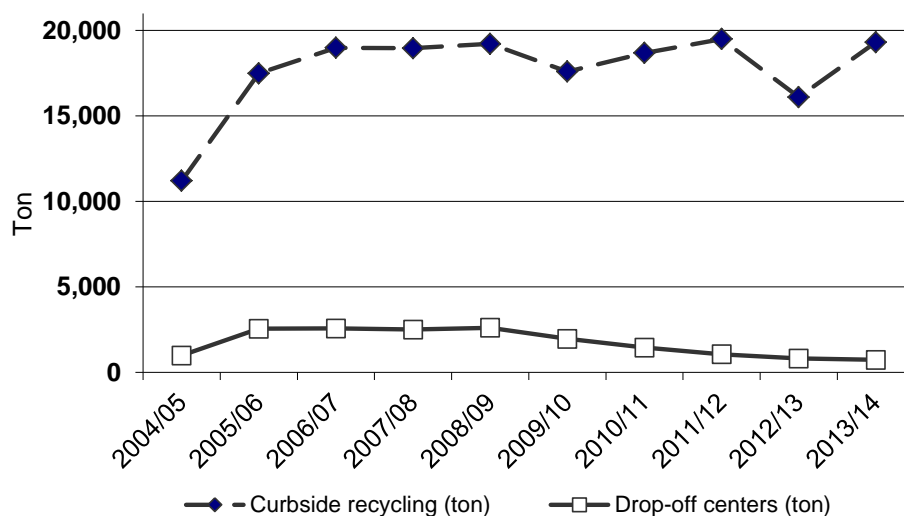


Figure 17. 2004-2014 KC Recycle program record

6.4 Data Summary

The monitoring results for representative stormwater discharges, ambient monitoring and bio-assessment programs for receiving streams have been summarized in **Section 6. Watershed Monitoring Program**.

6.5 Annual Expenditures

Table 15 provides a breakdown of the cost for the programs/activities that can be associated with stormwater management.

6.6 Activity Summaries – Inspection, Enforcement, and Public Education

Table 16 summarizes the enforcement, inspection, and public education activities that are relevant to stormwater issues.

6.7 Water Quality Degradation / Improvements

The trend analysis of bio-assessment data collected in the previous years is presented in **Section 5. Watershed Monitoring Program**. The City continues to have an in-depth evaluation of both its stormwater discharge monitoring data and ambient monitoring data accumulated throughout the permit years. The objective of these evaluations is to capture the temporal trend of the quality of stormwater and receiving streams, and to assess the impact of the City's stormwater management programs on water quality. The following activities are expected to have a positive impact on the City's surface water quality.

- Over one million pounds of household hazardous waste was collected, recycled, and properly disposed of in 2013;
- Over 730 tons of material was recovered by community drop-off recycling centers, 19,314 tons of material was recovered by curbside, as well as 419 tons of organics collected during FY 2013/14;
- A total of 13,035 tons of leaf and brush was collected from the drop-off centers and 4,780 tons were collected from residential curbside;
- More than 1,000 sediment /erosion control inspections were conducted for private development which disturbed areas more than one acre;
- Over 14,040 miles of streets were swept and 2,393 tons of litter was removed from streets;
- A total of 14,038 cleanings of storm inlets were completed.

As a result of these efforts, a significant amount of materials and waste did not get into the storm drainage system reducing pollution in our local waterways.

Table 15. Overall budget for programs/activities supporting stormwater management effort in FY 12/13 and projection for FY 13/14

Program/Service	Funding Source	FY 13/14 (Actual)	FY 14/15 (Adopted)
<i>Direct Cost (Activities conducted to ensure compliance with the Permit)</i>			
Permit administration – Stormwater Utility Division	Stormwater Fund	297,019 ¹	297,019 ¹
MS4 assistance	Stormwater Fund	0	50,000
Ambient monitoring	Stormwater Fund	16,643	35,000
Biological monitoring	Stormwater Fund	38,498 ²	96,000 ²
Industrial monitoring	Stormwater Fund	3,016	5,000
BMPs in drainage improvement projects	PIAC Fund ²	192,613	200,00
Landfill monitoring and control measures	General Fund	59,170 ²	50,000 ²
Stormwater discharge monitoring	Stormwater Fund	35,513	70,000
Stormwater public education	Stormwater Fund	61,200 ²	75,000 ²
<i>Indirect Cost (Activities conducted to help with stormwater pollution prevention effort)</i>			
Leaf & brush drop-off site operation and maintenance	General Fund	453,650	408,960
Leaf & brush collection (curbside)	Stormwater Fund	379,355	320,000
Bulky item collection	General Fund	1,725,605	1,697,678
Catch Basin Replacement program	Stormwater Fund	569,252 ²	500,000 ²
Stormwater Maintenance	Stormwater Fund	6,460,182	9,418,192
Deicing, snow/ice program	Motor Fuel Tax and General Fund	5,416,483	2,750,000
Household hazardous waste program	Wastewater/Stormwater Funds	1,121,237	941,608
Illegal dumping abatement	General Fund	1,790,378	2,096,579
KC Recycles (Recycle First) program	General Fund	4,505,733	4,240,522
Keep Kansas City Beautiful	General Fund	50,000 ²	50,000 ²
Land Development Inspection	Fee Supported	1,578,844	1,819,977
Levee maintenance	Stormwater Fund	67,609 ²	200,000 ²
Neighborhood Cleanup Assistance Program	General Fund	174,368	138,883
Property acquisition/demolition/clean-up for flood control	PIAC Fund ³	699,919	463,100
Special Sewer Connection & Septic Tank Disconnection Program	Wastewater Fund (SEP ⁴)	55,365	50,000
HazMat Team (Spill prevention and control)	Cigarette Tax	3,500,747	3,609,718
TOTAL		29,252,399	29,583,236

¹ The amount only covers staff within the Stormwater Utility Division of WSD at the level of both management and administration of the programs directly related to the Permit. These programs are: Ambient monitoring, Biological monitoring, Development plan review for stormwater control and BMPs (best management practices), High-risk runoff facility inspection/monitoring, Illicit discharge investigation, Land disturbance inspection for City projects, Stormwater discharge monitoring, Stormwater public education, Permit renewal effort, along with the management of the Permit in general. Fringe benefit (35%) is also included. The cost of City staff from other divisions and/or other departments supporting the above programs or managing other MS4 programs (e.g., Illegal dumping investigation, Landfill inspection/monitoring, Construction site runoff control at private development sites) is not included.

² The listed expenses only include new purchases and/or contract amounts. It does not cover either the cost of staff developing/managing/implementing/assisting this program and their associated training, or the additional cost of the existing City resources utilized (e.g., vehicles, computers, software programs including Arc/Map).

³ PIAC funds: the Sales Tax through Public Improvements Advisory Committee

⁴ SEP: Supplemental Environmental Program

Table 16. Activity summary – inspection, enforcement, and public education

ENFORCEMENT ACTION			
Sediment and erosion control			
> 1 acre (Inspection)		< 1 acre (Inspection)	
Site deficiency: >50		Correction notices: 485	
< 1 acre (Complaint-driven investigation)			
Letters on site deficiency: 6		Tickets prosecuted: 0	Stop Work Order: 0
Illegal dumping summonses / disposition: 125 / 118			
INSPECTION			
Public detention basin: 7		Private detention basin: 52	
Catch basin/Inlet: 14,038			
Municipal facility: 9		Private facility: 18	
TV sanitary sewer line: 198 miles			
Active construction site (erosion & sediment control)			
City projects ≥ 1 acre	Private development		
	≤ 1 acre	≤ 1 acre (Complaint-driven)	> 1 acre
153 ^a	4,911	15 (investigation)	>1,000
MUTI-MEDIA PUBLIC EDUCATION			
Local effort – Distribute education material: one (1) water bill inserts to >170,000 customers			
Regional efforts – 1 Sponsoring <i>Keep Kansas City Beautiful</i>			
Events: 37+		Organization/community assisted: 30	Trash cleaned (tons): 203
Regional efforts – 2 Partnering in <i>Blue River Rescue</i> Program			
Sites cleaned: 27		Volunteer number: 1,200	Trash removed: 55 tons Trees planted: 300
Regional efforts – 3 Lead sponsoring <i>Water Quality Public Education</i> Program			
<i>Brochures distributed (native plants)</i>		<i>Distributed (wild flower seed packet)</i>	<i>Grant issued</i>
100		1,000	6 projects/\$20,391
<i>Distributed (Storm Drain Inlet Marker Stencil)</i>		<i>Distributed (rain gauges with native landscape)</i>	
500		500	
<i>TV commercials (stormwater /healthy lawn)</i>		<i>Advertising billboards</i>	<i>Online ads Impressions (earned)</i> <i>Print ads Ads / publications / reader</i>
217 times/6 stations		4	408,626 94 /15 / about 2 million

7. FUTURE IMPLEMENTATION

A review of the ninth permit year's implementation of Kansas City, Missouri's MS4 permit was conducted. The City's first 5-year Permit term expired in 2009. The City has continued to operate its storm sewer system per the requirements listed in the expired permit, while working to have the Permit renewed for the second term. The following listing presents the City's vision for the near future regarding the permit activities for better managing stormwater, protecting natural resources, and ensuring full compliance with the Permit conditions:

- Continue to evaluate and improve relevant policies:

- Enhance/update the existing policies and operating procedures, where applicable, by incorporating and promoting stormwater protection elements.
- Establish strategic stormwater-related practices. For example, the City is targeting both municipal-owned or operated, as well as privately-owned or operated facilities for greater utilization of the *Stormwater Self-assessment* program.
- Investigate funding opportunities available to address funding levels needed to provide a more robust overall stormwater management system.

- Improve the existing services:

- Improve the database of stormwater infrastructure and assets and improve the Geographic Information System mapping.
- Explore opportunities for improved sweeping protocols utilizing the GPS capabilities on the new sweepers.

- Enhance public education and outreach:

- Better utilize dedicated water-quality outreach specialist and communications staff.
- Actively participate and support for the first Kansas City Regional Stormwater Symposium.

- Evaluate and improve the stormwater management programs:

- Evaluate the programs' progress against the predetermined goals or objectives.
- Improve Departmental maintenance capabilities for green infrastructure.
- Initiate an improved inspection procedure for private-side post construction BMPs.
- Provide a greater emphasis on dry weather outfall screenings.
- Initiate an assessment program for stormwater asset condition.

In summary, the City's goal is not only to comply with the state and federal regulations but also to reduce stormwater pollution and improve stormwater runoff quality.

LIST OF ATTACHMENTS

- A- 1 2014 Kansas City, Missouri Inventory of Industrial and Other High-Risk Runoff Facilities**
- A- 2 2014 Kansas City, Missouri Priority List of Industrial and Other High-Risk Runoff Facilities**
- A- 3 Kansas City, Missouri Public Education/Information Material – *Waterlines***