THE CITY OF KNOXVILLE
TENNESSEE

NPDES Permit Annual Report

National Pollutant Discharge Elimination System
Stormwater Discharge Permit TNS068055
July 1, 2011 - June 30, 2012

CITY OF KNOXVILLE

Signature and Certification

NPDES STORMWATER PERMIT TNS068055
2011/2012 MUNICIPAL ANNUAL REPORT

FOR: City of Knoxville, Tennessee

Federal regulations, 40 CFR 122.22 (a) (3) and 122.22 (d), require the application and reports for the NPDES permit to be signed and certified as follows:

> *For a municipality, State, Federal, or other public facility, by either a principal executive officer or ranking elected official.*
>
> *"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 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 fine and imprisonment for knowing violations."*

Madeline Rogero
Mayor

12/17/12
Date

James R. Hagerman, P.E.
Director of Engineering

12/14/2012
Date

CITY OF KNOXVILLE

Engineering
James R. Hagerman, P.E.
Director of Engineering

December 21, 2012

Mr. Michael Atchley
Tennessee Department of Environmental and Conservation
Division of Water Pollution Control
3711 Middlebrook Pike
Knoxville, TN 37921

RE: City of Knoxville, NPDES MS4 Permit # TNS068055
2011 – 2012 Annual Report

Dear Mr. Atchley:

The City of Knoxville is pleased to submit the eighth annual report for the NPDES permit issued July 1, 2004. This annual report summarizes the NPDES activities during the twelve-month period of July 1, 2011 through June 30, 2012. The annual report was coordinated and prepared by the Engineering Department in conformance with the reporting requirements in the City's NPDES Permit Part VI.

If you have any questions or wish to discuss any of the NPDES Permit programs, please contact me by email at dhagerman@cityofknoxville.org or by phone at (865) 215-3251.

Sincerely,

David Hagerman, P.E., Stormwater Management

CC: Mr. Vojin Janjic

City County Building • Room 480 • 400 Main Street • P.O. Box 1631 • Knoxville, Tennessee 37901
Office: 865-215-2148 • Fax: 865-215-2631
www.CityOfKnoxville.org

CITY OF KNOXVILLE

Engineering
James R. Hagerman, P.E.
Director of Engineering

December 21, 2012

Mr. Vojin Janjic
Tennessee Department of Environmental and Conservation
Division of Water Pollution Control
Attention: Compliance Review
401 Church Street
L & C Annex, 6th Floor
Nashville, TN 37243-1534

RE: City of Knoxville, NPDES MS4 Permit # TNS068055
2011 – 2012 Annual Report

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1.0 INTRODUCTION

The Tennessee Department of Environment and Conservation, Division of Water Pollution Control issued the City of Knoxville a National Pollutant Discharge Elimination System (NPDES) Permit (TNS068055) for the discharge of stormwater from the municipal separate storm drain system (MS4). Stormwater from the City of Knoxville discharges directly to the Tennessee River and to major creeks that drain to the Tennessee River. Only a small portion of the MS4 runoff will drain to sinkholes, ponds, and lakes throughout the area. In December 2008, the City submitted a reapplication as part of the Year Four annual report. The current permit was approved and made effective July 1, 2004 and expired June 30, 2009.

The NPDES Permit requires an annual progress report for the Stormwater Management Program outlined in the Part I and Part II applications. This annual report was completed in accordance with the reporting requirements of Part VI of the permit and will complete the requirements for the permit year from July 1, 2011 through June 30, 2012.

The Stormwater Quality Section of the City of Knoxville Engineering Department coordinated preparation and submittal of the system-wide annual report. Information for the annual report has been provided by the Engineering Department, Public Service Department, and the Solid Waste Management office. The Engineering Department has compiled the available information into the format outlined in Part VI of the current NPDES Permit.

2.0 CONTACTS LIST

David Hagerman, P.E., *(Primary Contact for City of Knoxville NPDES Related Issues)*
NPDES Stormwater Management (865) 215-3251 dhagerman@cityofknoxville.org

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P.O. Box 1631, Suite 480
400 Main Street
Knoxville, TN 37901

3.0 STORMWATER MANAGEMENT PROGRAM (SWMP) EVALUATION

The objective of the City of Knoxville's SWMP is to protect the taxpayer's health, safety, and welfare through an economically viable comprehensive stormwater quality and quantity program. Although it would be impossible to list all of the City's water quality related accomplishments in this report, the City is proud to report some of the major accomplishments related to the SWMP that occurred during the eighth year of the NPDES permit term.

- The City of Knoxville continued to expand the greenways/buffers zones along the major waterways. The City currently maintains over 65 miles of Greenways and unpaved trails. These linear parks help protect the adjacent waterways with natural buffers and provide opportunities for stream enhancements. Future plans may include connecting the Greenways from Fountain City Park down to the mouth of First Creek.

- The year 2012 was the 23st year for the River Rescue, which is coordinated by Ijams Nature Center and the Water Quality Forum partners. The spring 2012 River Rescue attracted 1,108 volunteers who collected 2500 bags of trash and 458 tires from the shores of the Tennessee River.

- During 2012, the City's Stormwater Engineering and Solid Waste Division had a one day rain barrel and compost bin sale. Over 370 rain barrels and 114 compost bins were sold during the six hours of operation.

- A total of 4,459 tons of recyclables including paper, plastic, metal, cardboard and glass was collected at the City's eleven solid waste drop-off recycling centers in 2011. This number is consistent with recyclables from 2005 to 2009. The City maintains updated information about recycling on the web at http://www.cityofknoxville.org/solidwaste/recycle.asp.

- On December 27, 2011 the City Solid Waste Office reached its initial goal of 20,000 household participants. As of this point in time, additional residents wishing to participate in the program are placed on a waiting list. If customer's move or drop out of the program, residents on the top of the waiting list are moved into program. If at some time in the future City administration and City Council approve additional funds, further participation will be expanded.

- The City partnered with the Water Quality Forum and sold another 26 rain barrels as part of the 5th annual Rainy Day Brush Off. The artistic barrels were on public display at various businesses around Knoxville. www.waterqualityforum.org

- A large mulch fire occurred on the banks of Third Creek. The Stormwater management staff monitored water quality, provided technical assistance, and devised an air injection system to offset the low oxygen in the Third creek.

- To improve the effectiveness of Knoxville's urban forest management program and the urban forest, the City performed a comprehensive operational review of its current urban forestry program and a tree inventory. An independent contractor was hired to assess the status of the City's urban forest, estimate the costs and benefits of the urban forest to the community, analyze the current urban forest management system employed by the City, and ultimately make recommendations to the City about its urban forestry program.

- During this permit year, the City installed a brine mixing facility and now adds this solution during dry weather as a preventative measure, which further reduces the overall quantity of de-icing materials. The City will continue to look for opportunities to minimize the use of deicing materials to reduce costs and protect the environment.

Since the stormwater quality program officially started in 1996, the City has defined a baseline to compare future surface water improvements and/or degradations. Although the continuing improvements are incremental and difficult to measure quantitatively, many programs initiated since the inception of this program have undeniably improved surface water quality throughout the city. The long-term results should become apparent in future years. Many of the SWMP tasks were implemented beyond the minimum requirements where economically feasible.

4.0 STORMWATER MANAGEMENT PROGRAM SUMMARY TABLE

SWMP activity summary tables for the last year of the NPDES permit program were compiled in accordance with the reporting requirements specified in Part VI(A)(2)(c) of the permit and included on the next few pages.

4.0 Stormwater Management Program Summary Table

MONITORING TASKS WET/DRY WEATHER	SCHEDULE OF ACTIVITIES	SCHEDULE FOLLOWED	ACTIVITIES ACCOMPLISHED	COMMENTS
Repeat High Parameter Sites	2 Outfalls repeated	Yes	2	Each outfall tested at least four times this year
Field Screening Industrial Outfalls	Visits to Industrial outfalls	Yes	69	Continued retesting outfalls from Industrial areas (four times)
Total Field Screening Outfalls	150 Outfalls	Yes	156	All field data sheets available for inspection. Outfalls tested four times this year.
Full Suite Stormwater Analysis (one station per year)	One Station / year	Yes	1 sample	Full Suite sample obtained at Fourth Creek Monitoring Station.
Storms Sampled at 5 monitoring stations	1 storm / quarter / 5 sites	Yes	20 storms	Summer: 5 storms, Fall: 5 storms, Winter: 5 storms, Spring: 5 storms
Ambient Samples at 5 monitoring stations	1 sample / quarter / 5 sites	Yes	20 samples	Summer: 5 samples, Fall: 5 samples, Winter: 5 samples, Spring: 5 samples
Storm Drain Televised	As Needed	Yes	11,527 feet	Pipes are defined as sections between inlets, catch basins, junction boxes, or outlets.

STORMWATER MANAGEMENT & INDUSTRIAL PROGRAM TASKS	SCHEDULE OF ACTIVITIES	SCHEDULE FOLLOWED	ACTIVITIES ACCOMPLISHED	COMMENTS
Stormwater Quantity Requests fo Service (Received / Resolved)	As Needed	Yes	818/1195	Complaints are investigated as received and resolved as solutions or resources are available
Stormwater Quality Requests for Service (Received / Resolved)	As Needed	Yes	361/455	Complaints are investigated as received and resolved as solutions or resources are available
Site Development Workshop/Professional Training	Annually	No	0	Included Engineers, contractors, developers, & surveyors involved in land disturbing activities.
Stormwater GIS Field Investigations for Annexations	As Required	Yes	1	Newly annexed areas are investigated within 60 days for all storm drain features and possible pollution sources.

4.0 Stormwater Management Program Summary Table

STRUCTURAL CONTROLS	SCHEDULE OF ACTIVITIES	SCHEDULE FOLLOWED	ACTIVITIES ACCOMPLISHED	COMMENTS
Street Cleaning	Daily/Bi-Weekly	Yes	29,489 Miles	Daily for downtown streets. Frequency varies for other streets.
Litter Pick-up, Hand	As Needed	Yes	120,444 Bags	Routine Schedule
Catch Basin Cleaning and Repair	As Needed	Yes	2,541 Jobs	Per work order and requests
Ditching: Hand, Truck, & Track/Gradall	As Needed	Yes	23,553 Feet	Per work order and requests
Storm Drain Installation & Repair	As Needed	Yes	61 Jobs	Per work order and requests
Brush & Leaf Pick-up	Bi-Weekly	Yes	16,524 Loads	Bi-Weekly curb pick-up
Seed/Sod, ROW	As Needed	Yes	58 Jobs	Per work order and requests
Storm Drain Cleaning	As Needed	Yes	33,752 Feet	Per work order and requests
Grate Replacement	As Needed	Yes	176 Jobs	As Needed
Field Inventory & Inspection of On-Site Detention Facilities	Within 60 Months	Yes	As needed	All new facilities are mapped after construction is complete. Existing facility's inventory is complete.
Creek Cleaning by Creek Restoration Crew	As Needed	Yes	31 Jobs	Creeks are inspected and cleaned on a routine schedule
Tree and Plant Planting	When Applicable	Yes	409 trees	Trees were planted by the City's Service Department
Total Waste Recycled	As Brought In	Yes	57,388 tons	7,092 tons of paper, metal, plastic, glass, etc. and over 50,891 tons of yard wastes

4.0 Stormwater Management Program Summary Table

EDUCATIONAL PROGRAM TASKS	SCHEDULE OF ACTIVITIES	SCHEDULE FOLLOWED	ACTIVITIES ACCOMPLISHED	COMMENTS
Publicize Hotline Number	Within 24 Months	Yes	Undetermined	Hotline number has been published in phone book, on road signs, pamphlets, magnets, radio PSA's, etc.
River Rescue	Annual Event	Yes	1 day event	2500 bags of trash and 458 tires removed by 1108 volunteers from 50 sites.
Water Quality Forum	Meets Monthly and Quarterly	Yes	Undetermined	Three committees meet monthly to plan projects focused on urban water quality.
Storm Drain Marking	As Needed or by volunteers	Yes	950	Catch Basins marked with decals labeled "Dump No Waste-Drains to Waterway"
Volunteer Creek Cleanups	Volunteers	Yes	Several sites on several creeks	A citizen based program that periodically hosts several creek cleanups in the spring and fall
Waterfest	Annual Event	Yes	1 Day Educational Event	A unique community event dedicated to educating citizens about water quality. Over 800 youths, 175 teachers & parents, and 150 volunteers participated.
Pooper Scoopers	As Needed or by volunteers	Yes	60,000	Disposable dog waste containers were distributed to 18 different pooper scooper stations.

NEW DEVELOPMENT PROGRAM TASKS	SCHEDULE OF ACTIVITIES	SCHEDULE FOLLOWED	ACTIVITIES ACCOMPLISHED	COMMENTS
Residential/Commercial Inspections	As Required	Yes	4965	As Required
Final Inspections	As Required	Yes	211	As Required
Site Development Permits Reviewed	As Required	Yes	867	As Required
Right of Way Permits Issued	As Required	Yes	58	As Required
As-Built Certificications Reviewed	As Required	Yes	201	As Required

5.0 NARRATIVE REPORT

The following narrative report is divided into the five main programs of the SWMP plus an additional section for specific Total Maximum Daily Load (TMDL) activities. The SWMP is described in the program element schedules listed in Part II of the permit application and Part III of the permit. The main programs are listed as follows:

5.1 Residential and Commercial Program (RC).
5.2 Illicit Discharges and Improper Disposal Program (ILL).
5.3 Industrial and Related Facilities Program (IN).
5.4 Construction Site Runoff Program (CS).
5.5 Comprehensive Monitoring Program (MN).
5.6 TMDL Implementation and Activities.

Each of the above programs are further divided into separate program elements and related tasks that correspond to the Implementation Schedules listed in Part IV of the Permit and to the requirements listed in 40 CFR 122.26(d)(2)(iv). Each specific task is briefly discussed in accordance with the reporting guidelines outlined in Part VI of the NPDES Permit. Some sections of this report may be a paraphrased version of earlier reports when the particular task elements are ongoing.

5.1 RESIDENTIAL AND COMMERCIAL PROGRAM (RC)

Program of Structural and Source Controls for Reducing Pollutants to the Municipal Separate Storm Sewer System, 40 CFR 122.26(d)(2)(iv)(A).

RC-1 Maintenance Activities for Structural Controls

SWMP Task: Continue Existing Maintenance Activities from Part 2 application

Status: Ongoing

The City's Public Service Department (PSD) currently performs maintenance of the municipal stormwater system. The PSD has developed and maintained an extensive database to track work tasks performed during the year. The database not only tracks labor category (e.g., Equipment Operator) and labor hours devoted to each task, but also includes equipment type and costs. The PSD database produces summary reports for monthly and annual work production and costs. The database includes more than 80 task activities of which 18 were identified as relating directly or indirectly to stormwater management. Only a small portion of the stormwater conveyance system is located on public rights-of-way and city-held easements. The City generally assumes no responsibility for maintenance or improvements on private property even though crews may work in some of those areas to remove blockages, spills, and trash with permission or in emergencies.

Maintenance by the City within rights-of-way and easements is normally performed on an as-needed basis by the PSD. Approximately 75 percent of the storm drainage system maintenance work performed by the PSD is in response to direct calls from property owners, requests from the Engineering department, and 311. The remainder of the storm drainage system maintenance work is in response to maintenance needs detected by the PSD, such as repairing collapsed pipes. Under

normal conditions, the PSD can respond to all complaints that are the responsibility of the City as defined by the City's stormwater policy.

Under the current system, the PSD has divided the City into six geographic maintenance zones, for routine work. Duties performed in each zone relating to stormwater are brush collection, leaf collection, street sweeping, and the cleaning of curb inlets. Cleaning and maintenance of catch basins are performed "as-needed". Most drainage facility maintenance is performed in response to complaints or known problems. The PSD logs all complaints by address and by category into the computerized database. The Construction Division of the PSD performs non-routine storm drain maintenance and installation.

The City has several multipurpose construction crews that perform storm drain installation. One of their primary responsibilities includes installing various sizes of corrugated metal pipe and reinforced concrete pipe, major repair to existing storm drains, and building catch basins. Each of the crews has six to seven employees, a backhoe, two single-axle dump trucks, and one 3/4-ton pickup truck. A single tool truck services all crews. These crews also provide emergency response in the event of flooding. The Storm Drain Maintenance Crew has five employees. They perform such tasks as: clearing culverts of debris, flushing storm drains, hand and mechanical ditching, and performing minor catch basin repair. A Storm Drain Vacuum Machine, a ditching machine, and a 3/4-ton pickup truck with a small crane are used to perform these tasks.

SWMP Task: Continue Improved Stream Restoration and Channel Maintenance Program.

Status: Ongoing

Stream restoration and channel maintenance have improved since the first permit cycle. These programs included stream bank stabilization projects to reduce erosion and sediment and a creek restoration crew to remove litter, debris, and flow blockages. The City has improved this program by providing an annual agreement to the Fort Loudon Lake Association (FLLA) for removing debris and blockages on the major urban creeks. The summary report for the FLLA's efforts is included in appendix of this report. Removal of the dams helps prevent streambank erosion and reduce large destructive pools of silt and trash. The FLLA primarily uses chain saws and hand tools to restore flow and remove the unnatural dams. Large or heavy objects require assistance by heavy equipment. The City properly disposes all of the trash and debris.

With the addition of the FLLA's work in the creeks, the 4-person Creek Restoration Crew that was added to the Public Service Department will now be able to focus their attention on maintaining the stormdrain system as the Stormwater Maintenance Crew. Obviously, the crew will still respond on a work order basis for work in the creek when needed. The crew still has access to a knuckle boom and a single-axle dump truck for performing their work. The crew has been trained and is used to assist with illicit discharge investigations in the MS4.

Since the City's NPDES permit program began in 1996, several bank stabilization projects have been completed with the help of TSMP, TDEC, TVA, USCOE, UTK, and CAC Americorps along urban creeks throughout the city.

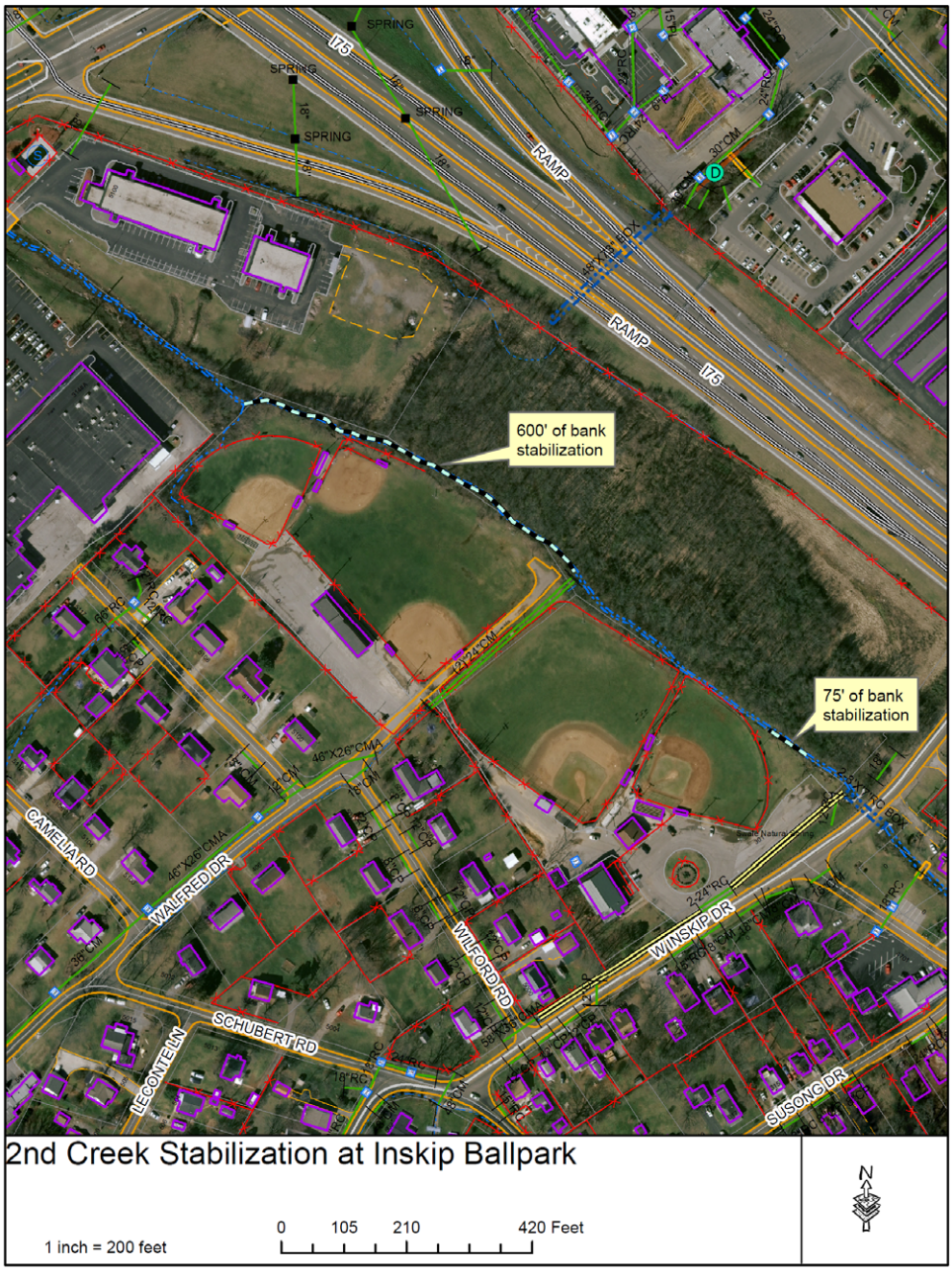
Since sediment, hydro-modification, and habitat alteration are the most common impairments in our urban creeks, the City will continue to focus on stream restoration projects where possible. Although these projects will certainly vary in scope, bio-stabilization techniques will be used instead of concrete or riprap. Whenever possible, the adjacent riparian zone will be enhanced with trees and

native vegetation to provide cooling effects and help restore habitat. The City will work with TDEC to obtain the appropriate ARAP permits before work begins.

SWMP Task: Implement Improved Stream Restoration and Channel Maintenance Program.

Status: Ongoing

During this permit year, the City of Knoxville again budgeted $350,000 for Capital Improvement Projects specifically to address Water Quality in streams. The funds allowed the City to develop and finalize construction plans for 600ft of bank stabilization near Inskip Ballfields (construction starting in fall of 2012), 270ft of restoration at Ulster/Cavalier, and 130ft at Cavalier/Graves (construction planned for 2013). In addition, the City has acquired a property on Banks Avenue where we plan to daylight and restore 140ft of stream that is currently in a culvert. The City has also updated its First Creek SWMM model to include a water quality component. Using this model, the City will be better able to determine reaches that has the highest erosive forces and take a proactive approach to stabilization projects.



SWMP Task: Implement Structural Controls To Prevent Floating Discharges To The TN River.

Status: Ongoing

Since the summer of 1999, the City has coordinated with TVA, UTK, TDEC, USACOE, the Isaac Walton League (IWL), Keep Knoxville Beautiful (KKB), Fort Loudon Lake Association (FLLA), and area businesses to reduce the amount of floating pollution entering the river from the urban creeks. The City has studied and identified several possible solutions. Short-term solutions have included increasing the frequency of the maintenance at the mouths of the major creeks, adding more trash receptacles at bus stops, increasing public awareness, installing temporary skimmers, etc.

During the first permit term, the City donated a new boat and hundreds of feet of trash skimmers to help then IWL and now the FLLA collect litter and debris along the riverfront in the downtown area. During this permit year, the City spent $3,500 dollars on replacement of the skimmers for First Creek. The City has approved funds to purchase a replacement boat for the FLLA. The boat will be purchased within the next permit year. The City has contracted with the FLLA to maintain a "Litter Free Zone" from the South Knoxville Bridge to the Alcoa Highway Bridge. Although the focus of this initiative has largely been to reduce unsightly trash from entering the river, the floating trash skimmers at the mouths of the creeks have also effectively detained oil spills until remediation personnel could respond. According to the FLLA, the booms have successfully prevented tons of floating material that would otherwise have been discharged from the creeks into the river. The original trash skimmers were purchased with penalty funds collected from polluters.

SWMP Task: Require Standard Maintenance Agreement for On-site Facilities.

Status: Ongoing

Since 1997, permanent maintenance agreements and/or covenants have been required for all new stormwater detention facilities and special pollution abatement devices (i.e. oil/water separators, catch basin inserts, etc.). To speed up the permit review process the original "Agreement" referred to in the Part II application and Part IV of the permit has been replaced with a "Covenant for Permanent Maintenance of Stormwater Facilities", which does not require the Mayor's signature or council approval. The end result for water quality protection and flood control is the same. The Stormwater and Street Ordinance section 22.5-34 now requires the owner of the property to execute a legal document entitled "Covenants" and record it in the office of the Knox County Register of Deeds before a site development permit is issued.

In the case of a lessee, the Stormwater and Street Ordinance Section 22.5-5 allows the City to require a Performance and Indemnity Agreement along with a surety bond or letter of credit to assure the stormwater facilities will be maintained and removed, if necessary, at the end of the lease. This is a new provision to allow some property owners the ability to share the responsibility of maintenance with the lessee who will use the land and create the need for the stormwater facility. The lessee must also pay the City no less than $5,000 to compensate for any perpetual maintenance that may be required after the expiration of their lease.

The City will retain the right to inspect to insure that the stormwater facilities are properly maintained, however, the responsibility for the maintenance of stormwater facilities will remain

with the property owner unless legally transferred to another person or entity by a properly recorded legal agreement. If the property owner does not maintain the facility properly, the City may authorize the maintenance to be completed and place a lien against the property for double the cost. To ensure access to the facility, a traversable access easement is recorded on the plat.

SWMP Task: Require Routine / Major maintenance of BMP facilities. Status: Ongoing

All stormwater facilities constructed since 1997 are required to be maintained according to the detailed agreement or covenant, which was recorded before the site development permit was issued. These agreements and covenants are discussed in the previous section above and also in the Stormwater and Street Ordinance sections 22.5-5 and 22.5-34. At a minimum, woody vegetation must be cut annually and sediment must be removed as necessary from detention ponds to maintain proper function of the facility. The standard maintenance requirements for large underground facilities (i.e. detention or oil/water separators) include a minimum of quarterly visual inspections and annual maintenance. Smaller BMPs, such as catch basin inserts, must be inspected at least monthly and maintained quarterly.

During the last permit term, the City designated a full time employee to inspect stormwater detention basins and to encourage property owners to maintain these devices. During this permit year the City has inspected 260 detention ponds. Sediment from the maintenance of detention/water quality ponds, treatment devices, or from stream restoration activities must be removed from the stormwater facility and disposed properly in a landfill classified for such material or used as fill outside the stormwater drainage system. The City does not propose to duplicate TDEC's efforts to regulate contaminated sediments from any stormwater management sources.

RC-2 Planning for New Development

SWMP Task: Review Stormwater & Streets Ordinance to evaluate possible improvements to existing water quality and quantity requirements for new development. Status: Complete

The City of Knoxville revised the Stormwater and Street Ordinance in 2005. The ordinance may be accessed on the Internet at www.cityofknoxville.org/engineering/stormwater. A brief summary of the current development requirements for stormwater detention and water quality control is included in the following paragraphs.

Stormwater detention is required for the following categories of development:

(1) All road construction exceeding one-half (1/2) acre of impervious area;

(2) All commercial, industrial, educational, institutional and recreational developments of one (1) acre or more of disturbed area;

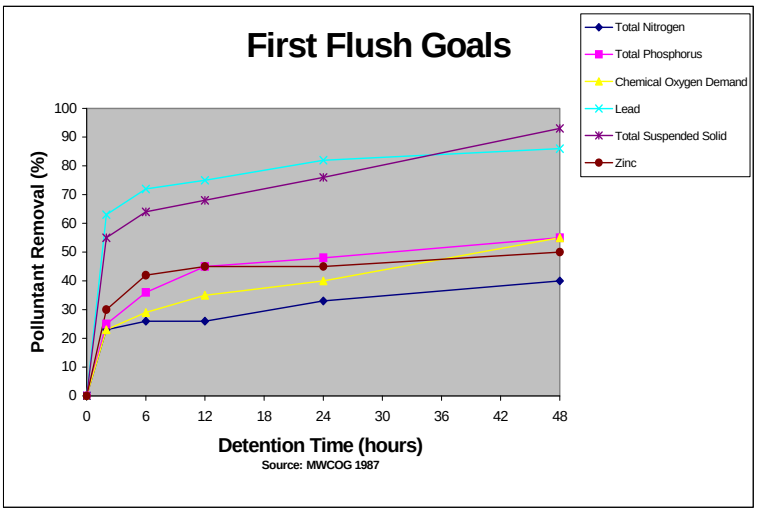
(3) Large single-family or duplex residential developments of five (5) acres or more of disturbed area or five (5) lots or more;

(4) Any site development which contains one-half (1/2) acre or more of additional impervious area.

(5) Any redevelopment that meets any of the four criteria above.

When a stormwater quantity detention pond is required, the engineer must design the pond to control the runoff from the 1-year, 2-year, 5-year, 10-year, 25-year and 100-year return frequency 24-hour storm events. The design Engineer must submit calculations to show that the detention facility will control the post development as required and that the downstream system is adequate to convey the flow from a 10-year storm. Detention may be waived for some developments discharging directly into a main stream (i.e. TN River) or if the developer submits supporting hydrologic and hydraulic computations to show that detention is unnecessary. For areas of redevelopment, detention requirements may be waived if the downstream stormwater system is adequate to convey the 2-year and 10-year 24-hour storms. The ordinance clearly states that a waiver of detention requirements "does not exempt the developer from providing the first flush and/or water quality requirements."

The standard management method for water quality control from new development and redevelopment includes first flush control outlets in the quantity pond or in a separate quality pond. The quality pond must be designed to collect the first one-half inch of direct runoff from the contributing drainage basin or the first 4500 cubic feet of stormwater runoff, whichever is greater, and attenuate that runoff for a minimum 24-hour period. Alternate treatment methods are accepted if they provide equivalent or better pollutant removal efficiencies than the standard first flush detention ponds.



The target removal efficiencies for the first flush treatment were estimated from the research and chart provided by the Metropolitan Washington Council of Governments' 1987 report titled "Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs." The target removal efficiencies for a 24-hour detention are estimated as follows: Total Suspended Solids – 76%, Lead – 81%, Zinc – 47%, Total Phosphorus – 44%, COD – 40%, and Total Nitrogen – 33%. The City chose 24-hour attenuation of the first flush since the pollutant removal rates for detention longer than 24 hours did not increase significantly. This may be reevaluated before the next ordinance update.

In addition to first flush treatment, Section 22.5-37 of the ordinance requires a Special Pollution Abatement Permit (SPAP) for certain land uses that are known to either contribute a disproportionate amount of stormwater pollution (a.k.a. hotspots) or contribute pollutants which would not be effectively removed by the standard first flush control. The SPAP requires the operator to submit the management and structural controls necessary to address the expected pollutants and sources of pollution from the site after development. The typical special pollution abatement requirement has been a minimum of an oil/water separator for large parking lots of 400 spaces or 120,000 square feet of area along with a management plan to keep the site free of

illicit discharges and pollution sources. Other special land uses that need a SPAP include any type of vehicle maintenance, fueling, washing, and storage areas; scrap and recycling facilities; restaurants; grocery stores; animal housing facilities; and other areas with concentrated bacteria sources. Most of these land uses are expected to have a much higher potential for either floatable pollutants (e.g. oil, grease, hydrocarbons, trash) or soluble pollutants (e.g. bacteria, nutrients) that will not be collected in a standard first flush pond.

After implementing the illicit discharge program for a few years, some of these land uses were added in the 2003 ordinance update when they proved to be common hotspots for pollution. The pollution is typically caused by illicit dumping/discharges from employees and contractors or from an increased volume of vehicle traffic. The SPAP program has effectively reduced pollution in our waterways by requiring planning and education to prevent pollution before it occurs from these new sources. This is more economical for the operator and the City since it reduces the need for enforcement, penalties, structural retrofits, and downstream remediation. Some businesses have reported that the pollution control requirements have paid for themselves by reducing other normal costs.

As the City implements the requirements of the NPDES permit and as other TMDLs are issued, other land uses may be added to the SPAP program to control specific pollutants.

The ordinance also requires protective streamside buffer zone along blue-line creeks. The three-tier restricted buffer zone requirement varies from 100', to 70' to 30', centered on the centerline of the low-flow channel of the creek. The width required for the buffer depends on whether the creek is a FEMA studied named creek, unstudied named creek, or unnamed tributary respectively. The natural streamside buffer zone must be shown on the plat and maintained in a stable condition for the life of the development. The ordinance does not allow any vertical or actively eroding creek banks to remain after development is complete. This may require the stream bank to be stabilized as part of the construction project. If stabilization is necessary, hard armor may only be used when bioengineering alternatives are not technologically feasible.

SWMP Task: Require "No Dumping" message cast into all curb irons and solid stormwater catch basin covers installed on new developments. Status: Complete

In January 2000, the City set a new standard to require a "No Dumping" message to be cast in all new curb irons and solid stormwater catch basin covers. The following year, the City included covers for stormwater treatment devices in this requirement. The message is an attempt to educate the public that our stormdrain system is not a sewer for their waste. When polluters are caught discharging or dumping pollutants into the stormdrain, they often plead ignorance to the fact that the stormdrain is directly connected to the creeks. After using stencils and plastic curb markers for years, the City decided to halt the growing number of curb irons that needed the temporary markers by requiring the permanently cast message. Before setting the standard, the City contacted the major foundries to be sure they could manufacture the new irons and remain competitive in Knoxville. East Jordon Iron Works, NEENAH, John Bouchard & Sons, Acheson, and Deeter are the primary foundries that provide irons in Tennessee. Each of the foundries could provide the new pattern without any additional cost to the development community. Since there was no additional cost for the messages and the message will never need to be replaced, this new standard may be the most cost effective educational program in the City.

SWMP Task: Plan and site location for regional BMP facilities for areas of new development.
Status: Ongoing

During the term of the permit, the City will target large development projects or strategically located smaller developments that are suitable for siting regional BMPs. Regional BMPs would serve multiple upstream developments and typically have drainage areas ranging from 50 acres to several hundred acres. Since most development activity within the City is primarily "infill" that occurs on the limited number of remaining vacant parcels, there are limited opportunities for siting regional BMPs without impacting existing developments.

The City only owns and maintains three regional detention facilities. Those facilities include the detention pond at the Acker Place development, the detention pond located at the Northwest Crossing shopping center on Clinton Highway, and the retention pond at Victor Ashe Park. However, private developers continue to build regional ponds for developments that have drainage areas over 50 acres.

In 2005, the City partnered with Knox County to hire a consultant to review the stormwater ordinances for each agency and to develop a master plan and SWMM model for First and Whites Creek. Although the initial project focused on flooding, it creates a base model that can be expanded in the future to include water quality parameters and analysis for the watershed. One benefit of the watershed model will be to help identify beneficial locations for regional detention. The full report was completed in year four and the executive summary did list three locations of regional detention that were evaluated. One is an existing on line pond South of Adair Drive on a tributary to First Creek that might be improved. The other two locations are located on White's Creek immediately upstream of I-640 and at McCampbell Road. The City has filled a full time hydrologist position to replicate the model in other watersheds.

SWMP Task: Review, update, and maintain guidance criteria for BMPs on City web page (www.cityofknoxville.org/engineering). Status: Ongoing

The City successfully completed a comprehensive BMP manual during the first permit term. The manual may be accessed at www.cityofknoxville.org/engineering on the Engineering Department's web page. The guidance criteria describe acceptable types of BMPs, design standards, and maintenance requirements for BMPs to be used throughout the City to meet the requirements of the new Stormwater and Street Ordinance. The guidance criteria is kept on file in the Engineering Department and distributed to developers as the official reference to ensure proper selection, design and maintenance criteria for BMPs.

Because maintenance of BMPs is critical to their long-term effectiveness in reducing pollutant loading from stormwater, the guidance criteria incorporates maintenance considerations with the design criteria to ensure that effective and maintainable BMPs are constructed in the City. The guidance criteria addresses the goals of the NPDES stormwater program by only allowing BMPs which are effective in reducing pollutants targeted by the NPDES stormwater regulations.

This manual is intended to be a live document that changes as new technology or future needs develop. Therefore, the website version is the preferred method of free distribution while CDs and paper copies may also be made available. Free CD versions are typically distributed

during the new development seminars each spring. The website and BMP content will continue to be updated at least annually as needed.

RC-3 Maintenance Activities for Public Streets, Roads, and Highways

SWMP Task: Continue street maintenance activities outlined in Part 2 application, p. 5-8.
Status: Ongoing

Street cleaning is performed daily for the downtown streets and less frequently for all other streets throughout the City. Eight large Vac-All trucks are used in most service areas while two smaller Johnston vacuum sweepers are used in the downtown areas where maneuverability is key. The Vac-All trucks are also used to vacuum debris from catch basins and remove leaves in the fall. Mowing in City rights of way is typically performed on a two to four week schedule between the months of April and September.

SWMP Task: Evaluate current deicing program and study alternatives and improvements.
Status: Complete

Snow removal, anti-icing, and de-icing of roadways are performed by the PSD and are essential programs to ensure public safety. Sodium chloride, stored undercover at the Loraine Street facility, mixed with liquid calcium chloride is applied to highways and streets by spreaders as necessary. Application of de-icing/anti-icing materials targets highways and major arteries first, and residential streets next. Priorities follow the adopted Major Roads Plan of the City of Knoxville. Because of the importance of maintaining public safety and public commerce, the City aggressively pursues its road clearing operations.

The Public Service Department evaluated the snow removal activities and materials and revises the Snow Removal Plan as needed. The City has been able to significantly reduce the quantity of deicing materials used by improved equipment, improved forecasting, chemicals, and operator training. During this permit year, the City installed a brine mixing facility and now adds this solution during dry weather as a preventative measure, which further reduces the overall quantity of de-icing materials. The City will continue to look for opportunities to minimize the use of deicing materials to reduce costs and protect the environment.

RC-4 Evaluation of Flood Management Projects

SWMP Task: Evaluate regional BMP facilities for water quality retrofit. Status: Ongoing

The City only owns and maintains three regional detention facilities. Those facilities include the detention pond adjacent to Middlebrook Pike and Weisgarber Road at the Acker Place development, the detention pond located at the Northwest Crossing shopping center on Clinton Highway, and the regional retention pond at Victor Ashe Park. Although the regional basins were designed for flood control, the City found that it was possible to retrofit the sites to achieve additional water quality benefits as well. All ponds built since 1997 were required to

comply with the water quality requirements for new development.

The City has assumed the responsibility of continued maintenance and water quality improvements at the large regional pond (Acker Place) in the Fourth Creek Watershed. The City restored a large section of Fourth Creek downstream of the pond in the first year of the permit. In 2008, the City made significant improvements to the pond to reduce sediment off loading from the stream bank erosion, establishment of the flood plain, re-meandering of the channel, and re-vegetation restoration. The City is currently evaluating further water quality retrofits to this regional pond through a partnership with an adjacent property development.

The regional pond at Northwest Crossing on Clinton Highway serves the Wal-Mart, Lowe's, and surrounding area. The City accepted the maintenance of this pond and immediately designed a water quality retrofit to reduce the pollution in the stormwater runoff. Three large Crystal Stream stormwater treatment devices (www.crystalstream.com) were installed. The units have effectively removed large amounts of trash, sediment, hydrocarbons and organic material from the runoff and prevented the discharge of those pollutants into the receiving stream. During this permit year, the City utilized volunteers from the Knox County Sheriff's Office to remove all the vegetation and debris from the pond.

The retention pond at Victor Ashe Park was designed and built with water quality in mind. Three Crystal Stream stormwater treatment vaults were installed to improve the quality of the stormwater runoff from the contributing parking lots, park, and subdivisions. Maintenance and inspection of the Crystal Stream units has been contracted out to Crystal Stream's service company to ensure proper function at both regional ponds.

SWMP Task: Maintain existing GIS inventory of on-site BMP facilities. Status: Ongoing

When the NPDES permit program first started, the City implemented a systematic method of inventorying the existing detention ponds by using a GIS grid of the city. Field crews inspected drainage features in each map grid and recorded the detention facilities in the GIS with a circled D. Since all new development must be certified to confirm that constructed facilities were built as planned, all new stormwater facilities will be properly recorded in the GIS after construction.

Engineering staff will continue to maintain and update the existing inventory of ponds, pipes, water quality facilities and other drainage features as part of an ongoing GIS maintenance program. The City has several positions which maintain and update the GIS program including; a stormwater technician designated to inspect and map field conditions, a GIS analysts which edits field note corrections, and a dedicated technician who inspects and records maintenance data related to stormwater detention/retention facilities.

RC-5 Monitoring of Solid Waste Facilities

This program is described in the management section IN-3 for industrial facilities.

RC-6 Management Program for Pesticides, Herbicides, and Fertilizer

SWMP Task: Evaluate possible improvements to existing public education program as part of the illicit connection and improper disposal program. Educate City staff, public, etc.

Status: Ongoing

Public education programs for pesticides, herbicides, and fertilizer use have already been implemented in conjunction with City public education programs for collection and recycling of household hazardous waste (HHW). In addition to the solid waste and household hazardous waste informational programs, the City has developed a stormwater pollution program that includes helpful information regarding pesticide and fertilizer use. The City's online Best Management Practices manual located at www.cityofknoxville.org/engineering/bmp_manual/ offers two BMPs for proper pesticide, herbicide, and fertilizer use and disposal. The BMP AM-13 is targeted towards institutional and commercial applications while the BMP RH-05 is directed towards residential and homeowner uses.

The HHW collection program, which includes collection of pesticide, herbicide, and fertilizer waste material, was officially implemented when the facility opened on April 22, 1997. More information about the HHW facility is included in the Illicit Discharges and Improper Disposal Program section ILL-6.

SWMP Task: Reevaluate effect of fertilizers as part of the City's ongoing monitoring program.

Status: Ongoing

Pesticides, herbicides, and fertilizer used by the City are stored in a building at the Loraine Street Operations Center. This building is in compliance with all regulations regarding the storage of hazardous materials. The Horticulture and Grounds Maintenance section of the PSD is responsible for the application of pesticides, herbicides, and fertilizer. The herbicide "Roundup" is applied annually to City parks and rights-of-way to control unwanted weed growth. PSD personnel, who have been trained to apply the herbicide as needed. Fertilizer is only used for minor landscaping projects and stormwater runoff from these projects is not considered a threat to receiving water quality.

The City does not currently require registration by commercial applicators; however, commercial applicators must be licensed under State and Federal Regulations. There are no regulations restricting the use of these substances by individual landowners. A permanent household hazardous waste collection facility is open six days per week to collect all types of hazardous wastes including pesticides, herbicides, and fertilizer.

The control program for pesticide, herbicide, and fertilizer pollutants is difficult to define since the presence of pesticides, herbicides, and fertilizers in urban runoff is not always evident. Current problems with pesticide, herbicide, and fertilizer pollutants are not believed to be significant. As part of the ongoing stormwater-monitoring program, the City will continue to

monitor the significance of these pollutants. Pesticides, PCBs, and nutrients are tested as part of the ongoing monitoring program described in Sections 5.5 and 6.0 of this report. To date, no significant traces of pesticides have been detected in the annual full-suite grab sample.

5.2 ILLICIT DISCHARGES AND IMPROPER DISPOSAL PROGRAM

Program to Detect and Remove Illicit and Improper Discharges to the Municipal Storm Sewer System, 40 CFR 122.26(d)(2)(iv)(B).

ILL-1 Ordinances

SWMP Task: Evaluate the prohibitions and exemptions of non-stormwater discharges in the original Stormwater & Streets Ordinance. Maintain authority for $5,000 penalties.

Status: Complete

This task was completed in 1997. See description below.

SWMP Task: Implement any new revisions to the Stormwater and Street ordinance.

Status: Complete

The Stormwater and Street Ordinance was developed to specifically prohibit non-stormwater discharges, increase penalties for illegal discharges, and to provide water quality regulations for new development. The first ordinance was effective June 20, 1997. The ordinance has been updated several times since then. The revised ordinance is available on the Internet at www.cityofknoxville.org/engineering/stormwater.

The ordinance section 22.5-52 specifically prohibits illicit discharges and illegal dumping to any portion of the MS4 or any area draining to the MS4. Illicit discharges were defined consistent with 40 CFR 122.26(b)(2) as any non-stormwater discharge to the MS4, which is not specifically exempted in the ordinance. This definition, along with the $5,000 penalty for violations, has formed the cornerstone of our successful enforcement program and will remain in place during this permit term.

Exemptions to the non-stormwater prohibition are listed in the ordinance in accordance with the list in 40 CFR 122.26(d)(2)(iv)(B)(1). The City added language to the exemption for individual car washing on residential property to include fund-raising washes by non-profit organizations for no more than two consecutive days in duration. During this permit term, the City did purchase two car washing kits which are available to charitable events at no charge.

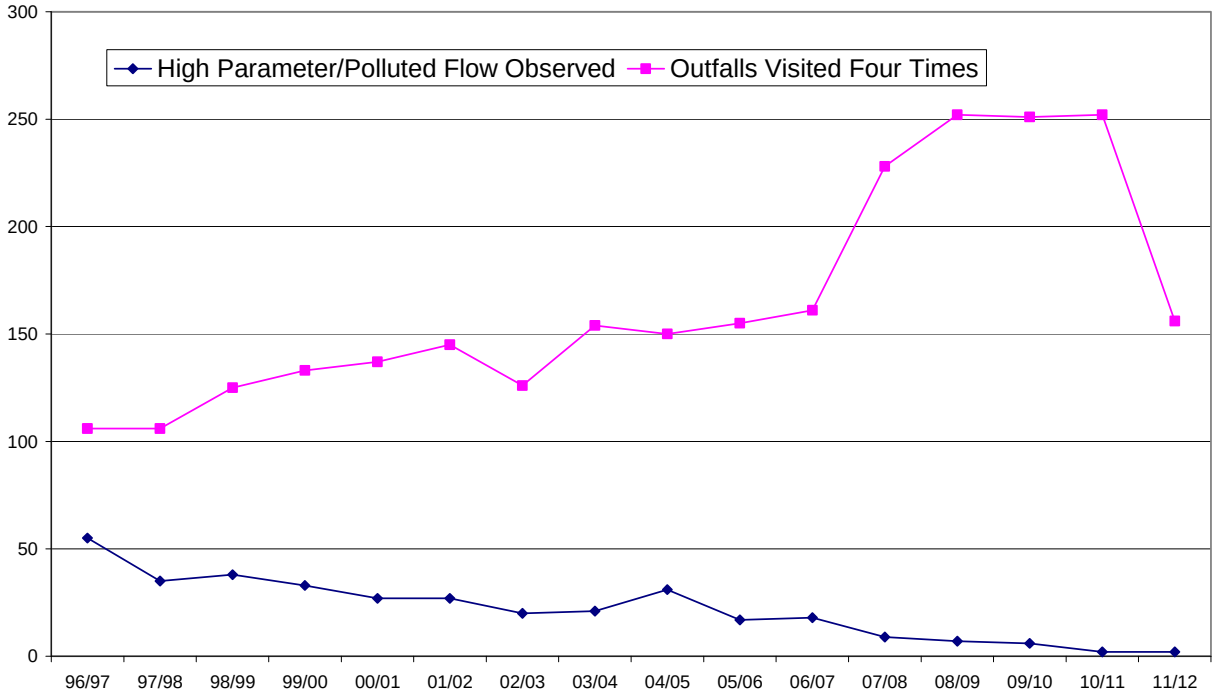
ILL-2 Field Screening

SWMP Task: Perform follow-up analysis at all high-risk screening sites. Status: Ongoing

The Dry-Weather Screening Program was developed and implemented during the first permit term to evaluate both randomly chosen outfalls and high-risk outfalls, which were tested during the previous year. Each high-risk stormwater outfall was checked for flow after a period of dry weather. If flow was present, the discharge was tested with a Chemetrics colorimetric field test kit for the following parameters: phenols, ammonia, detergents, copper, and chlorine. Turbidity, pH, color, temperature, and flow rate are also measured and recorded. If ammonia is greater than one part per million, then a fecal coliform and E-coli sample is collected for laboratory testing. The outfall test was repeated again between four and forty-eight hours after the first test. After one month, this process was repeated for each outfall to complete a total of four tests each year.

Since this program has successfully identified many illegal dumps and illicit discharges during the first permit term, the City will continue to annually retest all sites that have high parameters or signs of illegal dumping. Once the outfall has tested clean or dry during four site visits in a single year, it will only be retested if randomly selected from the list of inventoried outfalls.

As illustrated by the blue line "High Parameter/Polluted Flow Observed", the percentage of high-risk outfalls decreased each year since 1991 except for 2004/2005. The number of high-risk outfalls that need to be retested each year will obviously vary depending on the tested results of the previous year.



Permit Year

As required by Part VI (A)(2)(f)(ii) of the NPDES permit, the results of the dry-weather screening are included in the appendix of this report. Since the beginning of the program, 9148 outfall-screening visits have been conducted. The results from each of those visits are tabulated in the database by outfall identification number, testing date, and visit number. The testing results from the outfall screenings that occurred during the last permit year are included in the appendix of this report.

SWMP Task: Investigate 150 field-screening sites four times per year. Status: Ongoing

To insure that all outfalls are eventually tested each permit cycle, the City will continue to monitor a minimum of 150 outfalls each year throughout the new permit term. Last year the City visited 156 outfalls four times each. The monitored outfalls consisted of the previous year's 2 high-risk outfall sites plus 154 randomly selected outfalls from the general outfall inventory. The randomly selected sites were selected from areas of primarily industrial use and from areas that had not been previously tested. The City also selected outfalls throughout the city with some preference given to the highly developed areas.

The Engineering Department has developed an outfall database to maintain the testing data and site information for each outfall in the inventory. This outfall database is linked to the GIS to allow data access geographically for a single point or by report/query functions for many outfalls at a time. By maintaining a history of each outfall, illicit discharge trends may become apparent and therefore may be resolved with education or enforcement.

The dry-weather-screening program has been one of the most successful programs during the last permit term and will continue to be a high priority throughout the next permit cycle.

ILL-3 Investigation of the Storm Drain System

SWMP Task: Implement procedures for mapping, field surveys and upstream source identification. Status: Ongoing

The procedures for mapping, field surveys and upstream source identification were developed and included in the Part II Application section 5.3.5. The City will continue to utilize these procedures to maintain the effectiveness of the Illicit Discharge and Illegal Dumping Program. Last year there were no updates to report for this procedure. If the procedure is updated, it will be included in the following annual report.

SWMP Task: Evaluate and update enforcement procedures, policies, monitoring and inspections. Status: Ongoing

The schedule for this task appropriately coincided with the schedule for ordinance updates. The existing enforcement procedures and policies have been effective and were not amended when the ordinance was updated in 2005.

Depending on the violation, a first-time offender is usually educated and asked to remediate the damage or correct the violation if possible. This is usually followed up with a letter to inform the violator of the City's expectations and to provide helpful BMPs to prevent

future problems. More severe or repeated violations will merit a Notice of Violation (NOV), which is issued in the field directly to the violator if available on site. Copies of the NOV are distributed to the property owner or developer by certified mail, the City Law Department, and the Engineering Department's file. The NOV may order specific remedies and require the violator to submit reports and/or pollution prevention plans. Penalties, if any, are only issued after the NOV expires so the violation and remedies may be fully evaluated.

In the event that a penalty is assessed, a violator may appeal the penalty before a five-member Environmental Appeals Board. The five volunteer members of the Environmental Appeals Board are appointed by the Mayor and consist of individuals with an expertise as follows:

1) One licensed professional engineer with three (3) years of engineering experience as a
   Professional Engineer;
2) One architect, engineer, landscape architect or surveyor with three (3) years of experience;
3) One representative of the development or industrial community;
4) One neighborhood representative;
5) One member at large.

In addition to the above qualifications, one of the five members must have at least three years of civil engineering experience and a second member must have at least three years of civil or environmental engineering experience. Board members serve a 5-year term and may be re-appointed at the end of their term.

Some research has already begun to determine appropriate penalties for discharges that cannot be recovered but do not cause a fish kill or other quantifiable immediate damage. The City's current evaluation method does not account for incremental contributions to the overall pollutant loading or degradation of the waterway.

To help identify repeat violators, the City maintains an updated record of every NOV issued and a database for stormwater complaints. Follow-up monitoring and inspections will be a combination of City and self-inspections by industries. Enforcement actions resulting from the dry-weather screening program will be followed as defined within that program as a minimum. Any outfall that is tested for high parameters or identified as an illicit connection/ illegal dump source, will be tested four times a year, every year, until the outfall is dry or clean on all four visits. Sources of pollution identified by other means will be monitored as needed or specified for the individual situation. The ordinance Section 22.5-53 requires immediate reporting of spills and illicit discharges and Section 22.5-54 allows the City to require additional monitoring.

SWMP Task: Inspect stormdrain system and update features on GIS. Status: Ongoing

The City is dedicated to updating and maintaining reliable stormdrain data on the GIS. This task is implemented by a concerted effort within the Engineering Department. All employees are instructed to submit their completed stormwater work orders to a designated GIS analyst for the purpose of updating the GIS stormwater layer. All new developments require a development certification submitted by a design professional upon completion. The analyst in the stormwater division records the stormdrain features from the development certifications

into the GIS. Field personnel are instructed to log and report any discrepancies that are found between the maps and actual system in the field. The GIS analyst is responsible for completing the proper updates.

Engineering staff will continue to maintain and update the existing inventory of ponds, pipes, water quality facilities and other drainage features as part of an ongoing GIS maintenance program. The City has several positions which maintain and update the GIS program including; a stormwater technician designated to inspect and map field conditions, a GIS analysts which edits field note corrections, and a dedicated technician who inspects and records maintenance data related to stormwater detention/retention facilities.

ILL-4 Spill Response Program

SWMP Task: Coordinate with Knoxville Emergency Response Team (KERT) and TDEC.

Status: Ongoing

The City of Knoxville Stormwater Section of the Engineering Department continued to coordinate with both the KERT and TDEC during emergency situations. Each agency has specific roles to play during an emergency event. When discharges enter the MS4, the City's Stormwater Quality Section assists with information gathering, investigations, GIS support, containment, remediation, follow-up monitoring, and enforcement when necessary.

The Knoxville- Knox County Emergency Management Agency (KEMA) and/or the Knoxville Fire Department (KFD) coordinate most major spills when they are called in to 911. KEMA also coordinates routine training and simulations for various situations throughout the year. Workshops are provided to simulate real scenarios and allow coordination of the field teams and the Emergency Operations Center (EOC). Engineering Department staff participates in the EOC while the KEMA, KFD, Police Department, and Rural Metro units perform the field exercises.

The KFD and Engineering Department coordinate to respond to small spills and possible hazards as they are reported. The two groups will continue to work closely together to contain and remediate discharges in the street, stormdrain system, creeks or wherever necessary. The KFD maintains a fireboat downtown on the waterfront and a Hazardous Materials truck in one fire hall to assist with spills and signification discharges into the river, creeks or stormdrains.

When a responsible party is identified for a spill or hazardous discharge, the Engineering Department staff follow normal investigation and enforcement procedures to order the containment and remediation at the violator's expense. The HAZMAT team will work to contain the spill until the responsible party takes over. The City's HAZMAT team will then report back to the station to be ready for the next emergency while the Stormwater Section personnel monitor the remediation of site until the stormdrain and creek are restored.

This year, the Stormwater staff responded to assist the Fire Department with a variety of spills including traffic and boat accidents that lost fuel, illegal dumping, and discharges from permanent facilities. Most notably was a large mulch fire directly on the banks of Third creek. The Stormwater management staff monitored water quality, provided technical assistance, and devised an air injection system to offset the low oxygen in the Third creek. The small releases from accidents and illegal dumping were contained by the Fire Department and Stormwater

management staff. Stormwater staff and/or Public Service Department will remove and dispose of the materials from the small spills. Larger spills are typically referred to a private remediation company.

Engineering staff will continue to closely coordinate with other emergency personnel by attending the monthly Local Emergency Planning Committee meetings and by maintaining a staff member on call after hours and on weekends to help respond to water quality emergencies.

ILL-5 Reporting of Illicit Discharges

SWMP Task: Maintain and monitor the "Water Quality Hotline" for public reporting.

Status: Ongoing

The Water Quality Hotline for public reporting of water quality concerns was established as planned during year one of the first permit term. The hotline was operational in November of 1996 but did not receive mass publicity until December 1996. The hotline phone number is a local Greater Knoxville Area number listed in the blue pages as follows:

WATER QUALITY HOTLINE-
To Report Illegal Dumping Into Ditches
Creeks Or Catch Basins 24-Hours/Day……[865] 215-4147

The hotline has received a variety of calls including: industrial discharges, gray water discharges, broken laterals, commercial washing, and neighbors dumping, etc. The hotline has been a popular and convenient method for callers to anonymously report problems that they have witnessed or created. Common calls are from neighbors or dissatisfied employees of polluters. This program has been very successful and will be continued throughout the permit term.

The Water Quality Hotline is a dedicated phone line attached to a phone in the Stormwater Section of the Engineering Department. Employees in the section also have the hotline linked as a second line on their individual office phones so anyone may answer the phone during the day. After hours and on weekends, the messages are recorded and routinely retrieved by the on-call supervisor. If the water quality concern is within the City limits, the Engineering Department investigates the problem. Otherwise, the problem is referred to the Knox County Health Department, TDEC Environmental Assistance Center, or other appropriate agency.

The objective of this task is to increase the public awareness of the City's role in water quality issues and to create a quick and anonymous method for citizens to report water quality concerns. The publicity of the hotline has already provided a consistent and convenient resource for concerned citizens.

The City includes the hotline number in thousands of mass produced stormwater pollution prevention educational handouts such as magnets, brochures, presentations, business cards, and routine correspondence with residents. The hotline is prominently displayed at the bottom of the Second Creek watershed boundary road signs to let travelers know where they may report water quality concerns.

Recently, the Hotline was advertised by placing the number on the plastic stormdrain markers, which are placed on curb iron inlets. Although the curb iron markers have been used

for years, this custom design helps identify the markers specifically for Knoxville. The City will continue to seek out and develop innovative methods to advertise this successful program as a method for citizens to anonymously report complaints. Future opportunities to advertise may include: utility bills, public access TV, radio PSAs, signs on city buses, refrigerator magnets,

pamphlets, brochures, BMP manual CDs, permits, etc. The innovative methods of publicity will vary each year as opportunities are developed.

SWMP Task: Maintain public education program. Status: Ongoing

River Rescue

The year 2012 was the 23rd year for the River Rescue. The spring 2012 River Rescue attracted 1108 volunteers who collected 2500 bags of trash and 458 tires from the shores of the Tennessee River. This annual event is coordinated through Ijams Nature Center in cooperation with the City of Knoxville and Sea Ray Boats and more than 20 other partners, including members of the business community, government agencies, private organizations, and individuals. There are over 50 sites or "zones" that stretch from the forks of the river above Knoxville to Fort Loudoun Dam. River Rescue is also held in partnership with Lake User groups on Watts Bar Lake, Melton Hill Lake, and the Clinch River. Ijams Water Quality Specialists plan for this event throughout the year by recruiting volunteers, surveying riverbank conditions, securing additional sponsors, and pinpointing areas in need of cleanup.

Operation Storm Drain

The Blue Thumb Coalition started this ongoing program in 1994 in an effort to educate the public that there is a difference between the stormdrain system and the sanitary sewer. Operation Storm Drain attempts to reduce the amount of pollutants dumped into our waterways through education instead of enforcement.

For the past twelve years, a permanently cast "DUMP NO WASTE, DRAINS TO WATERWAYS" message has been the development standard for all new curb irons and solid stormwater manhole covers. The new standard requires the iron to be cast with the educational message included on top of all new curb irons and solid manhole lids. In an effort to make the curb irons more eye-catching, several foundries have cast into the iron a graphic of a fish in addition to the environmental message. The foundries offer these designs to the surrounding communities to simplify their stock

requirements. This program should continue to offer long-term educational benefits as citizens become familiar with the message and its meaning. Currently, the City has purchased and started to install permanent aluminum informational disks that contain the Water Quality Hotline number with the no dumping message.

Water Quality Forum

The WQF is a consortium of agencies, organizations, academic institutions, public utilities, and interested citizens working to protect and restore the waterways in Knox and the eight surrounding counties. It was initiated by the City of Knoxville in 1990. Currently it has twelve dues paying Partners; the City, TVA, Ijams Nature Center, Knox County, UTK-WRRC, the Town of Farragut, KGIS, the Knox County Soil Conservation District, KUB, QE2, Fort Loudon Lake Association, and the Hallsdale –Powell Utility District. There are numerous other stakeholders, who attend the quarterly meetings ranging from concerned individuals to agencies from other counties seeking information and guidance. The WQF's website is www.waterqualityforum.org.

Adopt-a-Watershed

Currently, fourteen area high schools and middle schools are participating in the program. The Americorp volunteers coordinate the program with the individual schools. This program has helped implement the goals of the NPDES program and increased public awareness of water quality issues. The primary goals of the Adopt-a-Watershed program include:

- Characterizing the school's watershed using, at minimum, two AAW characterization tools (e.g., watershed inventory, watershed mapping, windshield survey, stream walk).
- Monitor the school's watershed stream(s), conducting, at minimum, chemical testing twice and a biological (i.e. macroinvertebrate and/or fish) assessment once.
- Conduct at least one water quality improvement activity (e.g., tree planting, storm drain stenciling, stream cleanup, stream bank restoration, presentations to school groups/community organizations on the "state of the watershed" as determined by the students' characterization/monitoring efforts).

The City will continue working with the schools and provide support such as information, solid waste support for cleanups, GIS maps, stencils, testing supplies, training, and grants.

Adopt-A-Stream

The City of Knoxville, in conjunction with Knox County and The Town of Farragut is in the eighth year of administering the Adopt-A-Stream program. The City has provided the supervision and training in addition to gloves, trash bags, pitchforks, wheelbarrows, waders, and other tools for these activities.

City Employee Training

The City purchased a stormwater pollution prevention video from Excal Visual to train City employees. The eighteen-minute long video outlines BMP's for stormwater pollution prevention and has been shown to various businesses. To learn more about the video, go to www.excalvisual.com. We also evaluated another video for erosion & sedimentation control.

Public Displays And Presentations

In cooperation with the COK Solid Waste Office, Stormwater staff presented displays and informational materials at several public events including the Dogwood Arts Festival, Home Show, and Earth Day Celebration.

Various environmental presentations were also made to citizens through groups such as the West High School, Carter High School, and rain barrel workshops.

Clean, Protect and Restore (CPR)

This annual project coordinated by the Americorps Volunteers with the assistance of the Water Quality Forum, coordinates creek cleanups at seven sites throughout the City of Knoxville and Knox County in the fall and spring.

During this fiscal year, the CPR efforts were concentrated in the Williams Creek, First Creek, Goose Creek, Love Creek, Ten Mile, and two locations on Third Creek. The event was combined with River Rescue this past year and was very successful.

WaterFest

WaterFest is an annual festival designed to educate youth about the many values of water. It was initiated in 1995 by the Water Quality Forum (WQF) and has grown into an event with hundreds of elementary and middle school children attending from across Knox County. Ijams Nature Center hosts and coordinates this springtime event that is planned by forum partners throughout the year. It is designed to be fast-paced, engaging, educational, entertaining and just plain fun for the students. On the day of this event, WQF partners come together to make WaterFest happen.

ILL-6 Used Oil & Toxic Materials Program

SWMP Task: Continue coordination of Recycling Program. Status: Ongoing

The Solid Waste Division manages the City of Knoxville's recycling program. The entire annual report of these programs is included in the appendix of this report. This program is an important part of the City's solid waste reduction efforts and will continue in the future.

SWMP Task: Maintain and Operate Household Hazardous Waste Facility.
Status: Ongoing

The City continues to operate the Household Hazardous Waste (HHW) Collection Center, which first opened on April 22, 1997. When first opened, the City of Knoxville HHW Facility was the first permanent HHW Collection Center in the State of Tennessee. The HHW Facility is open five days a week. The center accepts HHW from both Knoxville and Knox County residents. Knox County shares the annual costs of operation. The capital expenditures associated with construction of this facility were partially paid for through a grant from the State of Tennessee. Activities at the center include:

- Diverting reusable products;
- Collecting, reusing and solidifying latex paint;
- Collecting car batteries, oil and antifreeze;
- Diverting selected acid and bases to waste water treatment;
- Bulking flammable materials; and
- Packing miscellaneous HHW materials for safe shipment and disposal.

Upon entering the HHW Collection Center, customers pull into a covered drive-through unloading area, where technicians remove HHW from vehicles. Material that is collected and is still "good" is separated and made available for pickup by the public free of charge in a "reuse area". "Good" material includes containers that have never been opened or materials that have not yet exceeded their useful shelf life. The staff then processes materials that are not reusable; diverting selected acids and bases to the wastewater treatment facility, bulking flammable materials, lab packing, and solidifying latex paint. After materials are processed, they are packed into 55-gallon drums, which are placed in one of two prefabricated storage units. Each of these units has a special fire suppression system, and drainage/spill containment systems. The hazardous materials are then stored in the units and held until sufficient quantities are collected. The HHW is operated by technicians trained to the 40-hour OSHA site worker level and managed by an on-site foreman and manager.

5.3 THE INDUSTRIAL AND RELATED FACILITIES PROGRAM (IN)

Program to Monitor and Control Runoff from TSD and Industrial Facilities Subject to SARA Title III, Section 313, requirements, 40 CFR 122.26(d)(2)(iv)(C).

IN-1 Ordinances

SWMP Task: Evaluate and implement revisions to the prohibitions and exemptions of non-stormwater discharges in the existing Stormwater & Streets Ordinance. Status: Complete

The Stormwater and Street Ordinance was developed to specifically prohibit non-stormwater discharges, increase penalties for illegal discharges, and to provide water quality regulations for new and redevelopment. The latest version of the ordinance was revised in 2005. The current Stormwater and Street Ordinance may be accessed on the Engineering Department's web page at www.cityofknoxville.org/engineering/stormwater.

The ordinance section 22.5-52 specifically prohibits illicit discharges and illegal dumping to any portion of the MS4 or any area draining to the MS4. Illicit discharges were defined according to 40 CFR 122.26(b)(2) as any non-stormwater discharge to the MS4, which is not specifically exempted in the ordinance. This definition, along with the $5,000 maximum penalty for violations, has formed the cornerstone of our successful enforcement program.

Exemptions to the non-stormwater prohibition are listed in the ordinance in accordance with the list in 40 CFR 122.26(d)(2)(iv)(B)(1). The City added language to the exemption for individual car washing on residential property to include fund-raising washes by non-profit organizations for no more than two consecutive days in duration. This exemption will likely be eliminated in the new permit cycle as alternative methods of car wash fund raising are established.

IN-2 Inspection Element

SWMP Task: Continue inspection program for non-permitted commercial facilities (i.e. car lots, restaurants, service stations, grocery stores, etc.). Status: Ongoing

The City has identified many common discharges from facilities that were not required to be permitted under the TDEC multi-sector general stormwater permit or individual NPDES permit program. Rather than spend limited resources attempting to duplicate the efforts of TDEC and EPA by monitoring existing permitted facilities, the City added a Special Pollution Abatement Permit (SPAP) program for those specific land-uses that have proven to cause polluted runoff problems (a.k.a. Hotspots). This program has been developed to fill in the gaps in the existing permit programs of those agencies with a local inspection program for otherwise non-permitted facilities.

In the current term, the City added a new Stormwater Technician position to perform additional education and inspections for industry and certain commercial areas. The technician performs most of the industrial and commercial facility inspections on sites that currently have a Special Pollution Abatement Permit (SPAP). Other technicians also perform inspections as

needed. A complete list of the SPAP facilities that were inspected during this permit year can be found in the appendix.

Each of the SPAP facilities is required to have some type of structural stormwater treatment device (i.e. oil/water separators, catch basin insets, sand filters, grass swales, etc.) in addition to their pollution prevention management controls. During the SPAP inspection, the City typically reviews the facilities maintenance records, provides technical advice on proper maintenance scheduling, records the GPS coordinates of the stormwater treatment devices if needed, and updates the City's industrial and commercial facilities database. Inspection of the SPAP facilities will occur systematically to insure that the structural controls are maintained and the management controls are being followed.

Stormwater Quality compliance inspections for non-SPAP sites are conducted in direct response to specific complaints from citizens or tips from the water quality hotline. The City will decide on a case-by-case basis whether this group of inspections will use education or enforcement to correct any problems found. In some cases, the old facility may be required to apply for a SPAP to correct violations.

The inspection program will focus on performing routine and/or random inspections on a variety of commercial sectors. The inspectors can work with the business to develop site-specific pollution prevention plans, employee training and structural modifications, if needed. The City's BMP manual has a wide assortment of information to assist a variety of businesses develop their stormwater quality pollution prevention plans. Since these businesses are not regulated in a permit program now, many of the operators are not focused on how their actions impact water quality in the area streams.

Section 22.5-37 of the Stormwater and Street Ordinance requires a Special Pollution Abatement Permit (SPAP) on new development and redevelopment of projects for certain land uses. Section RC-2 of this report provides more details on this program.

SWMP Task: Collect and analyze NOIs from Industrial Permit applicants.

Status: Ongoing

When the NOIs are received from TDEC or directly from the private industry, the City reviews and evaluates the information for potential impacts to the municipal storm drain system. In the past, the NOIs have been instrumental in locating and removing discharges from local industries. During inspections or enforcement actions with an industry, the City may verify that an NOI has been filed.

SWMP Task: Identify potential industrial discharges through Illicit Connection and Improper Disposal Program. (Both stormwater & non-stormwater discharges). Status: Ongoing

The illicit connection and improper disposal program defined in the City's Part II NPDES stormwater permit application and in the previous section of this report, primarily addresses runoff from industrial facilities. A large portion of dry weather screening occurs from areas of industrial use or outfalls indicated by a "300" in the identification number. Illicit connections or improper disposal from industrial facilities that are discovered while inspecting the storm drain

system under this program are recorded in the facilities' file in the Request for Service Database. The City contacts the industrial facility directly, along with TDEC if necessary, to identify the problem and work on an appropriate solution. If enforcement action is necessary, the City will track the situation until the illicit connection is corrected, the illegal dumping stopped, or until the facility receives a valid NPDES permit for the discharge.

SWMP Task: Review and update inspection program as part of Pollution Prevention Plans for Municipal Industrial Facilities. Conduct annual inspections at MIFs. Status: Ongoing

During the first permit term, the City developed an inspection and pollution prevention program for municipal industrial facilities. Currently only five municipal industrial facilities are operated in the City. These facilities include:

- the Solid Waste Management Facility (SWMF) on Elm Street,
- the fleet truck & heavy equipment garage on Loraine Street,
- the fleet and police garage at Prosser Road, and
- the Knoxville Area Transit (KAT bus station) on Magnolia Avenue
- the new Knoxville Area Transit Station on Church St.

Each facility is currently evaluated and inspected regularly by Engineering personnel and will continue to be inspected at least annually in the future. A new KAT facility opened during this permit year. The new facility was built using LEED standards and included stormwater quality treatment devices for the runoff.

The inspection and monitoring program has been productive at all of the MIF's in the past. Structural and management BMP's have been installed to control pollution and improve the runoff from each facility and all of the improvements were reported as they occurred. The SWMF has been retrofitted with structural controls to reduce the solids, sediment, hydrocarbons, and bacteria in the runoff from the paved areas. Future projects are planned to continue improving the runoff quality.

IN-3 Monitoring Element

SWMP Task: Collect monitoring data from industrial stormwater dischargers and/or from TDEC. Assess impacts to the storm drain system. Status: Ongoing

As part of the NPDES Permit for stormwater discharges associated with industrial activity, applicants are required to monitor, at least bi-annually, representative stormwater outfalls identified on the facilities' Pollution Prevention Plans. Applicants must monitor in accordance with TDEC Rule 1200-4-10-.04. The City currently receives copies of the results of the industrial outfall self-monitoring from some of the regulated industries. The City will continue to work with TDEC or directly with the industrial discharger to obtain copies of the information, as it becomes available. The City will maintain this information in the City's industrial files, and will assess the impact of the monitored discharges on the water quality of the storm drain system as the City receives the data.

If the City determines that additional data needs to be provided in the monitoring program for an industry (reports on additional parameters, etc.), requirements for an expanded program for

subsequent monitoring events will be coordinated with TDEC and/or the industrial discharger.

The Stormwater and Street Ordinance authorizes the City to require additional monitoring from industries not covered under the TDEC programs whenever necessary. This will usually be required in conjunction with some enforcement action after a problem has been observed.

SWMP Task: Continue monitoring program at non-permitted commercial facilities using guidelines pursuant to 40 CFR 122.26(d)(2)(iv)(c)(2). Identify pollutants and sources.
Status: Ongoing

During the current permit term, the City developed a program to sample commercial "hotspots" sites that do not require TDEC or EPA permits. The land uses that require a City of Knoxville Special Pollution Abatement Permit (see section RC-2) are targeted for samples. The standard operating procedures for the City's wet-weather sampling program are used except grab samples are substituted for the automatic sampler stations.

The samples from the hotspot land uses are analyzed for a wide range of parameters which vary depending on the pollutants of concern for each land use. For example, restaurants and grocery stores will likely have runoff containing a higher nutrient load from their dumpster/grease bin area than a new auto dealership. Both will likely have oil/grease, sediments, and metals from the vehicle traffic. An animal kennel will obviously have an entirely different set of concerns. This monitoring data may play an important role in determining the future direction of the SPAP program and to verify the suitability and effectiveness of the SPAP runoff controls.

In addition to the stormwater sampling above, all outfalls from industrial areas have been tested as part of the dry weather field-screening program to identify potential specific sources of the pollutants. Each year the City will continue to choose random outfalls from industrial areas as the primary dry weather screening locations. These outfalls are tested with field screening kits with additional laboratory tests as necessary.

Additional monitoring and reports from Hazardous Waste Treatment Storage and Disposal Facilities (HWTSDF) and industrial facilities subject to SARA Title III, Section 313 may be required when a problem has occurred, when the City has reason to believe a pollution problem exists, when TDEC or EPA do not already require sufficient testing, or if the City is mandated to test and report those facilities. Legal authority to require reports is maintained under Section 22.5-54 of the Stormwater & Streets Ordinance.

SWMP Task: Continue monitoring program at non-permitted commercial facilities and analyze the results from ongoing commercial monitoring program. Schedule: Ongoing

Beginning in year two, the City initiated an annual sampling program at the storage and maintenance areas at the City’s Loraine Street facility, Solid Waste Management Facility, and the KAT bus station. Samples are also collected at non-permitted commercial facilities such as restaurants, gas stations, car lots, grocery stores and other known hotspots. The sampling locations will change each year to ensure a wide variety of sites within each commercial group.

SWMP Task: Maintain adequate legal authority to require monitoring and reports from TSDs and Industrial facilities subject to SARA Title III, Section 313. Schedule: Ongoing

The Stormwater & Streets ordinance Section 22.5-54 states, *"The Director of Engineering may require any person engaging in any activity or owning any property, building or facility (including but not limited to a site of industrial activity) to undertake such reasonable monitoring of any discharge(s) to the stormwater system operated by the City and to furnish periodic reports of such discharges."* The City will maintain this legal authority to require monitoring from all facilities necessary when the Stormwater & Streets ordinance is updated in the next permit term. Additional monitoring may be required when a problem has occurred or still exists, when the City has reason to believe a pollution problem exists, when TDEC or EPA do not already require sufficient testing, or if the City is mandated to test and report those facilities.

SWMP Task: Evaluate and update the monitoring program for Municipal Industrial Facilities. Status: Ongoing

The City has implemented limited testing at these facilities including ambient monitoring, dry-weather screening, and industrial stormwater inspections conducted by the Engineering Department. Initial monitoring inspections resulted in some of the structural modifications mentioned above in section IN-2 as well as some management policies and procedures. The City evaluated the current monitoring at MIFs and updated the plan to include some laboratory analysis to help evaluate the effectiveness of the installed structural controls.

The Loraine Street facility was the site for a full-scale side-by-side BMP investigation project. Inflow and effluent samples are collected from each of the structural devices to determine the efficiency of each unit.

Stormwater runoff from the SWMF is sampled annually as described in MN-2. BMP monitoring has begun on the structural retrofits that included new filters for bacteria removal.

The dry-weather screening program will continue to monitor the outfalls from all MIFs to insure that management controls are sufficient.

SWMP Task: Manage and Conduct Monitoring Program at MIFs. Status: Ongoing

The monitoring program for the municipal industrial facilities was developed during the first permit term and included in the first annual report. The program specified that the only municipal industries included in the City's monitoring program will be limited to the Knoxville Area Transit station, the Prosser Road fleet and passenger vehicle garage, and the Loraine Street maintenance and storage facility. However, the City added additional monitoring and testing of the parking lot runoff from the Solid Waste Management Facility (SWMF) on Elm Street during the first permit term. This monitoring program was developed as a Best Management Practices test site to evaluate the usefulness and effectiveness of catch basin filters on ultra-urban land uses. After a significant amount of bacteria was found in the runoff at the SWMF, the City installed an Aqua-Swirl and Aqua-Filter system for sediment and bacteria removal. Monitoring results indicate significant removal rates for sediment and bacteria. The City has an approved

and funded capital improvement project to install a similar system to treat the upper loading section of the SWMF.

A BMP sampling project began in 2007 at the Loraine Street as described earlier. Two vault type stormwater treatment units were installed side-by-side at the Loraine Street facility in 2006.

Each year, the MIF outfalls are inspected at least once for non-stormwater flow in dry weather. If flow is observed, the normal dry weather screening parameters are analyzed, recorded, and investigated. In addition to the dry-weather screening, grab samples are collected from storage/maintenance areas at the City's Loraine Street facility, the Solid Waste Management Facility, Prosser Road Police Garage, and the KAT bus station.

5.4 CONSTRUCTION SITE RUNOFF PROGRAM (CS)

Program to Implement and Maintain BMP Plans to Reduce Construction Site Runoff to the Municipal Storm Sewer System, 40 CFR 122.26(d)(2)(iv)(D).

CS-1 Site Planning

SWMP Task: Requires construction sites greater than 10,000 sq. ft. to submit Erosion and Sediment (E&S) Control Plans. Status: Ongoing

The original Stormwater and Street Ordinance was passed in 1997 and specifically required construction sites greater than 10,000 square feet to provide erosion and sediment control plans. The ordinance was revised in 2005 but the requirement for erosion control plans was not removed. The current ordinance may be reviewed or downloaded on the Internet at www.cityofknoxville.org/engineering/stormwater. This requirement is satisfied in Section 22.5-27(j)(1) of the ordinance and will remain in place when the ordinance is renewed.

SWMP Task: Require Site Plans Submittals per the City of Knoxville BMP Manual.
Status: Ongoing

The Stormwater and Street Ordinance requires all erosion and sediment control plan submittals and all site development work to comply with the Erosion and Sediment Control Handbook produced by TDEC, dated March 2002, or as amended by TDEC or its successor, or the City of Knoxville's Best Management Practices Manual, whichever is more restrictive. The City will continue to maintain the requirement for compliance with the City's BMP manual or an equivalent BMP in the future.

SWMP Task: Review and update minimum criteria for plan review and checklists.
Status: Complete

Although the TDEC Erosion and Sediment Control Handbook provides a checklist for review of Erosion and Sediment Control Plans, the City developed a list of minimum criteria to

supplement the State checklist for various categories of site plans (residential, commercial, etc.). The City plans review staff uses the minimum criteria and checklists to ensure consistency in the plan review process. The checklist is available on the Stormwater section's web page at www.cityofknoxville.org/engineering/ldmanual as part of the Land Development manual.

SWMP Task: Require Pre-construction Assistance Meetings with Developers/Contractors for any project that requires a performance bond. Status: Ongoing

Since 1999, the City of Knoxville has required a Pre-construction Assistance Meeting with the contractor, and/or the developer, design engineer, and the City staff before a Site Development Permit is issued. This meeting is scheduled after the Site Development plans are ready for approval but before construction begins. The meeting ensures that all parties involved with the construction project are equally aware of the City's expectations. Topics covered in the meeting may include:

- The Development Inspection Checklists,
- The Stormwater & Streets Ordinance,
- The Engineering Department Enforcement Policy,
- Construction Best Management Practices,
- Inspection Schedules,
- State of Tennessee Erosion & Sediment Control Handbook,
- The City of Knoxville BMP manual,
- TDEC's SWPPP and ARAP,
- Special notes and considerations for the particular site,
- Other important information relevant to the project.

The Pre-construction Assistance Meeting format will continue to be reviewed and updated throughout the permit term as new policies, procedures, BMPs, and other regulations necessitate. Since the assistance meetings have been successful at increasing compliance and reducing enforcement, they will be an ongoing policy.

CS-2 BMP Requirements

SWMP Task: Require Construction BMPs from the City BMP manual or equivalent.
Status: Ongoing

As outlined in the new Stormwater and Street Ordinance section 22.5-27, all erosion and sediment control plans must comply with either the latest version of the Erosion and Sediment Control Handbook produced by TDEC, or the City of Knoxville's Best Management Practices Manual, whichever is more restrictive. The requirement to use BMPs from the BMP manual or TDEC manual applies to Utility, Single Family Residential (>10,000 s.f) and Large Residential and Commercial Developments. The City proposed to maintain the requirement for compliance with the City's BMP manual or an equivalent BMP in the reapplication.

SWMP Task: Evaluate additional BMP requirements and design modifications. Maintain the updated BMP requirements on the City's web page. Status: Ongoing

The Stormwater and Street Ordinance section 22.5-22 authorizes the Engineering Department to compose a development design manual as the standard for which the ordinance requirements will be met. The BMP manual may be accessed on the Stormwater Section's web site at www.cityofknoxville.org/engineering/stormwater.

The guidance criteria in the manual describe acceptable types of BMPs, design standards, and maintenance requirements for BMPs to be used throughout the City to meet the requirements of the Stormwater and Street Ordinance. The guidance criteria are maintained on the Internet and distributed to developers as the official reference to ensure proper selection, design and maintenance criteria for BMPs. To ensure that effective post-development BMPs are constructed and maintained in the City, a standard maintenance covenant is executed before site development plans are approved. The guidance criterion addresses the goals of the NPDES stormwater program by allowing only BMPs which are effective in reducing the targeted pollutants.

The BMP manual is intended to be a live manual with updates to add additional BMPs as necessary and to remove ineffective BMPs when appropriate. Maintaining the manual on the web is the easiest method to keep the manual current and available to the public.

SWMP Task: Continue to require construction site Good Housekeeping practices.
Status: Ongoing

To ensure that construction sites are kept clean and orderly, and to minimize pollutants in stormwater runoff as a result of other construction activities, the City will continue to require good housekeeping measures on all active construction sites. The good housekeeping practices included in the BMP manual address the following considerations:

- Designated areas for construction equipment maintenance and repair,
- Prohibition of discharges of oil and grease into the MS4 or receiving waters,
- Designated areas for construction equipment washing to ensure washwater is discharged to a maintained temporary holding basin or sediment trapping device,
- Designated construction site entrances, exits, and staging areas for all site traffic,
- Provision of storage areas for construction materials and receptacles for liquids (solvents, paints, acids) and solids in accordance with manufacturers recommendations,
- Provision of adequate waste storage areas and ensuring that the locations for collection of waste materials do not receive concentrated runoff, and
- Provision of adequate sanitary facilities on construction sites in accordance with Health Department Regulations.

Good Housekeeping issues are reviewed with the contractor, engineer, and developer during the pre-construction assistance meeting.

CS-3 Inspection / Enforcement

SWMP Task: Maintain expanded inspections to include smaller construction sites (single family). Status: Ongoing.

In the first permit term, the City of Knoxville expanded new development construction inspections to include single-family residential sites. The Engineering Department also created a new triage plans review position to focus primarily on small projects. Additional inspectors have been added in the current permit term to allow for inspections on these smaller sites. Although the small sites do not require the same type of frequency of inspections as the larger sites, all small sites should be inspected at some point in the construction process.

SWMP Task: Implement routine site inspections on commercial and large residential developments (e.g. rough grading, E&S control installation, final grading, and final stabilization.) Status: Ongoing

The Engineering Department continues site inspections for large residential and commercial developments. These inspections are not a new program and have been occurring since at least 1994. Inspections are performed during rough grading, final grading, and at various other times during the construction process. Although the site inspections are not always scheduled with the contractor or developer, the City staff may visit the construction sites approximately every three weeks or sooner if necessary. The time frame for some project inspections will vary due to the specific project.

These inspections are performed to ensure compliance with the approved erosion and sediment control plan, good housekeeping measures, and the design plan.

A significant improvement in this process was implemented after the 2003 ordinance revision. For bonded projects, the developer is now given a letter, which authorizes the installation of erosion and sediment controls after the submitted site development plan is approvable, but before the permit is issued. After the erosion and sediment controls are in place, a licensed professional must certify that the installation has been completed according to the e/s control plan. The site development permit is issued after the Engineering Department receives the certification and all other items complete.

SWMP Task: Require post-construction Development Certifications from licensed design professionals, before bond release to ensure the stormwater facilities are built as planned. Status: Ongoing

Since 1999, the City required all developments with a bond to submit to a post-construction Development Certification before the bond is released. A licensed professional Engineer and land surveyor must certify that the roads and stormwater features (quality & quantity) comply with the approved plans. Some deviation from the permitted plan may be allowed during construction as long as the final project still meets the City's minimum requirements. If the final certified project does not meet the minimum requirements, further adjustments must be made before the entire bond is released to the developer. This program does

require a second plan review by the Engineering Department after construction has finished to insure proper results in the field.

The Development Certification requires the following components when applicable:

- As-built drawings
- Complete detention calculations
- Roadway inspection reports
- Final site inspection in accordance with checklist
- Verification that all stormwater quantity and quality facilities are covered by a Covenants for Permanent Maintenance of Stormwater Facilities
- Engineering certification or soil retaining calculations for slopes or retaining walls steeper than 2:1.

This program has been successful and will be continued throughout the permit term.

SWMP Task: Maintain enforcement procedures, policies, and follow-up monitoring/ inspections.

Status: Ongoing

The schedule for this task appropriately coincided with the schedule for ordinance updates. The existing enforcement procedures and policies have been effective and were not amended when the ordinance was updated in 2005. During this permit year, 406 NOVs were written for construction site runoff violations, 35 of those resulted in civil penalties totaling $35,675.

Depending on the violation, a first-time offender is usually educated and asked to remediate the damage or correct the violation if possible. This is usually followed up with a letter to inform the violator of the City's expectations and to provide helpful BMPs to prevent future problems. More severe or repeated violations will merit a Notice of Violation (NOV), which is issued in the field directly to the violator if available on site. Copies of the NOV are distributed to the property owner or developer by certified mail, the City Law Department, and the Engineering Department's file. The NOV may order specific remedies and require the violator to submit reports and/or pollution prevention plans. Penalties, if any, are only issued after the NOV expires so the violation and remedies may be fully evaluated.

In the event that a penalty is assessed, a violator may appeal the penalty before a five-member Environmental Appeals Board. The five volunteer members of the Environmental Appeals Board are appointed by the Mayor and consists of individuals with an expertise as follows:

1. One licensed professional engineer with three (3) years of engineering experience as a
   Professional Engineer;
2. One architect, engineer, landscape architect or surveyor with three (3) years of experience;
3. One representative of the development or industrial community;
4. One neighborhood representative;
5. One member at large.

In addition to the above qualifications, one of the five members must have at least three years of civil engineering experience and a second member must have at least three years of civil or

environmental engineering experience. Board members serve a 5-year term and may be re-appointed at the end of their term.

Some research has already begun to determine appropriate penalties for discharges that cannot be recovered but do not cause a fish kill or other quantifiable immediate damage. The City's current evaluation method does not account for incremental contributions to the overall pollutant loading or degradation of the waterway. The City will develop standard penalties for construction violations to be more consistent with TDEC's expedited enforcement procedures in the new permit term.

To help identify repeat violators, the City maintains an updated record of every NOV issued and a database for stormwater complaints.

CS-4 Training Programs

SWMP Task: Co-Sponsor E&S Control Practice Seminars for all participants.

Status: Annually

The City and other Water Quality Forum members developed and presented free erosion and sediment control workshops throughout the first five years of the first permit term. To maximize participation, the workshops were typically presented in the early spring or late fall while construction activities are least intense. The workshops were very successful.

By the end of the first permit term, the City assisted UT and TDEC with promotion and presentation of the new TDEC erosion control certification program. This new certification program effectively duplicates the information the City had been providing in our annual seminars. To reduce the amount of competition for the two programs, the City will continue to promote and support the TDEC certification program in place of a separate competing erosion control workshop. Each year, the City will send inspectors and supervisors to the training program as needed. Last year, all the new inspectors received this training while some inspectors were retrained.

SWMP Task: Provide training for City plans review staff. Status: Ongoing

In an effort to fully train the Stormwater Management staff, the City has participated in several stormwater seminars around the region. Most staff members at the Engineer level will attend at least one, but typically more, seminars or training workshops annually. Typical seminars attended each year include: stormwater modeling, NAFSMA conference, regulatory updates, erosion control certification, NPDES updates, ASCE seminars, software workshops, and others. All licensed engineers must complete at least twelve hours of professional development each year. In addition to the stormwater management seminars attended, the Engineering staff have sponsored, planned, and presented a series of annual workshops/seminars to better educate the staff and development community about the development and plans review processes. Some of the topics of the City sponsored development process training sessions include:

- ***Technical Requirements of the Stormwater & Streets Ordinance***

- ***Construction Site Erosion and Sediment Control design and implementation***
- ***Site Development Permit Review***
- ***Special Pollution Abatement Permit program***
- ***Performance and Indemnity Agreements, Permanent Maintenance Covenants for Stormwater Facilities***
- ***Plat Review Process and Procedures***
- ***Development Certifications***

The City will continue to provide training to the Engineering staff by participating in seminars locally and outside the city; in-house training by professional engineers; tuition reimbursement for university engineering classes; cooperating with TDOT, TDEC, TVA, UTK, and other agencies to provide professional training for the staff. Training of the plans review and inspections staff is an ongoing program within the Engineering Department.

5.5 COMPREHENSIVE MONITORING PROGRAM (MN)

Program to Collect Quantitative Data to Determine the Impacts of Urban Stormwater on the Natural Environment, pursuant to 40 CFR 122.26(d)(2)(iii)(A).

MN-1 Seasonal Storm Event Monitoring

SWMP Task: Review and update the Standard Operating Procedures (SOP) for the seasonal sampling program. Status: Complete

The original SOP was developed in 1996 and submitted with the first annual report. Over time, the SOP became outdated and some parts became obsolete. The City revised the SOP to make it current and valid for the equipment, software, site locations, and procedures that are currently in use.

SWMP Task: Maintain at least five (5) automatic monitoring stations. Status: Ongoing

The five monitoring stations are currently located on First Creek, Love Creek, Williams Creek, Fourth Creek and Third Creek. The specific locations are noted on the large inventory map in the appendix of this report.

Each monitoring station consists of a tipping bucket rain gage, an automatic sampler with 24 individual bottles or bags, and a flow meter/data logger. The intake line and flow sensors are installed in the low flow path for constant monitoring. The city replaced three monitoring stations with digital technology that provides temperature monitoring and remote access. This newer equipment has restored communications to four out of the five stations and provides real time access to data. Rain, level and flow data is now available to the public from a city managed website: http://stormwater.knx/Flowlink (username = hotline and password = call 215-4147).

After each rain event, a technician will interrogate the sampler in the field via laptop computer and calculate the appropriate flow-weighted composite sample. The information is then used to prepare the actual sample from the individual bottles. The composite sample is

prepared; it is immediately transported to the laboratory for analysis.

SWMP Task: Collect twenty (20) to thirty (30) flow-weighted composite storm samples annually. Schedule: Ongoing

Each year, the automatic sampling stations should collect at least twenty (20) flow-weighted composite storm samples. Each of the five monitoring stations collect four (4) to six (6) storm samples each year with at least one storm sample per quarter to help distribute the sampling events seasonally. During dry weather, the stations also collect ambient samples as described below in section MN-3 unless grab samples are taken manually.

Each of the flow-weighted storm samples are analyzed for thirteen (13) routine parameters. Only pH will be recorded in the field. The remaining routine parameters are analyzed and recorded in the laboratory in accordance with 40 CFR part 122.26 and 40 CFR part 136. The routine parameters to be tested in the laboratory are listed in the table below:

Routine Parameters for Laboratory Analysis		
Total Suspended Solids (TSS)	Nitrate + Nitrite Nitrogen (as N)	Total Recoverable Lead
Total Dissolved Solids (TDS)	Total Nitrogen	Total Recoverable Zinc
Total Ammonia Nitrogen (as N)	Biochemical Oxygen Demand (BOD_5)	Dissolved Phosphorus
Total Ammonia + Organic Nitrogen	Chemical Oxygen Demand (COD)	Total Phosphorus

SWMP Task: Collect five (5) wet weather bacteria samples. Schedule: Ongoing

Five bacteria samples were collected this year. One grab sample was collected manually at each monitoring station during a qualified storm event. Since the TMDL includes both fecal coliform and e-coli standards, both parameters were analyzed in the laboratory.

SWMP Task: Collect five (5) full-suite grab samples (one/station/permit).
Schedule: Ongoing

Each year, one monitoring station was selected for a full-suite grab sample. The five stations were rotated throughout the permit term to allow one sample from each location. The full-suite sample was obtained from the Williams Creek location this year. In addition to the 13 routine parameters, the full-suite grab sample includes analysis for oil & grease and all the pollutants listed in Tables II & III of 40 CFR Part 122 Appendix D including: volatiles, pesticides, acids, base/neutrals, toxic metals, total phenol, and cyanide.

SWMP Task: Analyze Results from Ongoing Monitoring Program. Schedule: Complete

Sampling data were collected, evaluated, and analyzed by City staff as part of the ongoing seasonal monitoring program. The updated seasonal pollutant loading and event mean concentration for the major watersheds within the MS4 may be estimated from the City monitoring data and/or from other regional data, which may include:

- NURP study,

- USGS Open-File Report 94-68 titled "Rainfall, Streamflow, and Water-Quality Data for Five Small Watersheds, Nashville, Tennessee, 1990-1992",
- USGS Water-Resources Investigations Report 95-4140,
- USGS Open-File Report 93-xxx titled "Stormwater Data for Knoxville, TN '91-'92.
- Any available data from TVA, EPA, and the State of Tennessee.

The latest results of the analysis were included in the appendix for the year five annual report. An estimate of the total annual runoff from each of the major watersheds within the City will be provided in each annual report (see Section 6.2.4 in this report). Due to ongoing annexations, watersheds or portions of watersheds may be added to this estimate as needed.

MN-2 Dry Weather Screening & Industrial/Commercial Site Monitoring

SWMP Task: Dry Weather Screening as described in ILL-2. Status: Annually

SWMP Task: Implement Commercial/Industrial Monitoring in IN-3. Status: Ongoing

The City began sampling runoff from commercial sites such as restaurants, automotive facilities, and large parking lots in the current permit term. The purpose of this sampling is to determine the magnitude and variety of pollutants discharging from sites that have been targeted as pollution hotspots. The City began regulating some hotspots in 1997 through the Special Pollution Abatement Permit (SPAP) program. The list of SPAP land uses has expanded in the ordinance revisions. The current sampling program helped refine the SPAP requirements to better regulate the hotspots and reduce pollution in the streams.

MN-3 Ambient & Biological Monitoring

SWMP Task: Implement ongoing Ambient sampling program. Schedule: Ongoing

At least twenty (20) ambient samples were collected each year at a rate of one sample per quarter from each of the five monitoring station locations. The City has implemented a quarterly ambient sampling program since the first permit and continued in the next term.

The samples were collected either by a single grab sample or by using the automatic samplers for a timed composite. Each ambient sample collected was analyzed for the 13 routine parameters listed in MN-1. This program was first implemented after the monitoring stations were moved to locations that have base flow in dry weather. Since all of the locations have some flow in ambient conditions, the samples can be retrieved at the same location as the storm event samples. This is an added convenience for direct comparison of storm event and ambient samples as well as allowing more options for collecting samples automatically.

SWMP Task: Collect five (5) wet weather bacteria samples. Schedule: Ongoing

Five bacteria samples were collected each year. One grab sample was collected manually at each monitoring station during a qualified storm event. Since the TMDL includes both fecal coliform and e-coli standards, both parameters were analyzed in the laboratory.

SWMP Task: Collect five (20) ambient bacteria samples. Schedule: Ongoing

Twenty bacteria samples were collected each year by one grab sample per station per quarter. Each of the monitoring stations was sampled each quarter. The analysis of all 20 samples is summarized in section 6.2.2. of this report and will continue to be reported each year in the future permit. Both fecal coliform and e-coli parameters are analyzed as required in City's TMDL requirement.

SWMP Task: Continue the Biological-monitoring program (IBI, RBP III and stream surveys).
Status: Ongoing

During the current permit term, the City improved the Biological monitoring program by contracting with the Fort Loudon Lake Association to complete Index of Biological Integrity (IBI) and Rapid Bioassessment Protocols (RBP III) studies. Multiple streams and sites are selected to provide data to supplement any available TDEC data and to assess overall stream health. In addition to the IBI and RBP III studies, the City has used staff and interns to perform stream walks and surveys. The results of this year's IBI and RBP III studies are included in the appendix of this report.

MN-4 Training Programs

SWMP Task: Implement Monitoring Training Program for staff and/or volunteers.
Status: Ongoing

Ongoing training is necessary for staff and volunteers as part of sampling programs, stream walks, and the Adopt-a-Stream program. All new staff, interns, and volunteers will receive the appropriate training for their specific monitoring project as necessary.

5.6 TMDL IMPLEMENTATION AND ACTIVITIES

A TMDL Implementation Plan was approved by EPA on January 15, 2003 for the Fort Loudoun Lake Watershed (HUC 06010201) for the following creek systems: First Creek, Second Creek, Third Creek, Fourth Creek, and Goose Creek.

The City of Knoxville addressed the following bacteria sources and activities as required by the TMDL and permit.

Farm Animals Schedule: Complete

At the end of year two, the City contracted the CAC Americorps Water Quality Team (AWQT) to begin a study of the potential bacteria impact of farm animals on the 303(d) streams in Knoxville. Using agricultural zoning maps and GIS, the AWQT started to field verify potential livestock sites. During year two and three, they checked each site for signs of livestock

access and runoff to the creek as well as erosion caused by access. Five properties in the Third Creek watershed contained a total of 94 head of livestock, including horses and cattle. Grab samples were collected from upstream and downstream of the study sites and delivered to the State of Tennessee's Laboratory for bacteria analysis. The data was compiled and analyzed during year three but did not indicate that the livestock create a significant impact on the bacteria in the stream. In fact, two of the sampled sites showed a decrease in both fecal coliform and E. coli from the upstream sample to the downstream sample. A third property was sampled on three different dates with upstream and downstream samples. Only one of the downstream samples showed an increase in bacteria levels. The City may reevaluate the effect of livestock on urban streams in the future but at this time there is no evidence to indicate that livestock are a significant source of bacteria in Knoxville's streams. Due to codes and zoning, the properties that do contain livestock will likely shrink or be eliminated in the future.

Wild Birds — Schedule: Ongoing

During year one, the CAC Americorps Water Quality Team (AWQT) volunteered to study the biological impact that waterfowl populations have on our local waterways. The City identified 56 possible waterfowl locations that could be either a source or sink for bacteria. The AWQT visited those locations in the fall and spring, counted the number of birds, and selectively sampled for ammonia. Six sites that had a large number of waterfowl or high concentrations ammonia were analyzed for fecal Coliform and E. coli. Four sites were considered to be sources of bacterial pollution since they discharged to creeks and two were considered sinks since they had no outlet to waters. The results of the initial investigation were reported in year one.

The initial investigation reduced the original 56 possible locations down to only four sites that need to be analyzed for structural retrofit or some management control to reduce the bacteria levels entering the stream or river. Since two of those sites enter the Tennessee River directly, the City will concentrate on analyzing, designing and implementing some mitigation measure for the remaining two sites, which discharge directly into 303(d) streams listed in the bacteria TMDLs. The City has met with the property owners, a stormwater treatment unit manufacturer, and the Fort Loudon Lake Association to discuss retrofitting the outlet of the large duck pond on First Creek with a device to reduce bacteria. At TDEC's request, the project was put on hold until toxicity data could be collected on the media filter. The City also partnered with the Izaak Walton League to investigate ways to reduce waterfowl populations at the duck pond on First Creek. The IWL and the Lions Club have worked to reduce domestic duck populations. Any future progress on the analysis or mitigation measures will be reported in the future annual reports.

Domestic Pets — Status: Ongoing

The City partnered with the Izaak Walton League and Prestige Cleaners to encourage the use of pooper-scoopers in City parks and the Central Business Improvement District. A total of 36 pet waste bag dispensers are located within the City. Approximately 700 pooper-scoopers bags are restocked bi-weekly throughout the City, which indicates a successful start to our pet waste challenge downtown. Additional dispensers may be added in other parks in the future. The City has distributed pooper-scoopers to vet clinics, pet stores, and during public functions such as Bark-in-the-Park and Earth Fest. An attention-grabbing poster was placed on display at these functions to help educate the pet owners of their responsibility to manage their pet's waste. In March 2003, the City passed a pet waste ordinance (O-98-03) to require the owner or custodian of any pet to collect and remove all solid pet wastes from all areas within the CBID.

Outside dumping of animal wastes — Status: Ongoing

In year one, the City investigated possible bacterial pollution sources from the Knoxville/Knox County Animal shelter. The City helped the shelter personnel setup a maintenance schedule for quarterly inspections and annual cleanout of their Nutrient Baffle Box.

Fish/Bait Shops — Status: Complete

The City inspected Rea Springs Live Bait, Seymour Bait & Tackle, and Conservation Fisheries Inc. as possible sources of bacterial pollution. The effluent from Seymour Bait & Tackle and Conservation Fisheries Inc. discharged directly to a KUB sewer line. The effluent from Rea Springs Live Bait shop discharges to a constructed wetland and then into First Creek. Results of the bacterial sampling of the effluent entering First Creek were well below the threshold for human contact. TDEC was notified of the sampling and results.

Private Leaking Laterals — Status: Ongoing

The City has continued to coordinate with KUB to identify and correct sanitary sewer discharges as necessary. A standard procedure has been developed to insure that each possible contamination source is investigated after a problem is identified during dry weather screening. When high ammonia or fecal coliform levels are detected in the MS4, KUB and City personnel cooperate to identify the contamination source through dye testing or manhole by manhole testing. Once a source has been identified, KUB will be responsible for correcting problems in the main sanitary sewer system while the City will work with KUB and the private property

owners to correct problems on private property. These coordinated inspections have identified private residences, industries, and businesses with plumbing or floor drains connected to the MS4 instead of the sanitary sewer system. This type of close coordination with all sewer utilities is essential for solving illicit discharges to the MS4 and will likely continue throughout the new permit term.

A Memorandum of Understanding has clarified the cooperative roles and responsibilities of both the City and KUB with respect to the City's stormwater management program and compliance with the MS4 NPDES permit. A copy of the MOU was included in the appendix of the 2003/2004 annual report.

Human wastes (Outdoor Elimination by Humans) Schedule: Completed

In year two, the City implemented a survey and inventory of homeless populations in Knoxville. The Engineering Department was able to add a few questions to the survey to determine how transients use the creeks while living outdoors. The results of the survey indicate that there is likely some impact on stream water quality by homeless people.

Dr. Nooe issued the following statement regarding his homeless study for the City of Knoxville: *"In the February, 2006, survey of homelessness, we had planned to examine use of creeks and streams by those persons living in outside locations. However, finding a limited number of persons in the six camps visited, the data are incomplete. There are several observations based on visits to camps and conversations with outreach workers that I can share. Homeless camps are scattered throughout the county. Many are located in or near center city, but others can be found in various sections such as west in the Cedar Bluff and Lovell Road area. There appear to be approximately 18-20 camps along creeks and streams, with an average of 4-6 persons staying in each camp. Occasionally, someone will use the water for bathing, but the most frequent use seems to be cooling food and beverages (tying the food in a plastic bag and*
suspending it in the water). We did not observe directly using the water for disposal of waste, but the proximity suggests possible runoff."

Illicit connections to storm drain system Status: Ongoing

The Illicit Connections and Illegal Dumping Program (ILL) is an ongoing program reported in section 5.2 of this report.

6.0 MONITORING REPORTS SUMMARY

6.1 Dry-Weather Screening Program - New Outfall Inventory.

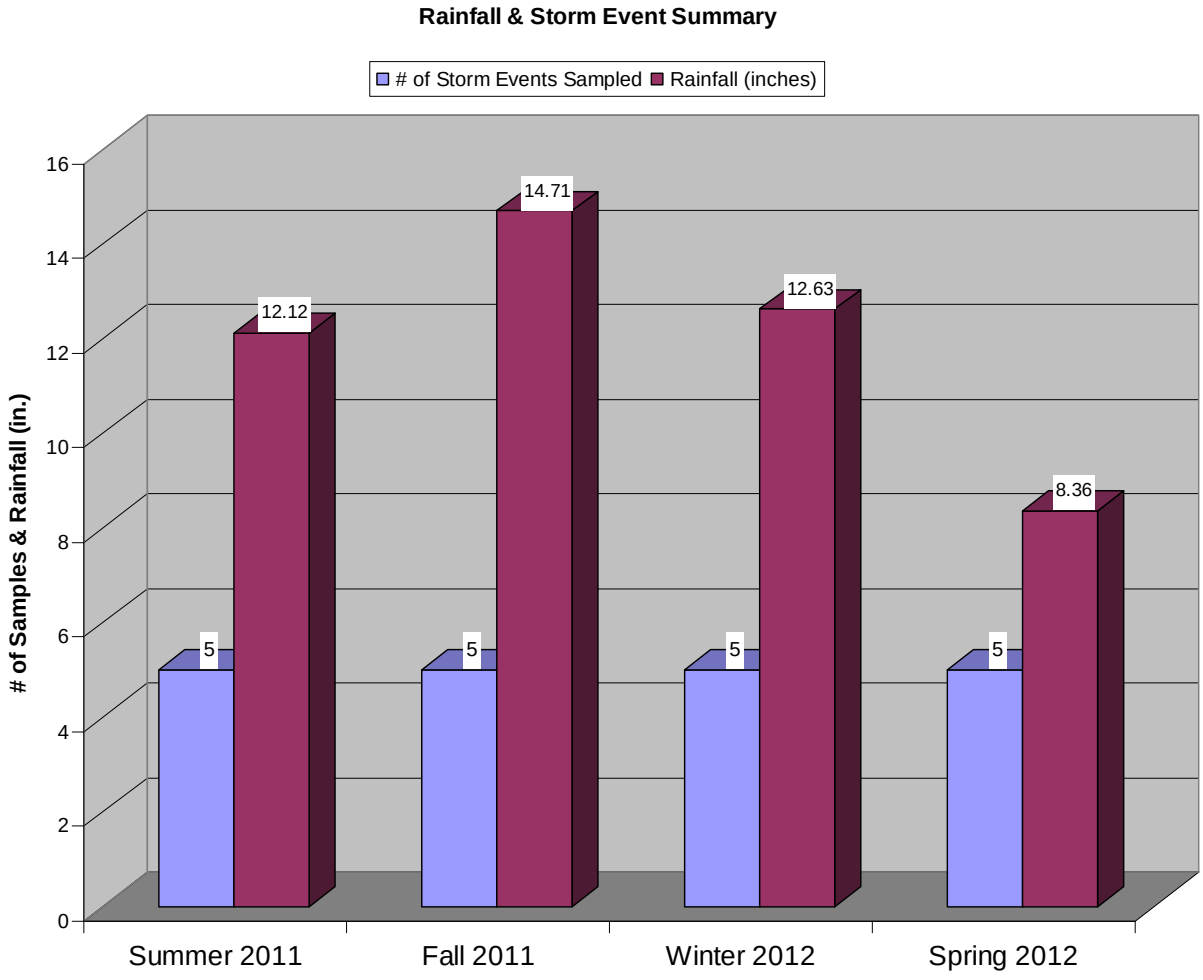
During the past permit year, no outfalls were removed from the City's outfall inventory and 0 outfalls were added. Outfalls are typically added as a result of re-development or annexations and removed as a result of drainage alterations.

All updated outfalls are clearly marked on the inventory map located in the appendix but attached separately. No new outfalls were added to the inventory this year.

6.2 Ongoing Stormwater Monitoring Program.

6.2.1 Area Rainfall Data & Storm Event Summary.

During the July 1, 2011 to June 30, 2012 monitoring period, an average of 47.82 inches of rainfall was recorded and 20 storm events were sampled from the City's five ISCO monitoring stations. Section V of the current NPDES Permit requires a sampling frequency for routine wet-weather samples of one storm event per season per station. This requirement was met. The graph below shows the relationship between the amounts of rainfall received and the number of storm events sampled per season. Monitoring data summaries for each of the sampling locations are included for TDEC's review on the following pages.



6.2.2 Laboratory Analysis Summary
First Creek Monitoring Station (KAT)

Quarter	Date	Type	pH	Flow	Rainfall amount	BOD	COD	Suspended Solids (TSS)	Dissolved Solids (TDS)	Nitrate + Nitrite nitrogen	Ammonia	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate	E. Coli	Fecal Colif.
Units				cu-ft	inches	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	cfu/100 mL	
SUMMER 2011	06-Sep	Comp	6.5	140,036,000	6.53	8.2	31	140	160	0.84	*0.10*	1.80	1.80	0.019	0.094	0.31	*0.025*	-	-
FALL 2011	16-Nov	Comp	7.0	77,832,800	1.76	*5.0*	27	42	170	0.58	*0.10*	0.50	0.50	*0.005*	0.034	0.13	0.042	-	-
WINTER 2012	02-Feb	Comp	6.0	42,208,300	0.74	*5.0*	17	45	180	1.10	*0.10*	0.61	0.61	*0.005*	*0.030*	*0.10*	0.025	-	-
SPRING 2012	27-Apr	Comp	6.0	11,846,800	0.25	*5.0*	47	99	160	0.87	*0.10*	1.00	1.00	0.012	0.049	0.15	0.052	2,420	TNTC
Sample Average			**6.4**	**67,980,975**	**2.32**	**5.8**	**30.5**	**81.5**	**167.5**	**0.85**	**0.10**	**0.98**	**0.98**	**0.0103**	**0.052**	**0.17**	**0.036**	**N/A**	**N/A**

***National NURP Study Average**	11.9	90.8	na	na	na	*****	2.35	3.31	0.18	0.176	0.16
***Characteristics of Urban Stormwater Range**	1 - 700	5 - 3,100	2 - 11,300	200 - 14,600	na	0.1 - 2.5	0.01 - 4.5	na	0.0 - 1.9	na	0.1 - 10

* Data was taken from tables 4-1 and 4-2 of the Stormwater Management for Maine: BMPS.

TNTC- too numerous to count

BDL: Results from lab procedures were below test detectable limits. Laboratory procedural limit values were used (in place of BDL) to determine averages for this report: BOD-5.0, COD-10, Ammonia-0.10, Nitrate-0.10, Organic Nitrogen-0.10, Oil & Grease-5.9, Ortho Phosphate-0.025, Total Phosphate-0.10, Kjeldahl-0.10, TDS-10, TSS-1, Lead-0.0050, Zinc-0.030

6.2.2 Laboratory Analysis Summary
Love Creek Monitoring Station

Quarter	Date	Type	pH	Flow	Rainfall amount	BOD	COD	Suspended Solids (TSS)	Dissolved Solids (TDS)	Nitrate + Nitrite nitrogen	Ammonia	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate	E. Coli	Fecal Colif.
Units				cu-ft	inches	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	cfu/100 mL	
SUMMER 2011	27-Sep	Comp	7.0	661,053	0.29	*5.0*	22	42	240	1.00	*0.10*	0.46	0.46	*0.005*	0.047	*0.10*	0.035	-	-
FALL 2011	12-Oct	Comp	7.0	298,824	0.42	*5.0*	18	15	230	0.25	0.18	0.44	0.26	*0.005*	*0.030*	*0.10*	*0.025*	-	-
WINTER 2012	27-Jan	Comp	6.0	6,583,830	0.49	*5.0*	15	35	210	1.10	*0.10*	0.30	0.30	*0.005*	*0.030*	*0.10*	0.042	-	-
SPRING 2012	14-May	Comp	6.0	5,117,390	1.29	*5.0*	56	250	110	0.31	*0.10*	1.40	1.40	0.018	0.087	0.25	*0.025*	2,420	TNTC
Sample Average			**6.5**	**3,165,274**	**0.62**	**5.00**	**27.8**	**85.5**	**197.5**	**0.67**	**0.12**	**0.65**	**0.61**	**0.0083**	**0.049**	**0.14**	**0.032**	**N/A**	**N/A**

***National NURP Study Average**	11.9	90.8	na	na	na	*****	2.35	3.31	0.18	0.176	0.16
***Characteristics of Urban Stormwater Range**	1 - 700	5 - 3,100	2 - 11,300	200 - 14,600	na	0.1 - 2.5	0.01 - 4.5	na	0.0 - 1.9	na	0.1 - 10

* Data was taken from tables 4-1 and 4-2 of the Stormwater Management for Maine: BMPS.

TNTC- too numerous to count

BDL: Results from lab procedures were below test detectable limits. Laboratory procedural limit values were used (in place of BDL) to determine averages for this report: BOD-5.0, COD-10, Ammonia-0.10, Nitrate-0.10, Organic Nitrogen-0.10, Oil & Grease-5.9, Ortho Phosphate-0.025, Total Phosphate-0.10, Kjeldahl-0.10, TDS-10, TSS-1, Lead-0.0050, Zinc-0.030

6.2.2 Laboratory Analysis Summary
Third Creek Monitoring Station

Quarter	Date	Type	pH	Flow	Rainfall amount	BOD	COD	Suspended Solids (TSS)	Dissolved Solids (TDS)	Nitrate + Nitrite nitrogen	Ammonia	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate	E. Coli	Fecal Colif.
Units				cu-ft	inches	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	cfu/100 mL	
SUMMER 2011	6-Sep	Comp	6.0	43,024,400	6.87	*5.0*	14	37	210	0.92	*0.10*	0.73	0.73	0.006	0.039	*0.10*	*0.025*	-	-
FALL 2011	6-Dec	Comp	6.0	6,853,650	0.20	*5.0*	34	87	160	0.70	*0.10*	0.54	0.54	0.019	0.120	0.20	0.071	-	-
WINTER 2012	2-Feb	Comp	6.0	5,848,150	0.77	*5.0*	49	49	180	1.00	0.13	0.78	0.65	0.009	0.052	*0.10*	0.058	-	-
SPRING 2012	1-Jun	Comp	7.0	888,964	0.50	7.9	240	76	200	1.10	0.20	1.10	0.90	0.021	0.086	0.20	0.076	2,420	TNTC
Sample Average			**6.3**	**14,153,791**	**2.09**	**5.73**	**84.3**	**62.3**	**187.5**	**0.93**	**0.13**	**0.79**	**0.71**	**0.0136**	**0.074**	**0.15**	**0.058**	**N/A**	**N/A**

***National NURP Study Average**	11.9	90.8	na	na	na	*****	2.35	3.31	0.18	0.176	0.16
***Characteristics of Urban Stormwater Range**	1 - 700	5 - 3,100	2 - 11,300	200 - 14,600	na	0.1 - 2.5	0.01 - 4.5	na	0.0 - 1.9	na	0.1 - 10

* Data was taken from tables 4-1 and 4-2 of the Stormwater Management for Maine: BMPS.

TNTC- too numerous to count

BDL: Results from lab procedures were below test detectable limits. Laboratory procedural limit values were used (in place of BDL) to determine averages for this report: BOD-5.0, COD-10, Ammonia-0.10, Nitrate-0.10, Organic Nitrogen-0.10, Oil & Grease-5.9, Ortho Phosphate-0.025, Total Phosphate-0.10, Kjeldahl-0.10, TDS-10, TSS-1, Lead-0.0050, Zinc-0.030

6.2.2 Laboratory Analysis Summary
Williams Creek Monitoring Station

Quarter	Date	Type	pH	Flow	Rainfall amount	BOD	COD	Suspended Solids (TSS)	Dissolved Solids (TDS)	Nitrate + Nitrite nitrogen	Ammonia	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate	E. Coli	Fecal Colif.
Units				cu-ft	inches	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	cfu/100 mL	
SUMMER 2011	06-Sep	Comp	6.5	16,114,600	0.73	8.9	18	470	180	1.10	*0.10*	1.70	1.70	0.029	0.092	0.39	0.044	-	-
FALL 2011	04-Nov	Comp	6.5	42,830,000	0.78	*5.0*	*10*	10	230	1.20	*0.10*	0.12	0.12	*0.005*	0.032	*0.10*	*0.025*	-	-
WINTER 2012	27-Jan	Comp	6.0	29,864,500	0.46	*5.0*	23	24	220	1.20	*0.10*	0.24	0.24	0.013	0.031	*0.10*	0.043	-	-
SPRING 2012	14-May	Comp	6.5	49,856,900	2.07	*5.0*	24	21	220	1.10	*0.10*	0.40	0.40	0.010	*0.030*	*0.10*	*0.025*	2,420	TNTC
Sample Average			**6.4**	**34,666,500**	**1.01**	**6.0**	**18.8**	**131.2**	**212.5**	**1.15**	**0.10**	**0.62**	**0.62**	**0.0143**	**0.046**	**0.17**	**0.034**	**N/A**	**N/A**

***National NURP Study Average**	11.9	90.8	na	na	na	*****	2.35	3.31	0.18	0.176	0.16
***Characteristics of Urban Stormwater Range**	1 - 700	5 - 3,100	2 - 11,300	200 - 14,600	na	0.1 - 2.5	0.01 - 4.5	na	0.0 - 1.9	na	0.1 - 10

* Data was taken from tables 4-1 and 4-2 of the Stormwater Management for Maine: BMPS.

TNTC- too numerous to count

BDL: Results from lab procedures were below test detectable limits. Laboratory procedural limit values were used (in place of BDL) to determine averages for this report: BOD-5.0, COD-10, Ammonia-0.10, Nitrate-0.10, Organic Nitrogen-0.10, Oil & Grease-5.9, Ortho Phosphate-0.025, Total Phosphate-0.10, Kjeldahl-0.10, TDS-10, TSS-1, Lead-0.0050, Zinc-0.030

6.2.2 Laboratory Analysis Summary
First Creek Monitoring Station (KAT)

Quarter	Date	Type	pH	Flow	Rainfall amount	BOD	COD	Suspended Solids (TSS)	Dissolved Solids (TDS)	Nitrate + Nitrite nitrogen	Ammonia	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate	E. Coli	Fecal Colif.
Units				cu-ft	inches	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	cfu/100 mL	
SUMMER 2011	06-Sep	Comp	6.5	140,036,000	6.53	8.2	31	140	160	0.84	*0.10*	1.80	1.80	0.019	0.094	0.31	*0.025*	-	-
FALL 2011	16-Nov	Comp	7.0	77,832,800	1.76	*5.0*	27	42	170	0.58	*0.10*	0.50	0.50	*0.005*	0.034	0.13	0.042	-	-
WINTER 2012	02-Feb	Comp	6.0	42,208,300	0.74	*5.0*	17	45	180	1.10	*0.10*	0.61	0.61	*0.005*	*0.030*	*0.10*	0.025	-	-
SPRING 2012	27-Apr	Comp	6.0	11,846,800	0.25	*5.0*	47	99	160	0.87	*0.10*	1.00	1.00	0.012	0.049	0.15	0.052	2,420	TNTC
Sample Average			**6.4**	**67,980,975**	**2.32**	**5.8**	**30.5**	**81.5**	**167.5**	**0.85**	**0.10**	**0.98**	**0.98**	**0.0103**	**0.052**	**0.17**	**0.036**	**N/A**	**N/A**

***National NURP Study Average**	11.9	90.8	na	na	na	*****	2.35	3.31	0.18	0.176	0.16
***Characteristics of Urban Stormwater Range**	1 - 700	5 - 3,100	2 - 11,300	200 - 14,600	na	0.1 - 2.5	0.01 - 4.5	na	0.0 - 1.9	na	0.1 - 10

* Data was taken from tables 4-1 and 4-2 of the Stormwater Management for Maine: BMPS.

TNTC- too numerous to count

BDL: Results from lab procedures were below test detectable limits. Laboratory procedural limit values were used (in place of BDL) to determine averages for this report: BOD-5.0, COD-10, Ammonia-0.10, Nitrate-0.10, Organic Nitrogen-0.10, Oil & Grease-5.9, Ortho Phosphate-0.025, Total Phosphate-0.10, Kjeldahl-0.10, TDS-10, TSS-1, Lead-0.0050, Zinc-0.030

6.2.2 Laboratory Analysis Summary
Walden Drive Monitoring Station

Quarter	Date	Type	pH	Flow	Rainfall amount	BOD	COD	Suspended Solids (TSS)	Dissolved Solids (TDS)	Nitrate + Nitrite nitrogen	Ammonia	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate	E. Coli	Fecal Colif.
Units				cu-ft	inches	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	cfu/100 mL	
SUMMER 2011	06-Sep	Comp	6.0	3,359,230	6.16	*5.0*	*10*	140	100	0.47	*0.10*	0.94	0.94	0.008	0.075	0.16	0.046	-	-
FALL 2011	12-Oct	Comp	7.0	642,292	0.37	*5.0*	72	69	210	0.80	*0.10*	0.78	0.78	*0.005*	0.043	0.16	0.150	-	-
WINTER 2012	27-Jan	Comp	6.0	1,027,390	0.51	*5.0*	33	68	120	0.52	*0.10*	0.53	0.53	0.007	0.059	0.13	0.069	-	-
SPRING 2012	27-Apr	Comp	6.0	1,087,825	0.54	8.7	77	180	100	0.60	0.16	1.40	1.20	0.012	0.110	0.15	0.140	575	TNTC
Sample Average			**6.3**	**1,529,184**	**1.90**	**5.93**	**48.0**	**114.3**	**132.5**	**0.60**	**0.12**	**0.91**	**0.86**	**0.0080**	**0.072**	**0.15**	**0.101**	**N/A**	**N/A**

***National NURP Study Average**	11.9	90.8	na	na	na	*****	2.35	3.31	0.180	0.176	0.16
***Characteristics of Urban Stormwater Range**	1 - 700	5 - 3,100	2 - 11,300	200 - 14,600	na	0.1 - 2.5	0.01 - 4.5	na	0.0 - 1.9	na	0.1 - 10

* Data was taken from tables 4-1 and 4-2 of the Stormwater Management for Maine: BMPS.

TNTC- too numerous to count

BDL: Results from lab procedures were below test detectable limits. Laboratory procedural limit values were used (in place of BDL) to determine averages for this report: BOD-5.0, COD-10, Ammonia-0.10, Nitrate-0.10, Organic Nitrogen-0.10, Oil & Grease-5.9, Ortho Phosphate-0.025, Total Phosphate-0.10, Kjeldahl-0.10, TDS-10, TSS-1, Lead-0.0050, Zinc-0.030

6.2.2 Laboratory Analysis Summary

Municipal Wet Weather Sampling Results

Point Source Sample Site	Period/Unit	Date	Type	pH	BOD	COD	Suspended Solids (TSS)	Dissolved Solids (TDS)	Nitrate + Nitrite nitrogen	Ammonia	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate	Oil/ Grease	E. Coli	Fecal Colif.
					mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	CFU/100ml	
KAT	Annual	21-Nov	Grab	6.0	48.0	100	21	40	0.16	0.12	0.61	0.49	0.0075	0.100	0.19	0.100	51.0	-	-
Loraine Street Treatment Units	Pretreated	21-Nov	Grab	5.0	6.2	31	15	30	*0.10*	*0.10*	0.38	0.38	0.0083	0.061	0.14	0.100	6.8	-	-
	East Suntree	21-Nov	Grab	5.0	6.4	41	44	44	*0.10*	*0.10*	0.51	0.51	0.0097	0.064	0.25	0.085	7.4	-	-
	West Baysaver	21-Nov	Grab	5.0	16.0	79	54	72	0.12	0.31	0.93	0.62	0.0140	0.098	0.32	0.180	14.0	-	-
Transfer Station	Pretreated	21-Nov	Grab	8.0	-	-	436	-	-	-	-	-	-	-	-	-	-	3,450	6,000
	Treated	21-Nov	Grab	8.0	-	-	157	-	-	-	-	-	-	-	-	-	-	3,680	2,000
	Pretreated	16-Feb	Grab	6.0	-	-	537	-	-	-	-	-	-	-	-	-	-	32,820	57,000
	Treated	16-Feb	Grab	6.0	-	-	260	-	-	-	-	-	-	-	-	-	-	51,720	70,000
	Pretreated	21-May	Grab	6.0	-	-	144	-	-	-	-	-	-	-	-	-	-	57,940	70,000
	Treated	21-May	Grab	6.0	-	-	132	-	-	-	-	-	-	-	-	-	-	32,550	60,000
Average				**6.1**	**19.2**	**62.8**	**180.0**	**46.5**	**0.12**	**0.16**	**0.61**	**0.50**	**0.0099**	**0.081**	**0.23**	**0.116**	**19.8**	**30,360**	**44,167**
*National NURP Study Average					11.9	90.8	na	na	na	*****	2.35	3.31	0.18	0.176	0.16				
*Characteristics of Urban Stormwater Range					1 - 700	5 - 3,100	2 - 11,300	200 - 14,600	na	0.1 - 2.5	0.01 - 4.5	na	0.0 - 1.9	na	0.1 - 10				

* Data was taken from tables 4-1 and 4-2 of the Stormwater Management for Maine: BMPS.

BDL: Results from lab procedures were below test detectable limits. Laboratory procedural limit values were used (in place of BDL) to determine averages for this report: BOD-5.0, COD-10, Ammonia-0.10, Nitrate-0.10, Organic Nitrogen-0.10, Oil & Grease-5.9, Ortho Phosphate-0.025, Total Phosphate-0.10, Kjeldahl-0.10, TDS-10, TSS-1, Lead-0.0050, Zinc-0.030

6.2.2 Laboratory Analysis Summary

Commercial Facilities Wet Weather Sampling Results

Point Source Sample Site	Location	Date	Type	pH	BOD	COD	Suspended Solids (TSS)	Dissolved Solids (TDS)	Nitrate + Nitrite nitrogen	Ammonia	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate	Oil/ Grease
					mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Blue Skies Carwash	Gallaher View Rd	11/21/11	Grab	6.0	9.8	160	190.0	72	0.58	0.28	2.50	2.20	0.0250	0.380	0.51	0.260	*5.9*
Broadway Carwash	5622 N. Broadway	12/16/11	Grab	5.0	*5.0*	33	56.0	45	*0.10*	*0.10*	0.53	0.53	0.0110	0.068	0.15	0.120	*5.9*
3-Min Carwash	4725 N. Broadway	12/16/11	Grab	5.0	*5.0*	20	64.0	66	0.14	*0.10*	0.32	0.32	0.0068	0.078	0.12	*0.025*	*5.9*
Simonize Carwash	Kingston Pike	12/16/11	Grab	5.5	*5.0*	12	9.1	43	*0.10*	*0.10*	0.16	0.16	*0.0050*	0.047	0.13	0.077	*5.9*
Sutherland Carwash	Sutherland Ave	12/16/11	Grab	5.0	*5.0*	14	7.5	37	0.22	*0.10*	0.23	0.23	*0.0050*	0.034	0.11	*0.025*	*5.9*
Western Carwash	3500 Western Ave	6/11/12	Grab	5.5	5.6	69	100.0	110	0.33	0.11	1.30	1.20	0.0140	0.150	0.67	0.600	*5.9*
Diamond Carwash	4605 Chapman Hwy	6/11/12	Grab	6.0	15.0	240	400.0	160	0.20	0.27	3.00	2.70	0.0810	0.440	0.73	0.650	7.6
Shamrock Mulch Co	Untreated	6/1/12	Grab	8.0	260.0	1700	-	-	-	-	-	-	-	-	-	-	-
Shamrock Mulch Co	PAM Treated	6/1/12	Grab	8.0	350.0	1600	-	-	-	-	-	-	-	-	-	-	-
Average				**6.0**	**73.4**	**427.6**	**118.1**	**76.1**	**0.24**	**0.15**	**1.15**	**1.05**	**0.0211**	**0.171**	**0.35**	**0.251**	**6.1**
*National NURP Study Average					11.9	91	na	na	na	*****	2.35	3.31	0.18	0.176	0.16		
*Characteristics of Urban Stormwater Range					1 - 700	5 - 3,100	2 - 11,300	200 - 14,600	na	0.1 - 2.5	0.01 - 4.5	na	0.0 - 1.9	na	0.1 - 10		

* Data was taken from tables 4-1 and 4-2 of the Stormwater Management for Maine: BMPS.

BDL: Results from lab procedures were below test detectable limits. Laboratory procedural limit values were used (in place of BDL) to determine averages for this report: BOD-5.0, COD-10, Ammonia-0.10, Nitrate-0.10, Organic Nitrogen-0.10, Oil & Grease-5.9, Ortho Phosphate-0.025, Total Phosphate-0.10, Kjeldahl-0.10, TDS-10, TSS-1, Lead-0.0050, Zinc-0.030

6.2.2 Laboratory Analysis Summary

Laboratory Analysis Summary - Seasonal Storm Sampling Program

July 1, 2011 thru June 30, 2012

Site	Quarter	pH	Average Sampled Volume	Rainfall per Event	BOD	COD	Total Suspended Solids (TSS)	Total Dissolved Solids (TDS)	Nitrate + Nitrite nitrogen	Ammonia nitrogen	Total Kjeldahl nitrogen	Total organic nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate
Units			cu-ft	inches	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
KAT First Creek	Sum '11	6.5	140,036,000	6.53	8.2	31	140	160	0.84	*0.10*	1.80	1.80	0.019	0.094	0.31	*0.025*
	Fall '11	7.0	77,832,800	1.76	*5.0*	27	42	170	0.58	*0.10*	0.50	0.50	*0.005*	0.034	0.13	0.042
	Wtr '12	6.0	42,208,300	0.74	*5.0*	17	45	180	1.10	*0.10*	0.61	0.61	*0.005*	*0.030*	*0.10*	0.025
	Spr '12	6.0	11,846,800	0.25	*5.0*	47	99	160	0.87	*0.10*	1.00	1.00	0.012	0.049	0.15	0.052
Average:		**6.4**	**67,980,975**	**2.32**	**5.80**	**30.5**	**81.5**	**167.5**	**0.85**	**0.10**	**0.98**	**0.98**	**0.0103**	**0.052**	**0.17**	**0.036**
Love Creek	Sum '11	7.0	661,053	0.29	*5.0*	22	42	240	1.00	*0.10*	0.46	0.46	*0.005*	0.047	*0.10*	0.035
	Fall '11	7.0	298,824	0.42	*5.0*	18	15	230	0.25	0.18	0.44	0.26	*0.005*	*0.030*	*0.10*	*0.025*
	Wtr '12	6.0	6,583,830	0.49	*5.0*	15	35	210	1.10	*0.10*	0.30	0.30	*0.005*	*0.030*	*0.10*	0.042
	Spr '12	6.0	5,117,390	1.29	*5.0*	56	250	110	0.31	*0.10*	1.40	1.40	0.018	0.087	0.25	*0.025*
Average:		**6.5**	**3,165,274**	**0.62**	**5.00**	**27.8**	**85.5**	**197.5**	**0.67**	**0.12**	**0.65**	**0.61**	**0.0083**	**0.049**	**0.14**	**0.032**
Third Creek	Sum '11	6.0	43,024,400	6.87	*5.0*	14	37	210	0.92	*0.10*	0.73	0.73	0.006	0.039	*0.10*	*0.025*
	Fall '11	6.0	6,853,650	0.20	*5.0*	34	87	160	0.70	*0.10*	0.54	0.54	0.019	0.120	0.20	0.071
	Wtr '12	6.0	5,848,150	0.77	*5.0*	49	49	180	1.00	0.13	0.78	0.65	0.009	0.052	*0.10*	0.058
	Spr '12	7.0	888,964	0.50	7.9	240	76	200	1.10	0.20	1.10	0.90	0.021	0.086	0.20	0.076
Average:		**6.3**	**14,153,791**	**2.09**	**5.73**	**84.3**	**62.3**	**187.5**	**0.93**	**0.13**	**0.79**	**0.71**	**0.0136**	**0.074**	**0.15**	**0.058**
Walden Drive Fourth Creek	Sum '11	6.0	3,359,230	6.16	*5.0*	*10*	140	100	0.47	*0.10*	0.94	0.94	0.008	0.075	0.16	0.046
	Fall '11	7.0	642,292	0.37	*5.0*	72	69	210	0.80	*0.10*	0.78	0.78	*0.005*	0.043	0.16	0.150
	Wtr '12	6.0	1,027,390	0.51	*5.0*	33	68	120	0.52	*0.10*	0.53	0.53	0.007	0.059	0.13	0.069
	Spr '12	6.0	1,087,825	0.54	8.7	77	180	100	0.60	0.16	1.40	1.20	0.012	0.110	0.15	0.140
Average:		**6.3**	**1,529,184**	**1.90**	**5.93**	**48.0**	**114.3**	**132.5**	**0.60**	**0.12**	**0.91**	**0.86**	**0.0080**	**0.072**	**0.15**	**0.101**
Williams Creek	Sum '11	6.5	16,114,600	0.73	8.9	18	470	180	1.10	*0.10*	1.70	1.70	0.029	0.092	0.39	0.044
	Fall '11	6.5	42,830,000	0.78	*5.0*	*10*	10	230	1.20	*0.10*	0.12	0.12	*0.005*	0.032	*0.10*	*0.025*
	Wtr '12	6.0	29,864,500	0.46	*5.0*	23	24	220	1.20	*0.10*	0.24	0.24	0.013	0.031	*0.10*	0.043
	Spr '12	6.5	49,856,900	2.07	*5.0*	24	21	220	1.10	*0.10*	0.40	0.40	0.010	*0.030*	*0.10*	*0.025*
Average:		**6.4**	**34,666,500**	**1.01**	**5.98**	**18.8**	**131.2**	**212.5**	**1.15**	**0.10**	**0.62**	**0.62**	**0.0143**	**0.046**	**0.17**	**0.034**
National NURP Study Average					11.9	90.8	na	na	na	*****	2.35	3.31	0.18	0.176	0.16	
Characteristics of Urban Stormwater Range					1 - 700	5 - 3,100	2 - 11,300	200 - 14,600	na	0.1 - 2.5	0.01 - 4.5	na	0.0 - 1.9	na	0.1 - 125	

-Winter (Jan., Feb., and March); Spring (April, May, and June); Summer (July, Aug., and Sept.); Fall (Oct., Nov., and Dec.)

-The Characteristics of Urban Stormwater and National NURP Study Average data was taken from tables 4-1 and 4-2 of the Stormwater Management for Maine: BMPS

BDL: Results from lab procedures were below test detectable limits. Laboratory procedural limit values were used (in place of BDL) to determine averages for this report: BOD-5.0, COD-10, Ammonia-0.10, Nitrate-0.10, Organic Nitrogen-0.10, Oil & Grease-5.9, Ortho Phosphate-0.025, Total Phosphate-0.10, Kjeldahl-0.10, TDS-10, TSS-1, Lead-0.0050, Zinc-0.030

6.2.3 Noncompliance.

The City of Knoxville has complied with all permit requirements.

6.2.4 Estimated Runoff from Major Watersheds within the MS4 Area.

Part VI (A)(2)(e)(i)(3) of the NPDES permit requires an estimate of the total volume of urban runoff discharged by the City of Knoxville for the year. This estimate is to be based on total rainfall for the year and the estimated imperviousness of different land uses. The total rainfall for the year was determined to be an average of the annual rainfall recorded during the year from the City's five stormwater monitoring stations located throughout the city and the National Weather Service's rain gage at the McGhee Tyson Airport. The average recorded annual rainfall amount was 47.82 inches.

To estimate the total runoff volume, the City utilized the GIS to determine approximate areas for each watershed within the city limits along with the corresponding land uses. Each land use is assigned an approximated impervious percentage according to the Camp Dresser and McKee Watershed Management Model described in the Part 2 application, pages 4-14 to 4-18.

It was assumed for each watershed that 95 percent of the rainfall from the impervious fraction, and 15 percent of the rainfall from the pervious fraction of each land use was converted to runoff. Therefore the impervious runoff coefficient and the pervious runoff coefficient were assumed to be 0.95 and 0.15, respectively. For example, based upon an average annual rainfall volume of 47.82 inches/year, the average annual runoff from a single-family residential land use (25% impervious) is 15.05 in/yr (47.82*[(0.15*0.75)+(0.95*0.25)]). The runoff coefficient for a single land use is the sum of the impervious percentage multiplied times the impervious runoff coefficient plus the pervious percentage multiplied by the pervious runoff coefficient. For the previous example, the average runoff coefficient for the single-family residential land use is 0.35 ([0.15*0.75]+[0.95*0.25]). For a watershed, the average runoff coefficient is an area weighted average of each land use runoff coefficients times the percentage of the area of each land use.

The runoff from the major watersheds within the MS4 area was estimated by a formula in Camp Dresser & Mckee's Watershed Management Module shown below:

$Qi = P \times Ci \times Ai$

Where,

P = total precipitation (inches/year)

C = land use area weighted runoff coefficient = 0.15*Pervious% + 0.95*Impervious%

A = drainage area (acres) = acres x (43,560 ft2/acre) = ft2

$Q = \Sigma Qi$ = total runoff rate / 1,000,000 = Mgal

$Q_{tot\ 11/12}$ = **36,175** Million Gallons

Please find the analysis for the each watershed and for the entire city in table 6.2.4 on the following page.

6.2.4 ESTIMATED RUNOFF FROM MAJOR WATERSHEDS WITHIN THE MS4

July 1, 2011 - June 30, 2012

Watershed	Agricul./ Forest/ Vacant, Public Parks	Vacant (>10)	Rural Res.	Single Family Res.	Private Rec., Public Land	Multi-Family Res., Church	Insti-tutional	Mining, Office/ Service	Manu-facturing/ Whole-sale	Commer., Trans./ Utility/ Commun.	Major Roads/ Hwys/ ROWs	Under Const	Not Loaded	Total Acres in Watershed	Acres in the City Limits	Est. % Imperv-ious	C Value	Total Rainfall during 08/09 (in./yr)	Total Runoff for 08/09 (Mgal/yr)
Baker Cr.	412	2	107	640	90	77	32	1	1	3	269	13	27	1,674	1,674	32	0.41	47.82	887
East Fork	313	0	10	475	302	78	73	31	195	235	584	33	180	2,509	2,509	53	0.57	47.82	1,866
First Cr.	724	0	300	3,152	544	501	110	157	127	556	1,412	51	116	7,750	7,750	44	0.50	47.82	5,023
Fourth Cr.	965	57	423	2,026	468	406	93	206	201	568	881	61	414	6,769	5,920	41	0.48	47.82	3,670
Goose Cr.	639	40	126	669	213	67	8	21	77	131	327	34	29	2,381	1,755	35	0.43	47.82	975
Grassy Cr.	2,230	176	561	610	215	24	0	14	31	95	211	39	95	4,301	433	17	0.29	47.82	161
Holston R.	2,362	69	371	1,222	417	45	5	2	219	33	805	32	50	5,632	2,455	28	0.37	47.82	1,184
Inman Br.	563	33	214	138	4	12	0	0	0	0	145	0	34	1,143	99	21	0.31	47.82	40
Knob Cr.	1,719	195	481	843	125	84	1	19	1	29	296	4	169	3,966	989	19	0.30	47.82	391
Knob Fork	1,659	26	398	675	182	56	5	93	6	124	257	19	252	3,752	823	22	0.33	47.82	350
Love Cr.	1,735	102	505	1,625	311	212	51	94	178	408	1,038	46	103	6,408	5,090	36	0.44	47.82	2,915
Second Cr.	443	0	90	1,281	346	247	29	107	140	542	1,161	35	82	4,503	4,498	53	0.57	47.82	3,335
Sinking Cr.	1,614	146	459	1,266	284	90	17	33	31	267	881	12	347	5,447	2,434	33	0.41	47.82	1,311
Swanpond C	3,892	303	833	604	121	36	4	79	240	232	457	65	285	7,151	499	19	0.30	47.82	197
Ten Mile Cr.	1,879	0	638	3,421	165	895	55	115	58	615	1,500	24	641	10,006	3,921	38	0.45	47.82	2,294
Third Cr.	1,757	79	436	3,003	406	512	184	124	225	443	1,252	98	220	8,739	8,417	37	0.45	47.82	4,882
TN River	7,197	503	2,269	4,681	2,910	403	187	72	170	238	990	121	1,113	20,854	8,232	22	0.33	47.82	3,499
Toll Cr.	535	69	154	222	42	26	1	0	37	4	93	42	4	1,229	767	22	0.32	47.82	321
Turkey Cr.	3,353	235	603	2,693	264	343	121	104	91	442	1,161	68	738	10,216	1,677	29	0.38	47.82	837
Whites Cr.	2,733	154	782	1,298	575	59	31	11	49	126	608	51	578	7,055	1,634	23	0.34	47.82	715
Williams Cr.	358	11	47	561	46	96	125	17	10	61	276	3	30	1,641	1,605	37	0.45	47.82	938
Woods Cr.	1,220	106	281	371	0	26	0	2	140	43	261	1	157	2,608	143	23	0.33	47.82	62
Sink-East	1,226	0		728	9	17	0	17	3	27	0	0	0	2,027	91	12	0.24	47.82	29
Beaver Cr	21,174	0	0	21,230	1,292	845	4	259	283	712	0	160	0	45,959	162	16	0.28	47.82	59
Tuckahoe	4,293	0	0	1,829	18	14	0	8	2	1	0	4	0	6,169	229	8	0.22	47.82	65
Fr.Broad riv	8,954	0	0	2,744	73	40	24	24	497	117	0	166	0	12,639	551	11	0.24	47.82	171
COK Total	73,949	2,306	10,088	58,007	9,422	5,211	1,160	1,610	3,012	6,052	14,865	1,182	5,664	192,528	64,357				**36,175**

The runoff from the major watersheds within the MS4 area was estimated by a formula in Camp Dresser & Mckee's Watershed Management Module. Q = P x C x A

where, P = total precipitation (inches/year) =47.82 in./yr. = 3.99 ft./yr.

C = land use area weighted runoff coefficient = 0.15*Pervious% + 0.95*Impervious%

A = drainage area (acres) = acres in watershed x (4.35E4 ft2/acre) = Ai ft2

Q = total runoff rate = sum of each watershed's Qi.

Total estimated runoff for Year Five = 36,175 Mgal

Approximate area and land use for each watershed was determined through the City's GIS. Total yearly rainfall amount was determined by averaging the amount of rain collected from the City's five monitoring stations located throughout the city (refer to map in appendix). Runoff coefficient (C) was calculated by adding 15 % of the pervious fraction to 95% of the impervious fraction in each watershed. This assumes that the fraction of rainfall producing runoff is 15% and 95% from pervious and impervious surfaces respectively. The summary of the runoff calculations are provided in the table above. Calculations for some of the watersheds were left out due to the insignificant amount of runoff that would be produced.

7.0 ASSESSMENT OF CONTROLS: ESTIMATED POLLUTANT LOADING REDUCTIONS FROM THE MS4.

Since the NPDES permit was first issued in 1996, the City of Knoxville has developed and implemented all of the scheduled programs. The ongoing monitoring program and the dry weather-screening program were started during the 1996-1997 permit year. Each required program has been implemented annually since that time. Data has been collected, analyzed, and archived for future reference.

Quantitative estimates of pollutant loads and event mean concentrations (EMC) were reported as required in the fifth annual report for each permit term. The new estimates have lower EMC values for BOD, COD, TSS, TKN, Pb and Zn. In addition, the new estimates have higher EMC values for N+NN and DP. However, as described in the dry weather-screening program (ILL-2), noticeable reductions in contaminated outfalls have been observed since the program began.

Although testing data may not be available to substantiate all of the illicit discharges and illegal dumping problems, which have been resolved, the qualitative effect on water quality within the MS4 and Waters-of-the State are irrefutable. Many industries have removed illicit discharges, homeowners and utilities have replaced sections of leaking or broken sanitary sewers, the last known sections of the combined sewers were separated, unknown combined sewer systems have been located and planned for repair, creek restoration and cleanup activities have begun, and many educational and volunteer programs have been sponsored, conducted, and/or coordinated to reduce dumping.

Structural controls for water quality control include stormwater treatment facilities on most new development and significant redevelopment throughout the city since 1997. Covenants are in place to require that these water quality facilities are maintained and/or replaced as needed. The City has also installed oil/water separators and/or stormwater treatment devices at the following locations: the KAT bus facility on First Creek, Victor Ashe Park, Northwest Crossing regional detention pond, the Prosser Road garage, the Loraine Street Public Works facility, and the Solid Waste Transfer Station. The City is planning new structural controls at the Solid Waste Transfer Station during this permit term. Floating trash skimmers were installed near the mouth of some major creeks to prevent floating pollutants from discharging to the river. The Fort Loudon Lake Association has been contracted to maintain and replace the skimmers as needed.

All of the programs implemented to improve water quality in the creeks and river throughout the city should provide some quantitative evidence of improvement in future years. This data will be reported, as it becomes apparent.

8.0 SUMMARY OF MODIFICATIONS TO THE SWMP.

As expected, the new permit created several modifications to the existing SWMP. The City did not install any new monitoring stations during this permit year. The current locations for all of the monitoring stations are shown on the detailed inventory map in the appendix. Future locations will be reported in each annual report.

9.0 FISCAL ANALYSIS

The Fiscal Analysis for this annual report will list the permit year budget sources and amounts along with estimates for the following permit year. Sources of funds are listed for each major program. Due to complexity, all of the support activities such as purchasing, payroll, legal support, information systems, fleet management, and human resources are not reflected in the table. Future funding sources may change if a stormwater utility fee is implemented.

Program Description	**Fund Source**	**Actual FY 11/12**	**Est. FY 12/13**
Solid Waste Recycling (includes: composting, education, staff, etc.)	Fund 230	$2,446,573	$2,757,573
Household Hazardous Waste Facility	Fund 230	$155,408	$180,000
Stormwater Mgmt Operating expenses	Fund 220	$2,121,053	$2,853,160
Public Service operating/maintenance (brush/leaf/litter pickup; street cleaning; curb/gutter repair; stormdrain/catch basin cleaning, repair, & installation; ditching; seed/sod in R.O.W.; grate replacement; water pumping; tree trimming, removal, and planting.)	General Fund 100	$6,176,859	$5,000,000
First Creek Restoration/Improvements	Mixed	$496,259	$80,000
Lake Ave/Drainage Improvements	Fund 401	$180,349	Complete
Emily Avenue Sinkhole Project	Fund 401	$2,000	$90,000
Cross Park Dr. Drainage Improvement	Fund 401	$0	$2,700,000
Prosser Rd Drainage Improvements	Fund 401	$24,796	$475,000
MLK Jr./Chestnut MS4	Fund 401	$39,677	$1,100,000
Water Quality Improvements	Fund 401	$208,396	$850,000
Middlebrook Pk. Channel Stablization	Fund 401	$0	$90,000
First Creek Water Quality Model	Fund 401	$134,330	$115,000
Neighborhood Drainage Projects	Fund 401	$179,990	$1,600,000
Total Estimated Stormwater Costs		**$12,165,690**	**$17,890,733**

APPENDIX A

Dry Weather Screening Results Summary

1. List of outfalls tested during the permit year with status (27 pages)
2. Table of testing results for outfalls with dry-weather flow (6 pages)

Dry Weather Screening Data for 2012

Outfall Permit Year	Date	Visit #	Flow ?	Flow Rate (gpm)	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Fecal Sample (mpn/100ml)	Turbidity (ntu)	Color	Odor?	Surface Scum	Oil Sheen
00-100-0115																
2012	2/27/12	1	No													
2012	2/27/12	2	No													
2012	5/1/12	3	No													
2012	5/1/12	4	No													
00-100-0140																
2012	2/27/12	1	No													
2012	2/27/12	2	No													
2012	5/1/12	3	No													
2012	5/1/12	4	No													
00-100-0180																
2012	1/25/12	3	No													
2012	2/21/12	1	No													
2012	2/22/12	2	No													
2012	5/1/12	4	No													
00-100-0185																
2012	2/21/12	1	No													
2012	2/22/12	2	No													
2012	5/1/12	3	No													
2012	5/1/12	4	No													
00-400-0193																
2012	2/21/12	1	No													
2012	2/21/12	2	No													
2012	4/30/12	3	No													
2012	4/30/12	4	No													

Outfall *Permit Year*	*Date*	*Visit #*	*Flow ?*	*Flow Rate (gpm)*	*pH (su)*	*Chlorine (ppm)*	*Copper (ppm)*	*Phenol (ppm)*	*Detergents (ppm)*	*Ammonia (ppm)*	*Fecal Sample (mpn/100ml)*	*Turbidity (ntu)*	*Color*	*Odor?*	*Surface Scum*	*Oil Sheen*
00-400-0194																
2012	2/21/12	1	No													
2012	2/21/12	2	No													
2012	4/30/12	3	No													
2012	4/30/12	4	No													
00-400-0196																
2012	2/21/12	1	No													
2012	2/21/12	2	No													
2012	4/30/12	3	No													
2012	4/30/12	4	No													
00-400-0197																
2012	2/21/12	3	No													
2012	2/21/12	4	No													
2012	4/30/12	1	No													
2012	4/30/12	2	No													
00-300-0240																
2012			No													
2012	2/21/12	1	No													
2012	2/21/12	3	No													
2012	2/21/12	4	No													
2012	4/30/12	1	No													
2012	4/30/12	2	No													
2012	4/30/12	2	No													
00-300-0260																
2012	2/21/12	1	No													
2012	2/21/12	2	No													
2012	4/23/12	3	No													
2012	4/24/12	4	No													

Outfall *Permit Year*	*Date*	*Visit #*	*Flow ?*	*Flow Rate (gpm)*	*pH (su)*	*Chlorine (ppm)*	*Copper (ppm)*	*Phenol (ppm)*	*Detergents (ppm)*	*Ammonia (ppm)*	*Fecal Sample (mpn/100ml)*	*Turbidity (ntu)*	*Color*	*Odor?*	*Surface Scum*	*Oil Sheen*
00-100-0300																
2012	2/13/12	1	No													
2012	2/13/12	2	No													
2012	4/23/12	3	No													
2012	4/24/12	4	No													
00-300-0385																
2012	2/21/12	1	No													
2012	2/21/12	2	No													
2012	2/21/12	3	No													
2012	4/23/12	4	No													
00-300-0412																
2012	2/7/12	1	No													
2012	2/7/12	2	No													
2012	4/23/12	3	No													
2012	4/24/12	4	No													
00-400-0413																
2012	2/7/12	1	No													
2012	2/7/12	2	No													
2012	4/23/12	3	No													
2012	4/24/12	4	No													
00-300-0415																
2012	2/7/12	1	No													
2012	2/7/12	2	No													
2012	4/23/12	3	No													
2012	4/24/12	4	No													
00-300-0435																
2012	2/7/12	1	No													
2012	2/7/12	2	No													
2012	4/23/12	3	No													
2012	4/23/12	4	No													

Outfall *Permit Year*	*Date*	*Visit #*	*Flow ?*	*Flow Rate (gpm)*	*pH (su)*	*Chlorine (ppm)*	*Copper (ppm)*	*Phenol (ppm)*	*Detergents (ppm)*	*Ammonia (ppm)*	*Fecal Sample (mpn/100ml)*	*Turbidity (ntu)*	*Color*	*Odor?*	*Surface Scum*	*Oil Sheen*
00-300-0460																
2012	2/7/12	1	No													
2012	2/7/12	2	No													
2012	4/20/12	3	No													
2012	4/20/12	4	No													
00-300-0475																
2012	2/7/12	1	No													
2012	2/7/12	2	No													
2012	4/20/12	3	No													
2012	4/20/12	4	No													
00-300-0480																
2012	2/7/12	1	No													
2012	2/7/12	2	No													
2012	4/20/12	3	No													
2012	4/20/12	4	No													
00-500-0515																
2012			No													
2012	2/7/12	1	No													
2012	2/7/12	2	No													
2012	4/20/12	3	No													
2012	4/20/12	4	No													
01-400-0053																
2012	1/31/12	1	No													
2012	1/31/12	2	No													
2012	5/1/12	3	No													
2012	5/1/12	4	No													
01-200-0057																
2012	1/31/12	1	No													
2012	1/31/12	2	No													
2012	4/17/12	3	No													
2012	4/17/12	4	No													

Outfall Permit Year	Date	Visit #	Flow ?	Flow Rate (gpm)	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Fecal Sample (mpn/100ml)	Turbidity (ntu)	Color	Odor?	Surface Scum	Oil Sheen
01-300-0060																
2012	1/31/12	1	No													
2012	1/31/12	2	No													
2012	4/17/12	3	No													
2012	4/17/12	4	No													
01-400-0062																
2012	1/31/12	1	No													
2012	1/31/12	2	No													
2012	4/17/12	3	No													
2012	4/17/12	4	No													
01-300-0070																
2012	1/31/12	1	No													
2012	1/31/12	2	No													
2012	4/17/12	3	No													
2012	4/17/12	4	No													
01-300-0115																
2012	1/31/12	1	No													
2012	1/31/12	2	No													
2012	4/17/12	3	No													
2012	4/17/12	4	No													
01-400-0119																
2012	1/31/12	1	No													
2012	1/31/12	2	No													
2012	4/13/12	3	No													
2012	4/13/12	4	No													
01-200-0137																
2012	1/30/12	1	No													
2012	1/30/12	2	No													
2012	4/13/12	3	No													
2012	4/13/12	4	No													

Outfall *Permit Year*	*Date*	*Visit #*	*Flow ?*	*Flow Rate (gpm)*	*pH (su)*	*Chlorine (ppm)*	*Copper (ppm)*	*Phenol (ppm)*	*Detergents (ppm)*	*Ammonia (ppm)*	*Fecal Sample (mpn/100ml)*	*Turbidity (ntu)*	*Color*	*Odor?*	*Surface Scum*	*Oil Sheen*
01-300-0142																
2012	1/30/12	1	No													
2012	1/30/12	2	No													
2012	4/12/12	3	No													
2012	4/12/12	4	No													
01-300-0143																
2012	1/30/12	1	No													
2012	1/30/12	2	No													
2012	4/12/12	3	No													
2012	4/12/12	4	No													
01-400-0146																
2012	1/30/12	1	No													
2012	1/30/12	2	No													
2012	4/12/12	3	No													
2012	4/12/12	4	No													
01-300-0147																
2012	1/30/12	1	No													
2012	1/30/12	2	No													
2012	4/12/12	3	No													
2012	4/12/12	4	No													
01-300-0149																
2012	1/30/12	1	No													
2012	1/30/12	2	No													
2012	4/12/12	3	No													
2012	4/12/12	4	No													
01-500-0180																
2012	2/21/12	1	No													
2012	2/21/12	2	No													
2012	5/1/12	3	No													
2012	5/1/12	4	No													

Outfall *Permit Year*	*Date*	*Visit #*	*Flow ?*	*Flow Rate (gpm)*	*pH (su)*	*Chlorine (ppm)*	*Copper (ppm)*	*Phenol (ppm)*	*Detergents (ppm)*	*Ammonia (ppm)*	*Fecal Sample (mpn/100ml)*	*Turbidity (ntu)*	*Color*	*Odor?*	*Surface Scum*	*Oil Sheen*
01-300-0350																
2012	1/30/12	1	No													
2012	1/30/12	2	No													
2012	4/13/12	3	No													
2012	4/13/12	4	No													
01-400-0435																
2012	1/31/12	1	No													
2012	1/31/12	2	No													
2012	4/13/12	3	No													
2012	4/13/12	4	No													
01-300-0520																
2012	1/30/12	1	No													
2012	1/30/12	2	No													
2012	4/11/12	3	No													
2012	4/11/12	4	No													
01-400-0675																
2012	1/30/12	1	No													
2012	1/30/12	2	No													
2012	4/9/12	3	No													
2012	4/9/12	4	No													
01-400-0685																
2012	1/25/12	1	No													
2012	1/25/12	2	No													
2012	4/11/12	3	No													
2012	4/11/12	4	No													
02-300-0171																
2012	10/4/11	1	No													
2012	10/4/11	2	No													
2012	3/14/12	3	No													
2012	3/14/12	4	No													

Outfall Permit Year	Date	Visit #	Flow ?	Flow Rate (gpm)	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Fecal Sample (mpn/100ml)	Turbidity (ntu)	Color	Odor?	Surface Scum	Oil Sheen
02-300-0172																
2012	10/4/11	1	No													
2012	10/4/11	2	No													
2012	3/14/12	3	No													
2012	3/14/12	4	No													
02-300-0174																
2012	10/4/11	1	No													
2012	10/4/11	2	No													
2012	3/14/12	3	No													
2012	3/14/12	4	No													
02-300-0175																
2012	10/4/11	1	No													
2012	10/4/11	2	No													
2012	3/14/12	3	No													
2012	3/14/12	4	No													
02-300-0176																
2012	10/4/11	2	No													
2012	3/14/12	3	No													
2012	3/14/12	4	No													
2012	10/4/12	1	No													
02-300-0178																
2012	10/4/11	1	No													
2012	10/4/11	2	No													
2012	3/14/12	3	No													
2012	3/14/12	4	No													
02-300-0179																
2012	10/3/11	1	No													
2012	10/3/11	2	No													
2012	3/14/12	3	No													
2012	3/14/12	4	No													

Outfall *Permit Year*	*Date*	*Visit #*	*Flow ?*	*Flow Rate (gpm)*	*pH (su)*	*Chlorine (ppm)*	*Copper (ppm)*	*Phenol (ppm)*	*Detergents (ppm)*	*Ammonia (ppm)*	*Fecal Sample (mpn/100ml)*	*Turbidity (ntu)*	*Color*	*Odor?*	*Surface Scum*	*Oil Sheen*
02-300-0180																
2012	1/25/12	1	No													
2012	1/25/12	2	No													
2012	4/9/12	3	No													
2012	4/9/12	4	No													
02-300-0181																
2012	10/3/11	1	No													
2012	10/3/11	2	No													
2012	4/9/12	3	No													
2012	4/9/12	4	No													
02-300-0190																
2012	1/25/12	1	No													
2012	1/25/12	2	No													
2012	4/9/12	3	No													
2012	4/9/12	4	No													
02-300-0230																
2012	1/25/12	1	No													
2012	1/25/12	2	No													
2012	4/9/12	3	No													
2012	4/9/12	4	No													
02-300-0245																
2012	1/25/12	1	No													
2012	1/25/12	2	No													
2012	4/9/12	3	No													
2012	4/9/12	4	No													
02-300-0250																
2012	1/25/12	1	No													
2012	1/25/12	2	No													
2012	4/11/12	3	No													
2012	4/11/12	4	No													

Outfall Permit Year	Date	Visit #	Flow ?	Flow Rate (gpm)	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Fecal Sample (mpn/100ml)	Turbidity (ntu)	Color	Odor?	Surface Scum	Oil Sheen
02-300-0260																
2012	1/25/12	1	No													
2012	1/25/12	2	No													
2012	4/11/12	3	No													
2012	4/11/12	4	No													
02-300-0295																
2012	1/25/12	1	No													
2012	1/25/12	2	No													
2012	4/11/12	3	No													
2012	4/11/12	4	No													
02-300-0359																
2012	1/20/12	1	No													
2012	1/20/12	2	No													
2012	3/21/12	3	No													
2012	3/21/12	4	No													
02-400-0361																
2012	1/20/12	1	No													
2012	1/20/12	2	No													
2012	3/22/12	3	No													
2012	3/22/12	4	No													
02-400-0365																
2012	1/20/12	1	No													
2012	1/20/12	2	No													
2012	3/22/12	3	No													
2012	3/22/12	4	No													
02-300-0366																
2012	1/20/12	1	No													
2012	1/20/12	2	No													
2012	3/22/12	3	No													
2012	3/22/12	4	No													

Outfall *Permit Year*	*Date*	*Visit #*	*Flow ?*	*Flow Rate (gpm)*	*pH (su)*	*Chlorine (ppm)*	*Copper (ppm)*	*Phenol (ppm)*	*Detergents (ppm)*	*Ammonia (ppm)*	*Fecal Sample (mpn/100ml)*	*Turbidity (ntu)*	*Color*	*Odor?*	*Surface Scum*	*Oil Sheen*
02-400-0367																
2012	1/20/12	1	No													
2012	1/20/12	2	No													
2012	3/22/12	3	No													
2012	3/22/12	4	No													
02-300-0371																
2012	1/20/12	1	No													
2012	1/20/12	2	No													
2012	3/22/12	3	No													
2012	3/22/12	4	No													
02-200-0444																
2012	1/20/12	1	No													
2012	1/20/12	2	No													
2012	3/22/12	3	No													
2012	3/22/12	4	No													
02-500-0535																
2012	1/20/12	1	No													
2012	1/20/12	2	No													
2012	3/22/12	3	No													
2012	3/22/12	4	No													
03-300-0010																
2012	1/20/12	1	No													
2012	1/20/12	2	No													
2012	4/8/12	3	No													
2012	4/8/12	4	No													
03-300-0015																
2012	1/19/12	1	No													
2012	1/19/12	2	No													
2012	4/8/12	3	No													
2012	4/8/12	4	No													

Outfall *Permit Year*	*Date*	*Visit #*	*Flow ?*	*Flow Rate (gpm)*	*pH (su)*	*Chlorine (ppm)*	*Copper (ppm)*	*Phenol (ppm)*	*Detergents (ppm)*	*Ammonia (ppm)*	*Fecal Sample (mpn/100ml)*	*Turbidity (ntu)*	*Color*	*Odor?*	*Surface Scum*	*Oil Sheen*
03-300-0035																
2012	1/19/12	1	No													
2012	1/19/12	2	No													
2012	4/8/12	3	No													
2012	4/8/12	4	No													
03-300-0075																
2012	1/19/12	1	No													
2012	1/19/12	2	No													
2012	3/27/12	3	No													
2012	3/27/12	4	No													
03-400-0085																
2012	1/19/12	1	No													
2012	1/19/12	2	No													
2012	3/27/12	3	No													
2012	3/27/12	4	No													
03-300-0115																
2012	1/19/12	1	No													
2012	1/19/12	2	No													
2012	4/8/12	3	No													
2012	4/8/12	4	No													
03-300-0370																
2012	10/3/11	1	No													
2012	10/3/11	2	No													
2012	10/3/12	3	No													
2012	10/3/12	4	No													
03-400-0376																
2012	1/19/12	1	No													
2012	1/19/12	2	No													
2012	4/8/12	3	No													
2012	4/8/12	4	No													

Outfall Permit Year	Date	Visit #	Flow ?	Flow Rate (gpm)	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Fecal Sample (mpn/100ml)	Turbidity (ntu)	Color	Odor?	Surface Scum	Oil Sheen
03-300-0385																
2012	1/4/12	1	No													
2012	1/4/12	2	No													
2012	3/27/12	3	No													
2012	3/27/12	4	No													
03-300-0398																
2012	1/4/12	1	No													
2012	1/4/12	2	No													
2012	3/27/12	3	No													
2012	3/27/12	4	No													
03-300-0400																
2012	1/4/12	1	No													
2012	1/4/12	2	No													
2012	3/26/12	3	No													
2012	3/26/12	4	No													
03-200-0409																
2012	1/4/12	1	No													
2012	1/4/12	2	No													
2012	3/26/12	3	No													
2012	3/26/12	4	No													
03-400-0411																
2012	1/4/12	1	No													
2012	1/4/12	2	No													
2012	3/26/12	3	No													
2012	3/26/12	4	No													
03-200-0414																
2012	1/4/12	1	No													
2012	1/4/12	2	No													
2012	3/26/12	3	No													
2012	3/26/12	4	No													

Outfall *Permit Year*	*Date*	*Visit #*	*Flow ?*	*Flow Rate (gpm)*	*pH (su)*	*Chlorine (ppm)*	*Copper (ppm)*	*Phenol (ppm)*	*Detergents (ppm)*	*Ammonia (ppm)*	*Fecal Sample (mpn/100ml)*	*Turbidity (ntu)*	*Color*	*Odor?*	*Surface Scum*	*Oil Sheen*
03-400-0422																
2012	1/4/12	1	No													
2012	1/4/12	2	No													
2012	3/26/12	3	No													
2012	3/26/12	4	No													
03-500-0425																
2012	1/4/12	1	No													
2012	1/4/12	2	No													
2012	3/21/12	3	No													
2012	3/21/12	4	No													
03-300-0430																
2012	1/4/12	1	No													
2012	1/4/12	2	No													
2012	3/21/12	3	No													
2012	3/21/12	4	No													
03-300-0480																
2012	3/21/12	1	No													
2012	3/21/12	2	No													
2012	4/13/12	3	No													
2012	4/13/12	4	No													
03-500-0535																
2012	4/8/12	3	No													
2012	4/8/12	4	No													
2012	12/14/12	1	No													
2012	12/14/12	2	No													
03-300-0550																
2012	3/21/12	3	No													
2012	3/21/12	4	No													
2012	12/14/12	1	No													
2012	12/14/12	2	No													

Outfall *Permit Year*	*Date*	*Visit #*	*Flow ?*	*Flow Rate (gpm)*	*pH (su)*	*Chlorine (ppm)*	*Copper (ppm)*	*Phenol (ppm)*	*Detergents (ppm)*	*Ammonia (ppm)*	*Fecal Sample (mpn/100ml)*	*Turbidity (ntu)*	*Color*	*Odor?*	*Surface Scum*	*Oil Sheen*
03-300-0615																
2012	4/2/12	3	No													
2012	4/2/12	4	No													
2012	12/14/12	1	No													
2012	12/14/12	2	No													
03-300-0625																
2012	4/2/12	3	No													
2012	4/2/12	4	No													
2012	12/14/12	1	No													
2012	12/14/12	2	No													
03-300-0630																
2012	4/2/12	3	No													
2012	4/2/12	4	No													
2012	12/14/12	1	No													
2012	12/14/12	2	No													
03-300-0640																
2012	4/2/12	3	No													
2012	4/2/12	4	No													
2012	12/9/12	1	No													
2012	12/9/12	2	No													
03-300-0645																
2012	4/2/12	3	No													
2012	4/2/12	4	No													
2012	12/9/12	1	No													
2012	12/9/12	2	No													
03-300-0655																
2012	4/2/12	3	No													
2012	4/2/12	4	No													
2012	12/9/12	1	No													
2012	12/9/12	2	No													

Outfall Permit Year	Date	Visit #	Flow ?	Flow Rate (gpm)	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Fecal Sample (mpn/100ml)	Turbidity (ntu)	Color	Odor?	Surface Scum	Oil Sheen
03-300-0670																
2012	4/2/12	3	Yes	2	7.0	0	0	0	0	0		0	0	No	No	No
2012	4/2/12	4	Yes	2	7.0	0	0	0	0	0		0	0			
2012	12/9/12	1	No													
2012	12/9/12	2	No													
03-400-0895																
2012	3/29/12	3	No													
2012	3/29/12	4	No													
2012	12/9/12	1	No													
2012	12/9/12	2	No													
04-500-0017																
2012	3/29/12	3	No													
2012	3/29/12	4	No													
2012	12/9/12	1	No													
2012	12/9/12	2	No													
04-500-0117																
2012	3/29/12	3	No													
2012	3/29/12	4	No													
2012	12/9/12	1	No													
2012	12/9/12	2	No													
04-500-0133																
2012	3/29/12	3	No													
2012	3/29/12	4	No													
2012	12/9/12	1	No													
2012	12/9/12	2	No													
04-200-0227																
2012	12/1/11	2	No													
2012	4/2/12	3	No													
2012	4/2/12	4	No													
2012	12/1/12	1	No													

Outfall Permit Year	Date	Visit #	Flow ?	Flow Rate (gpm)	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Fecal Sample (mpn/100ml)	Turbidity (ntu)	Color	Odor?	Surface Scum	Oil Sheen
04-500-0245																
2012	12/1/11	1	No													
2012	12/1/11	2	No													
2012	3/28/12	3	No													
2012	3/28/12	4	No													
04-500-0272																
2012	12/1/11	1	No													
2012	12/1/11	2	No													
2012	3/28/12	3	No													
2012	3/28/12	4	No													
04-500-0276																
2012	3/29/12	3	No													
2012	3/29/12	4	No													
2012	12/14/12	1	No													
2012	12/14/12	2	No													
04-400-0287																
2012	12/1/11	1	No													
2012	12/1/11	2	No													
2012	3/28/12	3	No													
2012	3/28/12	4	No													
04-400-0289																
2012	12/1/11	1	No													
2012	12/1/11	2	No													
2012	3/28/12	3	No													
2012	3/28/12	4	No													
04-400-0294																
2012	12/1/11	1	No													
2012	12/1/11	2	No													
2012	4/8/12	3	No													
2012	4/8/12	4	No													

Outfall *Permit Year*	*Date*	*Visit #*	*Flow ?*	*Flow Rate (gpm)*	*pH (su)*	*Chlorine (ppm)*	*Copper (ppm)*	*Phenol (ppm)*	*Detergents (ppm)*	*Ammonia (ppm)*	*Fecal Sample (mpn/100ml)*	*Turbidity (ntu)*	*Color*	*Odor?*	*Surface Scum*	*Oil Sheen*
04-400-0313																
2012	12/1/11	1	No													
2012	12/1/11	2	No													
2012	3/28/12	3	No													
2012	3/28/12	4	No													
05-500-0020																
2012	11/18/11	1	No													
2012	11/18/11	2	No													
2012	4/13/12	3	No													
2012	4/13/12	4	No													
06-500-0120																
2012	11/18/11	1	No													
2012	4/13/12	3	No													
2012	4/13/12	4	No													
2012	11/18/12	2	No													
06-500-0144																
2012	11/18/11	1	No													
2012	11/18/11	2	No													
2012	4/17/12	3	No													
2012	4/17/12	4	No													
06-500-0215																
2012	5/2/12	1	No													
2012	5/2/12	2	No													
2012	11/18/12	3	No													
2012	11/18/12	4	No													
10-500-0380																
2012	8/23/11	1	No													
2012	8/23/11	2	No													
2012	3/19/12	3	No													
2012	3/19/12	4	No													

Outfall *Permit Year*	*Date*	*Visit #*	*Flow ?*	*Flow Rate (gpm)*	*pH (su)*	*Chlorine (ppm)*	*Copper (ppm)*	*Phenol (ppm)*	*Detergents (ppm)*	*Ammonia (ppm)*	*Fecal Sample (mpn/100ml)*	*Turbidity (ntu)*	*Color*	*Odor?*	*Surface Scum*	*Oil Sheen*
10-500-0390																
2012	8/23/11	1	No													
2012	8/23/11	2	No													
2012	3/19/12	3	No													
2012	3/19/12	4	No													
10-500-0405																
2012	8/23/11	1	No													
2012	8/23/11	2	No													
2012	3/19/12	3	No													
2012	3/19/12	4	No													
10-500-0550																
2012	8/23/11	1	No													
2012	8/23/11	2	No													
2012	3/19/12	3	No													
2012	3/19/12	4	No													
11-300-0602																
2012	11/8/11	1	No													
2012	11/8/11	2	No													
2012	3/19/12	3	No													
2012	3/19/12	4	No													
11-300-0610																
2012	11/8/11	1	No													
2012	11/8/11	2	No													
2012	3/13/12	3	No													
2012	3/13/12	4	No													
11-300-0611																
2012	11/8/11	1	No													
2012	11/8/11	2	No													
2012	3/13/12	3	No													
2012	3/13/12	4	No													

Outfall *Permit Year*	*Date*	*Visit #*	*Flow ?*	*Flow Rate (gpm)*	*pH (su)*	*Chlorine (ppm)*	*Copper (ppm)*	*Phenol (ppm)*	*Detergents (ppm)*	*Ammonia (ppm)*	*Fecal Sample (mpn/100ml)*	*Turbidity (ntu)*	*Color*	*Odor?*	*Surface Scum*	*Oil Sheen*
11-300-0612																
2012	11/8/11	1	No													
2012	11/8/11	2	No													
2012	3/13/12	3	No													
2012	3/13/12	4	No													
11-300-0613																
2012	11/8/11	1	No													
2012	11/8/11	2	No													
2012	3/13/12	3	No													
2012	3/13/12	4	No													
11-300-0614																
2012	11/8/11	1	No													
2012	11/8/11	2	No													
2012	3/13/12	3	No													
2012	3/13/12	4	No													
11-300-0615																
2012	11/8/11	1	No													
2012	11/8/11	2	No													
2012	3/13/12	3	No													
2012	3/13/12	4	No													
12-500-0575																
2012	11/1/11	1	No													
2012	11/2/11	2	No													
2012	3/20/12	3	No													
2012	3/20/12	4	No													
12-500-0720																
2012	11/1/11	1	No													
2012	11/2/11	2	No													
2012	3/20/12	3	No													
2012	3/20/12	4	No													

Outfall Permit Year	Date	Visit #	Flow ?	Flow Rate (gpm)	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Fecal Sample (mpn/100ml)	Turbidity (ntu)	Color	Odor?	Surface Scum	Oil Sheen
13-300-0135																
2012	10/3/11	1	Yes	5	7.0	0	0	0	0	3.00		0	0	No	No	No
2012	10/3/11	2	Yes	5	7.0	0	0	0	0	3.00		0	0	No	No	No
2012	3/13/12	3	No													
2012	3/13/12	4	No													
13-300-0140																
2012	10/17/11	1	Yes	35	7.0	0	0	0	0	0		0	0	No	No	No
2012	10/17/11	2	Yes	35	7.0	0	0	0	0	0		0	0	No	No	No
2012	3/20/12	3	No													
2012	3/20/12	4	No													
13-300-0145																
2012	10/17/11	1	No													
2012	10/17/11	2	No													
2012	3/20/12	3	No													
2012	3/20/12	4	No													
13-300-0147																
2012	10/17/11	1	No													
2012	10/17/11	2	No													
2012	3/20/12	3	No													
2012	3/20/12	4	No													
13-300-0155																
2012	10/17/11	1	Yes	10	7.0	0	0	0	0	0		0	0	No	No	No
2012	10/17/11	2	Yes	10	7.0	0		0	0	0		0	0	No	No	No
2012	3/20/12	3	Yes	2	7.0	0	0	0	0	0		0	0	No	No	No
2012	3/20/12	4	Yes	2	7.0	0	0	0	0	0		0	0	No	No	No
13-300-0170																
2012	10/24/11	1	No													
2012	10/25/11	2	No													
2012	3/20/12	3	No													
2012	3/20/12	4	No													

Outfall *Permit Year*	*Date*	*Visit #*	*Flow ?*	*Flow Rate (gpm)*	*pH (su)*	*Chlorine (ppm)*	*Copper (ppm)*	*Phenol (ppm)*	*Detergents (ppm)*	*Ammonia (ppm)*	*Fecal Sample (mpn/100ml)*	*Turbidity (ntu)*	*Color*	*Odor?*	*Surface Scum*	*Oil Sheen*
13-300-0181																
2012	10/24/11	1	No													
2012	10/25/11	2	No													
2012	3/12/12	3	No													
2012	3/12/12	4	No													
13-300-0182																
2012	10/24/11	1	No													
2012	10/25/11	2	No													
2012	3/12/12	3	No													
2012	3/12/12	4	No													
13-300-0184																
2012	10/24/11	1	No													
2012	10/25/11	2	No													
2012	3/12/12	3	No													
2012	3/12/12	4	No													
13-300-0185																
2012	10/24/11	1	No													
2012	10/25/11	2	No													
2012	3/12/12	3	No													
2012	3/12/12	4	No													
13-300-0190																
2012	11/2/11	1	No													
2012	11/3/11	2	No													
2012	3/12/12	3	No													
2012	3/12/12	4	No													
13-300-0226																
2012	11/2/11	1	No													
2012	11/3/11	2	No													
2012	3/12/12	3	No													
2012	3/12/12	4	No													

Outfall *Permit Year*	*Date*	*Visit #*	*Flow ?*	*Flow Rate (gpm)*	*pH (su)*	*Chlorine (ppm)*	*Copper (ppm)*	*Phenol (ppm)*	*Detergents (ppm)*	*Ammonia (ppm)*	*Fecal Sample (mpn/100ml)*	*Turbidity (ntu)*	*Color*	*Odor?*	*Surface Scum*	*Oil Sheen*
13-300-0227																
2012	9/12/11	1	No													
2012	9/13/11	2	No													
2012	3/8/12	3	No													
2012	3/8/12	4	No													
13-300-0228																
2012	9/12/11	1	Yes	0.50	7.0	0.30	0	0	0	0		0	0	No	No	No
2012	9/13/11	2	Yes	0.50	7.0	0	0	0	0	0		0	0	No	No	No
2012	3/8/12	3	No													
2012	3/8/12	4	No													
13-300-0305																
2012	9/12/11	1	Yes	4	7.0	0.01	0	0	0	0.03		0	0	No	No	No
2012	9/13/11	2	Yes	4	7.0	0.10	0	0	0	1.00		0	0	No	No	No
2012	3/3/12	4	No													
2012	3/8/12	3	No													
13-300-0350																
2012	9/12/11	1	No													
2012	9/13/11	2	No													
2012	3/8/12	3	No													
2012	3/8/12	4	No													
13-300-0365																
2012	9/12/11	1	No													
2012	9/13/11	2	No													
2012	3/7/12	3	No													
2012	3/7/12	4	No													
18-100-0690																
2012	8/23/11	1	No													
2012	8/23/11	2	No													
2012	3/7/12	3	No													
2012	3/7/12	4	No													

Outfall *Permit Year*	*Date*	*Visit #*	*Flow ?*	*Flow Rate (gpm)*	*pH (su)*	*Chlorine (ppm)*	*Copper (ppm)*	*Phenol (ppm)*	*Detergents (ppm)*	*Ammonia (ppm)*	*Fecal Sample (mpn/100ml)*	*Turbidity (ntu)*	*Color*	*Odor?*	*Surface Scum*	*Oil Sheen*
18-100-0700																
2012	8/23/11	1	No													
2012	8/23/11	2	No													
2012	3/7/12	3	No													
2012	3/7/12	4	No													
31-100-0500																
2012	8/29/11	1	Yes	18	7.0	0	0	0	0	0		0	0	No	No	No
2012	8/29/11	2	Yes	18	7.0	0	0	0	0	0		0	0	No	No	No
2012	3/7/12	3	Yes	10	7.0	0	0	0	0	0		0	0	No	No	No
2012	3/7/12	4	Yes	10	7.0	0	0	0	0	0		0	0	No	No	No
31-300-0505																
2012	8/29/11	1	No													
2012	8/29/11	2	No													
2012	3/6/12	3	No													
2012	3/6/12	4	No													
31-300-0515																
2012	8/29/11	1	No													
2012	8/29/11	2	No													
2012	3/6/12	3	No													
2012	3/6/12	4	No													
31-300-0520																
2012	8/29/11	1	No													
2012	8/29/11	2	No													
2012	3/6/12	3	No													
2012	3/6/12	4	No													
51-100-0900																
2012	8/29/11	1	No													
2012	8/29/11	2	No													
2012	3/6/12	3	No													
2012	3/6/12	4	No													

Outfall Permit Year	Date	Visit #	Flow ?	Flow Rate (gpm)	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Fecal Sample (mpn/100ml)	Turbidity (ntu)	Color	Odor?	Surface Scum	Oil Sheen
53-100-0030																
2012	8/3/11	1	No													
2012	8/3/11	2	No													
2012	3/6/12	3	No													
2012	3/6/12	4	No													
53-100-0045																
2012	8/3/11	1	Yes	2	7.0	0	0	0	0	0		0	0	No	No	No
2012	8/3/11	2	Yes	2	7.0	0	0	0	0	0		0	0	No	No	No
2012	3/5/12	3	No													
2012	3/5/12	4	No													
53-100-0065																
2012	8/3/11	1	No													
2012	8/3/11	2	No													
2012	3/5/12	3	No													
2012	3/5/12	4	No													
53-100-0085																
2012	8/3/11	1	Yes	5	7.0	0	0	0	0	0		0	0	No	No	No
2012	8/3/11	2	Yes	5	7.0									No	No	No
2012	3/5/12	3	Yes	5	7.0	0	0	0	0	0		0	0	No	No	No
2012	3/5/12	4	Yes	5	7.0	0	0	0	0	0		0	0	No	No	No
53-100-0133																
2012	8/3/11	1	No													
2012	8/3/11	2	No													
2012	3/5/12	3	No													
2012	3/5/12	4	No													
53-500-0220																
2012	8/3/11	1	No													
2012	8/3/11	2	No													
2012	3/5/12	3	No													
2012	3/5/12	4	No													

Outfall Permit Year	Date	Visit #	Flow ?	Flow Rate (gpm)	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Fecal Sample (mpn/100ml)	Turbidity (ntu)	Color	Odor?	Surface Scum	Oil Sheen
53-500-0230																
2012	8/3/11	1	No													
2012	8/3/11	2	No													
2012	2/28/12	3	No													
2012	2/28/12	4	No													
55-100-0150																
2012	8/3/11	1	No													
2012	8/3/11	2	No													
2012	2/28/12	3	No													
2012	2/28/12	4	No													
56-100-0230																
2012	8/3/11	1	No													
2012	8/3/11	2	No													
2012	2/28/12	3	No													
2012	2/28/12	4	No													
79-500-0050																
2012	8/24/11	1	No													
2012	8/24/11	2	No													
2012	2/28/12	3	No													
2012	2/28/12	4	No													
79-500-0343																
2012	8/24/11	1	No													
2012	8/24/11	2	No													
2012	2/27/12	3	No													
2012	2/28/12	4	Yes	0.50	6.0	0	0	0	0	0		0	0	No	No	No
79-100-0365																
2012	8/24/11	1	No													
2012	8/24/11	2	No													
2012	2/27/12	3	No													
2012	2/27/12	4	No													

Outfall *Permit Year*	*Date*	*Visit #*	*Flow ?*	*Flow Rate (gpm)*	*pH (su)*	*Chlorine (ppm)*	*Copper (ppm)*	*Phenol (ppm)*	*Detergents (ppm)*	*Ammonia (ppm)*	*Fecal Sample (mpn/100ml)*	*Turbidity (ntu)*	*Color*	*Odor?*	*Surface Scum*	*Oil Sheen*
79-100-0400																
2012	8/24/11	1	No													
2012	8/24/11	2	No													
2012	2/27/12	3	Yes	1	6.0	0	0	0	0	0		0	0	No	No	No
2012	2/27/12	4	Yes	1	6.0	0	0	0	0	0		0	0	No	No	No

Shaded rows represent samples which contained eleveated levels for at least 1 sampled parameter.

Oracle - Dry Weather Screening Data

Elevated readings have been underlined.

Below is a listing of sample parameters and their elevated reading criteria:

pH	< 6.5 or > 9 su
Chlorine	> 0.2 ppm
Copper	>= 0.1 ppm
Phenol	>= 0.1 ppm
Detergents	> 0.25 ppm
Ammonia	>= 1 ppm
Fecal Sample	>= 200 mpn/100 ml

Dry Weather Screening - Sample Events for 2012

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
00-100-0115	DRY	2/27/2012	2/27/2012	5/1/2012	5/1/2012
00-100-0140	DRY	2/27/2012	2/27/2012	5/1/2012	5/1/2012
00-100-0180	DRY	2/21/2012	2/22/2012	1/25/2012	5/1/2012
00-100-0185	DRY	2/21/2012	2/22/2012	5/1/2012	5/1/2012
00-400-0193	DRY	2/21/2012	2/21/2012	4/30/2012	4/30/2012
00-400-0194	DRY	2/21/2012	2/21/2012	4/30/2012	4/30/2012
00-400-0196	DRY	2/21/2012	2/21/2012	4/30/2012	4/30/2012
00-400-0197	DRY	4/30/2012	4/30/2012	2/21/2012	2/21/2012
00-300-0240	DRY	2/21/2012	4/30/2012	4/30/2012	4/30/2012
00-300-0260	DRY	2/21/2012	2/21/2012	4/23/2012	4/24/2012
00-100-0300	DRY	2/13/2012	2/13/2012	4/23/2012	4/24/2012
00-300-0385	DRY	2/21/2012	2/21/2012	2/21/2012	4/23/2012
00-300-0412	DRY	2/7/2012	2/7/2012	4/23/2012	4/24/2012
00-400-0413	DRY	2/7/2012	2/7/2012	4/23/2012	4/24/2012
00-300-0415	DRY	2/7/2012	2/7/2012	4/23/2012	4/24/2012
00-300-0435	DRY	2/7/2012	2/7/2012	4/23/2012	4/23/2012
00-300-0460	DRY	2/7/2012	2/7/2012	4/20/2012	4/20/2012
00-300-0475	DRY	2/7/2012	2/7/2012	4/20/2012	4/20/2012
00-300-0480	DRY	2/7/2012	2/7/2012	4/20/2012	4/20/2012
00-500-0515	DRY	2/7/2012	2/7/2012	4/20/2012	4/20/2012
01-400-0053	DRY	1/31/2012	1/31/2012	5/1/2012	5/1/2012
01-200-0057	DRY	1/31/2012	1/31/2012	4/17/2012	4/17/2012
01-300-0060	DRY	1/31/2012	1/31/2012	4/17/2012	4/17/2012
01-400-0062	DRY	1/31/2012	1/31/2012	4/17/2012	4/17/2012
01-300-0070	DRY	1/31/2012	1/31/2012	4/17/2012	4/17/2012
01-300-0115	DRY	1/31/2012	1/31/2012	4/17/2012	4/17/2012

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
01-400-0119	DRY	1/31/2012	1/31/2012	4/13/2012	4/13/2012
01-200-0137	DRY	1/30/2012	1/30/2012	4/13/2012	4/13/2012
01-300-0142	DRY	1/30/2012	1/30/2012	4/12/2012	4/12/2012
01-300-0143	DRY	1/30/2012	1/30/2012	4/12/2012	4/12/2012
01-400-0146	DRY	1/30/2012	1/30/2012	4/12/2012	4/12/2012
01-300-0147	DRY	1/30/2012	1/30/2012	4/12/2012	4/12/2012
01-300-0149	DRY	1/30/2012	1/30/2012	4/12/2012	4/12/2012
01-500-0180	DRY	2/21/2012	2/21/2012	5/1/2012	5/1/2012
01-300-0350	DRY	1/30/2012	1/30/2012	4/13/2012	4/13/2012
01-400-0435	DRY	1/31/2012	1/31/2012	4/13/2012	4/13/2012
01-300-0520	DRY	1/30/2012	1/30/2012	4/11/2012	4/11/2012
01-400-0675	DRY	1/30/2012	1/30/2012	4/9/2012	4/9/2012
01-400-0685	DRY	1/25/2012	1/25/2012	4/11/2012	4/11/2012
02-300-0171	DRY	10/4/2011	10/4/2011	3/14/2012	3/14/2012
02-300-0172	DRY	10/4/2011	10/4/2011	3/14/2012	3/14/2012
02-300-0174	DRY	10/4/2011	10/4/2011	3/14/2012	3/14/2012
02-300-0175	DRY	10/4/2011	10/4/2011	3/14/2012	3/14/2012
02-300-0176	DRY	10/4/2012	10/4/2011	3/14/2012	3/14/2012
02-300-0178	DRY	10/4/2011	10/4/2011	3/14/2012	3/14/2012
02-300-0179	DRY	10/3/2011	10/3/2011	3/14/2012	3/14/2012
02-300-0180	DRY	1/25/2012	1/25/2012	4/9/2012	4/9/2012
02-300-0181	DRY	10/3/2011	10/3/2011	4/9/2012	4/9/2012
02-300-0190	DRY	1/25/2012	1/25/2012	4/9/2012	4/9/2012
02-300-0230	DRY	1/25/2012	1/25/2012	4/9/2012	4/9/2012
02-300-0245	DRY	1/25/2012	1/25/2012	4/9/2012	4/9/2012
02-300-0250	DRY	1/25/2012	1/25/2012	4/11/2012	4/11/2012
02-300-0260	DRY	1/25/2012	1/25/2012	4/11/2012	4/11/2012
02-300-0295	DRY	1/25/2012	1/25/2012	4/11/2012	4/11/2012

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
02-300-0359	DRY	1/20/2012	1/20/2012	3/21/2012	3/21/2012
02-400-0361	DRY	1/20/2012	1/20/2012	3/22/2012	3/22/2012
02-400-0365	DRY	1/20/2012	1/20/2012	3/22/2012	3/22/2012
02-300-0366	DRY	1/20/2012	1/20/2012	3/22/2012	3/22/2012
02-400-0367	DRY	1/20/2012	1/20/2012	3/22/2012	3/22/2012
02-300-0371	DRY	1/20/2012	1/20/2012	3/22/2012	3/22/2012
02-200-0444	DRY	1/20/2012	1/20/2012	3/22/2012	3/22/2012
02-500-0535	DRY	1/20/2012	1/20/2012	3/22/2012	3/22/2012
03-300-0010	DRY	1/20/2012	1/20/2012	4/8/2012	4/8/2012
03-300-0015	DRY	1/19/2012	1/19/2012	4/8/2012	4/8/2012
03-300-0035	DRY	1/19/2012	1/19/2012	4/8/2012	4/8/2012
03-300-0075	DRY	1/19/2012	1/19/2012	3/27/2012	3/27/2012
03-400-0085	DRY	1/19/2012	1/19/2012	3/27/2012	3/27/2012
03-300-0115	DRY	1/19/2012	1/19/2012	4/8/2012	4/8/2012
03-300-0370	DRY	10/3/2011	10/3/2011	10/3/2012	10/3/2012
03-400-0376	DRY	1/19/2012	1/19/2012	4/8/2012	4/8/2012
03-300-0385	DRY	1/4/2012	1/4/2012	3/27/2012	3/27/2012
03-300-0398	DRY	1/4/2012	1/4/2012	3/27/2012	3/27/2012
03-300-0400	DRY	1/4/2012	1/4/2012	3/26/2012	3/26/2012
03-200-0409	DRY	1/4/2012	1/4/2012	3/26/2012	3/26/2012
03-400-0411	DRY	1/4/2012	1/4/2012	3/26/2012	3/26/2012
03-200-0414	DRY	1/4/2012	1/4/2012	3/26/2012	3/26/2012
03-400-0422	DRY	1/4/2012	1/4/2012	3/26/2012	3/26/2012
03-500-0425	DRY	1/4/2012	1/4/2012	3/21/2012	3/21/2012
03-300-0430	DRY	1/4/2012	1/4/2012	3/21/2012	3/21/2012
03-300-0480	DRY	3/21/2012	3/21/2012	4/13/2012	4/13/2012
03-500-0535	DRY	12/14/2012	12/14/2012	4/8/2012	4/8/2012
03-300-0550	DRY	12/14/2012	12/14/2012	3/21/2012	3/21/2012

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
03-300-0615	DRY	12/14/2012	12/14/2012	4/2/2012	4/2/2012
03-300-0625	DRY	12/14/2012	12/14/2012	4/2/2012	4/2/2012
03-300-0630	DRY	12/14/2012	12/14/2012	4/2/2012	4/2/2012
03-300-0640	DRY	12/9/2012	12/9/2012	4/2/2012	4/2/2012
03-300-0645	DRY	12/9/2012	12/9/2012	4/2/2012	4/2/2012
03-300-0655	DRY	12/9/2012	12/9/2012	4/2/2012	4/2/2012
03-300-0670	DRY	12/9/2012	12/9/2012	4/2/2012	4/2/2012
03-400-0895	DRY	12/9/2012	12/9/2012	3/29/2012	3/29/2012
04-500-0017	DRY	12/9/2012	12/9/2012	3/29/2012	3/29/2012
04-500-0117	DRY	12/9/2012	12/9/2012	3/29/2012	3/29/2012
04-500-0133	DRY	12/9/2012	12/9/2012	3/29/2012	3/29/2012
04-200-0227	DRY	12/1/2012	12/1/2011	4/2/2012	4/2/2012
04-500-0245	DRY	12/1/2011	12/1/2011	3/28/2012	3/28/2012
04-500-0272	DRY	12/1/2011	12/1/2011	3/28/2012	3/28/2012
04-500-0276	DRY	12/14/2012	12/14/2012	3/29/2012	3/29/2012
04-400-0287	DRY	12/1/2011	12/1/2011	3/28/2012	3/28/2012
04-400-0289	DRY	12/1/2011	12/1/2011	3/28/2012	3/28/2012
04-400-0294	DRY	12/1/2011	12/1/2011	4/8/2012	4/8/2012
04-400-0313	DRY	12/1/2011	12/1/2011	3/28/2012	3/28/2012
05-500-0020	DRY	11/18/2011	11/18/2011	4/13/2012	4/13/2012
06-500-0120	DRY	11/18/2011	11/18/2012	4/13/2012	4/13/2012
06-500-0144	DRY	11/18/2011	11/18/2011	4/17/2012	4/17/2012
06-500-0215	DRY	5/2/2012	5/2/2012	11/18/2012	11/18/2012
10-500-0380	DRY	8/23/2011	8/23/2011	3/19/2012	3/19/2012
10-500-0390	DRY	8/23/2011	8/23/2011	3/19/2012	3/19/2012
10-500-0405	DRY	8/23/2011	8/23/2011	3/19/2012	3/19/2012
10-500-0550	DRY	8/23/2011	8/23/2011	3/19/2012	3/19/2012
11-300-0602	DRY	11/8/2011	11/8/2011	3/19/2012	3/19/2012

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
11-300-0610	DRY	11/8/2011	11/8/2011	3/13/2012	3/13/2012
11-300-0611	DRY	11/8/2011	11/8/2011	3/13/2012	3/13/2012
11-300-0612	DRY	11/8/2011	11/8/2011	3/13/2012	3/13/2012
11-300-0613	DRY	11/8/2011	11/8/2011	3/13/2012	3/13/2012
11-300-0614	DRY	11/8/2011	11/8/2011	3/13/2012	3/13/2012
11-300-0615	DRY	11/8/2011	11/8/2011	3/13/2012	3/13/2012
12-500-0575	DRY	11/1/2011	11/2/2011	3/20/2012	3/20/2012
12-500-0720	DRY	11/1/2011	11/2/2011	3/20/2012	3/20/2012
13-300-0135	WET	10/3/2011	10/3/2011	3/13/2012	3/13/2012
13-300-0140	WET	10/17/2011	10/17/2011	3/20/2012	3/20/2012
13-300-0145	DRY	10/17/2011	10/17/2011	3/20/2012	3/20/2012
13-300-0147	DRY	10/17/2011	10/17/2011	3/20/2012	3/20/2012
13-300-0155	WET	10/17/2011	10/17/2011	3/20/2012	3/20/2012
13-300-0170	DRY	10/24/2011	10/25/2011	3/20/2012	3/20/2012
13-300-0181	DRY	10/24/2011	10/25/2011	3/12/2012	3/12/2012
13-300-0182	DRY	10/24/2011	10/25/2011	3/12/2012	3/12/2012
13-300-0184	DRY	10/24/2011	10/25/2011	3/12/2012	3/12/2012
13-300-0185	DRY	10/24/2011	10/25/2011	3/12/2012	3/12/2012
13-300-0190	DRY	11/2/2011	11/3/2011	3/12/2012	3/12/2012
13-300-0226	DRY	11/2/2011	11/3/2011	3/12/2012	3/12/2012
13-300-0227	DRY	9/12/2011	9/13/2011	3/8/2012	3/8/2012
13-300-0228	ILLICIT CONNECTION	9/12/2011	9/13/2011	3/8/2012	3/8/2012
13-300-0305	ILLICIT CONNECTION	9/12/2011	9/13/2011	3/8/2012	3/3/2012
13-300-0350	WET	9/12/2011	9/13/2011	3/8/2012	3/8/2012
13-300-0365	DRY	9/12/2011	9/13/2011	3/7/2012	3/7/2012
18-100-0690	DRY	8/23/2011	8/23/2011	3/7/2012	3/7/2012
18-100-0700	DRY	8/23/2011	8/23/2011	3/7/2012	3/7/2012
31-100-0500	WET	8/29/2011	8/29/2011	3/7/2012	3/7/2012

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
31-300-0505	DRY	8/29/2011	8/29/2011	3/6/2012	3/6/2012
31-300-0515	DRY	8/29/2011	8/29/2011	3/6/2012	3/6/2012
31-300-0520	DRY	8/29/2011	8/29/2011	3/6/2012	3/6/2012
51-100-0900	DRY	8/29/2011	8/29/2011	3/6/2012	3/6/2012
53-100-0030	WET	8/3/2011	8/3/2011	3/6/2012	3/6/2012
53-100-0045	WET	8/3/2011	8/3/2011	3/5/2012	3/5/2012
53-100-0065	DRY	8/3/2011	8/3/2011	3/5/2012	3/5/2012
53-100-0085	WET	8/3/2011	8/3/2011	3/5/2012	3/5/2012
53-100-0133	DRY	8/3/2011	8/3/2011	3/5/2012	3/5/2012
53-500-0220	DRY	8/3/2011	8/3/2011	3/5/2012	3/5/2012
53-500-0230	DRY	8/3/2011	8/3/2011	2/28/2012	2/28/2012
55-100-0150	DRY	8/3/2011	8/3/2011	2/28/2012	2/28/2012
56-100-0230	WET	8/3/2011	8/3/2011	2/28/2012	2/28/2012
79-500-0050	DRY	8/24/2011	8/24/2011	2/28/2012	2/28/2012
79-500-0343	WET	8/24/2011	8/24/2011	2/27/2012	2/28/2012
79-100-0365	DRY	8/24/2011	8/24/2011	2/27/2012	2/27/2012
79-100-0400	WET	8/24/2011	8/24/2011	2/27/2012	2/27/2012

TYPE CODE	COUNT
100	**18**
200	**6**
300	**83**
400	**23**
500	**25**

APPENDIX B

Summary Report for IBI Studies

INDEX OF BIOTIC INTEGRITY
ON GOOSE CREEK AND TURKEY CREEK IN THE CITY OF KNOXVILLE FINAL DATA 2012 REPORT
CITY OF KNOXVILLE CONTRACT C-08-0184

CONDUCTED BY:

FORT LOUDOUN LAKE ASSOCIATION

REPORT PREPARED BY:

Michael S. Gaugler, Stormwater Services Program Director

IBI DATA PROVIDED BY:

Fish IBI Data Provided By: Michael S. Gaugler
Macroinvertebrate IBI Data Provided By: Michael S. Gaugler
Habitat Analysis Data Provided By: Michael S. Gaugler

INDEX OF BIOTIC INTEGRITY ON GOOSE CREEK AND TURKEY CREEK IN THE CITY OF KNOXVILLE FINAL DATA 2012 REPORT

INTRODUCTION

This document represents data collected from two streams located in Knoxville, TN by the Fort Loudoun Lake Association (FLLA) for the City of Knoxville. Goose Creek and Turkey Creek were the two streams surveyed for the Index of Biotic Integrity (IBI) May – June, 2012. In this document we will describe the study sites and methodologies utilized to assess sampling sites, provide data, analyze and interpret the survey results.

OBJECTIVES

1. Perform backpack electro-shocking fish survey on two creeks with two sites each.
2. Perform a macroinvertebrate survey on two creeks with two sites each.
3. Perform a habitat assessment at each stream site.
4. Record the instant water parameters at each stream site.
5. Provide photographic evidence of current conditions at each site. Photographs are located in appendices.
6. Score the IBI-F, IBI-M, and habitat assessment and analysis for each site and deliver the write-up to the City of Knoxville.

STUDY AREAS

FLLA assessed two sites along Goose Creek (Figure 1). The upper site was located behind the Vestal Boys and Girls Club at 522 Maryville Pike upstream from the Mary Vestal Park. The lower site was located within the Mary Vestal Park. This creek flows through South Knoxville and drains into the Tennessee River at river mile 646.8. Goose Creek flows westward through downtown Knoxville and the surrounding land uses include residential areas, roadways, and some businesses. The survey was approximately 1.1 river miles from the confluence of Fort Loudoun Lake.

Two sampling sites were chosen on Turkey Creek (Figure 2). The upper site was adjacent to Parkside Drive and began behind 10521 Plum Creek Drive and continued downstream to Glade Drive. The lower site began downstream of Glade Drive and continued downstream to Lovell Road next to Wasabi Japanese Steakhouse at the intersection of Lovell Road and Parkside Drive.

Figure 1. IBI sites on Goose Creek.

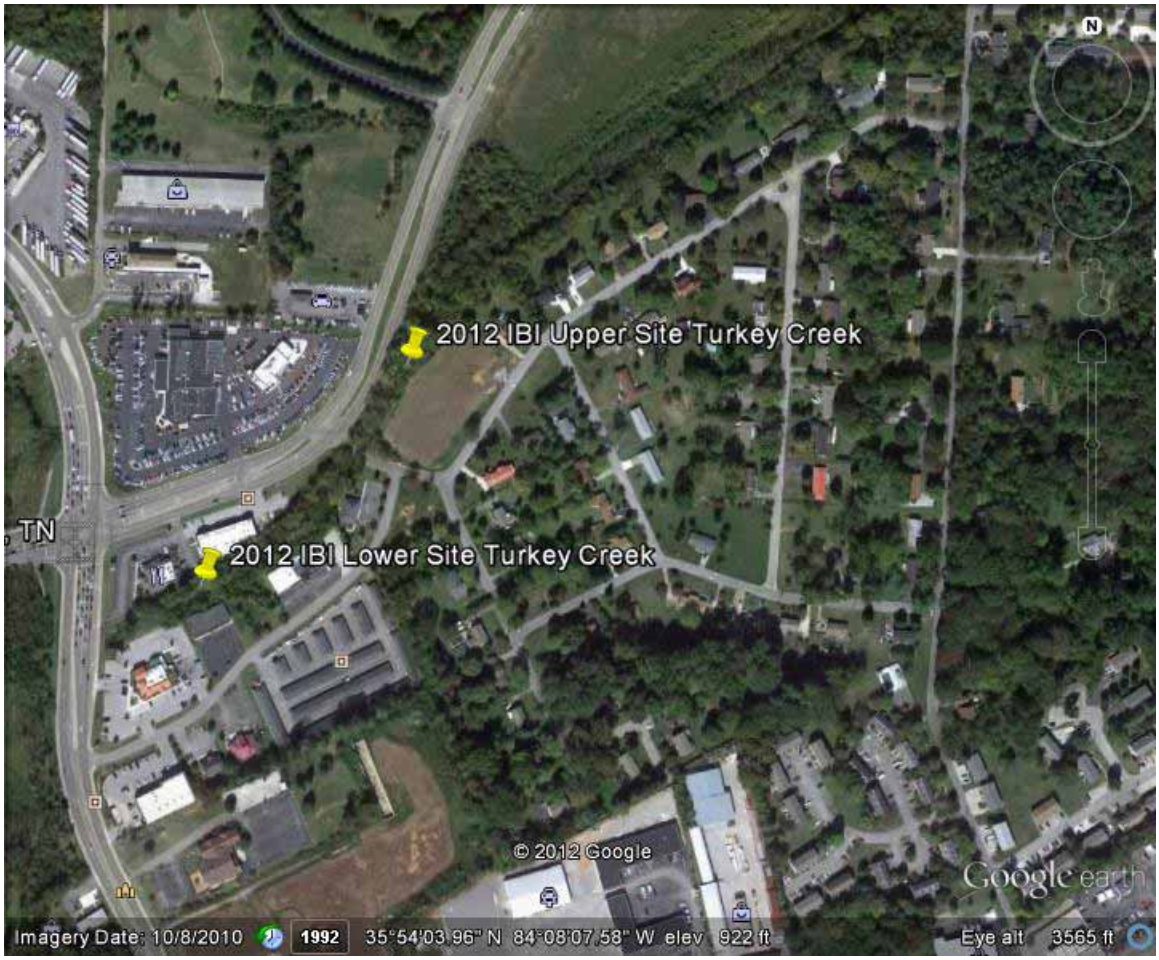


Figure 2. IBI sites on Turkey Creek.

METHODS

Stream assessment utilizing IBI methodologies and physical habitat protocols

FLLA followed the United States Environmental Protection Agency (US EPA) Methodology for Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish (Barbour et al. 1999) for sampling protocols. This methodology is in compliance with the Tennessee Department of Environment and Conservation (TDEC), Division of Water Pollution Control Standard Operating Procedures for Stream Surveys (Arnwine 2007). Sampling sites were chosen based upon geographic location (within the City of Knoxville), the presence of suitable habitat, and easy of access. The biological conditions of Whites Creek and Williams Creek were assessed by collection and identification of the fish and benthic macroinvertebrates to lowest taxon possible, usually to the species level. The physical environment was assessed by classifying the instream and out-of-stream habitat parameters as well as water parameters.

The fish community was sampled based upon the methodologies of Karr (1981) and TDEC (1997). The Index of Biotic Integrity for the fish community (IBI-F) assesses the environmental quality of the stream at a sampling site by application of ecologically based metrics to fish community data (Karr 1981). Karr's 12 metrics address species richness and composition, trophic structure, fish abundance, and fish condition. Each metric shows the condition of one aspect of the fish community and is scored against an expected value under a reference condition. Scores are "1" or poor, "3" or intermediate, and "5" or the best to be expected. The 12 scores are summed and a total IBI score is determined for the sampling site. The total IBI score rates the site from "Very poor" to "Excellent" (Karr et al. 1986). Please see Table 1 below for the metric description and scoring criteria. IBI classification is as follows: 0 = no fish; 12 – 22 Very poor; 28 – 34 = Poor; 40 – 44 = Fair; 48 – 52 = Good; 59 – 60 = Excellent.

Table 1. Metrics and scoring criteria of fish IBI.

Metric Description	Scoring Criteria		
	1	3	5
Total number of native fish species	<5	(5-10)	>10
Number of darter species	<1.5	(1.5-2.5)	>2.5
Number of sunfish species, less *Micropterus*	<1.5	(1.5-2.5)	>5
Number of sucker species	<0.5	(0.5-1)	>1
Number of intolerant species	<1	(1-2.5)	>2.5
Percent of individuals as tolerant species	>40%	20%-40%	<20
Percent of individuals as omnivores and stoneroller species	>50%	25%-50%	<25
Percent of individuals as specialized insectivores	<10%	10%-20%	>20%
Percent of individuals as piscivores	<2%	2%-4%	>4%
Catch rate (average number of fish per 300 sq. ft. sampling unit)	<22	22-43.8	>43.8
Percent of individuals as hybrids	<1%	TR-1%	0%
Percent of individuals with diseases, tumors, fin damage, and other anomalies	>5%	2%-5%	<2%

Fish collection used a Smith-Root LR-24 backpack shocker, one 20 foot seine, two collection nets and one five gallon bucket. Backpack shocking fish into the seine was used in the riffle, run, and pool habitats. The seine was positioned perpendicular to the stream flow at the downstream section of habitat sample. Working downstream the backpack operator shocked approximately 300 ft^2 area. Fish stunned became suspended in the water column and were transported downstream to the seine. Any stunned fish trapped under rocks were physically removed and placed in the collection bucket or into the water column allowing transport downstream. Upon sampling the area, the seine was picked up and all fish remaining in the seine were placed into the sampling bucket that contained water. Fish were examined for anomalies, identified to species and released. The sampling team worked from downstream to upstream to prevent sampling bias of previously caught fish. Each of the habitats was sampled until three sampling efforts produced no additional species for that habitat.

FLLA followed the Tennessee Department of Environment and Conservation's (TDEC) Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys (Arnwine, 2011) for sampling procedures of collecting biological samples. The biological conditions of Goose Creek and Turkey Creek were assessed by conducting an Index of Biotic Integrity for Macroinvertebrates (IBI-M) by collecting and identifying the benthic macroinvertebrates present at two sites per creek. Sampling sites were considered suitable based upon the presence of one fast-flowing and one slow-flowing riffle.

A semi-quantitative riffle kick (SQKICK) was used to collect samples. A one-meter kick net with 500 micrometer mesh was used to sample the riffles. At each site, four collection kicks were performed. Two kicks were taken in a slower current velocity riffle and two kicks were taken in a faster current velocity riffle. Sampling was conducted from the downstream riffle to the upstream sample. After each kick approximately one minute passed before removing the net from the riffle to allow all debris to wash into the net. Next all debris collected was washed into a sampling bucket with a 500 micrometer screen on the bottom. All kicks were combined and all debris was washed into a 1 L (1000 ml) bottle and samples were stored in 70% isopropyl alcohol. Any aquatic macroinvertebrates remaining on the net were removed and placed in the storage container. After completion at each site both the net and bucket were thoroughly washed to prevent contamination at the next sampling site.

Before sampling, the physical and chemical field sheet was completed. After sampling the top portion of the "Benthic Macroinvertebrate Field Data Sheet" was completed as well as a habitat assessment (Form 3 of Barbour et al. 1999).

In the laboratory, samples were washed onto a 500 micrometer mesh sieve and washed with water to remove additional sediment and residual alcohol. Each sample was processed completely and all macroinvertebrates were removed and stored in a second container for identification purposes. The processed sample was returned to the original container and stored.

All macroinvertebrates were identified using a Fisher Scientific microscope and Brigham et al. species key (1982) along with recent corrections to this edition. Taxa counts were recorded and specimens were identified to species level when possible

A macroinvertebrate index using seven metrics was created based upon semi-quantitative macroinvertebrate surveys (Arnwine and Denton 2001). The index is based upon ecoregion reference data and calibrated by bioregion. The seven biometrics are:
EPT (Ephemeroptera Plecoptera Trichoptera Richness)
TR (Taxa richness)
% EPT-Cheum (EPT abundance except *Cheumatopsyche* caddisflies)
%OC (Oligochaetes and chironomids)
NCBI (North Carolina Biotic Index)
% NUTOL (% nutrient tolerant organisms)
% Clingers

After calculating the seven biometric values, the data are equalized and assigned a score of 0, 2, 4, or 6 based upon the reference database of the bioregion. The seven scores are totaled and the biological condition is determined. There are two categories of the index score:
Non-impaired (supporting) is equal to or greater than 32.
Impaired (not supporting) is equal to or less than 31.

Water Quality

Water parameters recorded included dissolved oxygen (DO), pH, temperature (^{o}C), and conductivity. Parameters were recorded using YSI meters. The YSI 100 meter recorded temperature and pH and the YSI 85 was used to compare temperature and to measure DO and conductivity. Before each field day the meters were calibrated per the manufacturer's directions and tested for reading drift at the end of each sampling day.

Habitat Analysis

A visual habitat assessment was conducted following Barbour et al (1999) methodology to evaluate the integrity of the habitat at each sampling site. The Physical Characterization and Water Quality Field Data Sheet (Appendix A-1, Form 1 of Barbour et al. 1999) and the Habitat Assessment Field Data Sheet (Appendix A-1, Form 2 of Barbour et al. 1999) were used. Because samples were collected in Ecoregion 67f, the High Gradient Stream Assessment Sheet was used to evaluate habitats. In all ten parameters were evaluated:

Epifaunal substrate/available cover
Embeddedness
Velocity/Depth combinations
Sediment deposition
Channel flow status
Channel alteration
Frequency of riffles or bends
Bank stability
Bank vegetative protection
Riparian vegetative zone width

Each parameter was individually scored 0 to 20 with 20 being the highest attainable score. A maximum of 200 points per site was possible. The scores were divided into four categories (Optimal, Suboptimal, Marginal and Poor) with a range of five points per category. After totaling the scores, the final score was compared with the Habitat Assessment Guidelines for Ecoregion 67f from Tennessee's Department of Environment and Conservation Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys (Arnwine 2011) to determine if the habitat is capable of supporting a healthy macroinvertebrate community. Scores for the Habitat Assessment are:

Scores 140 or greater indicate the habitat is not impaired.
Scores 139 or less indicated the habitat is impaired.

RESULTS

Table 2. Summary of IBI-F, IBI-M, and habitat assessment scores on Goose Creek and Turkey Creek, May – June, 2012.

	Goose Creek		Turkey Creek	
	Upper Site	**Lower Site**	**Upper Site**	**Lower Site**
IBI-F score	**24**	**22**	**26**	**28**
Rating	**Poor**	**Very Poor**	**Poor**	**Poor**
IBI-M score	**26**	**28**	**24**	**20**
Rating	**Impaired**	**Impaired**	**Impaired**	**Impaired**
Habitat score	**98**	**124**	**112**	**83**
Rating	**Impaired**	**Impaired**	**Impaired**	**Impaired**

Table 3. Fish collected on Goose Creek and Turkey Creek, May – June, 2012.

			Goose Creek		Turkey Creek	
Family	**Species**	**Common Name**	**Upper Site**	**Lower Site**	**Upper Site**	**Lower Site**
Cyprinidae (minnows)	*Capostoma anomalum*	Central stoneroller	**7**	**7**	**19**	**27**
	Rhinichthys atratulus	Blacknose dace	**26 (3 BS)**	**16 (1 BS)**	**21 (2 BS)**	**16 (1 BS)**
	Semotilus atromaculatus	Creek chub	**31 (2 BS)**	**93 (6 BS)**	**35 (2 BS)**	**15 (2 BS)**
Catostomidae (suckers)	*Hypentelium nigricans*	Northern hogsucker				**1**
Centrachidae (sunfishes)	*Micropterus dolomieu*	Small mouth bass		**7**		
	Micropterus punctulatus	Spotted bass				**2**
	Lepomis macrochirus	Bluegill		**3**		
	Lepomis gibbosus	Pumpkinseed			**17**	**70**
Percidae (perches)	*Etheostoma simoterum*	Snubnose darter	**6**	**3**	**4**	**1**
		TOTALS	**70**	**129**	**96**	**132**
Note: ( )equals number of abnormalities observed: black spot, BS						

A total of 427 fish among nine species were collected, identified, and checked for anomalies. Six species were identified in Goose Creek and seven species were identified in Turkey Creek. The most numerous fish species was *S. atromaculatus*, creek chub, with 174 specimens that represented 40.8% of the total catch and was the most numerous fish collected at three sampling sites. Pumpkinseed, *L. gibbosus*, was most numerous at

the lower site on Turkey Creek. This area was characterized by slow flowing water and deeper runs and pools than in other areas.

Table 4. Fish IBI score of the upper site of Goose Creek.

Metric Description	**Scoring Criteria**			**Observed**	**Score**
	1	3	5		
Total number of native fish species	<5	(5-10)	>10	5	3
Number of darter species	<1.5	(1.5-2.5)	>2.5	1	1
Number of sunfish species, less *Micropterus*	<1.5	(1.5-2.5)	>5	0	1
Number of sucker species	<0.5	(0.5-1)	>1	0	1
Number of intolerant species	<1	(1-2.5)	>2.5	0	1
Percent of individuals as tolerant species	>40%	20%-40%	<20%	44.3	1
Percent of individuals as omnivores and stoneroller species	>50%	25%-50%	<25%	7	5
Percent of individuals as specialized insectivores	<10%	10%-20%	>20%	45.7	3
Percent of individuals as piscivores	<2%	2%-4%	>4%	0	1
Catch rate (average number of fish per 300 sq. ft. sampling unit)	<22	22-43.8	>43.8	5.8	1
Percent of individuals as hybrids	<1%	TR-1%	0%	0	5
Percent of individuals with diseases, tumors, fin damage, and other anomalies	>5%	2%-5%	<2%	7.1	1
			IBI		24
			IBI Classification		Poor

Fish sampling yielded an IBI score of 24 and the fish community was classified as ‘poor’.

Table 5. Fish IBI score of the lower site of Goose Creek

Metric Description	Scoring Criteria			Observed	Score
	1	3	5		
Total number of native fish species	<5	(5-10)	>10	6	3
Number of darter species	<1.5	(1.5-2.5)	>2.5	1	1
Number of sunfish species, less *Micropterus*	<1.5	(1.5-2.5)	>5	1	1
Number of sucker species	<0.5	(0.5-1)	>1	0	1
Number of intolerant species	<1	(1-2.5)	>2.5	0	1
Percent of individuals as tolerant species	>40%	20%-40%	<20%	72.1	1
Percent of individuals as omnivores and stoneroller species	>50%	25%-50%	<25%	7.5	5
Percent of individuals as specialized insectivores	<10%	10%-20%	>20%	14.7	1
Percent of individuals as piscivores	<2%	2%-4%	>4%	0	1
Catch rate (average number of fish per 300 sq. ft. sampling unit)	<22	22-43.8	>43.8	8.1	1
Percent of individuals as hybrids	<1%	TR-1%	0%	0	5
Percent of individuals with diseases, tumors, fin damage, and other anomalies	>5%	2%-5%	<2%	5.4	1
			IBI		22
			IBI Classification		Very Poor

Fish sampling yielded an IBI score of 22 and the fish community was classified as ‘very poor’.

Table 6. Fish IBI score of the upper site of Turkey Creek.

Metric Description	Scoring Criteria			Observed	Score
	1	3	5		
Total number of native fish species	<5	(5-10)	>10	5	3
Number of darter species	<1.5	(1.5-2.5)	>2.5	1	1
Number of sunfish species, less *Micropterus*	<1.5	(1.5-2.5)	>5	1	1
Number of sucker species	<0.5	(0.5-1)	>1	0	1
Number of intolerant species	<1	(1-2.5)	>2.5	0	1
Percent of individuals as tolerant species	>40%	20%-40%	<20	36.4	3
Percent of individuals as omnivores and stoneroller species	>50%	25%-50%	<25	19.8	3
Percent of individuals as specialized insectivores	<10%	10%-20%	>20%	26.0	3

Table 6 continued.					
Percent of individuals as piscivores	<2%	2%-4%	>4%	0	1
Catch rate (average number of fish per 300 sq. ft. sampling unit)	<22	22-43.8	>43.8	7.4	1
Percent of individuals as hybrids	<1%	TR-1%	0%	0	5
Percent of individuals with diseases, tumors, fin damage, and other anomalies	>5%	2%-5%	<2%	4.2	3
			IBI		26
			IBI Classification		Poor

Fish sampling yielded an IBI score of. 26 and the fish community was classified as 'poor'.

Table 7. Fish IBI score of lower site of Turkey Creek

Metric Description	**Scoring Criteria**			**Observed**	**Score**
	1	3	5		
Total number of native fish species	<5	(5-10)	>10	7	3
Number of darter species	<1.5	(1.5-2.5)	>2.5	1	1
Number of sunfish species, less *Micropterus*	<1.5	(1.5-2.5)	>5	1	1
Number of sucker species	<0.5	(0.5-1)	>1	1	3
Number of intolerant species	<1	(1-2.5)	>2.5	0	1
Percent of individuals as tolerant species	>40%	20%-40%	<20%	11.4	5
Percent of individuals as omnivores and stoneroller species	>50%	25%-50%	<25%	20.4	3
Percent of individuals as specialized insectivores	<10%	10%-20%	>20%	12.9	1
Percent of individuals as piscivores	<2%	2%-4%	>4%	0	1
Catch rate (average number of fish per 300 sq. ft. sampling unit)	<22	22-43.8	>43.8	6.3	1
Percent of individuals as hybrids	<1%	TR-1%	0%	0	5
Percent of individuals with diseases, tumors, fin damage, and other anomalies	>5%	2%-5%	<2%	2.3	3
			IBI		28
			IBI Classification		Poor

Fish sampling yielded an IBI score of 28 and the fish community was classified as 'poor'.

Table 8. Macroinvertebrates collected at Goose Creek and Turkey Creek, May-June, 2012.

TAXA				
	Goose Creek		Turkey Creek	
	Upper Site	Lower Site	Upper Site	Lower Site
OLIGOCHAETA (Aquatic worms)				
Haplotaxidae				
Haplotaxis gordioides	9	7	1	8
EPHEMEROPTERA (Mayflies)				
Heptagenidae				
Baetis tricaudatus	6	3	3	1
Stenonema femoratum	1			
TRICHOPTERA (Caddisflies)				
Hydropsychidae				
Certatopsyche sparna	19	20	16	7
Cheumatopsyche spp.	26	13	12	9
Hydropsyche demora	14	30	9	9
COLEOPTERA (Beetles)				
Elmidae				
Stenelmis spp.	4	32	69	30
Psephenidae				
Psephenus herricki	21	4		
HETEROPTERA (True bugs)				
Veliidae				
Rhagovelia obesca			2	
DIPTERA (Flies)				
Chironomidae				
Polypedilum spp.	16	9	24	27
Rheotanytarsus exiguus	15	16		
Tanytarsus spp.	11	20		
Tanypus cariantus			10	5
Thienemannimyia spp.			19	30
Tipulidae				
Antocha spp.	1		1	
Tipula abdominalis	1	2	2	
Tabanidae				
Tabanus	1	1		
Simuliidae				
Simulium snowi	3	1	7	10
Trepobates spp.	1			
AMPHIPODA (Crustaceans)				
Crangonyctidae				

Table 8 continued				
	Goose Creek		**Turkey Creek**	
	Upper Site	**Lower Site**	**Upper Site**	**Lower Site**
Crangonyx spp.	3	2	6	6
BASOMMATOPHORA (Snails)				
Pleuroceridae				
Elimia spp.	5	2	11	21
Planorbella spp.			1	5
TUBIFICIDA				
Naidiade				
Nais spp.	3	5	1	2
Totals	160	167	194	170

A total of 691 specimens were collected at the four sampling sites. The two most numerous taxa at each of the sites were hydropsychid caddisflies and midges. At Turkey Creek's upper site, the riffle beetle, *Stenelmis*, was the most numerous taxon. Few EPT taxa were identified at any of the sites. Though caddisflies were numerous few mayflies were collected and identified and no stoneflies were observed.

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Table 9. Summary table for macroinvertebrate index of four sampling sites, May – June, 2012.

		METRIC							
Site		**Taxa Richness**	**EPT Richness**	**% EPT-Cheum**	**% OC**	**NCBI**	**% Clingers**	**% NUTROL**	**Index Score**
Goose Creek, Upper	Value	19	5	25.0	31.9	5.1	65.6	30.6	
	Score	4	2	2	4	4	6	4	**26**
Goose Creek, Lower	Value	16	4	31.7	31.1	5.4	69.5	17.4	
	Score	2	2	4	4	4	6	6	**28**
Turkey Creek, Upper	Value	17	4	14.4	27.8	5.3	58.8	24.7	
	Score	2	2	0	4	4	6	6	**24**
Turkey Creek, Lower	Value	14	4	10.0	41.2	5.9	38.2	34.7	
	Score	2	2	0	4	4	4	4	**20**

	INDEX SCORE	**INDEX SCORE RATING**
SITE		
Goose Creek, Upper	26	Impaired
Goose Creek, Lower	28	Impaired
Turkey Creek, Upper	24	Impaired
Turkey Creek, Lower	20	Impaired

Scores ranged from 26 to 20 therefore classifying each sampling site as ‘impaired’.

Table 10. Summary of water quality parameters taken on Goose Creek and Turkey Creek in May - June, 2012.

	WATER QUALITY PARAMETERS *			
Site	Temperature (^{o}C)	DO (mg/L)	pH	Conductivity (um/hos)
Creek, Upper	19.0	7.0	7.4	398.6
Goose Creek, Lower	18.8	7.0	7.4	400.1
Turkey Creek, Upper	19.8	6.92	7.17	360.4
Turkey Creek, Lower	19.7	6.90	7.23	363.1

Water quality parameters were taken at the end of sampling for both the fish and the macroinvertebrate surveys. Values recorded were within the standards range for streams in East Tennessee (Arnwine and Denton 2001).

Table 11. Summary for Habitat Assessment on Goose Creek and Turkey Creek in May - June 2012.

Habitat Parameter	**Goose Creek, Upper**	**Goose Creek, Lower**	**Turkey Creek, Upper**	**Turkey Creek, Lower**
Latitude	35^{o} 56’ 06.99”	35 ^{o} 56’ 13.50”	35 ^{o} 54’ 6.89”	35 ^{o} 54’ 01.52”
Longitude	83 ^{o} 54’56.07”	83 ^{o} 54’ 56.96”	83 ^{o} 8’ 13.30”	84 ^{o} 08’19.88”
Epifaunal Cover	10	15	11	10
Embeddedness	10	14	11	6
Velocity/Depth Regime	12	12	11	11
Sediment Deposition	8	11	10	8
Channel Flow	13	14	10	8
Channel Alteration	10	13	11	8
Riffle Frequency	9	13	12	8
Bank stability (left/right)	5/5	7/6	6/6	4/4
Vegetative Protection (left/right)	5/5	7/6	6/6	4/4
Riparian Zone Width (left/right)	3/3	3/3	6/6	4/4
Total (200 max.)	**98**	**124**	**112**	**83**

Table 11. Continued.		
	TOTAL SCORE	**TOTAL SCORE RATING**
SITE		
Goose Creek, Upper	98	Impaired
Goose Creek, Lower	124	Impaired
Turkey Creek, Upper	112	Impaired
Turkey Creek, Lower	83	Impaired

Each of the site's habitats was classified as 'impaired'. The Goose Creek upper site was characterized by a high degree of embeddedness and sediment deposition. Though some cobble and gravel mix was observed most of the streambed was covered by fines such as sand and silt. Flow was present but riffles were infrequent in the sampling reach. The riparian zone had been impacted as well due to the roadways and parking lot adjacent to the stream. The lower site was rated higher because the instream habitat had a greater number of riffles and the level of embeddedness had decreased compared to the upper site. There were several large sand bars observed between the two sampling sites. Also because this section was within the Mary James Vestal Park the riparian zone was better intact though signs of human impacts were evident such as sanitary sewer lines crossing Goose Creek and some access points to the creek.

Both Turkey Creek sites had areas of concern. The surrounding land uses of roadways, business, and residential have altered the area and impacted the stream conditions. There were high degrees of embeddedness at both sites but the upper site's riffle-run complexes were cleaner. Also the riparian zone was more intact at the upper site than the lower one. The reach between sampling sites was an undeveloped lot that was characterized by Turkey Creek widening and channelized. Flows were reduced and much of the stream bed was embedded by fines. Businesses could be observed from the creek at the lower site. The lower site had few riffles and was characterized by low flows and deeper pools. The stream channel had down cut and was narrow. Rip rap rocks were placed in several locations to prevent additional erosion. Other issues observed were the degree of trash that had collected in the riparian zone and several outfall pipes that originated from the parking lots of the businesses near Turkey Creek.

DISCUSSION

Many 67f Ecoregion streams are characterized by reduced riparian cover, high amounts of erosion and sedimentation and nutrient loading (Arnwine and Denton 2001). Both creeks in the current IBI study are listed in the final report of the 2010, 303 d list for the state of Tennessee's impaired water bodies (TDEC 2010). Goose Creek has 4.9 impaired stream miles that priorities include loss of biological integrity due to silt, other anthropogenic habitat alterations, PCB levels, and *Escherichia coli* levels due to collection system failures, MS4 area discharges, and RCRA hazardous waste. Turkey Creek's 15.8 impaired stream miles whose priorities include loss of biological integrity due to silt and *E. coli* levels due to discharges form a MS4 area.

Both creeks demonstrated similar trends in regards to the biological communities and the conditions of the physical habitat though Goose Creek is located in the southern section of Knoxville and Turkey Creek is located in the western section of Knoxville (Farragut). At each site, the IBI-F rated the stream reach as 'poor' to 'very poor' (Goose Creek, lower site). Only nine fish species were collected with three (northern hogsucker, spotted bass, and bluegill) being collect at a single site and the number of individuals was less than three (Table 3). Two species, blacknose dace and creek chub, accounted for a majority of all fish collected and identified at 59.3% of the catch effort. Some individuals showed signs of black spot as well though these numbers were relatively low.

The macroinvertebrate community was rated as 'impaired' at each of the four creek sites and failed to meet the TMI of 32 for Ecoregion 67f. Caddisflies and midges were numerous at each site but few mayflies and no stoneflies were collected and identified. The metrics that were severely impacted by the current conditions were taxa richness, EPT richness, and %EPT. These values were 4 to 0 with only two ratings of 4 (Goose Creek upper site for taxa richness and Goose Creek lower site for %EPT).

The physical habitat was rated as 'impaired' at each of the sample sites as well. Each habitat parameter received a lowered score due to current conditions and no scores were in the 'optimal' category. At each of the locations instream issues included embeddedness, sediment deposition and riffle frequency. Flows were reduced due to drought conditions and velocity regime and channel flow parameters were affected. The riparian zone was altered at each site. Because the vegetative protection and zone width was reduced, the banks had decreased stability and showed signs of erosion due to the presence of exposed soils and the presence of undercut banks.

Overall both streams are degrading due to anthropogenic activities throughout their stream lengths. Both of these streams have degraded in overall quality as evident of both of their biological scores. If these pressures continue, the biological community and the physical habitat will continue to degrade. Additional sampling on both of these creeks is warranted because of the current status of the biological communities along the sampling locations. Please refer to Appendix A photos for current conditions and pressures on Goose Creek and Appendix B photos for current conditions and pressures on Turkey Creek.

REFERENCES

Arnwine, D.H. 2011. Quality system standard operating procedure for macroinvertebrate stream surveys. Tennessee Department of Environment and Conservation, Division of Water Pollution Control. Nashville, TN.

Arnwine, D.H. and G.M. Denton. 2001. Habitat quality of least-impacted streams in Tennessee. Tennessee Department of Environment and Conservation, Division of Water Pollution Control. Nashville, TN. Pp. 65.

Barbour, M.T., J. Gerritsen, B.D. Snyder and J.B. Stribling. 1999. 2nd Edition. Rapid bioassessment protocols for use in streams and wadeable rivers: Periphyton, benthic macroinvertebrates and fish. EPA 841-B-99-002. U. S. Environmental Protection Agency, Office of Water. Washington D.C.

Brigham, A.R., W.U. Brigham and A. Gnilka (eds.). 1982. Aquatic insects and oligochaetes of North and South Carolina. Midwest Aquatic Enterprises, Mahomet, IL.

Karr, J.R. 1981. Assessment of biotic integrity using fish communities. Fisheries 66:21-7.

Karr J.R., K.D. Fausch, P.L. Angermeier, P.R. Yant,, and I.J. Schlosser. 1986. Assessing biological integrity in running waters: A method and its rationale. Special publication 5. Illinois Natural History Survey.

TDEC (Tennessee Department of Environment and Conservation). 1997. Biological standard operating procedures manual: Volume II: Fish communities, final version. Division of Water Pollution Control. Nashville, TN.

TDEC (Tennessee Department of Environment and Conservation). 2010. Final Report: Year 2010 303 (d) list. Division of Water Pollution Control. Nashville, TN.

APPENDIX A: PHOTOS OF GOOSE CREEK

Photo 1. Stream conditions at Mary James Park.

Photo 2. Heavy levels of embeddedness in slow run.

Photo 3. Natural fish barrier at upper site.

APPENDIX B: PHOTOS OF TURKEY CREEK

Photo 1. Fish collection at the lower site.

Photo 2. Substrate conditions.

Photo 3. Riparian zone and stream at upper site.

APPENDIX C

Summary Report for RBP III Studies

RAPID BIOASSESSMENT PROTOCOL (III) ON FIRST CREEK AND WHITES CREEK IN THE CITY OF KNOXVILLE FINAL DATA 2012 REPORT
CITY OF KNOXVILLE CONTRACT C-08-0185

CONDUCTED BY:

FORT LOUDOUN LAKE ASSOCIATION

REPORT PREPARED BY:
Michael S. Gaugler, Stormwater Services Program Director

DATA PROVIDED BY:
Michael S. Gaugler

RAPID BIOASSESSMENT PROTOCOL (III) ON FIRST CREEK AND WHITES CREEK IN THE CITY OF KNOXVILLE FINAL DATA 2012 REPORT CITY OF KNOXVILLE CONTRACT C-08-0185

INTRODUCTION

This document represents data collected from two streams located in Knoxville, TN by the Fort Loudoun Lake Association (FLLA) for the City of Knoxville. First Creek and Whites Creek were the two streams surveyed for the Rapid Bioassessment Protocol III (RBP III) in May–June, 2012. This document will describe the study areas, explain methodology, collect data, analyze, present and discuss results.

OBJECTIVES

1. Perform a macroinvertebrate study on two creeks with two sites per stream.
2. Record instant water parameters at each site.
3. Perform a habitat analysis at each stream site.
4. Provide photographic evidence of current conditions and pressures at each site. Photographs are located in appendices.
5. Score the RBP and analysis for each site and deliver the write-up to the City of Knoxville.

STUDY AREAS

First Creek is a 12.09 mi^2 (31.32 km^2) drainage area that flows through Knoxville and empties into the Tennessee River at the waterfront at mile 647.5. This creek drains a significant portion of North Knoxville. First Creek begins due north of downtown Knoxville and flows southward to the Tennessee River. First Creek runs parallel to Broadway. This creek meanders through some residential areas and along roadways. First Creek has been placed on the 2010 303(d) list (TDEC, 2010) for impaired water bodies dues to levels of nitrate and nitrite, loss of biological diversity due to siltation, other anthropogenic habitat losses, and levels of *Escherichia coli* due to MS4 discharges, high density urban setting, and collection system failures.

FLLA assessed two sites along First Creek. The upstream site (Figure 1) was on North Broadway at the Kroger Shopping Center, KAT bus terminal and skate park. The downstream site was off of North Broadway along the Greenway near Cecil Avenue (Figure 2).

Whites Creek flows from the county into the city north of I-640 near Broadway. This creek has been placed on the 2010 303(d) list (TDEC, 2010) for impaired water bodies due to habitat alterations and high levels of *E. coli*. In the county much of the area is agricultural based and land uses within the city include industry and urbanization. The

Figure 1. Upper site on First Creek.

Figure 2. Lower site of First Creek.

Figure 3. Upper site of Whites Creek

upper site was adjacent to the railroad tracks near 4800 Beverly Road at the city-county line (Figure 3) and continued downstream following the tracks. The lower site was adjacent to I-640 off of Addison Drive and continued upstream until appropriate habitat was located (Figure 4).

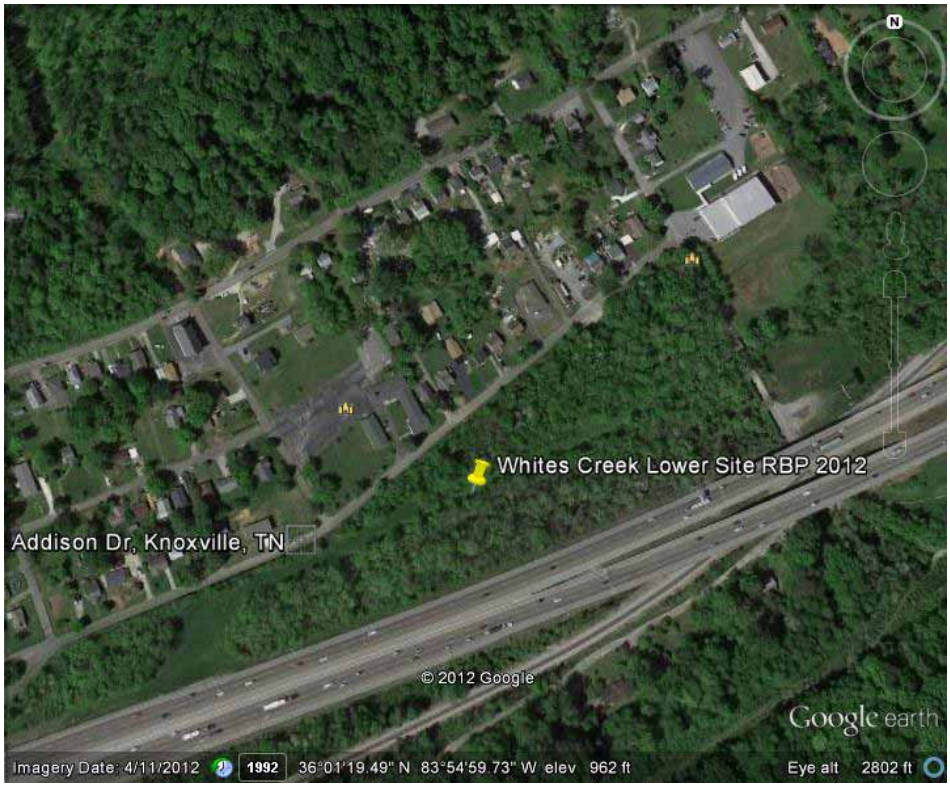


Figure 4. Lower site on Whites Creek.

METHODS

FLLA followed the United States Environmental Protection Agency (US EPA) Methodology for Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish (Barbour et al., 1999) for macroinvertebrate sampling using the multi-habitat approach, habitat assessment, and water quality sampling. This methodology is in compliance with the Tennessee Department of Environment and Conservation (TDEC), Division of Water Pollution Control Standard Operating Procedures for Stream Surveys (Arnwine, 2011). Sampling sites were chosen based upon geographic location (within the City of Knoxville), the presence of two suitable habitats, and easy of access. The biological conditions of the creeks were assessed by collection and identification of the benthic macroinvertebrates to lowest taxon possible usually to the species level. The physical environment was assessed looking at the instream and the out-of-stream (riparian) habitat parameters and water quality parameters.

The method is based upon the design recommendations of the Mid-Atlantic Coastal Streams Workgroup for use in variable habitat structure (US EPA, 1997) and has been used for state stream bioassessment programs in Florida (DEP, 1996) and Massachusetts (DEP, 1995). The method utilizes a multiple habitat approach in order to sample major habitats in proportional representation within a sampling reach by systematically collecting the benthic macroinvertebrates from the instream habitats by kicking the substrate or jabbing with a D-frame dip net (Barbour et al., 2006).

At each location a 100 m representative reach was sampled for benthic macroinvertebrates. Before aquatic macroinvertebrate sampling, the Physical and Chemical Field Sheet was completed to document site description, weather conditions and land use. Photographs were taken to further describe the area. Based upon habitats present and their approximate proportion, the number of jabs per habitat type was determined. Working from downstream to upstream a total of 20 jabs or kicks were taken at each site. After two sampling attempts all material in the net was washed into a 500 micrometer bucket sieve. The least number of sampling efforts per habitat was two. After sampling the cumulative sample was washed to remove additional sediment and any remaining sediment was washed into a 1-L plastic bottle. Macroinvertebrates remaining in the bucket or on the net were removed by forceps and placed into the bottle as well. The sample was preserved in 70% isopropyl alcohol. The bottle was labeled with location, date, and preservative information. The Benthic Macroinvertebrate Field Data Sheet (Appendix A-3, Form 1 Barbour et al. 1999) and the Physical Habitat Sheets (Appendix A-1, Form 2 Barbour et al., 1999) were completed after the sampling.

In the laboratory, samples were washed onto a 500 micrometer mesh sieve with water to remove additional sediment and residual alcohol. Each sample was processed and all macroinvertebrates were removed and stored in a second container for identification purposes. The processed sample was returned to the original container and stored in alcohol.

All macroinvertebrates were identified using a Fisher Scientific microscope and Brigham et al. (1982) along with recent corrections to this edition. Taxa counts were recorded and specimens were identified to species level when possible.

A macroinvertebrate index using seven biometric values was created based upon semi-quantitative macroinvertebrate surveys (Arnwine and Denton, 2001). The index is based upon ecoregional reference data and calibrated by region. The seven biometrics are:
EPT (Ephemeroptera, Plecoptera, and Trichoptera Richness)
TR (Taxa richness)
% EPT (EPT abundance)
%OC (% oligochaetes and chrinomids)
NCBI (North Carolina Biotic Index)
% NUTOL (% nutrient tolerant organisms)
% Clingers

After calculating the seven biometric values, the data were equalized and assigned a score of 0, 2, 4, or 6 based upon the reference database of the bioregion. The seven scores are totaled and the biological condition is determined for each sampling site. There are three categories of the index score:
Non-impaired (supporting) is equal to or greater than 32.
Slightly impaired (partially supporting) is 21 – 31.
Moderately impaired (partially supporting) is equal to or less than 20.

Water Quality

Water parameters recorded were dissolved oxygen (DO), pH, temperature and conductivity using YSI meters. The YSI 100 meter recorded temperature (^{o}C) and pH and the YSI 85 was used to compare temperature and to measure DO and conductivity. Before each field day the meters were calibrated per the manufacturer's directions and tested for reading drift at the end of each sampling day.

Habitat Analysis

A visual habitat assessment was conducted at each of the sampling sites following Barbour et al (1999) methodology to evaluate the integrity of the habitat at each sampling site. The Physical Characterization and Water Quality Field Data Sheet (Appendix A-1, Form 1 of Barbour et al. 1999) and the Habitat Assessment Field Data Sheet (Appendix A-1, Form 2 of Barbour et al. 1999) were used. Because samples were collected in Ecoregion 67f, the High Gradient Stream assessment sheet was used to evaluate habitats. In all ten parameters were evaluated:
Epifaunal substrate/available cover
Embeddedness
Velocity/Depth combinations
Sediment deposition
Channel flow status
Channel alteration
Frequency of riffles or bends
Bank stability
Bank vegetative protection
Riparian vegetative zone width

Each parameter was individually scored 0 to 20 with 20 being the highest attainable score. A maximum of 200 points per site was possible. The scores were divided into four categories (Optimal, Suboptimal, Marginal and Poor) with a range of five points per category. After totaling the scores, the final score was compared with the Habitat Assessment Guidelines for Ecoregion 67f from Tennessee's Department of Environment and Conservation Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys (Arnwine, 2011) to determine if the habitat is capable of supporting a healthy macroinvertebrate community. Scores for the Habitat Assessment are:
Scores greater than or equal to 130 indicate the habitat is not impaired.
Scores 103 – 129 indicate the habitat is moderately impaired.
Scores less than or equal to 102 indicate the habitat is severely impaired.

RESULTS

Table 1. Summary of biotic conditions and habitat assessment scores on First Creek and Whites Creek, May 2012.

	FIRST CREEK		WHITES CREEK	
	Upper	**Lower**	**Upper**	**Lower**
IBI-M score	**28**	**28**	**32**	**30**
Rating	**Slightly impaired**	**Slightly impaired**	**Slightly impaired**	**Slightly impaired**
Habitat score	**114**	**131**	**94**	**114**
Rating	**Moderately impaired**	**Moderately impaired**	**Severely impaired**	**Moderately impaired**

Table 2. Abundances of macroinvertebrates collected in First Creek and Whites Creek, May 2012.

TAXA	FIRST CREEK		WHITES CREEK	
	Upper	**Lower**	**Upper**	**Lower**
OLIGOCHAETA (Aquatic worms)				
Lumbricidae				
Haplotaxis gordioides	13	10	4	2
EPHEMEROPTERA (mayflies)				
Baetidae				
Baetis tricaduatus	1	3		
Heptagenidae				
Stenacron interpunctatum			4	1
TRICHOPTERA (Caddisflies)				
Hydropsychidae				
Certatopsyche sparna	24	22	38	28
Hydropsyche demora	21	19	29	22
Cheumatopsyche spp.	29	21	26	26
COLEOPTRA (Beetles)				
Elmidae				
Stenelmis spp.	10	9	14	16
Psephenidae				
Psephenus herricki	7	9	6	11
DIPTERA (Flies)				
Chironomidae				
Polypedilum spp.	18	20	18	14
Tanytarsus spp.	11	9	15	19
Thienemannimyia spp.		1		
Rhenotanytarsus spp.	5	3		

Table 2 continued.				
	FIRST CREEK		**WHITES CREEK**	
	Upper	Lower	Upper	Lower
Tipulidae				
Antocha spp.	1	2	1	1
Hexatoma spp.				
Tipula abdominalis	3	1	2	
Simuliidae				
Simulium snowi	16	10	12	6
TUBIFICIDA (Aquatic worms)				
Naididae				
Nais spp.	6	7	8	8
AMPHIPODA (Crustaceans)				
Crangonyctidae				
Crangonyx spp.	9	8	6	6
MESOGASTROPODA (Snails)				
Pleuroceridae				
Elimia spp.	8	10	11	7
TOTALS	182	164	194	167

A total of 707 individuals were collected among the four sampling sites on the two creeks. Hydropsychid caddisflies, midges, and black flies dominated each location. One mayfly genus was collected at each site but no stoneflies were found at any of the sites. Other notable genera included beetles from the genera *Stenelmis* and *Psephenus.*

Table 3. Summary table for macroinvertebrate RPB3 Index of four sampling sites on First Creek and Whites Creek, May 2012.

		METRIC							
Site		**Taxa Richness**	**EPT Richness**	**% EPT**	**% OC**	**NCBI**	**% Clingers**	**% NUTROL**	**Index Score**
First Cr., Upper		16	4	41.2	25.8	5.41	62.1	49.4	
Score		2	2	4	6	4	6	4	**28**
First Cr., Lower		17	4	39.6	26.2	5.27	57.9	47.6	
Score		2	2	4	6	4	6	4	**28**
Whites Cr., Upper		15	4	50.0	19.1	4.6	67.0	36.6	
Score		2	2	6	6	6	6	4	**32**
Whites Cr., Lower		14	4	46.7	21.0	5.0	66.5	32.9	
Score		2	2	4	6	4	6	6	**30**

	INDEX SCORE	**INDEX SCORE RATING**
SITE		
First Cr., Upper	28	Slightly impaired
First Cr., Lower	28	Slightly impaired
Whites Cr., Upper	32	Supporting
Whites Cr., Lower	30	Slightly impaired

Scores ranged from 28 to 32. Of the four sampling sites, only Whites Creek at the upper site met the TMI of 32 for Ecoregion 67f streams in the area. Sites were characterized by low taxa richness and EPT richness scoring two (2) in each biometric at each location. This location was able to meet the TMI because of a larger percentage of EPT taxa of the sample and the tolerance values from the NCBI biometric.

Table 4. Summary of water quality analysis taken on First Creek and Whites Creek collected in May 2012.

	WATER QUALITY PARAMETERS			
Site	**Temperature (^{o}C)**	**DO (mg/L)**	**pH**	**Conductivity (um/hos)**
First Cr., Upstream	19.9	6.4	7.6	391.2
First Cr., Downstream	20.2	6.6	7.3	381.4
Whites Cr., Upstream	17.2	6.2	7.1	411.6
Whites Cr., Downstream	17.4	6.1	7.2	424.0

Water quality parameters were taken at the end of sampling effort. Values recorded were within the standards range for streams in East Tennessee (Arnwine and Denton 2001).

Table 5. Summary of habitat assessment on First Creek and Whites Creek, May 2012

	SAMPLING SITE			
Habitat Parameter	**First Creek, Upper Site**	**First Creek, Lower Site**	**Whites Creek, Upper Site**	**Whites Creek, Lower Site**
Latitude	36^{o} 01’50.73”	35^{o} 59’21.31”	36^{o} 01’58.05”	36^{o} 01’19.49”
Longitude	83^{o} 55’50.36”	83^{o} 54’58.60”	84^{o} 54’09.66”	84^{o} 54’59.73”
Epifaunal Cover	12	16	10	14
Embeddedness	11	15	6	7
Velocity/Depth Regime	16	16	16	15
Sediment Deposition	10	10	7	9
Channel Flow	13	16	15	16
Channel Alteration	7	11	9	10
Riffle Frequency	10	11	9	11
Bank stability (left/right)	5/5	7/7	6/2	6/5
Vegetative Protection (left/right)	7/6	6/6	6/1	6/5
Riparian Zone Width (left/right)	7/5	5/5	6/1	6/4
Total (200 max.)	**114**	**131**	**94**	**114**

Table 5. Continued

	TOTAL SCORE	TOTAL SCORE RATING
SITE		
First Cr., Upper	114	Moderately impaired
First Cr., Lower	131	Moderately impaired
Whites Cr., Upper	94	Severely impaired
Whites Cr., Lower	114	Moderately impaired

Three of the sites received a 'moderately impaired' rating for habitat quality and one received a rating of 'severely impaired'. The First Creek upper site was surrounded by high levels of development from North Broadway. The channel had been altered and straightened to follow the roadway. There were high levels of embeddedness and sediment deposits were observed in several areas. Because of the disturbances, the stream banks showed signs of failure and were being undercut. The First Creek lower site scored highest at 131. The site was along the greenway off of Broadway. This section was characterized by multiple stream flow regimes, with good epifaunal cover and clean riffle/run sequences. Whites Creek upper site received the lowest rating of the four sampling locations. There were long pools and runs that were severely embedded. However the faster flowing areas such as the riffle habitats were relatively clean. Little to no vegetation was present along the right bank (facing downstream) due to the railroad tracks. The lower site was also impaired. This site differed from the upper site because it was in a residential area but was adjacent to I-640. The site was characterized by a well developed riparian zone providing a complete canopy throughout the sampling location. In-stream habitat was characterized by high levels of embeddedness with fines covering most of the stream bed. Walking through the site disturbed these fines and sediment plumbs were observed. This section was also deeper than the upper site with several root wads being sampled.

DISCUSSION

Both creeks are listed in the State of Tennessee's Final Version of the 2010, 303(d) list for impaired water bodies (TDEC 2010). First Creek's 16.1 impaired streams miles are due to levels of nitrate and nitrite, loss of biological diversity due to siltation, other anthropogenic habitat losses, and levels of *Escherichia coli* due to MS4 discharges, high density urban setting, and collection system failures. Whites Creek's 10.2 impaired stream miles are due to habitat alterations and high levels of *E. coli* due to MS4 discharges and stream bank modifications.

Both sampling sites on First Creek were rated as 'slightly impaired' for the biological community and 'moderately impaired' for the physical habitat. The system has been impacted due to land uses as evident of the lower scores. With the high levels of development along First Creek it is uncertain the steps that can be taken to improve the physical habitat and restoring the biological community. Downstream of the upper site has impervious surfaces from businesses such as parking lots adjacent to the creek. Efforts to improve this zone would be difficult and more than likely have a minimal impact to First Creek.

Whites Creek was rated as 'supporting' at the upper site and 'slightly impaired' at the lower site. The physical habitat was rated as 'severely impaired' at the upper site and 'moderately impaired' at the lower site. Much of the riparian zone at the upper site had been removed due to the train tracks and was in poor conditions. The stream width decreased at the sampling site and flows increased until 10 – 20 meters past the last sampling area where Whites Creek became wider and deeper. This wooded area could not be sampled however due to safety concerns. Though the physical habitat was 'severely impaired' this stream segment was able to support the macroinvertebrate community. The creek above the sampling site was characterized as a slow flowing and wide creek with few riffles. Further upstream of the sampling site was a rural setting with unprotected stream banks due to agricultural practices. Suitable habitat was difficult to observe in these areas. Because the upper sampling site was narrow with faster flows it is believed that this allowed the stream bed to be scoured thus increasing the level of suitable habitat for the macroinvertebrates compared to the areas above. The areas below were similar in regards to flow regime and levels of embeddedness. The lower site was predominately in a forested area but again this area had numerous deep pools (> 1m deep) and slow flowing runs with few riffles. Finding suitable habitat for sampling macroinvertebrates was difficult due to water depths of Whites Creek. Because of this, it is proposed that the community was concentrated on those smaller suitable areas that were sampled thus the higher community scores compared to First Creek even though First Creek had better habitat overall.

Overall both creeks are impacted by the surrounding land uses throughout the stream systems. Water quality is important and it is believed that at current condition the creeks will continue being classified as impaired on a moderate to severe level. If trends continue however the physical habitat and biological communities could be further impacted and pushed to the poorest categories of the rating systems. First Creek is in a dense urban setting within Knoxville therefore options are limited to the activities and structures that can be utilized to make improvements to the system. Whites Creek begins in the county therefore is under county control. In this section of the creek, the county

could help homeowners with agricultural interests improve the riparian zone and possibly reduce the bacterial levels as the result of these practices. Within the city's section of Whites Creek, a review of the stream bank modifications is in order to determine what improvements could be made to those affected areas along the creek.

REFERENCES

Arnwine, D.H. 2007. Quality system standard operating procedure for macroinvertebrate stream surveys. Tennessee Department of Environment and Conservation, Division of Water Pollution Control. Nashville, TN.

Arnwine, D. H. and G. M. Denton. 2001. Development of regionally-based interpretations of Tennessee's existing biological integrity criteria. Tennessee Department of Environment and Conservation, Division of Water Pollution Control. Nashville, TN.

Barbour M.T., Stribling J. B., and P. F. M. Verdonschot. 2006. The multihabitat approach of USEPA's rapid bioassessment protocols: benthic macroinvertebrates. Limnetica 25(3):839–50.

Barbour, M.T., J. Gerritsen, B.D. Snyder and J.B. Stribling. 1999. 2nd Edition. Rapid bioassessment protocols for use in streams and wadeable rivers: Periphyton, benthic macroinvertebrates and fish. EPA 841-B-99-002. U. S. Environmental Protection Agency, Office of Water. Washington D.C.

Brigham, A.R., W.U. Brigham and A. Gnilka (eds.). 1982. Aquatic insects and oligochaetes of North and South Carolina. Midwest Aquatic Enterprises, Mahomet, IL.

FLDEP (Florida Department of Environmental Protection). 1996. Standard operating procedures for biological assessment. Florida Department of Environmental Protection, Biology Section. July 1996.

MADEP (Massachusetts Department of Environmental Protection). 1995. Massachusetts DEP preliminary biological monitoring and assessment protocols for wadeable rivers and streams. Massachusetts Department of Environmental Protection, North Grafton, Massachusetts.

TDEC (Tennessee Department of Environment and Conservation). 2010. Final Report: Year 2010 303 (d) list. Division of Water Pollution Control. Nashville, TN.

USEPA (United States Environmental Protection Agency). 1997. Field and laboratory methods for macroinvertebrate and habitat assessment of low gradient nontidal streams. Mid-Atlantic Coastal Streams Workgroup, Environmental Services Division, Region 3, Wheeling, WV. 23 pages with appendices.

APPENDIX A: PHOTOS OF FIRST CREEK

Photo 1. Streambed conditions at upper site.

Photo 2. Riparian zone at upper site.

Photo 3. Streambed conditions at lower site.

Photo 4. Riparian zone at lower site.

APPENDIX B: PHOTOS OF WHITES CREEK

Photo 1. Upper sampling site.

Photo 2. Riffle habitat at upper site.

Photo 3. Stream bed conditions at lower site.

APPENDIX D

Stream Restoration/Weir Removal Contract Report

2012
City of Knoxville
Weir Removal Program

Fort Loudoun Lake Association, 956 Volunteer Landing Lane, Knoxville, TN 37915

Goose Creek 01

N 35˚56.296'
W 83˚54.956’

This weir was found by FLLA staff. On June 4, 2012, it was removed by Kirk Forgety, Jake Hudson and Colten Marcum, an Intern. A tree had fallen at Mary Vestal Park blocking the stream. Using a chain saw, the log was removed and the trash was placed in bags and removed.

Goose Creek 02

N 35˚56.209’
W 83˚54.911’

This weir was found by FLLA staff. On June 4, 2012, it was removed by Kirk Forgety, Jake Hudson and Colten Marcum. Several small trees were partially blocking the stream at Mary Vestal Park. The trees were removed and the flow was restored.

Goose Creek 03

N 35˚56.206’
W 83˚54.912’

This weir was found by FLLA staff. On June 4, 2012, it was removed by Kirk Forgety, Jake Hudson and Colten Marcum. A combination of rocks and sticks were blocking the stream under the bridge at Mary Vestal Park. The obstructions were removed and the flow was restored.

Love Creek 01

N 36˚01.290’
W 83˚51.567’

This weir was found by FLLA staff. On June 4, 2012, it was removed by Kirk Forgety, Jake Hudson and Colten Marcum. A dam had been built across the stream at Spring Place Park. The rocks were removed and placed on the edge of the stream to reinforce the bank.

Love Creek 02

N 36˚01.223’
W 83˚51.530’

This weir was found by FLLA staff. On June 4, 2012, it was removed by Kirk Forgety, Jake Hudson and Colten Marcum. A dam had been built across the stream and a tree had fallen in front of it at Spring Place Park. The rocks were removed and placed on the edge of the stream to reinforce the bank, and the downed tree was hauled away using a Dodge Dakota 4X4 with a Magnum V-8 (it'll pass anything but a gas pump).

Love Creek 03

N 36˚01.206’
W 83˚51.527’

This weir was found by FLLA staff. On June 4, 2012, it was removed by Kirk Forgety, Jake Hudson and Colten Marcum. A dam had been built across the stream at Spring Place Park. The rocks were removed and placed on the edge of the stream to reinforce the bank.

Love Creek 04

N 36˚01.017’
W 83˚51.468’

This weir was found by FLLA staff. On June 4, 2012, it was removed by Kirk Forgety, Jake Hudson and Colten Marcum. A tree had become wedged under a bridge built across the stream at 5226 Rutledge Pike.

The tree was hauled out using a truck and cut up and deposited on an existing wood pile. Remaining limbs were removed by hand.

Third Creek 01

N 35˚57.262’
W 83˚56.659’

This weir was found by FLLA staff. On June 6, 2012, it was removed by Jake Hudson and Colten Marcum. A tree had become wedged under the Alcoa Highway Bridge at Tyson Park. This tree and other debris were cut up and hauled to the Bike Trail by truck and rope for removal by the City Public Service Department.

Third Creek 02

N 35˚57.248’
W 83˚56.700’

This weir was found by FLLA staff on June 6, 2012, at Tyson Park. It was removed by Jake Hudson and Colten Marcum. Two trees and several limbs were removed from the creek and left for the Service Dept.

Third Creek 03

N 35˚57.256’
W 83˚56.667’

This weir was found by FLLA staff on June 6, 2012, at Tyson Park. It was removed by Jake Hudson and Colten Marcum. A board was trapped in the limbs of a tree and blocking one-half the stream and collecting debris. This was removed from the creek and left for the Service Dept.

Third Creek 04

N 35˚57.299’
W 83˚56.925’

This weir was found by FLLA staff on June 6, 2012, at Tyson Park. It was removed by Jake Hudson and Colten Marcum. There were several large logs trapped in the overhanging branches of two trees. They were hauled out and Alan Grant of Horticulture was willing to trim the trees so they would no longer trap debris.

Third Creek 05

N 35˚57.301’
W 83˚56.919’

This weir was found by FLLA staff on June 6, 2012. The blockage was on the right-of-way across Concord Street from Tyson Park. It was removed by Jake Hudson and Colten Marcum. The logs were towed to the bench on the bank and the Service Dept notified.

Third Creek 06

N 35˚57.302’
W 83˚56.917’

This weir was found by FLLA staff on June 6, 2012. The blockage was in the bridge under Concord Street, upstream from Tyson Park. It was removed by Colten Marcum. The log was wedged in and had to be broken to be removed.

Ten Mile Creek 01

N 35˚55.533’
W 84˚04.317’

This weir was removed by Kirk Forgety, Jake Hudson and Colten Marcum from Ten Mile Creek beside the greenway at Greenway Park, on June 8, 2012. The weir consisted of a large log across the creek with some debris caught behind it. The logs and debris were removed.

Ten Mile Creek 02

N 35˚55.569’
W 84˚04.275’

This weir was removed by Kirk Forgety, Jake Hudson and Colten Marcum from Ten Mile Creek beside the greenway on June 8, 2012. The weir consisted of a downed tree across the creek with logs and debris caught behind it. The tree was cut up with a chain saw and the logs and debris were removed.

Ten Mile Creek 03

N 35˚55.606’
W 84˚04.249’

This weir was removed by Kirk Forgety, Jake Hudson and Colten Marcum from Ten Mile Creek beside the greenway on June 8, 2012. The weir consisted of a downed tree across the creek with logs and debris caught behind it. The tree was cut up with a chain saw and the logs and debris were removed.

Ten Mile Creek 04

N 35˚55.625’
W 84˚04.221’

This weir was removed by Kirk Forgety, Jake Hudson and Colten Marcum from Ten Mile Creek beside the greenway on June 8, 2012. The weir consisted of a log wedged in the creek with logs and debris caught behind it. The logs and debris were removed.

Ten Mile Creek 05

N 35˚55.628’
W 84˚04.210’

This weir was removed by Kirk Forgety, Jake Hudson and Colten Marcum from Ten Mile Creek beside the greenway on June 8, 2012. The weir consisted of a log across the creek. The log was removed.

Ten Mile Creek 06

N 35˚55.650’
W 84˚04.197’

This weir was removed by Kirk Forgety, Jake Hudson and Colten Marcum from Ten Mile Creek beside the greenway on June 8, 2012. The weir consisted of a downed tree in the creek with logs and debris caught behind it. The tree was sawn up and the logs and debris were removed.

Ten Mile Creek 07

N 35˚55.712’
W 84˚04.184’

This weir was removed by Kirk Forgety, Jake Hudson and Colten Marcum from Ten Mile Creek beside the greenway on June 8, 2012. The weir consisted of a log across the creek with sticks and debris caught behind it. The logs and debris were removed.

Summary

As urban runoff has increased within watersheds in the Knoxville area, stream bank scouring and stream widening has increased the frequency of tree falls into the creeks causing weirs. These weirs are a problem in that they can create additional stream bank scouring and erosion, trash and debris buildup, streambed sedimentation, urban flooding, oxygen depletion, mosquito and other pest breeding sites and barriers to fish movement. The removal of these obstructions can help prevent further degradation to the creek, both visually and biologically. The above weirs were removed by the staff of the Fort Loudoun Lake Association, Kirk Forgety, Jake Hudson and Colten Marcum, using chain saws, a one-ton come along winch, pitch forks, machetes and a Dodge Dakota 4X4 truck.

APPENDIX E

Table of SPAP Facilities Inspections

Commerical and Industrial Facilities Inspected During 2011-2012

Permit Number	Project Name	Address	Street Name	Inspection Date	Inspector	Water Quality Device
01-011	Knoxville News Sentinel	2332	News Sentinel Dr	10/17/2011	US Tanks	Vortechnics
07-008	Onsite Environmental	403	Bernard Ave	11/10/2011	J. Shubzda/B. Swanner	Managerial Controls
08-027	Winters Auto Center	3701	Western Ave.	11/10/2011	J. Shubzda/B. Swanner	Suntree Tech
08-033	U-Haul	4717	Clinton Hwy	11/10/2011	J. Shubzda/B. Swanneer	Precast 1000
09-038	Relix Variety	1208	N Central St	11/10/2011	J. Shubzda/B. Swanner	Managerial Controls
10-016	Three Rivers Market	1100	N Central St	11/10/2011	J. Shubzda/B. Swanner	Flow Guard Catch Basin Inserts
11-008	Lonsdale Market & Deli	3208	Rudy St.	11/10/2011	J. Shubzda/B. Swanner	
11-009	501 Arthur	501	Arthur	11/10/2011	J. Shubzda/B. Swanner	Managerial Controls
03-005	Shops	7420	Chapman Hwy	11/15/2011	Storm System Services	Oil and grit seperator
07-024	Broadway Carwash	5622	N. Broadway	11/22/2011	J. Shubzda	Suntree Inserts
04-005	Outback Steakhouse Strawberry Plains	7400	Sawyer Ln	12/21/2011	Dynamis, Inc	4 catch basin inserts
02-004	CarMax	11225	Parkside Dr	12/22/2011	Ledford/Harris/Crawford	Aqua-Swirl AS-9
05-021	Food City	2712	Loves Creek Road	12/22/2011	J. Shubzda	oil/water separator
08-021	Food City Gas-n-Go Clinton Plaza	5078	Clinton Hwy	01/05/2012	J. Shubzda/B. Swanner	Triton T-Dam 12 filters in trench drain
06-013	Food City Western & 21st	1919	Leslie ave	01/12/2012	J. Shubzda	Suntree Nutrient Baffle Box
06-004	Pilot Foodmart # 215	410	Merchants Drive	02/20/2012	Dynamis Inc.	Flow Guard-Plus Filtration insrts
06-020	Pilot Food Mart #119	2518	N. Broadway	03/02/2012	Dynamis Inc.	2 Suntree Catch Basin Inserts
09-012	Pilot Food Mart #244	2218	Cumberland Ave	03/02/2012	Dynamis, Inc.	
01-005	Pilot Food Mart 166	4603	Chapman Hwy.	03/12/2012	Dynamis Inc.	catch basin inserts
01-010	Pilot Food Mart-158	405	Lovell Rd	03/12/2012	Dynamis Inc.	Fossil Filter Flo Guard
05-020	Pilot Food Mart #217	4800	N. Broadway & Adair I	03/12/2012	Dynamis Inc.	media filtration inserts
09-014	Chick-Fil-A West Town Mall	7063	Kingston Pike	03/12/2012	J. Shubzda	Suntree Catch Basin Insert
09-031	The Bistro by the Tracks	215	Brookview Centre Wa	03/12/2012	J. Shubzda	Suntree and DVS
10-026	Five Guys Burger and Fries	234	Brookview Centre Wa	03/12/2012	J. Shubzda	Suntree and DVS
10-039	Expressway 40	7301	Kingston Pike	03/12/2012	J. Shubzda	Suntree Catch Basin Insert
10-040	Mooyah Burgers & Fries	7301	Kingston Pike	03/12/2012	J. Shubzda	Suntree Catch Basin Insert
10-042	Pilot Food Mart #277	400	E. Emory Rd	03/12/2012	Dynamis, Inc.	
11-007	Krispy Kreme Doughnut Shop	6201	Kingston Pike	03/12/2012	J. Shubzda	Catch Basin Insert Flexstorm
11-050	The Casual Pint	234	Brookview Centre Wa	03/12/2012	J. Shubzda	Suntree and DVS
11-055	Ott's BBQ	234	Brookview Centre	03/12/2012	J. Shubzda	Suntree and DVS
02-005	The Car Spa	435	E. Emory Rd	03/20/2012	J. Shubzda	Baysaver
04-004	Pilot Food Mart-187	100	Merchant Drive	03/20/2012	Dynamis Inc.	Catch Basin Inserts
04-028	Zaxby's Restaurant	607	East Emory Road	03/20/2012	J. Shubzda	4 Suntree Catch Basin & 2 Grease Guards
05-027	Pilot Food Mart #138	136	N. Northshore Dr.	03/20/2012	Dynamis Inc.	Flow Guard-Plus/filtrtn inserts
06-035	Starbucks - Emory Rd.	401	E. Emory Rd.	03/20/2012	J. Shubzda	Suntree Technologies
08-028	Ingles Expansion	430	E. Emory Rd	03/20/2012	J. Shubzda	
09-042	3 Amigo's Mexican Bar and Grill	603	East Emory Road	03/20/2012	J. Shubzda	
00-005	Pilot Food Mart-111	1826	Western Ave	03/21/2012	Dynamis, Inc.	grass swale
02-001	Pilot Food Mart-105	206	Walker Springs Rd	03/21/2012	Dynamis Inc.	Fossil Filter Flo Guard
05-025	Cars Inc.	1106	Callahan Rd	03/21/2012	J. Shubzda	Grassy Swale
06-018	Morton Square (Jubilee Center)	1506	Callahan Dr	03/21/2012	J. Shubzda	First Flush @Detention Basin, Vortex model 9000
07-002	All in One Automotive, Inc	1926	Callahan Dr.	03/21/2012	J. Shubzda	
08-019	Kia Dealership	705	Callahan Drive	03/21/2012	J. Shubzda	Suntree
09-009	All in One Automotive/Carwash	1926	Callahan Drive	03/21/2012	J. Shubzda/L. Marcum	Suntree GISP-A-24-37-25
09-016	Pilot Food Mart Cedar Bluff Rd #334	412	N Cedar Bluff Rd	03/21/2012	Dynamis, Inc.	Abtech WQS P1-01

Commerical and Industrial Facilities Inspected During 2011-2012

Permit Number	Project Name	Address	Street Name	Inspection Date	Inspector	Water Quality Device
10-052	Bearden Hill Fieldhouse	6600	Kingston Pike	04/03/2012	J. Shubzda	Managerial Controls
04-027	Ingles Markets Gas Express #399	430	East Emory Road	04/11/2012	Dynamis, Inc.	Stormceptor Oil/Water Separator
03-004	Chapman Hwy Wal-Mart Supercenter	7420	Chapman Hwy	04/13/2012	J. Shubzda	Oil and grit seperator
03-015	Murphy Oil @ Wal-Mart Supercenter	120	Green Rd.	04/13/2012	J. Shubzda	Downstream Defender
04-003	Ruby Tuesday Restaurant	7406	Chapman Highway	04/13/2012	J. Shubzda	Crystal Stream
05-011	Home Depot	140	Green Rd	04/13/2012	J. Shubzda	Suntree Nutrient Separating Baffle Box
05-028	The Chop House South	7417	Chapman Hwy	04/13/2012	J. Shubzda	Abtech Catch Basin Insert
08-013	South Grove, Gondoliers	7644	Mountain Grove Dr.	04/13/2012	J. Shubzda	Catch Basin Inserts
08-020	Food City Gas-N-Go Southgrove	7644	Mountain Grove Dr.	04/13/2012	J. Shubzda	Suntree GISB 32-32-24-SB 2 ea, N. end of Prop
08-043	South Knoxville Carwash	7525	Mountain Grove Rd	04/13/2012	J. Shubzda	2 Kristar Catch Basin Inserts
09-003	Weigels Mountain Grove Rd	7514	Mountain Grove Rd	04/13/2012	J. Shubzda	Suntree Catch Basin Insert
10-036	First Tennessee Bank	7555	Mountain Grove Drive	04/13/2012	J. Shubzda	Suntree Catch Basin Inserts
10-037	Chick-Fil-A	7565	Mountain Grove Drive	04/13/2012	J. Shubzda	Suntree Catch Basin Inserts
02-009	Fed Ex Ground Package	3700	Middlebrook Pk	05/22/2012	Storm System Services	Crystal Stream 1056
02-013	Kroger Fuel Facility U-531	4409	Chapman Hwy	05/23/2012	Storm System Services	Crystal Stream 645
03-012	Earthfare and Shops	10921	Parkside Dr	06/06/2012	J. Shubzda	3 Catch basin inserts
04-011	Connor Seafood	10915	Turkey Drive	06/06/2012	J. Shubzda	Catch Basin Inserts
04-014	Colonial Pinnacle-Phase I	11325	Parkside Drive	06/06/2012	J. Shubzda	Oil water separators
05-001	Texas Roadhouse @ Turkey Creek	11001	Turkey Drive	06/06/2012	J. Shubzda	2 Suntree Catch Basin Inserts
05-003	Mimi's Café	10945	Parkside Drive	06/06/2012	J. Shubzda	Grease Catcher System & Suntree CB
05-014	Stowers Rental & Supply	10616	Lexington Drive	06/06/2012	J. Shubzda	Suntree Vault
05-015	Three Minute Express Car Wash	300	Simmons Road	06/06/2012	J. Shubzda	Grassy Swale
07-020	Christian Academy of Knoxville	529	Academy Way	06/06/2012	J. Shubzda	Suntree GISB-17-35-24-
07-029	SoHo Asian Bistro	10901	Parkside Dr. # 105	06/06/2012	J. Shubzda	Catch Basin Inserts
08-006	Mercedes of Knoxville	10131	Parkside Drive	06/06/2012	US Tanks	Kristar Enterprises, FloGard CB inserts
09-011	Pimento's Café And Market	6638	Kingston Pike	06/06/2012	J. Shubzda	Catch Basin Inserts
09-040	Grayson BMW	10671	Parkside Drive	06/06/2012	J. Shubzda	Kristar Flow Guard Duel Vortex
10-002	Grayson Mini Cooper & BMW Service Addition	10671	Parkside Drive	06/06/2012	J. Shubzda	Kristar Flow Guard Duel Vortex
10-025	Earth Fare, Inc. #400	10903	Parkside Drive	06/06/2012	J. Shubzda	3 Catch basin inserts
10-035	Kabuki Fusion Sushi & Grill	10901	Parkside Drive	06/06/2012	J. Shubzda	Kristar Catch Basin Inserts
07-016	Toyota of Knoxville-Service Bay Addition	10415	Parkside Drive	06/08/2012	T&W Properties	AquaGuardian Catch Basin insert AG-18
06-019	Lexus of Knoxville	10315	Parkside Drive	06/11/2012	T&W Properties	5 Suntree Catch Basin Inserts
06-032	Knoxville PDI Center	10416	Parkside Drive	06/12/2012	T&W Properties	Suntree Vault
07-007	Sonic-Walker Springs	8475	Kingston Pike	06/12/2012	J. Shubzda	Suntree Catch Basin Insert
04-026	Peerless Restaurant	318	N. Peters Road	06/22/2012	J. Shubzda	Abtech catch basin inserts
05-007	Krystal	8901	Kingston Pike	06/22/2012	J. Shubzda	2 Suntree Catch Basin Inserts
07-010	Superior Ice Company	2729	Middlebrook Pike	06/22/2012	J. Shubzda	Suntree Catch Basin Insert
11-020	Academy Sports & Outdoors	145	Moss Grove Blvd	06/22/2012	J. Shubzda	Suntree Vault
11-032	Kroger Store GA 684	135	N. Cedar Bluff Road	06/22/2012	J. Shubzda	Vaults and Catch Basin Inserts
11-040	NTB	8088	Kingston Pike	06/22/2012	J. Shubzda	Catch Basin Insert and Infiltration Pits
12-024	Harman Ice	2727	Middlebrook Pike	06/22/2012	J. Shubzda	Catch Basin Insert
12-025	Sonic-Walker Springs	8475	Kingston Pike	06/22/2012	J. Shubzda	Catch Basin Insert

APPENDIX F

City of Knoxville Solid Waste Office 2011 Annual Report

Public Service Department
Solid Waste Division
2011 Annual Report

CITY OF KNOXVILLE

MAYOR MADELINE ROGERO

Public Works
Christi Branscom, Senior Director

Public Service Department
David Brace, Director

INTRODUCTION

In 2011, the City of Knoxville Public Service Department continued to show positive progress in the development of it's solid waste management programs. We continued active enforcement of the solid waste ordinances through the Neighborhood Codes Enforcement field inspections program and completed our fourteenth full year of operations at the Household Hazardous Waste (HHW) Collection facility. The Public Service Department is in it's tenth year of garbage collection service and recycling in the Central Business Improvement District (CBID) at a cost savings of approximately $30,000 annually.. In addition, the City has worked tirelessly to develop and implement a new household curbside single stream recycling program that had a start date of October 1, 2011. This new service is offered via contract to households in the City and is completed using in house staff within the CBID. All of these programs reflect the continued interest and forward thinking approach towards the City's development of a truly comprehensive solid waste management program.

The following pages summarize our solid waste activities for the calendar year 2011. The final page is a compilation and analysis of residential waste stream data such as:

* The total waste stream increased by 39,178.08 tons from 2010
* The diversion rate increased to 66.14% from 60.47% in 2010
* The recycling rate increased to 33.72% from 28.31% in 2010

The total waste stream shows an overall increase from 2010. This increase is largely attributable to yard waste collection and C&D landfill materials from several violent storms and a tornado event that occurred in April. These storms resulted in significant yard waste debris taxing both our collection resources and our processing contractor. Diversion and recycling rates have remained level over the last five years with minimal variations each year. Household recycling averaged 10.12 % during the first three quarters in 2011 and as the curbside recycling program started household recycling averages 16.55% in the fourth quarter of 2011. Additional participation growth is anticipated as the program grows into the 2012 calendar year.

I. RECYCLING

A total of 4459.85 tons of recyclables were collected at the City's eleven drop-off recycling centers in 2011. This number decreased in 2011 due to the direct impact of the new household single stream recycling program as well as the closure of three drop off centers due to site ownership changes. It was the intention of the City to close some centers as a result of the curbside recycling program, but the closures occurred earlier then staff anticipated. These closures also reflect the City's increasing challenges with economical site leases for drop center facilities at retail "big box" sites within the City.

Goodwill Industries is in year two of a five year contract to assist in on-site management of the City's recycling drop off centers. For 2011 new five year contracts were signed with Rock-Tenn Recycling to handle processing of recyclable materials collected at all drop off centers and for all new single stream curbside recycling materials. Rock-Tenn made significant capital equipment improvements at their Knoxville operation in anticipation the City's new single stream program and continues to invest in technology supportive of modern recycling processing. Another five year contract was signed with Waste Connections of Tennessee, Inc. to haul recyclable materials from the drop centers and curbside recycling to Rock-Tenn Recycling. Rock-Tenn Recycling pays the City current market value for all material collected from the drop off centers.

In 2011, the City extended a contract to collect cardboard brought to the Market Street Garage by downtown businesses. A local recycling non profit organization was asked to assist in collection, processing and weighting of the material. During 2011, over 131 tons of material was collected from the downtown area, which was up from 18 tons in 2010.

In 2011 a pilot project was started to study and consider recycling on the several miles of the City's 50+ miles of multi-purpose greenways. This was done under a contract with the Knoxville Recycling Coalition using a bike and cart to haul materials from receptacles located in ten to twelve locations along a four-mile stretch of the 3rd Creek Greenway. Slightly less then one ton of single stream recycling materials have been collected since the start of this pilot project.

One major recycling initiative of the Solid Waste Office has been the continued push towards implementing a new household curbside single stream recycling program. Since 2004 the City's contractor for the collection of residential solid waste, Waste Connections of Tennessee, Inc, has provided a subscription curbside recycling program to interested City residents for a fee. The program has had limited impact with only 3300 out of the City's 60,000 households participating in this fee-based service. For over twenty years the City's primary waste reduction service has been a "drop off center" recycling program, where residents sort and store recyclables at home and then transport them to one of eleven recycling convenience drop off centers. This program has been highly successful, but due to the barriers created by this "sort and drive" program this model had maximized its capacity for attracting additional participants beyond those individuals currently involved in the program. As recycling markets and technologies have matured, the advent of curbside single-stream recycling has enabled residents to participate in "no sort" curbside recycling where participants deposit all accepted materials into a single, large receptacle that is then collected at the residence. The curbside single-stream model – where recycling is as simple as throwing away garbage – provides an opportunity in Knoxville to increase participation and divert additional materials from existing landfills.

In 2007, the City began seriously examining ways to bring sustainable practices to the way we do business. As part of this process, the Public Service and Policy & Communications Departments at the request of then Mayor Bill Haslam initiated a process to evaluate best practices and to consider improvements to the City's existing solid waste management system and specifically recycling. Two key goals of this initiative were for the City to increase both recycling participation and the diversion of recyclable materials from area landfills. To support this effort the City was awarded a Model Cities grant in 2008 through the combined efforts of the American Beverage Association (ABA) and The Climate Group, providing up to $200,000 in third party research and technical assistance supportive of improving recycling in the City. The Model Cities program afforded the City with a unique opportunity to take a critical look at the City's existing solid waste and waste reduction programs and to develop a clear strategy designed to increase participation and materials diversion. The research-based strategy resulting from the Model Cities grant is to the implementation of a new single-stream, curbside recycling collection service for approximately 20,000 participants.

In addition to Model Cities grant the City in 2009 was awarded $2,012,700 for energy savings initiatives through a DOE program designed to assist local governments in creating and implementing strategies to increase energy efficiency, reduce fossil fuel emissions, reduce energy costs, deploy renewable energy technologies, leverage public and private resources, create jobs spur economic growth, and maximize benefits over the long term. Of

the $2,012,700 award, ultimately $700,000 was designated to assist in the implementation of the new City-wide curbside recycling program for the acquisition of needed capital items (carts) from Toter Inc.
The 2011 contracts called for the new service to be provided by City contractors starting October 1, 2011 for up to 20,000 households. The City's Solid Waste Office is excited to announce that it met its goal to have signed up by December of 2011, 20,000 households to receive the new service.

During the first three months of the curbside recycling program 1,374.26tons of single stream recyclable materials were collected to be processed into new products.

II. MUNICIPAL SOLID WASTE (MSW)

A total of 45,220.65 tons of garbage were collected from Knoxville homes in 2011 as part of the weekly garbage collection service the City offers via its contractor, Waste Connections of Tennessee, Inc. This number reflects a less than 1% increase from the previous year. The City is currently in a five year extension contract with Waste Connections of Tennessee, Inc. that expires in 2016. The extension eliminated a free backdoor collection service offered to only some households and now only offers the free backdoor service to those with a verified medical or age necessity. Current collection costs per this contract are:

Jan. - Oct. 11	Curbside Collection	$6.68 / house/month	41,267 residents
Jan. - Oct. 11	Backdoor Collection	$8.36 / house/month	14,727 residents
Oct. - Dec. 11	Curbside Collection	$6.39 / house/month	53,673 residents
Oct. - Dec. 11	Backdoor Collection	$6.39 / house/month	2,329 residents

All household garbage is disposed of at the Chestnut Ridge Landfill operated by Waste Management of Knoxville. The City is currently in a new 10 year contract with Waste Management that expires in 2020. Contract prices change in October of each year based on the CPI.

- Oct. '10 - Sep. '11 $20.09 / ton
- Oct. '11 - Sep. '12 $20.71 / ton (reflects new contract pricing)

III. YARD WASTE COLLECTION / MULCHING

A total of 50,891.46 tons of yard waste was collected by City Public Service Department crews in 2010. This number is up by 25,113.35 tons from last year. The Solid Waste Department believes this increase is based on extremely wet weather conditions during the entire year of 2010 and extreme weather conditions in April and May of 2011 with tornados, and with numerous other storms and wind conditions throughout the year. All yard waste is taken to Shamrock Organic Products where it is recycled into mulch and soil products. The City is currently in a five year contract with Shamrock and recently executed early the final extension based on rate savings to the City. The current contract expires in 2016. There was a decrease in the cost in April of 2010 because of a billing error that extended into 2011. Costs for disposal in 2011 at Shamrock are as follows:

- Jan. 11 – Feb. 11 $29.94 / ton
  Mar. 11-- Dec. 11 $28.82 / ton (new prices based on contract extension)

IV. SOLID WASTE MANAGEMENT FACILITY

Transfer Station

The design of the Public Service Department Transfer Station encourages separation of Construction and Demolition waste (C&D) from Municipal Solid Waste. This allows us to save money by sending C&D waste to a Class III landfill and also enable us to comply with the State mandate calling for a reduction in the volume of waste placed in Class I landfills. In 2011, we diverted 37,101.03 tons of C&D waste to a Class III landfill. This was 55% of the waste received at the Transfer Station. The total number of vehicles accessing the numerous services at the facility in 2011 was just over 63,481 up 8738 vehicles as compared to 2010 including City of Knoxville vehicles. Total revenue from charge and cash customers was $1,126,552.25 up $560,370.46 from 2010. This increase is a reflection of a both a September of 2010 a rate change from $25 a ton to $35 a ton fee and the increase in C&D debris volume due to inclement weather events as described above.

Household Hazardous Waste (HHW) Collection Center

Staffed by Public Service Department Solid Waste Management Facility employees, the HHW Facility is operated jointly by the City with funding from Knox County and available to all County residents. Based on approximately 50/50 usage by City and County residents, the County contributes 50% of the operating and disposal cost. In 2011, this facility was visited by 6,135 vehicles, up by 48 from 2010, and processed 146 tons of HHW, 68% of which was latex paint.

V. EDUCATION

The Public Service Department Solid Waste Office engaged in many activities and special programs throughout 2011 to educate Knoxville residents and visitors about waste reduction, recycling, composting and other solid waste issues.

America Recycles Day - The City of Knoxville, along with several other local organizations, participated in the eleventh annual America Recycles Day, a national education campaign aimed at increasing citizens' commitment to recycling and buying recycled goods.

Telephone Book Recycling - Once again this year the Solid Waste Office coordinated the Knoxville/Knox County schools telephone book recycling program. Thirty four Knox County schools competed for cash prizes donated by the City and County. Over fifty nine tons of old phone books were collected from the schools.

Earth Day - The Solid Waste Office helped develop this program more then eleven years ago and once again played an active role on the steering committee that developed EarthFest 2011, which celebrated the 38th anniversary of Earth Day at Pellissippi State Community College. Over 3,000 people attended the event which hosted 100 + exhibitors from the region's environmental community.

Computer Collection Events – Two**,** single day computer collection events were held on Saturdays in January with ten sponsors contributing to the success of the event. Approximately 1,700 residents participated in the events with just over seventy five tons of electronic materials collected. Material collected at the event was recycled at Creative Recycling, Nashville, TN.

Used Residential Thermometer Exchange - The Solid Waste Office started an ongoing mercury thermometer exchange program in 2005. The exchanges, conducted in cooperation with the Tennessee Department of Environment and Conservation, the City of Knoxville Public Service Department and the Safe Kids Coalition of the Greater Knox Area, collected

over 829 mercury thermometers from City and County residents, containing a total of 1.85 pounds of mercury in 2011. New digital thermometers were given out for each used mercury thermometer that was turned in.

Unwanted Medicines Collection Event - The Solid Waste Office coordinated several unwanted medicines collection events in cooperation with the Knoxville Police Department, Knox County Solid Waste Office and Health Department and The University of Tennessee Student Pharmacy Association. This program was initiated by the City in November of 2008 and has grown rapidly since its inception. Over 2,134 pounds of medications were collected during 2011 and properly disposed of by the KPD and just over 4,000 pounds since 2008. Other collection events are in the planning stages for 2012 with a regional event to be held in cooperation with six surrounding counties.

Other - In 2011, the Solid Waste Office continued to produce and distribute educational brochures and promotional items. Staff of the Solid Waste Office participated in several educational events in 2010 using our exhibit booth display at the City County Building and at events including EarthFest, the Dogwood Arts' House and Garden Show, Women's Expo and, America Recycles Day Events.

Annual Report by Tons of Materials

Annual Report 2011	Kroger 5003	Goodwill Magnolia &	Kroger 4818	Goodwill 225	Kroger 4440	Goodwill 341	Goodwill 820	Downtown 400	Food City 5941	Food City 2939	Drop Off Center	Curbside Recycling Oct-Dec '11	Curbside Recycling Oct-Dec '11	Drop Off Curbside
Drop Off Centers	**N. Broadway**	**Alice**	**Kingston Pk.**	**Moody Av.**	**Western Av.**	**Parkvillage**	**Metler**	**State St.**	**Kingston Pk.**	**Alcoa Hwy**	**Totals**	**City Wide**	**Totals**	**Totals**
Aluminum	15490 lbs	4300 lbs	24775 lbs	13720 lbs	7540 lbs	40458 lbs	3800 lbs	7400 lbs	250 lbs	3080 lbs	60.41 tons	31254 lbs	15.63 tons	76.06 tons
Steel	22150 lbs	8100 lbs	33010 lbs	15940 lbs	12520 lbs	49662 lbs	6300 lbs	12480 lbs	250 lbs	8440 lbs	84.43 tons	61001 lbs	30.50 tons	114.97 tons
Plastics	162572 lbs	63670 lbs	249452 lbs	123980 lbs	98760 lbs	370258 lbs	56669 lbs	57240 lbs	9910 lbs	3760 lbs	598.14 tons	264263 lbs	132.13 tons	730.57 tons
Clear Glass	54090 lbs	22266 lbs	122021 lbs	51638 lbs	32403 lbs	135791 lbs	15758 lbs	42485 lbs	0 lbs	0 lbs	238.23 tons	135073 lbs	67.54 tons	305.88 tons
Brown Glass	54090 lbs	22266 lbs	122021 lbs	51638 lbs	32403 lbs	135791 lbs	15758 lbs	42485 lbs	0 lbs	0 lbs	238.23 tons	135073 lbs	67.54 tons	305.88 tons
Green Glass	54090 lbs	22266 lbs	122021 lbs	51638 lbs	32403 lbs	135791 lbs	15758 lbs	42485 lbs	0 lbs	0 lbs	238.23 tons	135073 lbs	67.54 tons	305.88 tons
Newspaper	209970 lbs	99480 lbs	258640 lbs	155180 lbs	165200 lbs	460240 lbs	98940 lbs	59930 lbs	6337 lbs	7647 lbs	760.78 tons	737244 lbs	368.62 tons	1,129.78 tons
Mixed Paper	396690 lbs	151860 lbs	751087 lbs	298020 lbs	235820 lbs	950230 lbs	153120 lbs	176450 lbs	21040 lbs	14010 lbs	1574.16 tons	737244 lbs	368.62 tons	1,943.57 tons
Cardboard	183172 lbs	95710 lbs	239094 lbs	117940 lbs	122310 lbs	401746 lbs	58410 lbs	104280 lbs	1100 lbs	10760 lbs	667.26 tons	393421 lbs	196.71 tons	864.31 tons
Drop Off Center Totals	**576.16 tons**	**244.96 tons**	**961.06 tons**	**439.85 tons**	**369.68 tons**	**1,339.98 tons**	**212.26 tons**	**272.62 tons**	**19.44 tons**	**23.85 tons**	**4,459.85 tons**	**1,314.82 tons**		5,776.91 tons

KPD / Lorain St.	29.79 tons
Cardboard / Paper	131.17 tons
Downtown Cardboard Recycling	
Phone Books	59.60 tons

	Leaves	Brush	Total
Mulching Site	7,330.48 tons	43,560.98 tons	50,891.46 tons

	Scrap Metal	Rec. Tlr.	HHW REC.	HHW Divert.	C&D	Compacted	Computers	Tires	Total
Transfer Station	230.65 tons	1.10 tons	44.03 tons	7.94 tons	37,101.03 tons	11,839.93 tons	108.26 tons	115.32 tons	49,448.26 tons

	Household	Misc. Trash	Total
Landfill Class I	45,220.65 tons	617.14 tons	45,837.79 tons

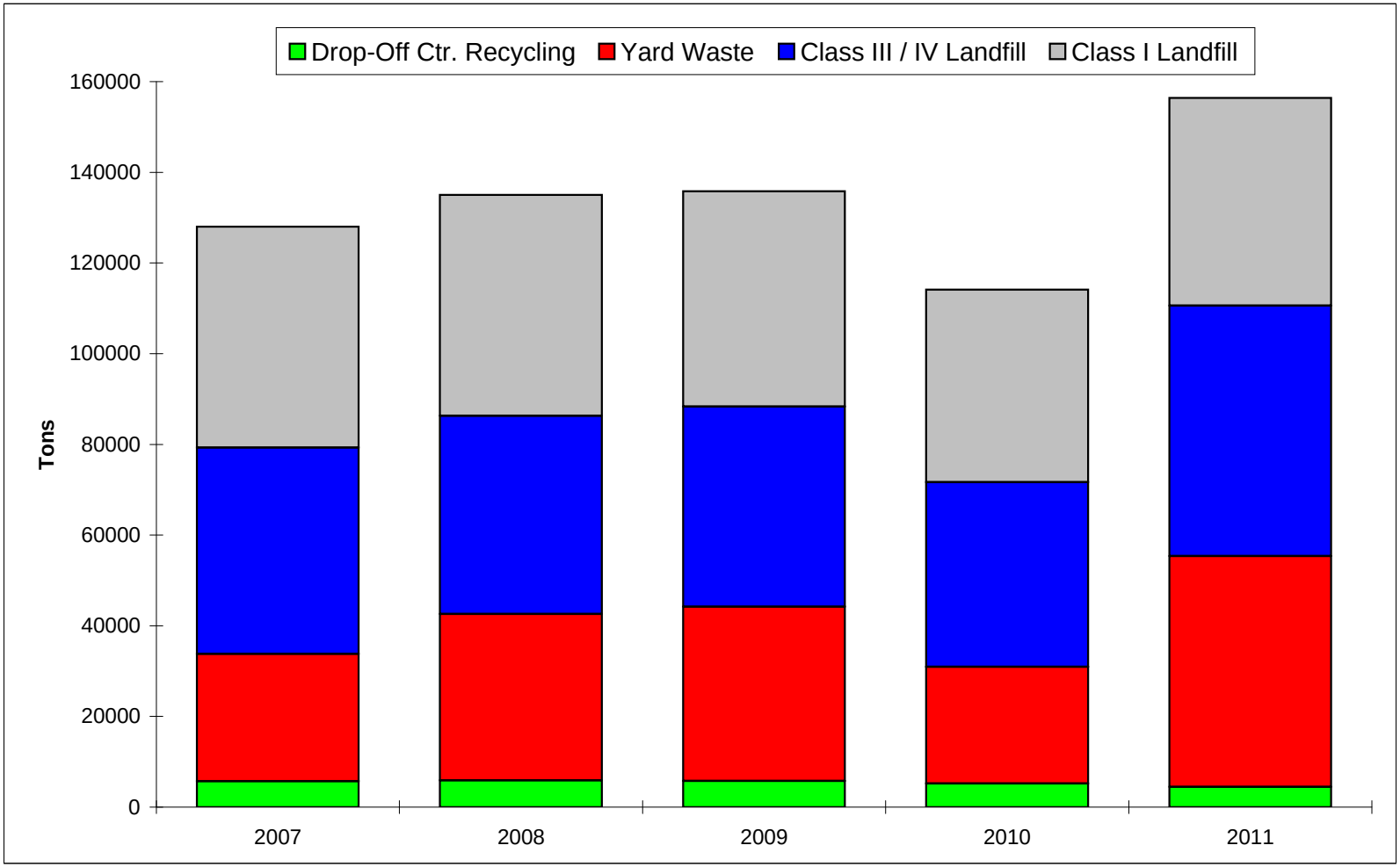
	Transfer Station	Construction	Codes	Total
Landfill Class III	37,101.03 tons	6,856.41 tons	11,273.45 tons	55,230.89 tons

Total Waste Recycled	57,388.28 tons		***Recycling %***	33.70%
Total Waste Diverted, Class III & Rec.	112,627.11 tons		***Diversion %***	66.13%
Total Waste Landfilled, Class I	57,677.72 tons		**** Recycling / Total WS***	5.44%
Total Wastestream	170,304.83 tons		**** Recycling / Household Trash***	11.32%

*** Yard Waste Not Included**

*** w/ Just Residential Trash**

Destination of Knoxville's Residential Waste Stream, 2007 - 2011



Diversion Rate	**56.50%**	**61.74%**	**63.52%**	**60.47%**	**65.87%**
Recycling Rate	**25.83%**	**30.72%**	**35.50%**	**26.51%**	**33.18%**

APPENDIX G

NPDES Permit Program Inventory Map

(Attached separately)