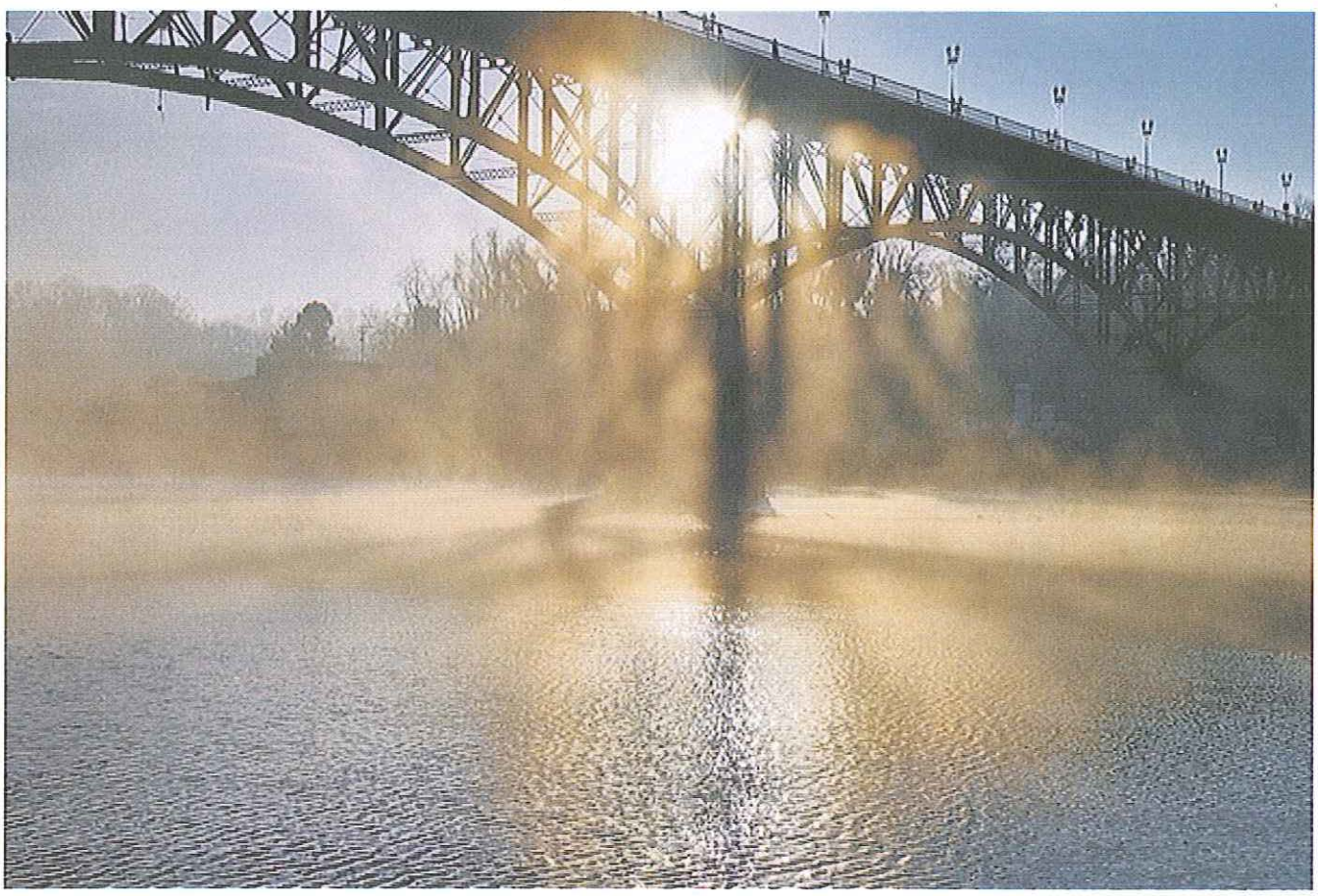
THE CITY OF KNOXVILLE
TENNESSEE

NPDES Permit Annual Report



CITY OF KNOXVILLE
BILL HASLAM, MAYOR

National Pollutant Discharge Elimination System
Stormwater Discharge Permit TNS068055
July 1, 2009 - June 30, 2010

Signature and Certification

NPDES STORMWATER PERMIT TNS068055
2009/2010 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."*

Bill Haslam by Larry Mark — 11/17/10

Bill Haslam
Mayor — Date

Stephen J. King — 11-18-2010

Stephen J. King, P.E.
Public Works Director — Date

CITY OF KNOXVILLE

BILL HASLAM, MAYOR

Stephen J. King, P.E.
Director of Public Works
Brently J. Johnson, P.E., R.L.S.
Deputy Director of Engineering

December 7, 2010

Mr. Jim McAdoo
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
2009 – 2010 Annual Report

Dear Mr. McAdoo:

The City of Knoxville is pleased to submit the sixth 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, 2009 through June 30, 2010. 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: Ms. Natalie Ransone Harris

400 MAIN STREET, SUITE 480, KNOXVILLE, TENNESSEE 37902
OFFICE: 865-215-2148 • FAX: 865-215-2631
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Deputy Director of Engineering

December 7, 2010

Ms. Natalie Ransone Harris
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
2009 – 2010 Annual Report

Dear Ms. Harris:

The City of Knoxville is pleased to submit the sixth 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, 2009 through June 30, 2010. 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

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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, 2009 through June 30, 2010.

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, Solid Waste Management office, and Knoxville/Knox County Emergency Management Agency (KEMA). 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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David Brace, Deputy Director		
Public Service Department & Solid Waste	(865) 215-2060	dbrace@cityofknoxville.org
Stephen J. King, P.E., Director		
Public Works Department	(865) 215-6100	sking@cityofknoxville.org

Mailing Address: City of Knoxville
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 sixth year of the NPDES permit term.

- The City partnered with the Water Quality Forum and sold nearly 100 rain barrels at the 2010 Earthfest at Pellissippi State Community College. Over 10,000 people attended the event, which had over 100 exhibitors from the environmental community.

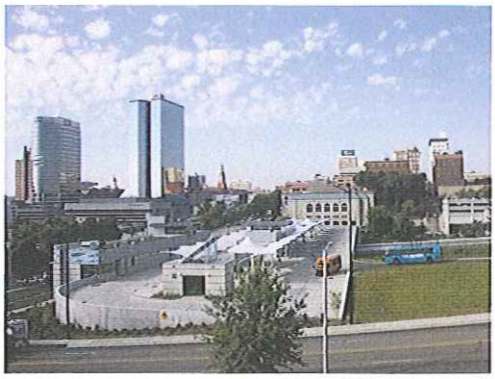
- The City of Knoxville continued to expand the greenways/buffers zones along the major waterways. The City currently maintains over 41 miles of trail distributed over 31 greenways. These linear parks help protect the adjacent waterways with natural buffers and provide opportunities for stream enhancements. The City has extensive plans to connect the Greenways from Fountain City Park down to the mouth of First Creek.

- The year 2010 was the 21st year for the River Rescue, which is coordinated by Ijams Nature Center and the Water Quality Forum partners. The spring 2010 River Rescue attracted 1054 volunteers who collected 15 tons of trash and 95 tires from the shores of the Tennessee River.

- During 2009, the City's Stormwater Engineering and Solid Waste Departments had a one day rain barrel and compost bin sale. Over 500 rain barrels and 550 compost bins were sold during the first three hours of operation.

- A total of 5,762 tons of recyclables including paper, plastic, metal, cardboard and glass was collected at the City's eleven solid waste drop-off recycling centers in 2009. This number is level with recyclables from 2005 to 2008. The City maintains updated information on the web at http://www.cityofknoxville.org/solidwaste/recycle.asp.

- The new Knoxville Station Transit Station opened in 2010. The building uses LEED standards to use less energy than conventional buildings and was built with sustainable building practices. Large storm water quality BMP's will treat all of the impervious surface areas.



- The City broke ground on the First Creek Improvement Project during this permit year. The scope of the work includes widening a 1,853-foot-long section of the First Creek channel to establish additional 40-feet of stabilized and vegetated floodplain; the replacement of the existing bridge at Fairmont Boulevard and construction of a new bridge at Emoriland Boulevard designed to provide a high-flow bypass for the First Creek channel during heavy flood events.

- In 2009, the City along with the Water Quality Forum partners received the Governor's Environmental Stewardship Award in Environmental Education and Outreach for the Rain Day Brush-off program. Local artists, business, and schools painted thirty-one 55-gallon rain barrels as part of the event. The event was designed to bring awareness to water conservation and water quality by promoting the use of rain barrels throughout the community. The rain barrels can be viewed at http://www.waterqualityforum.org.

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 quality of surface waters throughout the city. The long-term results should become apparent in future years. The City implemented many of the SWMP tasks beyond the minimum permit requirements and will continue to advance the water quality programs beyond the minimum requirements as 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. Although the summary tables concisely document many program activities, some activities could not be quantified and have therefore been omitted.

4.0 Stormwater Management Program Summary Table

MONITORING TASKS WET/DRY WEATHER	SCHEDULE OF ACTIVITIES	SCHEDULE FOLLOWED	ACTIVITIES ACCOMPLISHED	COMMENTS
Repeat High Parameter Sites	7 Outfalls repeated	Yes	7	Each outfall tested at least four times this year
Field Screening Industrial Outfalls	Visits to Industrial outfalls	Yes	95	Continued retesting outfalls from Industrial areas (four times)
Total Field Screening Outfalls	High Parameter repeats + 30 to 40	Yes	251	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	5,077 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 for Service (Received / Resolved)	As Needed	Yes	781/979	Complaints are investigated as received and resolved as solutions or resources are available
Stormwater Quality Requests for Service (Received / Resolved)	As Needed	Yes	125/236	Complaints are investigated as received and resolved as solutions or resources are available
Site Development Workshop/Professional Training	Annually	Yes	79	Included Engineers, contractors, developers, & surveyors involved in land disturbing activities.
Stormwater GIS Field Investigations for Annexations	As Required	Yes	0	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	25,745 Miles	Daily for downtown streets. Frequency varies for other streets.
Litter Pick-up, Hand	As Needed	Yes	91,445 Bags	Routine Schedule
Catch Basin Cleaning and Repair	As Needed	Yes	6,032 Jobs	Per work order and requests
Ditching: Hand, Truck, & Track/Gradall	As Needed	Yes	19,951 Feet	Per work order and requests
Storm Drain Installation & Repair	As Needed	Yes	53 Jobs	Per work order and requests
Brush & Leaf Pick-up	Bi-Weekly	Yes	14,756 Loads	Bi-Weekly curb pick-up
Seed/Sod, ROW	As Needed	Yes	48 Jobs	Per work order and requests
Storm Drain Cleaning	As Needed	Yes	42,108 Feet	Per work order and requests
Grate Replacement	As Needed	Yes	70 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	87 Jobs	Creeks are inspected and cleaned on a routine schedule
Tree and Plant Planting	When Applicable	Yes	182 trees	Trees were planted by the City's Service Department
Total Waste Recycled	As Brought In	Yes	39,124 tons	5,895 tons of paper, metal, plastic, glass, etc. and over 36,683 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	15 tons of trash and 95 tires removed by 1054 volunteers from 44 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	Approx. 50	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, 200 teachers & parents, and 100 volunteers participated.
Pooper Scoopers	As Needed or by volunteers	Yes	27,600	Disposable dog waste containers were distributed to 9 different pooper scooper stations.

NEW DEVELOPMENT PROGRAM TASKS	SCHEDULE OF ACTIVITIES	SCHEDULE FOLLOWED	ACTIVITIES ACCOMPLISHED	COMMENTS
Residential/Commercial Inspections	As Required	Yes	~4000	One quarter = 1112
Final Inspections	As Required	Yes	186	As Required
Site Development Permits Reviewed	As Required	Yes	985	As Required
Right of Way Permits Issued	As Required	Yes	60	As Required
As-Built Certificications Reviewed	As Required	Yes	238	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 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 an abbreviated 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, pp. 5-5 to 5-9.
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 and requests from the Engineering department. 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. Catch basins are inspected annually. 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-seven employees, a backhoe, two single-axle dump trucks, and one 3/4-ton pickup truck. A 2-ton 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 grant 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 used 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

The City has completed some initial flood control projects in the upper portion of First Creek. These projects focus on improving flow capacity but include the benefit of stabilized creek banks and improved high-flow bench. The design for the lower sections of the First Creek project will include the same concept for stabilizing the low-flow channel and creating access to the floodplain. Stream improvements and watershed modeling in First Creek will continue to be a priority in the next year. The 2009/2010 budget included $1,172,871 to continue improvements in First Creek.

The 2003 ordinance revisions added a significant improvement to the stream restoration program. The City began requiring private development to stabilize eroding creek banks on their project sites before completing their development. The ordinance specifically prohibits the use of hard armor unless no better alternative exists. TDEC can exempt the work if they determine that stabilization efforts would do more harm than good.

The City initiated a major improvement project on Baker Creek in 2009 to restore over 375 feet of degraded and channelized stream. The goals of the restoration projects are to reduce sediment, hydro-modification and flooding while improving habitat, riparian zones and water quality. Opportunities to implement large-scale restoration projects such as the First Creek and Baker Creek projects may not be feasible every year. However, the City will continue to focus when feasible on large projects, which may produce significant and measurable impacts.

Baker Creek Restoration Project

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. The City will continue to fund replacement of the skimmers as long as they remain effective. 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 "Covenants", 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 for Permanent Maintenance of Stormwater Facilities" 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 this permit year, 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 233 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;

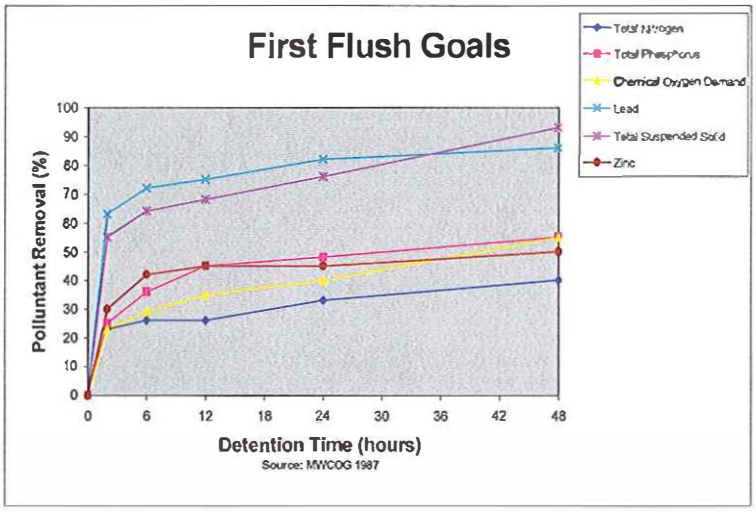
(4) Any site development which contains one-half (1/2) acre or more of additional impervious area.

(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 unlike the plastic markers or stencils, 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 has 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 will be 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 be made available for a fee at a local copy center. 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.

TDEC and the UT Water Resources Research Center have adopted the BMP manual as a basic model for use by Phase II NPDES communities. The City provided an electronic copy and has authorized modifications by the State for this purpose. Several other municipalities have obtained electronic copies of the Knoxville BMP manual for edit and adoption in their community. The City intends to continue providing the editable version of the BMP manual to other MS4s to help develop some consistency in the region.

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 on an annual basis. The City has been able to significantly reduce the quantity of deicing materials used by improved equipment, improved forecasting, chemicals, and operator training. 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. Since this pond is a site of one of the permanent stormwater monitoring stations, the City will continue to monitor the water quality enhancements and improve the pond as needed in the future. 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.

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. 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; however, a household hazardous waste collection facility has been opened to collect all types of hazardous wastes including pesticides, herbicides, and fertilizer.

For pesticide, herbicide, and fertilizer pollutants, the control program 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

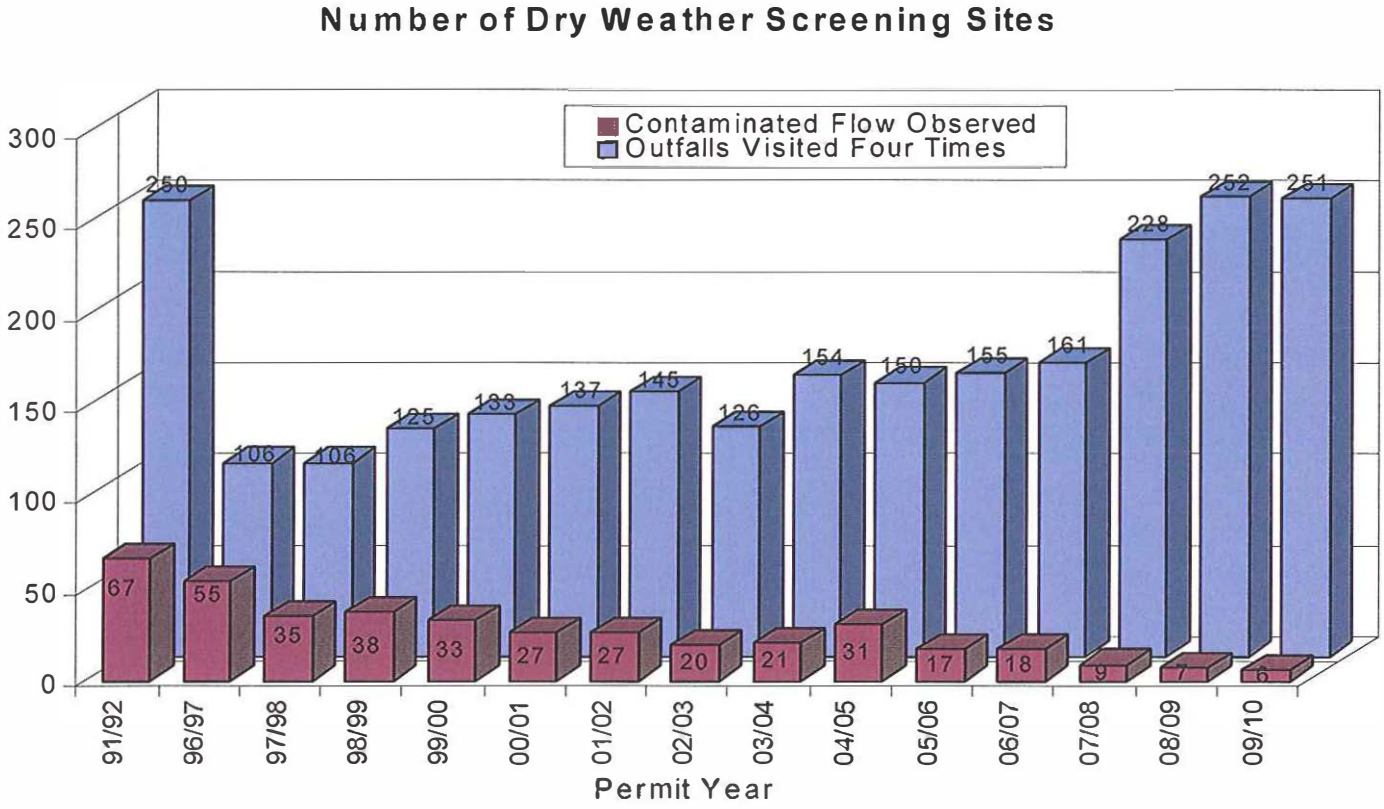
The Stormwater and Street Ordinance was developed to specifically prohibit non-stormwater discharges, increase penalties for illegal discharges, and to provide water quality regulations for new development. The first ordinance was effective June 20, 1997. The ordinance has been updated several times 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 (shown) for the following parameters: phenols, ammonia, detergents, copper, chlorine, pH, turbidity, color, temperature, and flow rate. 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 bar graph, 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.

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, 8740 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 251 outfalls four times each. The monitored outfalls consisted of the previous year's 7 high-risk outfall sites plus 245 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 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 enviromnental 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 quality group 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 Quality 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 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 will 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.

Last year, the Stormwater staff responded to assist the Fire Department with a variety of spills including traffic accidents that lost fuel, illegal dumping, and discharges from permanent facilities. 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 Quality 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 2010 was the 21st year for the River Rescue. The spring 2010 River Rescue attracted 1054 volunteers who collected 15 tons of trash and 95 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 44 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 Status: Ongoing

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 ten 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. Existing storm drains are also marked by volunteers and City staff using the informational disks that contain the Water Quality Hotline phone number and some Spanish text contain the no dumping message.

Water Quality Forum — Status: Ongoing

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. In 2010, the WQF won the Governor's Environmental Stewardship Award in Environmental Education and Outreach for the second annual Rainy Day Brush-off. The WQF's website is www.waterqualityforum.org.

Adopt-a-Watershed — Status: Ongoing

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 — Status: Ongoing

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 — Status: Ongoing

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.

Clean, Protect and Restore (CPR) Status: Ongoing

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 had 190 volunteers and removed 10.5 tons of trash from a combination of all the sites.

Public Displays And Presentations Status: Ongoing

In cooperation with the COK Solid Waste Office 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 Fulton High School, rain barrel workshops, and University of Tennessee classes.

WaterFest Status: Ongoing

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. The CAC AmeriCorps Team takes the lead in conducting games, arts and crafts and model-building activities with the students. Storytellers and musicians engage students in audience participation performances and forum partners run informational/demonstration booths. Local high school and university students provide great volunteer support.

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 paid for through a $500,000 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 revision of the ordinance was last 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 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.

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. 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 normally reviews the facilities maintenance records, provides technical advice on proper maintenance scheduling, records the devices GPS coordinates if needed, and updates the City's industrial and commercial facilities database. Inspection of the SPAP permitted facilities will occur systematically to insure that the structural controls are maintained and the management controls are being followed.

In addition to inspections of sites that have SPAP's, the City will select for inspection some existing sites that were built before the SPAP program was implemented. These sites will be targeted for education rather than enforcement to bring the sites into compliance using proper BMPs from the City's manual. Other commercial site inspections will need to be performed 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 for a variety of businesses. 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 ordinance requires a Special Pollution Abatement Permit (SPAP) for certain land uses and 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. If an NOI has not been filed, the City will coordinate with TDEC to obtain the NOI. Future NOIs may be obtained annually from TDEC in bulk or electronically.

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

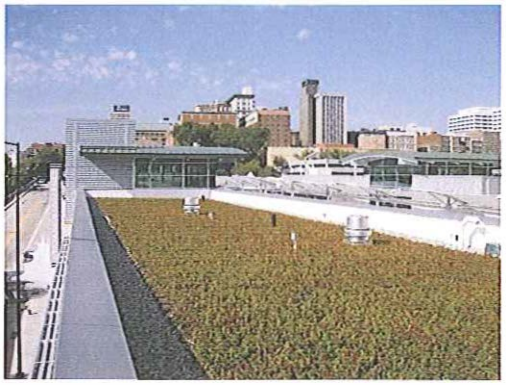
The illicit connection and improper disposal program defined in the City's Part II NPDES stormwater permit application and in the previous section of this report, primarily addresses runoff from industrial facilities. The majority of dry weather screening occurs from areas of industrial use or outfalls 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 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 just after this permit year ended. Their SWPPP will be updated to include both facilities and reported at the following annual report. 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. All of the improvements were reported as they occurred. The SWMF is currently being retrofitted with structural controls to reduce the solids, sediment, hydrocarbons, and bacteria in the runoff from the paved areas.

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 pollutants. These pollutants should vary from one land use to the other. 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. 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 TSDs 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. The Stormwater & Streets ordinance Section 22.5-54 states, *"The Engineering Director 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 as the Stormwater & Streets ordinance is updated throughout the permit term.

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 22A-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 if 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. For example, the large Stormceptors that were installed at the bus terminal may be monitored with a before and after treatment sample to determine the removal efficiency of that BMP.

The Loraine Street facility is 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. The City completed installation of the test site in year two and started sampling in year three.

Stormwater runoff from the SWMF is sampled annually as described in MN-2. BMP monitoring will begin after the structural retrofits are completed.

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.

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. The City began BMP testing at the SWMF in year four.

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 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 proposes 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 does provide 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 insure 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 requires a Pre-construction Assistance Meeting with the Developer, contractors, design Engineers, 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 insures 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, and
- The City inspector, which is assigned 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 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 requirement to use BMPs from the BMP manual or TDEC manual applies to Utility, Single Family Residential (>10,000 s.f), 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 new 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 new 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 permitted. The guidance criteria address the goals of the NPDES stormwater program by allowing only BMPs, which are effective in reducing the targeted pollutants.

The BMP manual was 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 regulations included in the new 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 to implement 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 insure 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 e/s 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.

SWMP Task: Require post-construction Development Certifications from licensed design professionals, before bond release to insure 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, 246 NOVs were written for construction site runoff violations, 25 of those resulted in civil penalties totaling $87,725.

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 Enviromnental 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 is developing standard penalties for construction violations to be more consistent with TDEC's expedited enforcement procedures.

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.

Beginning in year six, 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 and some 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.

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) - 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 should 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 may also collect ambient samples as described below in section MN-3 unless grab samples are taken manually.

Each of the flow-weighted storm samples will be analyzed for thirteen (13) routine parameters. Only pH will be recorded in the field. The remaining routine parameters will be 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 Anunonia 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 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 (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.

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 currant 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 help refined 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 were 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 Izaak Walton League and now 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 the monitoring project.

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. Any future progress on the analysis or mitigation measures will be reported in the future annual reports.

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.

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. Four dispensers are located downtown and four are located in two City parks. Approximately 500

pooper-scoopers bags are restocked bi-weekly at the dispenser on Gay and Summit, 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.

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.

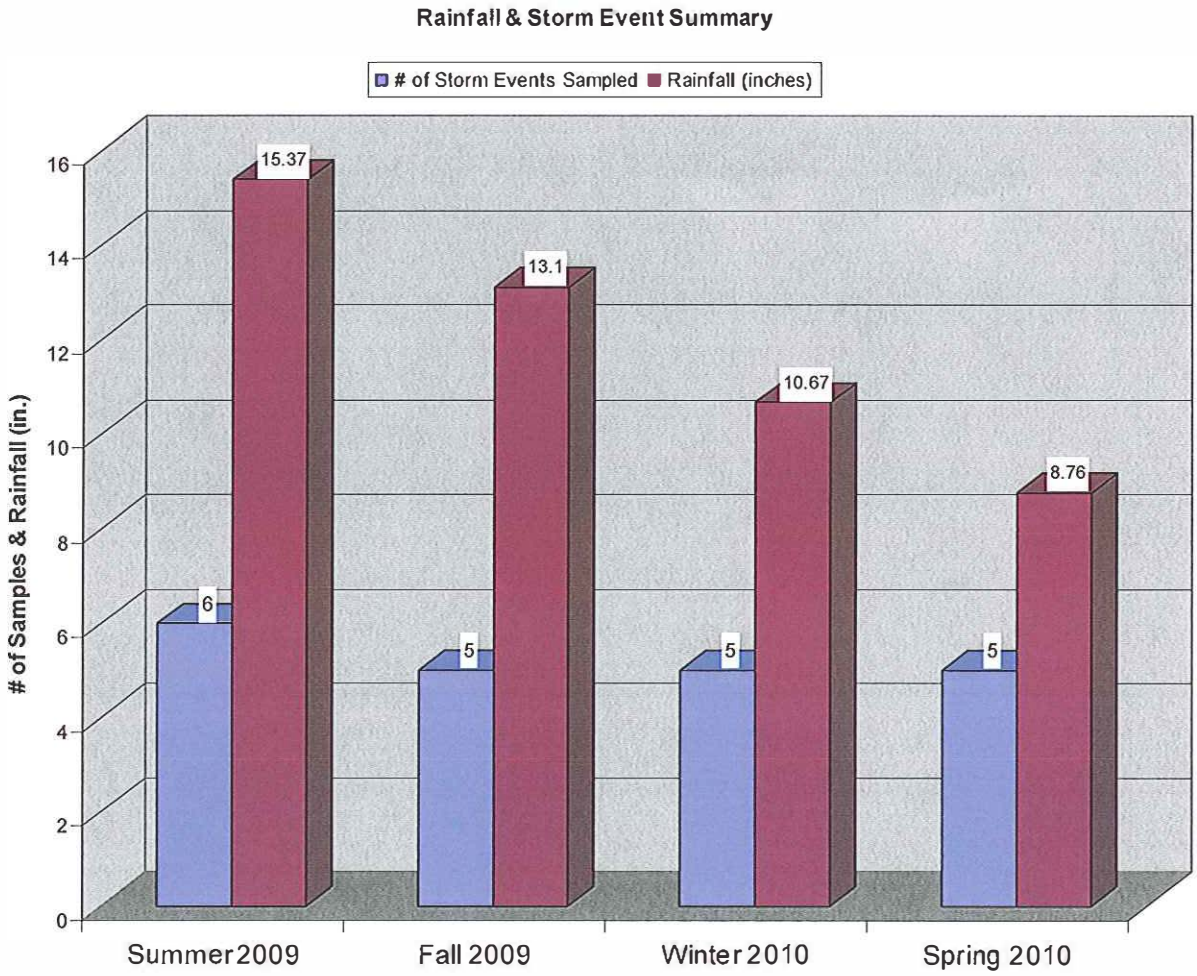
During the past permit year, no outfalls were removed from the City's outfall inventory and 9 outfalls were added. Outfalls are typically added as a result of re-development or annexations and removed as a result of drainage alterations.

All updated outfalls are clearly marked on the inventory map located in the appendix but attached separately. The outfalls added to the inventory this year are listed in the Appendix:

6.2 Ongoing Stormwater Monitoring Program.

6.2.1 Area Rainfall Data & Storm Event Summary.

During the July 1, 2009 to June 30, 2010 monitoring period, an average of 47.90 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

Laboratory Analysis Summary - Seasonal Storm Sampling Program

July 1, 2009 thru June 30, 2010

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. '09	7.0	2,856,450	0.44	7.9	42.0	41.0	220	0.70	0.17	0.65	0.48	0.009	0.099	BDL	BDL
	Fall '09	7.0	9,502,040	0.54	BDL	BDL	32.0	93	0.94	BDL	0.35	0.35	BDL	0.068	BDL	BDL
	Wtr. '10	6.0	15,333,400	0.50	BDL	56.0	150.0	240	0.76	BDL	0.94	0.94	0.017	0.073	0.22	0.19
	Spr. '10	6.0	10,106,500	0.56	6.7	49.0	33.0	200	0.85	BDL	1.00	1.00	0.0075	BDL	BDL	0.068
Average:		**6.5**	**9,449,598**	**0.51**	**6.2**	**39.3**	**64.0**	**188**	**0.81**	**0.12**	**0.74**	**0.69**	**0.010**	**0.068**	**0.13**	**0.08**
Love Creek	Sum. '09	7.0	1,035,330	0.57	BDL	36.0	42	210	0.76	BDL	0.64	0.64	BDL	0.046	BDL	0.054
	Fall'09	7.5	9,408,340	1.65	BDL	25.0	21	250	0.86	BDL	0.44	0.44	BDL	0.100	BDL	0.054
	Wtr. '10	6.0	656,738	0.41	BDL	48.0	140	280	0.71	BDL	1.50	1.50	0.0097	0.084	0.18	0.350
	Spr. '10	6.0	569,147	0.56	BDL	32.0	17	240	0.98	BDL	0.88	0.88	0.0090	0.032	BDL	0.050
Average:		**6.6**	**2,917,389**	**0.80**	**5.0**	**35.3**	**55**	**245**	**0.83**	**0.10**	**0.87**	**0.87**	**0.0072**	**0.066**	**0.120**	**0.13**
Third Creek	Sum. '09	7.5	9,166,140	0.09	BDL	65.0	78	250	1.40	0.29	0.89	0.60	0.008	0.12	BDL	BDL
	Fall '09	7.0	23,821,800	0.62	BDL	25.0	35	150	0.66	BDL	0.55	0.55	BDL	0.15	BDL	0.033
	Wtr. '10	6.0	16,802,600	0.54	BDL	48.0	120	320	0.55	0.29	1.30	1.00	0.019	0.12	BDL	0.300
	Spr. '10	6.0	10,389,900	0.76	9.2	54.0	91	170	0.84	BDL	1.00	1.00	0.0180	0.12	0.17	0.130
Average:		**6.6**	**15,045,110**	**0.50**	**6.1**	**48**	**81**	**223**	**0.86**	**0.20**	**0.94**	**0.79**	**0.012**	**0.13**	**0.12**	**0.122**
Walden Drive Fourth Creek	Sum. '09	6.0	6,024,720	0.76	BDL	77	170	110	0.72	0.34	1.50	1.20	0.017	0.140	0.30	BDL
	Fall'09	7.0	4,421,800	0.58	BDL	22	1800	160	0.78	0.11	0.69	0.58	0.012	0.110	0.12	BDL
	Wtr. '10	6.0	3,710,880	0.51	BDL	66	220	180	0.54	0.12	0.83	0.71	0.014	0.100	0.31	0.53
	Spr. '10	6.0	3,337,560	0.80	11	100	120	120	0.56	BDL	2.10	2.10	0.011	0.110	0.12	0.14
Average:		**6.3**	**4,373,740**	**0.66**	**6.5**	**66**	**578**	**143**	**0.65**	**0.17**	**1.28**	**1.15**	**0.014**	**0.115**	**0.21**	**0.18**
Williams Creek	Sum. '09	7.0	6,570,290	1.12	7	57.0	83	220	0.91	BDL	0.74	0.74	0.0120	0.110	0.18	0.05
	Fall'09	8.0	7,235,410	0.48	BDL	18.0	53	130	0.54	BDL	0.49	0.49	0.0072	0.061	0.11	BDL
	Wtr. '10	7.5	2,774,720	0.08	BDL	19.0	6	270	1.60	BDL	0.86	0.86	BDL	BDL	BDL	BDL
	Spr. '10	6.5	6,924,130	0.68	18	150.0	96	180	0.89	BDL	2.20	2.20	0.0230	0.076	0.22	0.17
Average:		**7.3**	**5,876,138**	**0.59**	**9**	**61**	**59**	**200**	**0.99**	**0.10**	**1.07**	**1.07**	**0.0118**	**0.0693**	**0.15**	**0.07**
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	

-The above chart is comprised of seasonal averages from the data collected from each individual storm event.

-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-5.6, 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

Seasonal Ambient Grab Samples 2009-2010

Summer 2009	Date	pH	BOD	COD	Suspended Solids (TSS)	Dissolved Solids (TDS)	Nitrate + Nitrite Nitrogen	Ammonia Nitrogen	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate	E. Coli	Fecal Colif.
First Creek	8/19/09	7.5	BDL	BDL	4.8	260	1.20	BDL	1.10	1.10	BDL	0.230	BDL	0.053	42	250
Love Creek	8/19/09	7.5	BDL	28	4.8	310	1.20	0.15	0.55	0.40	BDL	0.052	BDL	BDL	138	300
Third Creek	8/19/09	7.0	BDL	19	9.0	290	1.40	0.22	0.56	0.34	BDL	0.034	BDL	BDL	58	180
Walden Drive	8/19/09	7.5	BDL	BDL	3.6	250	1.10	BDL	0.60	0.60	BDL	BDL	BDL	0.100	105	500
Williams Creek	8/19/09	7.0	7	57	83.0	220	0.91	BDL	0.74	0.74	0.012	0.110	0.18	0.052	129	700
Average		**7.3**	**5.4**	**24.8**	**21.0**	**266**	**1.16**	**0.13**	**0.71**	**0.64**	**0.006**	**0.091**	**0.12**	**0.051**	**94**	**386**

Fall2009	Date	pH	BOD	COD	Suspended Solids (TSS)	Dissolved Solids (TDS)	Nitrate + Nitrite Nitrogen	Ammonia Nitrogen	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate	E. Coli	Fecal Colif.
First Creek	12/8/09	6.5	BDL	BDL	1.5	260	1.40	BDL	0.63	0.63	BDL	0.078	BDL	BDL	236	200
Love Creek	12/8/09	6.0	BDL	28	1.1	320	1.30	BDL	0.61	0.61	BDL	0.220	BDL	BDL	180	980
Third Creek	12/8/09	7.0	BDL	12	3.4	260	1.30	BDL	0.49	0.49	BDL	0.034	BDL	BDL	345	210
Walden Drive	12/8/09	7.0	BDL	20	2.0	280	1.20	BDL	0.47	0.47	BDL	0.170	BDL	BDL	613	520
Williams Creek	12/8/09	6.0	BDL	83	3.4	310	1.70	BDL	0.75	0.75	BDL	0.340	BDL	BDL	194	330
Average		**6.5**	**5.0**	**30.6**	**2.3**	**286**	**1.38**	**0.10**	**0.59**	**0.59**	**0.005**	**0.168**	**0.10**	**0.03**	**314**	**448**

Winter 2010	Date	pH	BOD	COD	Suspended Solids (TSS)	Dissolved Solids (TDS)	Nitrate + Nitrite Nitrogen	Ammonia Nitrogen	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate	E. Coli	Fecal Colif.
First Creek	1/15/10	6.5	BDL	BDL	1.2	250	1.30	0.10	0.21	0.11	BDL	BDL	BDL	BDL	130	90
Love Creek	1/15/10	6.5	BDL	BDL	1.1	300	1.50	0.40	0.52	0.12	BDL	BDL	BDL	BDL	55	56
Third Creek	1/15/10	6.5	BDL	BDL	2.8	270	1.40	0.18	0.26	BDL	BDL	BDL	BDL	BDL	131	112
Walden Drive	1/15/10	6.5	BDL	BDL	5.6	270	1.20	BDL	0.15	0.15	0.006	BDL	BDL	BDL	49	24
Williams Creek	1/15/10	6.5	BDL	BDL	8.5	260	1.50	0.11	0.31	0.20	0.007	BDL	BDL	BDL	66	48
Average		**6.5**	**5.0**	**10.0**	**3.8**	**270**	**1.38**	**0.18**	**0.29**	**0.14**	**0.005**	**0.030**	**0.10**	**0.03**	**86**	**66**

Spring 2010	Date	pH	BOD	COD	Suspended Solids (TSS)	Dissolved Solids (TDS)	Nitrate + Nitrite Nitrogen	Ammonia Nitrogen	Total Kjeldahl Nitrogen	Total Organic Nitrogen	Lead	Zinc	Total Phosphorus	Ortho Phosphate	E. Coli	Fecal Colif.
First Creek	5/25/10	7.0	BDL	BDL	5.4	280	1.20	BDL	0.21	0.21	BDL	BDL	BDL	BDL	517	600
Love Creek	5/25/10	7.5	9.6	BDL	3.4	340	1.30	BDL	0.32	0.32	BDL	BDL	BDL	BDL	326	240
Third Creek	5/25/10	7.5	BDL	BDL	12.0	310	1.40	BDL	0.27	BDL	BDL	BDL	BDL	BDL	308	420
Walden Drive	5/25/10	7.0	BDL	BDL	5.8	280	1.10	BDL	0.26	0.26	BDL	BDL	BDL	BDL	261	410
Williams Creek	5/25/10	7.0	BDL	BDL	1.9	310	1.50	0.13	0.24	0.10	BDL	BDL	BDL	BDL	411	460
Average		**36.0**	**5.9**	**10.0**	**5.7**	**304**	**1.30**	**0.1**	**0.26**	**0.20**	**0.005**	**0.030**	**0.10**	**0.025**	**365**	**426**

U = Analyte requested but not detected

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-5.6, 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		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	11-Aug	Grab	6.0	10	48	11	25	0.12	0.21	0.55	0.34	BDL	0.20	BDL	0.130	12.0	-	-
Loraine St. Combined	Fall '09	8-Dec	Grab	6.0	200	580	370	1400	0.25	BDL	3.20	3.20	0.045	0.78	1.60	1.100	BDL	-	-
Loraine St. East Unit	Sum. '09	11-Aug	Grab	5.5	-	63	-	-	0.11	BDL	0.47	0.47	0.0077	0.10	0.21	-	BDL	-	-
	Fall '09	8-Dec	Grab	6.0	9	88	33	100	BDL	BDL	1.20	1.20	0.016	0.10	0.37	0.420	BDL	-	-
Loraine St. West Unit	Sum. '09	11-Aug	Grab	5.5	8	82	50	60	0.12	0.35	1.10	0.75	BDL	0.11	1.30	0.980	BDL	-	-
	Fall '09	8-Dec	Grab	6.0	61	220	100	670	0.24	BDL	1.80	1.80	0.013	0.46	2.10	0.860	6.7	-	-
Transfer Station	Sum. '09	18-Aug	Grab	6.0	470	2600	700	3300	0.83	1.40	24.00	23.00	0.330	1.30	2.30	0.700	8.0	-	-
	Fall '09	8-Dec	Grab	5.5	250	840	500	1700	0.60	0.18	7.60	7.40	0.280	1.10	0.90	0.750	BDL	1,000	77,010
	Pretreated	15-Jun	Grab	7.0	-	-	5030	-	-	-	-	-	-	-	-	-	-	241,920	241,920
	Treated	15-Jun	Grab	7.0	-	-	840	-	-	-	-	-	-	-	-	-	-	6,000	6,000
Average				**6.1**	**144**	**565**	**848**	**1036**	**0.30**	**0.32**	**4.99**	**4.77**	**0.09**	**0.52**	**1.11**	**0.62**	**6.8**	**82,973**	**108,310**
*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-5.6, 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	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.
Units				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	
Quik Lube	8/11/09	Grab	6.0	15	41	8.2	25	0.15	BDL	0.40	0.40	BDL	0.200	0.12	0.10	BDL	-	-
Long John Silver's (Magnolia)	8/19/09	Grab	5.0	9	520	290.0	90	0.44	0.22	5.30	5.10	0.200	0.650	0.82	0.43	BDL	10,810	240,000
McDonalds (Magnolia)	8/19/09	Grab	5.0	BDL	580	300.0	270	0.27	0.20	4.60	4.40	0.024	0.610	0.57	BDL	10.00	15,760	30,000
El Charro's (Kingston Pike, Bearden)	9/16/09	Grab	5.0	72	150	70.0	130	0.32	0.12	1.40	1.30	BDL	0.130	BDL	BDL	BDL	961	21,000
Sawyer's (Kingston Pike, Bearden)	6/9/10	Grab	5.5	BDL	71	40.0	41	0.21	0.23	0.91	0.68	0.013	0.100	0.22	0.08	BDL	2,010	6,000
Denton's (Kingston Pike, Bearden)	6/9/10	Grab	5.5	BDL	31	11.0	39	0.21	0.12	0.47	0.35	BDL	BDL	0.12	0.06	BDL	727	2,000
Applebees (Kingston Pike, Bearden)	6/9/10	Grab	5.5	12	38	12.0	51	0.62	0.17	0.91	0.74	BDL	0.081	0.11	0.08	BDL	4,870	6,000
McDonalds (Merchants)	6/9/10	Grab	5.0	8	BDL	4.5	23	BDL	0.11	0.49	0.38	0.009	0.035	0.11	0.08	BDL	1,200	5,600
Average			**5.3**	**16.4**	**180.1**	**92.0**	**84**	**0.29**	**0.16**	**1.81**	**1.67**	**0.033**	**0.230**	**0.27**	**0.17**	**6.15**	**5,191**	**44,371**
*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-5.6, 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 2009	11-Sep	Comp	7.0	2,856,450	0.44	7.9	42.0	41.0	220	0.70	0.17	0.65	0.48	0.009	0.099	BDL	BDL	-	-
FALL 2009	28-Oct	Comp	7.0	9,502,040	0.54	BDL	BDL	32.0	93	0.94	BDL	0.35	0.35	BDL	0.068	BDL	BDL	-	-
WINTER 2010	23-Feb	Comp	6.0	15,333,400	0.50	BDL	56.0	150.0	240	0.76	BDL	0.94	0.94	0.017	0.073	0.22	0.19	-	-
SPRING 2010	9-Apr	Comp	6.0	10,106,500	0.56	6.7	49.0	33.0	200	0.85	BDL	1.00	1.00	0.0075	BDL	BDL	0.068	17,220	6,000
Sample Average			6.5	9,449,598	0.51	6.2	39.3	64.0	188	0.81	0.12	0.74	0.69	0.010	0.068	0.13	0.08	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.

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-5.6, 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 2009	20-Aug	Comp	7.0	1,035,330	0.57	BDL	36.0	42	210	0.76	BDL	0.64	0.64	BDL	0.046	BDL	0.054	-	-
FALL 2009	10-Nov	Comp	7.5	9,408,340	1.65	BDL	25.0	21	250	0.86	BDL	0.44	0.44	BDL	0.100	BDL	0.054	-	-
WINTER 2010	23-Feb	Comp	6.0	656,738	0.41	BDL	48.0	140	280	0.71	BDL	1.50	1.50	0.0097	0.084	0.18	0.350	-	-
SPRING 2010	9-Apr	Comp	6.0	569,147	0.56	BDL	32.0	17	240	0.98	BDL	0.88	0.88	0.0090	0.032	BDL	0.050	111,990	6,000
Sample Average			6.6	2,917,389	0.80	5.0	35.3	55	245	0.83	0.10	0.87	0.87	0.0072	0.066	0.120	0.13	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.

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-5.6, 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 2009	28-Aug	Comp	7.5	9,166,140	0.09	BDL	65.0	78	250	1.40	0.29	0.89	0.60	0.008	0.12	BDL	BDL	-	-
FALL 2009	28-Oct	Comp	7.0	23,821,800	0.62	BDL	25.0	35	150	0.66	BDL	0.55	0.55	BDL	0.15	BDL	0.033	-	-
WINTER 2010	23-Feb	Comp	6.0	16,802,600	0.54	BDL	48.0	120	320	0.55	0.29	1.30	1.00	0.019	0.12	BDL	0.300	-	-
SPRING 2010	9-Apr	Comp	6.0	10,389,900	0.76	9.2	54.0	91	170	0.84	BDL	1.00	1.00	0.0180	0.12	0.17	0.130	10,170	6,000
Sample Average			6.6	15,045,110	0.50	6.1	48	81	223	0.86	0.20	0.94	0.79	0.012	0.13	0.12	0.122	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.

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-5.6, 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 2009	20-Aug	Comp	7.0	6,570,290	1.12	7	57.0	83	220	0.91	BDL	0.74	0.74	0.0120	0.110	0.18	0.05	-	-
FALL 2009	28-Oct	Comp	8.0	7,235,410	0.48	BDL	18.0	53	130	0.54	BDL	0.49	0.49	0.0072	0.061	0.11	BDL	-	-
WINTER 2010	12-Mar	Comp	7.5	2,774,720	0.08	BDL	19.0	6	270	1.60	BDL	0.86	0.86	BDL	BDL	BDL	BDL	-	-
SPRING 2010	9-Apr	Comp	6.5	6,924,130	0.68	18	150.0	96	180	0.89	BDL	2.20	2.20	0.0230	0.076	0.22	0.17	1,046	2,100
Sample Average			7.3	5,876,138	0.59	9	61	59	200	0.99	0.10	1.07	1.07	0.0118	0.0693	0.15	0.07	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.

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-5.6, 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 2009	11-Sep	Comp	6.0	6,024,720	0.76	BDL	77	170	110	0.72	0.34	1.50	1.20	0.017	0.140	0.30	BDL	-	-
FALL 2009	28-Oct	Comp	7.0	4,421,800	0.58	BDL	22	1800	160	0.78	0.11	0.69	0.58	0.012	0.110	0.12	BDL	-	-
WINTER 2010	23-Feb	Comp	6.0	3,710,880	0.51	BDL	66	220	180	0.54	0.12	0.83	0.71	0.014	0.100	0.31	0.53	-	-
SPRING 2010	9-Apr	Comp	6.0	3,337,560	0.80	11	100	120	120	0.56	BDL	2.10	2.10	0.011	0.110	0.12	0.14	19,350	6,000
Sample Average			6.3	4,373,740	0.66	6.5	66	578	143	0.65	0.17	1.28	1.15	0.014	0.115	0.21	0.18	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.

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-5.6, 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 47.90 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 47.90 inches/year, the average annual runoff from a single-family residential land use (25% impervious) is 15.05 in/yr (47.90*[(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 = ΣQi = total runoff rate / 1,000,000 = Mgal

$Q_{tot\ 09/10}$ = **36,236** 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, 2009 - June 30, 2010

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	47.9	888
East Fork	313	0	10	475	302	78	73	31	195	235	584	33	180	2,509	2,509	53	0.57	47.9	1,869
First Cr.	724	0	300	3,152	544	501	110	157	127	556	1,412	51	116	7,750	7,750	44	0.50	47.9	5,031
Fourth Cr.	965	57	423	2,026	468	406	93	206	201	568	881	61	414	6,769	5,920	41	0.48	47.9	3,676
Goose Cr.	639	40	126	669	213	67	8	21	77	131	327	34	29	2,381	1,755	35	0.43	47.9	976
Grassy Cr.	2,230	176	561	610	215	24	0	14	31	95	211	39	95	4,301	433	17	0.29	47.9	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	47.9	1,186
Inman Br.	563	33	214	138	4	12	0	0	0	0	145	0	34	1,143	99	21	0.31	47.9	41
Knob Cr.	1,719	195	481	843	125	84	1	19	1	29	296	4	169	3,966	989	19	0.30	47.9	391
Knob Fork	1,659	26	398	675	182	56	5	93	6	124	257	19	252	3,752	823	22	0.33	47.9	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	47.9	2,920
Second Cr.	443	0	90	1,281	346	247	29	107	140	542	1,161	35	82	4,503	4,498	53	0.57	47.9	3,341
Sinking Cr.	1,614	146	459	1,266	284	90	17	33	31	267	881	12	347	5,447	2,434	33	0.41	47.9	1,314
Swanpond C	3,892	303	833	604	121	36	4	79	240	232	457	65	285	7,151	499	19	0.30	47.9	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	47.9	2,298
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	47.9	4,890
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	47.9	3,505
Toll Cr.	535	69	154	222	42	26	1	0	37	4	93	42	4	1,229	767	22	0.32	47.9	322
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	47.9	838
Whites Cr.	2,733	154	782	1,298	575	59	31	11	49	126	608	51	578	7,055	1,634	23	0.34	47.9	716
Williams Cr.	358	11	47	561	46	96	125	17	10	61	276	3	30	1,641	1,605	37	0.45	47.9	939
Woods Cr.	1,220	106	281	371	0	26	0	2	140	43	261	1	157	2,608	143	23	0.33	47.9	62
Sink-East	1,226	0		728	9	17	0	17	3	27	0	0	0	2,027	91	12	0.24	47.9	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	47.9	59
Tuckahoe	4,293	0	0	1,829	18	14	0	8	2	1	0	4	0	6,169	229	8	0.22	47.9	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	47.9	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				36,236

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) = 47.90 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 = 36,236 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 in during the 1996-1997 permit year. Each 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 were reported as required in the fifth annual report. In the fifth year of the new permit term, the pollutant loads and event mean concentrations were calculated again and included in the Appendix of that report. Any quantitative reductions or groundwater impacts from the MS4 may become evident at that time and will be reported. 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 is 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 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 facility, and the Solid Waste Transfer facility. 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 09/10	Est. FY 10/11
Solid Waste Recycling (includes: composting, education, staff, etc.)	Fund 230	$1,839,361	$1,249,361
Household Hazardous Waste Facility	Fund 230	$168,484	$175,000
Stormwater Mgmt Operating expenses	Fund 220	$2,049,280	$1,714,680
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	$2,796,275	$2,800,000
First Creek Restoration/Improvements	Mixed	$1,172,871	$4,010,224
Lake Ave/Drainage Improvements	Fund 401	$46,005	$247,953
MJP/Baker Creek Restoration	Fund 401	$94,038	$0
Emily Avenue Sinkhole Project	Fund 401	$1,062	$0
Solid Waste Transfer Station – SWPPP	Fund 401	$127,915	$0
Loraine St. Stormwater Improvement	Fund 401	$199,745	$771,807
Cross Park Dr. Drainage Improvement	Fund 401	$145,871	$2,044,336
Prosser Road Groundwater Study	Fund 401	$12,866	$77,134
MLK Jr./Chestnut MS4	Fund 401	$4,606	$1,300,713
Johnston St. Drainage Improvements	Fund 401	$238,210	$1,790
First Creek Water Quality Model	Fund 401	$162	$21,838
Neighborhood Drainage Projects	Fund 401	$151,498	$471,575
Total Estimated Stormwater Costs		**$9,048249**	**$14,886,411**

APPENDIX A

Dry Weather Screening Results Summary

1. List of outfalls tested during the permit year with status (10 pages)
2. Table of testing results for outfalls with dry-weather flow (9 pages)
3. List of outfalls added during the permit year (3 pages)

Dry Weather Screening - Sample Events for 2010

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
00-400-0195	DRY	09/14/2009	09/14/2009	04/01/2010	04/01/2010
00-400-0200	DRY	09/14/2009	09/14/2009	04/01/2010	04/01/2010
00-400-0205	DRY	09/14/2009	09/14/2009	04/01/2010	04/01/2010
00-400-0220	DRY	09/14/2009	09/14/2009	04/01/2010	04/01/2010
00-400-0225	DRY	09/14/2009	09/14/2009	04/01/2010	04/01/2010
00-200-0235	WET	08/17/2009	08/17/2009	04/01/2010	04/01/2010
00-300-0240	DRY	08/17/2009	08/17/2009	04/01/2010	04/01/2010
00-300-0260	DRY	08/17/2009	08/17/2009	04/01/2010	04/01/2010
00-400-0275	DRY	09/30/2009	09/30/2009	04/01/2010	04/01/2010
00-400-0280	DRY	09/30/2009	09/30/2009	04/01/2010	04/01/2010
00-400-0295	DRY	09/30/2009	09/30/2009	04/01/2010	04/01/2010
00-400-0355	DRY	09/30/2009	09/30/2009	04/06/2010	04/06/2010
00-300-0385	DRY	08/17/2009	08/17/2009	04/06/2010	04/06/2010
00-300-0415	DRY	08/17/2009	08/17/2009	04/06/2010	04/06/2010
00-400-0420	DRY	09/30/2009	09/30/2009	04/06/2010	04/06/2010
00-400-0425	DRY	09/30/2009	09/30/2009	04/06/2010	04/06/2010
00-300-0435	DRY	08/17/2009	08/17/2009	04/07/2010	04/07/2010
00-400-0440	DRY	09/14/2009	09/14/2009	04/07/2010	04/07/2010
00-400-0445	DRY	09/14/2009	09/14/2009	04/07/2010	04/07/2010
00-400-0450	DRY	09/14/2009	09/14/2009	04/07/2010	04/07/2010
00-400-0455	DRY	09/14/2009	09/14/2009	04/07/2010	04/07/2010
00-300-0460	DRY	08/17/2009	08/17/2009	04/07/2010	04/07/2010
00-400-0465	DRY	09/14/2009	09/14/2009	04/07/2010	04/07/2010
00-300-0475	DRY	08/17/2009	08/17/2009	04/05/2010	04/05/2010
00-300-0480	DRY	08/17/2009	08/17/2009	04/05/2010	04/05/2010
00-100-0505	DRY	08/17/2009	08/17/2009	04/05/2010	04/05/2010

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
01-300-0060	DRY	08/04/2009	08/04/2009	05/19/2010	05/19/2010
01-300-0070	DRY	08/04/2009	08/04/2009	05/19/2010	05/19/2010
01-300-0115	DRY	08/04/2009	08/04/2009	05/19/2010	05/19/2010
01-300-0142	DRY	12/23/2009	12/23/2009	05/19/2010	05/19/2010
01-300-0143	DRY	08/04/2009	08/04/2009	05/19/2010	05/19/2010
01-300-0147	DRY	08/04/2009	08/04/2009	05/19/2010	05/19/2010
01-300-0149	DRY	08/04/2009	08/04/2009	05/19/2010	05/19/2010
01-300-0150	ILLICIT CONNECTION	08/04/2009	08/04/2009	05/19/2010	05/19/2010
01-100-0155	WET	08/04/2009	08/04/2009	05/19/2010	05/19/2010
01-300-0160	ILLICIT CONNECTION	08/04/2009	08/04/2009	05/19/2010	05/19/2010
01-400-0165	DRY	09/14/2009	09/14/2009	05/13/2010	05/13/2010
01-400-0170	DRY	09/14/2009	09/14/2009	05/13/2010	05/13/2010
01-400-0220	DRY	08/04/2009	08/04/2009	05/13/2010	05/13/2010
01-100-0230	WET	08/04/2009	08/04/2009	05/13/2010	05/13/2010
01-100-0245	DRY	08/25/2009	08/25/2009	05/13/2010	05/13/2010
01-400-0270	DRY	08/25/2009	08/25/2009	05/13/2010	05/13/2010
01-400-0285	DRY	08/25/2009	08/25/2009	05/13/2010	05/13/2010
01-400-0290	DRY	09/14/2009	09/14/2009	05/05/2010	05/05/2010
01-400-0295	DRY	09/14/2009	09/14/2009	05/05/2010	05/05/2010
01-400-0300	DRY	08/25/2009	08/25/2009	05/05/2010	05/05/2010
01-400-0305	DRY	08/25/2009	08/25/2009	05/05/2010	05/05/2010
01-400-0310	DRY	08/25/2009	08/25/2009	05/05/2010	05/05/2010
01-400-0320	DRY	08/25/2009	08/25/2009	05/05/2010	05/05/2010
01-400-0330	DRY	09/14/2009	09/14/2009	05/05/2010	05/05/2010
01-400-0335	DRY	08/25/2009	08/25/2009	05/05/2010	05/05/2010
01-300-0350	DRY	08/25/2009	08/25/2009	05/05/2010	05/05/2010
01-100-0375	DRY	08/25/2009	08/25/2009	05/05/2010	05/05/2010
01-300-0520	DRY	08/25/2009	08/25/2009	05/13/2010	05/13/2010

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
01-100-0660	DRY	08/25/2009	08/25/2009	04/13/2010	04/13/2010
01-400-0665	DRY	10/19/2009	10/19/2009	04/13/2010	04/13/2010
01-400-0720	DRY	10/19/2009	10/19/2009	04/13/2010	04/13/2010
01-400-0725	DRY	10/19/2009	10/19/2009	04/13/2010	04/13/2010
01-400-0730	DRY	10/19/2009	10/19/2009	04/13/2010	04/13/2010
01-400-0740	DRY	10/19/2009	10/19/2009	04/13/2010	04/13/2010
01-400-0745	DRY	10/19/2009	10/19/2009	04/13/2010	04/13/2010
01-400-0750	DRY	10/19/2009	10/19/2009	04/13/2010	04/13/2010
01-400-0755	DRY	10/19/2009	10/19/2009	04/13/2010	04/13/2010
01-400-0765	DRY	10/19/2009	10/19/2009	04/13/2010	04/13/2010
01-400-0770	WET	10/19/2009	10/19/2009	04/13/2010	04/13/2010
01-100-0775	DRY	10/19/2009	10/19/2009	04/13/2010	04/13/2010
01-400-0935	DRY	10/19/2009	10/19/2009	04/13/2010	04/13/2010
02-400-0050	ILLICIT CONNECTION	10/09/2009	10/09/2009	04/14/2010	04/14/2010
02-100-0090	DRY	10/09/2009	10/09/2009	04/14/2010	04/14/2010
02-100-0130	DRY	10/09/2009	10/09/2009	04/14/2010	04/14/2010
02-300-0171	DRY	08/27/2009	08/27/2009	04/14/2010	04/14/2010
02-300-0172	DRY	08/27/2009	08/27/2009	04/14/2010	04/14/2010
02-300-0174	DRY	08/27/2009	08/27/2009	04/14/2010	04/14/2010
02-300-0175	DRY	08/27/2009	08/27/2009	04/14/2010	04/14/2010
02-300-0176	DRY	08/27/2009	08/27/2009	04/14/2010	04/14/2010
02-300-0178	DRY	08/27/2009	08/27/2009	04/14/2010	04/14/2010
02-300-0179	DRY	08/27/2009	08/27/2009	04/14/2010	04/14/2010
02-300-0180	DRY	08/27/2009	08/27/2009	04/14/2010	04/14/2010
02-300-0181	DRY	08/27/2009	08/27/2009	04/14/2010	04/14/2010
02-300-0190	WET	10/09/2009	10/09/2009	05/13/2010	05/13/2010
02-200-0205	DRY	10/09/2009	10/09/2009	05/13/2010	05/13/2010
02-300-0230	WET	10/09/2009	10/09/2009	05/13/2010	05/13/2010

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
02-300-0245	DRY	09/29/2009	09/29/2009	03/31/2010	03/31/2010
02-300-0250	WET	09/29/2009	09/29/2009	03/31/2010	03/31/2010
02-300-0260	DRY	09/29/2009	09/29/2009	03/31/2010	03/31/2010
02-400-0265	DRY	09/29/2009	09/29/2009	03/31/2010	03/31/2010
02-300-0295	DRY	08/27/2009	08/27/2009	03/30/2010	03/30/2010
02-400-0300	WET	09/29/2009	09/29/2009	03/30/2010	03/30/2010
02-400-0305	WET	09/29/2009	09/29/2009	03/30/2010	03/30/2010
02-400-0310	WET	09/29/2009	09/29/2009	03/30/2010	03/30/2010
02-400-0315	DRY	09/29/2009	09/29/2009	03/30/2010	03/30/2010
02-400-0320	DRY	09/29/2009	09/29/2009	03/30/2010	03/30/2010
02-400-0325	DRY	09/29/2009	09/29/2009	03/30/2010	03/30/2010
02-100-0405	DRY	08/27/2009	08/27/2009	03/30/2010	03/30/2010
02-100-0425	DRY	08/27/2009	08/27/2009	03/30/2010	03/30/2010
02-400-0455	DRY	09/29/2009	09/29/2009	03/30/2010	03/30/2010
02-400-0506	WET	08/27/2009	08/27/2009	03/30/2010	03/30/2010
02-400-0540	WET	08/27/2009	08/27/2009	03/30/2010	03/30/2010
03-300-0010	DRY	08/26/2009	08/26/2009	03/24/2010	03/24/2010
03-300-0015	DRY	08/25/2009	08/25/2009	03/24/2010	03/24/2010
03-300-0035	WET	08/26/2009	08/26/2009	03/24/2010	03/24/2010
03-400-0060	DRY	09/10/2009	09/10/2009	03/24/2010	03/24/2010
03-400-0065	DRY	09/10/2009	09/10/2009	03/24/2010	03/24/2010
03-300-0075	DRY	08/26/2009	08/26/2009	03/24/2010	03/24/2010
03-300-0115	DRY	08/26/2009	08/26/2009	03/24/2010	03/24/2010
03-400-0120	DRY	08/26/2009	08/26/2009	03/24/2010	03/24/2010
03-400-0125	DRY	08/26/2009	08/26/2009	03/24/2010	03/24/2010
03-300-0370	DRY	08/26/2009	08/26/2009	03/24/2010	03/24/2010
03-300-0385	DRY	08/26/2009	08/26/2009	03/15/2010	03/15/2010
03-200-0395	DRY	08/26/2009	08/26/2009	03/15/2010	03/15/2010

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
03-300-0398	WET	08/26/2009	08/26/2009	03/15/2010	03/15/2010
03-300-0400	WET	08/26/2009	08/26/2009	03/15/2010	03/15/2010
03-100-0410	DRY	08/26/2009	08/26/2009	03/15/2010	03/15/2010
03-300-0430	WET	09/08/2009	09/08/2009	03/15/2010	03/15/2010
03-100-0455	DRY	09/08/2009	09/08/2009	03/15/2010	03/15/2010
03-100-0465	DRY	09/08/2009	09/08/2009	03/15/2010	03/15/2010
03-300-0480	DRY	09/08/2009	09/08/2009	03/15/2010	03/15/2010
03-500-0540	WET	09/10/2009	09/10/2009	03/17/2010	03/17/2010
03-400-0545	DRY	09/08/2009	09/08/2009	03/17/2010	03/17/2010
03-300-0550	DRY	09/08/2009	09/08/2009	03/17/2010	03/17/2010
03-400-0560	DRY	09/10/2009	09/10/2009	03/17/2010	03/17/2010
03-400-0565	DRY	09/10/2009	09/10/2009	03/17/2010	03/17/2010
03-400-0570	DRY	09/10/2009	09/10/2009	03/17/2010	03/17/2010
03-400-0575	DRY	09/10/2009	09/10/2009	03/17/2010	03/17/2010
03-400-0610	DRY	09/10/2009	09/10/2009	03/18/2010	03/18/2010
03-300-0615	WET	09/08/2009	09/08/2009	03/23/2010	03/23/2010
03-300-0625	DRY	08/31/2009	08/31/2009	03/23/2010	03/23/2010
03-300-0630	DRY	09/08/2009	09/08/2009	03/23/2010	03/23/2010
03-300-0640	DRY	08/31/2009	08/31/2009	03/23/2010	03/23/2010
03-300-0645	DRY	08/31/2009	08/31/2009	03/23/2010	03/23/2010
03-300-0655	WET	08/31/2009	08/31/2009	03/23/2010	03/23/2010
03-300-0670	DRY	08/31/2009	08/31/2009	03/23/2010	03/23/2010
03-300-0675	ILLICIT CONNECTION	08/31/2009	08/31/2009	03/23/2010	03/23/2010
03-400-0880	DRY	08/31/2009	08/31/2009	03/18/2010	03/18/2010
03-200-0965	WET	08/31/2009	08/31/2009	03/18/2010	03/18/2010
03-200-0990	WET	08/31/2009	08/31/2009	03/18/2010	03/18/2010
04-400-0135	DRY	08/24/2009	08/24/2009	01/19/2010	01/19/2010
04-400-0140	DRY	08/24/2009	08/24/2009	01/19/2010	01/19/2010

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
04-400-0145	DRY	08/24/2009	08/24/2009	01/19/2010	01/19/2010
04-400-0150	DRY	08/24/2009	08/24/2009	01/19/2010	01/19/2010
04-500-0160	DRY	10/20/2009	10/20/2009	01/19/2010	01/19/2010
04-400-0180	DRY	08/24/2009	08/24/2009	01/19/2010	01/19/2010
04-400-0190	DRY	08/24/2009	08/24/2009	01/19/2010	01/19/2010
04-400-0210	WET	10/20/2009	10/20/2009	01/19/2010	01/19/2010
04-400-0236	DRY	10/20/2009	10/20/2009	01/19/2010	01/19/2010
04-400-0237	DRY	10/20/2009	10/20/2009	01/19/2010	01/19/2010
04-500-0239	DRY	10/20/2009	10/20/2009	01/19/2010	01/19/2010
04-400-0246	DRY	08/24/2009	08/24/2009	01/19/2010	01/19/2010
04-500-0253	DRY	10/20/2009	10/20/2009	01/19/2010	01/19/2010
04-300-0264	DRY	08/24/2009	08/24/2009	01/28/2010	01/28/2010
04-300-0267	WET	08/24/2009	08/24/2009	01/28/2010	01/28/2010
04-200-0270	WET	08/24/2009	08/24/2009	01/28/2010	01/28/2010
04-300-0308	DRY	10/20/2009	10/20/2009	01/28/2010	01/28/2010
04-300-0337	DRY	08/24/2009	08/24/2009	01/28/2010	01/28/2010
04-300-0345	DRY	08/24/2009	08/24/2009	01/28/2010	01/28/2010
04-300-0355	DRY	08/24/2009	08/24/2009	01/28/2010	01/28/2010
04-300-0375	DRY	08/24/2009	08/24/2009	01/28/2010	01/28/2010
05-500-0015	DRY	10/21/2009	10/21/2009	02/08/2010	02/08/2010
05-400-0025	DRY	10/21/2009	10/21/2009	02/08/2010	02/08/2010
05-400-0030	DRY	10/21/2009	10/21/2009	02/08/2010	02/08/2010
05-300-0035	DRY	09/01/2009	09/01/2009	02/08/2010	02/08/2010
05-400-0040	DRY	10/21/2009	10/21/2009	02/08/2010	02/08/2010
05-400-0045	DRY	10/21/2009	10/21/2009	02/08/2010	02/08/2010
05-400-0050	DRY	10/21/2009	10/21/2009	02/08/2010	02/08/2010
05-400-0070	DRY	09/01/2009	09/01/2009	02/08/2010	02/08/2010
05-100-0100	DRY	09/01/2009	09/01/2009	02/08/2010	02/08/2010

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
05-400-0105	DRY	09/01/2009	09/01/2009	02/08/2010	02/08/2010
05-400-0117	DRY	09/01/2009	09/01/2009	02/18/2010	02/18/2010
05-300-0185	DRY	09/01/2009	09/01/2009	02/18/2010	02/18/2010
05-300-0210	DRY	09/01/2009	09/01/2009	02/18/2010	02/18/2010
05-400-0215	DRY	09/01/2009	09/01/2009	02/18/2010	02/18/2010
05-300-0220	DRY	09/01/2009	09/01/2009	02/18/2010	02/18/2010
05-300-0222	WET	09/01/2009	09/01/2009	02/18/2010	02/18/2010
05-300-0240	DRY	10/21/2009	10/21/2009	02/18/2010	02/18/2010
05-400-0245	DRY	10/21/2009	10/21/2009	02/18/2010	02/18/2010
06-400-0020	DRY	11/06/2009	11/06/2009	02/17/2010	02/17/2010
06-400-0025	DRY	11/06/2009	11/06/2009	02/17/2010	02/17/2010
06-400-0055	WET	11/06/2009	11/06/2009	02/17/2010	02/17/2010
06-400-0125	DRY	11/06/2009	11/06/2009	02/17/2010	02/17/2010
06-400-0140	DRY	11/06/2009	11/06/2009	02/17/2010	02/17/2010
06-400-0145	WET	11/06/2009	11/06/2009	02/17/2010	02/17/2010
06-400-0165	DRY	11/06/2009	11/06/2009	02/17/2010	02/17/2010
06-400-0170	DRY	11/06/2009	11/06/2009	02/17/2010	02/17/2010
06-400-0175	WET	11/06/2009	11/06/2009	02/17/2010	02/17/2010
06-400-0180	WET	11/06/2009	11/06/2009	02/17/2010	02/17/2010
06-400-0195	DRY	11/06/2009	11/06/2009	02/17/2010	02/17/2010
06-400-0205	DRY	11/06/2009	11/06/2009	02/17/2010	02/17/2010
06-400-0210	DRY	11/06/2009	11/06/2009	02/17/2010	02/17/2010
07-500-0010	DRY	10/21/2009	10/22/2009	02/25/2010	02/25/2010
07-100-0055	ILLICIT CONNECTION	10/21/2009	10/22/2009	02/25/2010	02/25/2010
07-100-0090	DRY	10/21/2009	10/22/2009	02/25/2010	02/25/2010
07-400-0115	DRY	10/21/2009	10/22/2009	02/25/2010	02/25/2010
07-400-0210	DRY	10/21/2009	10/22/2009	02/25/2010	02/25/2010
07-400-0215	DRY	10/21/2009	10/22/2009	02/25/2010	02/25/2010

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
08-400-0145	DRY	09/30/2009	09/30/2009	02/18/2010	02/18/2010
10-300-0401	DRY	09/30/2009	09/30/2009	02/25/2010	02/25/2010
11-400-0585	DRY	12/16/2009	12/16/2009	03/01/2010	03/01/2010
11-400-0590	DRY	12/16/2009	12/16/2009	03/01/2010	03/01/2010
11-200-0600	WET	12/16/2009	12/16/2009	03/01/2010	03/01/2010
11-300-0602	DRY	12/16/2009	12/16/2009	03/01/2010	03/01/2010
11-300-0610	WET	12/16/2009	12/16/2009	03/01/2010	03/01/2010
11-300-0611	DRY	12/16/2009	12/16/2009	03/01/2010	03/01/2010
11-300-0612	DRY	12/16/2009	12/16/2009	03/01/2010	03/01/2010
11-300-0613	DRY	12/16/2009	12/16/2009	03/01/2010	03/01/2010
11-300-0614	WET	12/16/2009	12/16/2009	03/01/2010	03/01/2010
11-300-0615	WET	12/16/2009	12/16/2009	03/01/2010	03/01/2010
13-300-0135	ILLICIT CONNECTION	12/17/2009	12/17/2009	03/04/2010	03/04/2010
13-300-0140	WET	12/17/2009	12/17/2009	03/04/2010	03/04/2010
13-300-0145	DRY	12/17/2009	12/17/2009	03/04/2010	03/04/2010
13-300-0147	DRY	12/17/2009	12/17/2009	03/04/2010	03/04/2010
13-300-0155	WET	12/17/2009	12/17/2009	03/04/2010	03/04/2010
13-400-0160	DRY	12/17/2009	12/17/2009	03/04/2010	03/04/2010
13-300-0181	DRY	12/17/2009	12/17/2009	03/04/2010	03/04/2010
13-300-0182	DRY	12/17/2009	12/17/2009	03/04/2010	03/04/2010
13-300-0184	WET	12/17/2009	12/17/2009	03/04/2010	03/04/2010
13-400-0188	DRY	12/04/2009	12/04/2009	03/04/2010	03/04/2010
13-300-0190	DRY	12/04/2009	12/04/2009	03/04/2010	03/04/2010
13-400-0195	DRY	12/04/2009	12/04/2009	03/04/2010	03/04/2010
13-400-0200	DRY	12/04/2009	12/04/2009	03/04/2010	03/04/2010
13-400-0205	DRY	12/04/2009	12/04/2009	03/04/2010	03/04/2010
13-400-0210	DRY	12/04/2009	12/04/2009	03/04/2010	03/04/2010
13-400-0225	DRY	12/04/2009	12/04/2009	03/04/2010	03/04/2010

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
13-300-0226	WET	12/16/2009	12/16/2009	03/08/2010	03/08/2010
13-300-0227	DRY	12/16/2009	12/16/2009	03/08/2010	03/08/2010
13-300-0228	WET	12/16/2009	12/16/2009	03/08/2010	03/08/2010
13-400-0280	DRY	12/04/2009	12/04/2009	03/08/2010	03/08/2010
13-400-0295	DRY	12/04/2009	12/04/2009	03/08/2010	03/08/2010
13-400-0300	DRY	12/04/2009	12/04/2009	03/08/2010	03/08/2010
13-300-0305	DRY	12/04/2009	12/04/2009	03/08/2010	03/08/2010
13-400-0310	WET	12/04/2009	12/04/2009	03/08/2010	03/08/2010
13-400-0315	DRY	12/04/2009	12/04/2009	03/08/2010	03/08/2010
13-400-0325	WET	12/04/2009	12/04/2009	03/08/2010	03/08/2010
13-400-0345	DRY	12/04/2009	12/04/2009	03/08/2010	03/08/2010
13-300-0350	WET	12/04/2009	12/04/2009	03/08/2010	03/08/2010
13-300-0365	DRY	12/04/2009	12/04/2009	03/08/2010	03/08/2010
31-300-0505	DRY	12/07/2009	12/07/2009	03/09/2010	03/09/2010
31-300-0515	DRY	12/07/2009	12/07/2009	03/09/2010	03/09/2010
31-300-0520	DRY	12/07/2009	12/07/2009	03/09/2010	03/09/2010
50-200-0055	DRY	12/07/2009	12/07/2009	03/09/2010	03/09/2010
50-200-0120	DRY	12/07/2009	12/07/2009	03/09/2010	03/09/2010
50-100-0130	DRY	12/07/2009	12/07/2009	03/09/2010	03/09/2010
50-100-0135	DRY	12/07/2009	12/07/2009	03/09/2010	03/09/2010
53-400-0050	DRY	10/26/2009	10/26/2009	03/01/2010	03/01/2010
53-400-0100	DRY	10/26/2009	10/26/2009	03/01/2010	03/01/2010
53-100-0129	DRY	10/26/2009	10/26/2009	03/01/2010	03/01/2010
53-500-0185	DRY	10/26/2009	10/26/2009	03/01/2010	03/01/2010
53-300-0275	DRY	10/26/2009	10/26/2009	03/01/2010	03/01/2010
54-500-0005	DRY	12/23/2009	12/23/2009	03/09/2010	03/09/2010
79-400-0375	WET	10/26/2009	10/26/2009	01/28/2010	01/28/2010
79-300-0376	DRY	10/26/2009	10/26/2009	01/28/2010	01/28/2010

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
79-400-0385	WET	10/26/2009	10/26/2009	01/28/2010	01/28/2010

TYPE CODE	COUNT
100	20
200	9
300	95
400	119
500	8

Dry Weather Screening Data for 2010

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
00-200-0235																
2010	8/17/09	1	No													
2010	8/17/09	2	No													
2010	4/1/10	3	No													
2010	4/1/10	4	No													
01-300-0150																
2010	8/4/09	1	Yes	100	6.5	0.03										
2010	8/4/09	2	Yes	100	7.0	0.01										
2010	5/19/10	3	Yes	18	7.0	0.02								No	No	No
2010	5/19/10	4	Yes	18	7.0	0.02								No	No	No
01-100-0155																
2010	8/4/09	1	Yes	30	7.0											
2010	8/4/09	2	Yes	30	7.0											
2010	5/19/10	3	Yes	25	6.8									No	No	No
2010	5/19/10	4	Yes	25	6.8									No	No	No
01-300-0160																
2010	8/4/09	1	Yes	10		0.04										
2010	8/4/09	2	Yes	10		0.04										
2010	5/19/10	3	Yes	2	7.0	0.02								No	No	No
2010	5/19/10	4	Yes	2	7.0	0.02								No	No	No
01-100-0230																
2010	8/4/09	1	No													
2010	8/4/09	2	No													
2010	5/13/10	3	Yes	1	7.0									No	No	No
2010	5/13/10	4	Yes	1	7.0									No	No	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
01-400-0770																
2010	10/19/09	1	Yes	0.50	7.0	0.02								No	No	No
2010	10/19/09	2	Yes	0.50	7.0	0.02								No	No	No
2010	4/13/10	3	Yes	0.50	7.0									No	No	No
2010	4/13/10	4	Yes	0.50	7.0									No	No	No
02-400-0050																
2010	10/9/09	1	No													
2010	10/9/09	2	No													
2010	4/14/10	3	Yes	20	7.0	0.08								No	No	No
2010	4/14/10	4	Yes	20	7.0	0.08								No	No	No
02-300-0190																
2010	10/9/09	1	No													
2010	10/9/09	2	No													
2010	5/13/10	3	No													
2010	5/13/10	4	No													
02-300-0230																
2010	10/9/09	1	Yes	12	6.5									No	No	No
2010	10/9/09	2	Yes	12	6.5									No	No	No
2010	5/13/10	3	Yes	7	7.0									No	No	No
2010	5/13/10	4	Yes	7	7.0									No	No	No
02-300-0250																
2010	9/29/09	1	No													
2010	9/29/09	2	No													
2010	3/31/10	3	No													
2010	3/31/10	4	No													
02-400-0300																
2010	9/29/09	1	No													
2010	9/29/09	2	No													
2010	3/30/10	3	No													
2010	3/30/10	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
02-400-0305																
2010	9/29/09	1	Yes	2	6.8									No	No	No
2010	9/29/09	2	Yes	2	6.8									No	No	No
2010	3/30/10	3	Yes	4	7.0									No	No	No
2010	3/30/10	4	Yes	4	7.0									No	No	No
02-400-0310																
2010	9/29/09	1	No													
2010	9/29/09	2	No													
2010	3/30/10	3	No													
2010	3/30/10	4	No													
02-400-0506																
2010	8/27/09	1	No													
2010	8/27/09	2	No													
2010	3/30/10	3	No													
2010	3/30/10	4	No													
02-400-0540																
2010	8/27/09	1	Yes	2	6.8									No	No	No
2010	8/27/09	2	Yes	2	6.8									No	No	No
2010	3/30/10	3	Yes	3	7.0									No	No	No
2010	3/30/10	4	Yes	3	7.0									No	No	No
03-300-0035																
2010	8/26/09	1	No													
2010	8/26/09	2	No													
2010	3/24/10	3	Yes	2	7.0									No	No	No
2010	3/24/10	4	Yes	2	7.0									No	No	No
03-300-0398																
2010	8/26/09	1	No													
2010	8/26/09	2	No													
2010	3/15/10	3	No													
2010	3/15/10	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
03-300-0400																
2010	8/26/09	1	Yes	5	7.0									No	No	No
2010	8/26/09	2	Yes	5	7.0									No	No	No
2010	3/15/10	3	Yes	15	7.0	0	0	0	0	0		150	20	No	No	No
2010	3/15/10	4	Yes	15	7.0	0	0	0	0	0		150	20	No	No	No
03-300-0430																
2010	9/8/09	1	No													
2010	9/8/09	2	No													
2010	3/15/10	3	Yes	1	7.0											
2010	3/15/10	4	Yes	1	7.0											
03-500-0540																
2010	9/10/09	1	Yes	12	7.0	0	0	0	0	0		240	10	No	No	No
2010	9/10/09	2	Yes	12	7.0	0	0	0	0	0		240	10	No	No	No
2010	3/17/10	3	Yes	20	7.0									No	No	No
2010	3/17/10	4	Yes	20	7.0									No	No	No
03-300-0615																
2010	9/8/09	1	No													
2010	9/8/09	2	No													
2010	3/23/10	3	No													
2010	3/23/10	4	No													
03-300-0655																
2010	8/31/09	1	No													
2010	8/31/09	2	No													
2010	3/23/10	3	No													
2010	3/23/10	4	No													
03-300-0675																
2010	8/31/09	1	Yes	1	7.0	0.01	0	0	0	0.02		0	0	No	No	No
2010	8/31/09	2	Yes	1	7.0	0.01	0	0	0	0.02		0	0	No	No	No
2010	3/23/10	3	Yes	0.50	7.0	0.01	0	0		0.02		0	0	No	No	No
2010	3/23/10	4	Yes	0.50	7.0	0.01	0	0		0.02		0	0	No	No	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
03-200-0965																
2010	8/31/09	1	Yes	5	6.8									No	No	No
2010	8/31/09	2	Yes	5	6.8									No	No	No
2010	3/18/10	3	Yes	5	7.0									No	No	No
2010	3/18/10	4	Yes	5	7.0									No	No	No
03-200-0990																
2010	8/31/09	1	Yes	3	7.0									No	No	No
2010	8/31/09	2	Yes	3	7.0									No	No	No
2010	3/18/10	3	Yes	2	7.0									No	No	No
2010	3/18/10	4	Yes	2	7.0									No	No	No
04-400-0210																
2010	10/20/09	1	No													
2010	10/20/09	2	No													
2010	1/19/10	3	No													
2010	1/19/10	4	No													
04-300-0267																
2010	8/24/09	1	No													
2010	8/24/09	2	No													
2010	1/28/10	3	No													
2010	1/28/10	4	No													
04-200-0270																
2010	8/24/09	1	Yes	10	6.8											
2010	8/24/09	2	Yes	10	6.8											
2010	1/28/10	3	No													
2010	1/28/10	4	No													
05-300-0222																
2010	9/1/09	1	Yes	4	7.0									No	No	No
2010	9/1/09	2	Yes	4	7.0									No	No	No
2010	2/18/10	3	Yes	10	7.0									No	No	No
2010	2/18/10	4	Yes	10	7.0									No	No	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
06-400-0055																
2010	11/6/09	1	Yes	15	7.0									No	No	No
2010	11/6/09	2	Yes	15	7.0									No	No	No
2010	2/17/10	3	Yes	20	6.8									No	No	No
2010	2/17/10	4	Yes	20	6.8									No	No	No
06-400-0145																
2010	11/6/09	1	Yes	0.50	6.8									No	No	No
2010	11/6/09	2	Yes	0.50	6.8									No	No	No
2010	2/17/10	3	No													
2010	2/17/10	4	No													
06-400-0175																
2010	11/6/09	1	No													
2010	11/6/09	2	No													
2010	2/17/10	3	No													
2010	2/17/10	4	No													
06-400-0180																
2010	11/6/09	1	No													
2010	11/6/09	2	No													
2010	2/17/10	3	No													
2010	2/17/10	4	No													
07-100-0055																
2010	10/21/09	1	Yes	25	6.5	0.01								No	No	No
2010	10/22/09	2	Yes	25	6.5	0.02								No	No	No
2010	2/25/10	3	Yes	25	7.0	0.01								No	No	No
2010	2/25/10	4	Yes	25	7.0	0.01								No	No	No
11-200-0600																
2010	12/16/09	1	No													
2010	12/16/09	2	No													
2010	3/1/10	3	No													
2010	3/1/10	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
11-300-0610																
2010	12/16/09	1	Yes	4	7.0									No	No	No
2010	12/16/09	2	Yes	4	7.0									No	No	No
2010	3/1/10	3	No													
2010	3/1/10	4	No													
11-300-0614																
2010	12/16/09	1	No													
2010	12/16/09	2	No													
2010	3/1/10	3	No													
2010	3/1/10	4	No													
11-300-0615																
2010	12/16/09	1	Yes	0.50	7.0									No	No	No
2010	12/16/09	2	Yes	0.50	7.0									No	No	No
2010	3/1/10	3	No													
2010	3/1/10	4	No													
13-300-0135																
2010	12/17/09	1	Yes	15	7.0									No	No	No
2010	12/17/09	2	Yes	15	7.0									No	No	No
2010	3/4/10	3	Yes	15	7.0									No	No	No
2010	3/4/10	4	Yes	15	7.0	0.01			0.25					No	No	No
13-300-0140																
2010	12/17/09	1	Yes	40	7.0							250	40	No	No	No
2010	12/17/09	2	Yes	40	7.0							250	40	No	No	No
2010	3/4/10	3	No													
2010	3/4/10	4	No													
13-300-0155																
2010	12/17/09	1	Yes	12	7.0									No	No	No
2010	12/17/09	2	Yes	12	7.0									No	No	No
2010	3/4/10	3	Yes	12	7.0									No	No	No
2010	3/4/10	4	Yes	12	7.0									No	No	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
13-300-0184																
2010	12/17/09	1	Yes	8	7.0	0.30	0	0		3.00		0	40	No	No	No
2010	12/17/09	2	Yes	8	7.0	0.30	0	0		3.00		0	40	No	No	No
2010	3/4/10	3	No													
2010	3/4/10	4	No													
13-300-0226																
2010	12/16/09	1	No													
2010	12/16/09	2	No													
2010	3/8/10	3	No													
2010	3/8/10	4	No													
13-300-0228																
2010	12/16/09	1	No													
2010	12/16/09	2	No													
2010	3/8/10	3	No													
2010	3/8/10	4	No													
13-400-0310																
2010	12/4/09	1	No													
2010	12/4/09	2	No													
2010	3/8/10	3	No													
2010	3/8/10	4	No													
13-400-0325																
2010	12/4/09	1	No													
2010	12/4/09	2	No													
2010	3/8/10	3	No													
2010	3/8/10	4	No													
13-300-0350																
2010	12/4/09	1	Yes	5	6.8									No	No	No
2010	12/4/09	2	Yes	5	6.8									No	No	No
2010	3/8/10	3	No													
2010	3/8/10	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
79-400-0375																
2010	10/26/09	1	No											No	No	No
2010	10/26/09	2	No											No	No	No
2010	1/28/10	3	No													
2010	1/28/10	4	No													
79-400-0385																
2010	10/26/09	1	Yes	20	6.8									No	No	No
2010	10/26/09	2	Yes	15	6.8									No	No	No
2010	1/28/10	3	No													
2010	1/28/10	4	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

Outfall Changes Report - Fiscal Year 2010

Outfall	Date Created	Date Retired
01-300-0052	07/14/2009	--
01-400-0053	07/14/2009	--
01-200-0057	07/14/2009	--
01-400-0062	07/14/2009	--
01-400-0064	07/15/2009	--
01-400-0071	07/15/2009	--
01-300-0072	07/15/2009	--
01-400-0073	07/15/2009	--
01-300-0076	07/15/2009	--
01-300-0083	07/15/2009	--
01-300-0094	07/15/2009	--
01-400-0096	07/15/2009	--
01-300-0097	07/15/2009	--
01-400-0098	07/15/2009	--
01-300-0101	07/15/2009	--
01-300-0106	07/15/2009	--
01-300-0107	07/15/2009	--
01-300-0108	07/15/2009	--
01-300-0109	07/15/2009	--
01-400-0111	07/15/2009	--
01-300-0112	07/29/2009	--
01-400-0113	07/29/2009	--
01-400-0114	07/29/2009	--
01-400-0119	07/29/2009	--
01-300-0121	07/29/2009	--
01-300-0124	07/29/2009	--
01-400-0126	07/29/2009	--
01-300-0127	07/29/2009	--
01-300-0128	07/29/2009	--
01-400-0129	07/29/2009	--
01-300-0131	07/29/2009	--
01-400-0132	07/29/2009	--
01-300-0133	07/29/2009	--
01-400-0134	07/29/2009	--
01-300-0136	07/29/2009	--
01-200-0137	07/29/2009	--

Outfall	Date Created	Date Retired
01-300-0138	07/29/2009	--
01-300-0142	12/23/2009	--
01-300-0144	07/14/2009	--
01-400-0146	07/14/2009	--
01-400-0148	07/14/2009	--
01-400-0287	05/07/2010	--
01-100-0308	08/24/2009	--
01-400-0666	04/13/2010	--
01-100-0667	04/13/2010	--
01-500-0668	04/13/2010	--
01-400-0669	04/13/2010	--
01-400-0777	05/07/2010	--
02-400-0207	05/13/2010	--
02-400-0438	07/14/2009	--
02-200-0444	07/14/2009	--
03-100-0408	07/10/2009	--
03-200-0409	07/10/2009	--
03-400-0411	07/10/2009	--
03-200-0414	07/14/2009	--
03-400-0422	07/14/2009	--
03-100-0929	07/14/2009	--
03-100-0931	07/14/2009	--
03-400-0932	07/14/2009	--
03-100-0933	07/14/2009	--
03-400-0934	07/14/2009	--
04-400-0072	07/14/2009	--
04-400-0074	07/14/2009	--
04-400-0147	10/27/2009	--
04-400-0148	10/27/2009	--
04-200-0227	07/09/2009	--
04-400-0288	07/15/2009	--
04-300-0308	07/10/2009	--
04-400-0312	05/07/2010	--
05-400-0013	07/14/2009	--
06-500-0144	07/14/2009	--
07-400-0006	07/29/2009	--
07-400-0007	07/29/2009	--
07-400-0008	07/29/2009	--

Outfall	Date Created	Date Retired
07-500-0009	07/29/2009	--
10-300-0401	07/15/2009	--
10-100-0403	10/27/2009	--
10-300-0444	10/27/2009	--
10-400-0446	10/27/2009	--
10-400-0447	10/27/2009	--
10-400-0448	10/27/2009	--
13-400-0218	03/12/2010	--
53-400-0123	07/29/2009	--
53-400-0124	07/29/2009	--
53-400-0126	07/20/2009	--
53-400-0127	07/29/2009	--
53-100-0129	09/17/2009	--
53-400-0131	09/17/2009	--
53-400-0134	09/17/2009	--
53-400-0136	09/17/2009	--
53-300-0188	10/27/2009	--
53-300-0275	07/29/2009	--

Total Outfalls Reported: 92

APPENDIX B

Summary Report for IBI Studies

INDEX OF BIOTIC INTEGRITY ON BAKER CREEK AND FIRST CREEK IN THE CITY OF KNOXVILLE FINAL DATA REPORT MAY – JUNE, 2010

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 BAKER CREEK AND FIRST CREEK IN THE CITY OF KNOXVILLE MAY - JUNE, 2010

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. Baker Creek and First Creek were the two streams surveyed for the Index of Biotic Integrity (IBI) May - June 2010. 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 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

Baker Creek is a 2.61 mi^2 (6.77 km^2) drainage area that flows through South Knoxville and empties into the Tennessee River at two miles up stream of the waterfront development in downtown Knoxville. Baker Creek is listed in the final version of the State of Tennessee's 2008 303d List for impaired water bodies due to habitat alterations and high levels of pathogens (TDEC 2008).

FLLA assessed two sites along Baker Creek. The upper site was located on Baker Creek at Rock City Park at the intersection near Moody Ave and Sevier Ave (see Figure 1 for location). This survey was conducted at approximately 1.25 miles up stream from the confluence with Fort Loudoun Lake. The lower stream site was located on a tributary to Baker Creek at Mary James Park on South Haven Drive (see Figure 2). This survey was conducted at approximately 1 mile up stream from the confluence with Fort Loudoun Lake.

First Creek is a 12.09 mi^2 or 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.

FLLA assessed two sites along First Creek. The upper site (see Figure 3) was located at North Broadway and Highland Drive. The lower site was just off of North Broadway along the Greenway near Cecil Avenue (see Figure 4).

Figure 1. Baker Creek at Rock City Park, upper sampling site.

Figure 2. Baker Creek at Mary James Park, lower sampling site.

Figure 3. First Creek, upper sampling site at North Broadway and Highland Drive.

Figure 4. First Creek, lower sampling site off of Cecil Avenue.

METHODS

Stream assessment utilizing IBI methodologies and physical habitat protocols

FLLA followed the United States Enviromnental 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 Baker Creek and First 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). The Index of Biotic Integrity (IBI) 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 twelve 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 twelve 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 2007) for sampling procedures of collecting biological samples. The biological conditions of Baker Creek and Third Creek were assessed by collecting and identifying the benthic macroinvertebrates (IBI-M) present at two sites per creek. Sampling sites were considered suitable based upon the presence of one fast flowing and one slow flowing riffles.

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 ecoregional reference data and calibrated by bioregion. The seven biometrics are:
EPT (Ephemeroptera Plecoptera Trichoptera Richness)
TR (Taxa richness)
% EPT (EPT abundance)
%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 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 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 2007) 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 2. Summary of IBI-F, IBI-M, and habitat assessment scores on Baker Creek and First Creek surveyed in May 2010.

	Baker Creek		First Creek	
	Upstream Site	Downstream Site	Upstream Site	Downstream Site
IBI-F score	30	30	30	34
Rating	Poor	Poor	Poor	Poor
IBI-M score	26	14	26	26
Rating	Slightly impaired	Moderately impaired	Slightly impaired	Slightly impaired
Habitat score	134	84	110	129
Rating	Not impaired	Seriously impaired	Moderately impaired	Moderately impaired

Table 3. Fish collected on Baker Creek and First Creek in May 2010.

			Baker Creek		First Creek	
Family	Species	Common Name	Upper Site	Lower Site	Upper Site	Lower Site
Cyprinidae (minnows)	*Capostoma anomalum*	Central stoneroller	1	20	43	18
	Luxilus chrysocephalus	Striped shiner				1
	Pimephales notatus	Bluntnose minnow			1	
	Rhinichthys atratulus	Blacknose dace	130 (6 BS)	47	151 (11 BS)	10
	Semotilus atromaculatus	Creek chub		6	75 (2 DE)	52
Poeciliidae (livebearers)	*Gambusia affinis*	Mosquitofish			1	
Catostomidae (suckers)	*Catostomus commersonnii*	White sucker		25		6
	Hypentelium nigricans	Northern hogsucker				9
Centrachidae (sunfishes)	*Ambloplites ruprestris*	Rock bass				13
	Lepomis gibbosus	Pumpkin seed		1		
	Lepomis macrochirus	Bluegill			1 (P)	
Percidae (perches)	*Etheostoma simoterum*	Snubnose darter		7	36	33

			Baker Creek		First Creek	
			Upper Site	Lower Site	Upper Site	Lower Site
Cottidae (Sculpins)	*Cottus carolinae*	Banded sculpin	**3**	**7**		
		Totals	**134**	**113**	**307**	**142**
Note: * equals abnormalities such as black spot (BS), deformities (DE), and parasite (P) and number in parenthesis is total number with an abnormality. Young of the year fish were recorded on the field data sheets but those numbers were not used to determine stream health.						

A total of 696 fish among 13 species were collected, identified, and checked for anomalies. The most numerous fish species was *R. atratulus*, blacknose dace, with 328 specimens that represented 47.13% of the total catch. It was the most numerous fish collected at three of the sites with the exception at First Creek's lower site where *S. atromaculatus,* was the most numerous species collected. Though these sampling efforts yielded lower numbers than in the past fewer specimens had abnormalities unlike the effort at Fourth Creek last year in which a majority of fish (>80%) was observed with block spot, body lesions or both.

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

Metric Description	Scoring Criteria			Observed	Score
	1	3	5		
Total number of native fish species	<5	(5-10)	>10	3	1
Number of darter species	<1.5	(1.5-2.5)	>2.5	0	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%	0	5
Percent of individuals as omnivores and stoneroller species	>50%	25%-50%	<25%	0.75%	5
Percent of individuals as specialized insectivores	<10%	10%-20%	>20%	97.0%	5
Percent of individuals as piscivores	<2%	2%-4%	>4%	0.00%	1
Catch rate (average number of fish per 300 sq. ft. sampling unit)	<22	22-43.8	>43.8	7.88	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%	4.48%	3
			IBI		30
			IBI Classification		Poor

Fish sampling yielded an IBI score of 30 that equals a poor classification.

Table 5. Fish IBI score of the lower site of Baker 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%	49.56%	1
Percent of individuals as omnivores and stoneroller species	>50%	25%-50%	<25%	39.82%	3
Percent of individuals as specialized insectivores	<10%	10%-20%	>20%	47.79%	5
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	5.95	1
Percent of individuals as hybrids	<1%	TR-1%	0%	0.00%	5
Percent of individuals with diseases, tumors, fin damage, and other anomalies	>5%	2%-5%	<2%	0.00%	5
			IBI		30
			IBI Classification		Poor

Fish sampling yielded an IBI score of 30 that equals a poor classification.

Table 6. Fish IBI score of the upper site of First 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	0	1
Number of intolerant species	<1	(1-2.5)	>2.5	0	1
Percent of individuals as tolerant species	>40%	20%-40%	<20	24.84%	3
Percent of individuals as omnivores and stoneroller species	>50%	25%-50%	<25	0.00%	5

Percent of individuals as specialized insectivores	<10%	10%-20%	>20%	60.91%	5
Percent of individuals as piscivores	<2%	2%-4%	>4%	0.00%	1
Catch rate (average number of fish per 300 sq. ft. sampling unit)	<22	22-43.8	>43.8	18.06	1
Percent of individuals as hybrids	<1%	TR-1%	0%	0.00%	5
Percent of individuals with diseases, tumors, fin damage, and other anomalies	>5%	2%-5%	<2%	4.23%	3
			IBI		30
			IBI Classification		Poor

Fish sampling yielded an IBI score of 30 that equals a poor classification.

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

Metric Description	Scoring Criteria			Observed	Score
	1	3	5		
Total number of native fish species	<5	(5-10)	>10	8	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	2	5
Number of intolerant species	<1	(1-2.5)	>2.5	0	1
Percent of individuals as tolerant species	>40%	20%-40%	<20%	40.84%	1
Percent of individuals as omnivores and stoneroller species	>50%	25%-50%	<25%	21.83%	5
Percent of individuals as specialized insectivores	<10%	10%-20%	>20%	30.28%	5
Percent of individuals as piscivores	<2%	2%-4%	>4%	0.00%	1
Catch rate (average number of fish per 300 sq. ft. sampling unit)	<22	22-43.8	>43.8	10.14	1
Percent of individuals as hybrids	<1%	TR-1%	0%	0.00	5
Percent of individuals with diseases, tumors, fin damage, and other anomalies	>5%	2%-5%	<2%	0.00	5
			IBI		34
			IBI Classification		Poor

Fish sampling yielded an IBI score of 34 that equals a poor classification.

Table 8. Macroinvertebrates collected in Baker Creek and First Creek on May 2010.

TAXA				
	Baker Creek		First Creek	
	Upper Site	Lower Site	Upper Site	Lower Site
OLIGOCHAETA (Aquatic worms)				
Haplotaxidae				
Haplotaxis gordioides	26	48	21	29
EPHEMEROPTERA (Mayflies)				
Baetidae				
Baetis tricaudatus	2			
TRICHOPTERA (Caddisflies)				
Hydropsychidae				
Certatopsyche alhedra	29	13		30
Certatopsyche sparna				22
Cheumatopsyche spp.	46		66	
Hydropsyche demora	1		26	27
Leptoceridae				
Leptocerus americanus	1			
COLEOPTERA (Beetles)				
Elmidae				
Optioservus spp.	9		16	
Stenelmis spp.	16		8	
Haliplidae				
Peltodytes spp.	1	2		2
Psephenidae				
Psephenus herricki	2		7	5
DIPTERA (Flies)				
Tabanidae				
Tabanus sp.		1		
Certopogonidae				
Dasyhelea spp.		2		
Chironomidae				
Paramerina spp.			9	
Polypedilum spp.	26	45	16	33
Rheotanytarsus exiguus				25
Tanytarsus spp.		6		
Thienemanniella spp.		3		
Tipulidae				
Antocha spp.	4	2	5	6
Dicranota spp.		3		
Hexatoma spp.		1		2

	Baker Creek		First Creek	
	Upper Site	**Lower Site**	**Upper Site**	**Lower Site**
Tipula abdominalis	6	4	2	
Simuliidae				
Prosimulium rhizophorum		8		
Simulium snowi	14		7	14
PLECOPTERA (Stoneflies)				
Perlidae				
Acroneuria abnormis				1
AMPHIPODA (Crustaceans)				
Crangonyctidae				
Crangonyx spp.		36		17
BASOMMATOPHORA (Snails)				
Pleuroceridae				
Elimia spp.		8	14	
VENEROIDA (Bi-valves)				
Corbiculidae				
Corbicula fluminea				5
TOTALS	183	182	197	218

A total of 780 specimens were collected at the four sampling sites. First Creek's lower site had the greatest number of specimens at 218. At each sampling site, the dominant taxa were *H. gordioides*, hydropsychid caddisflies and chironomids or midges. Of the EPT taxa caddisflies were collected at all sites but mayflies were collected once at Baker Creek's upper site and a stonefly was collected at the lower site on First Creek.

Table 9. Summary table for macroinvertebrate index of four sampling sites on Baker Creek and First Creek collected May 2010.

		METRIC							
Site		**Taxa Richness**	**EPT Richness**	**% EPT**	**% OC**	**NCBI**	**% Clingers**	**% NUTROL**	**Index Score**
Baker Creek, Upper	Value	14	4	42.62	28.42	4.12	80.33	57.92	
	Score	2	2	4	4	6	6	2	**26**
Baker Creek, Lower	Value	15	1	7.14	56.04	3.94	12.64	55.49	
	Score	2	0	0	2	6	0	4	**14**
First Creek, Upper	Value	12	2	46.70	23.35	3.95	55.33	70.56	
	Score	2	0	4	6	6	6	2	**26**
First Creek, Lower	Value	13	3	36.70	39.90	4.12	72.94	48.62	
	Score	2	0	4	4	6	6	4	**26**

Table 9. Continued.

	INDEX SCORE	**INDEX SCORE RATING**
SITE		
Baker Creek, Upper	26	Slightly impaired
Baker Creek, Lower	14	Moderately impaired
First Creek, Upper	26	Slightly impaired
First Creek, Lower	26	Slightly impaired

Scores ranged from 14 to 26. Mary James Park scored the lowest of the four sites and was rated as moderately impaired. The score was lowered due to lack of EPT taxa and their percentages as well as the low percentage of clingers identified.

Table 10. Summary of water quality parameters taken on Baker Creek and First Creek, May 2010.

	WATER QUALITY PARAMETERS *			
Site	Temperature (°C)	DO (mg/L)	pH	Conductivity (um/hos)
Baker Creek, Upper	18.9/18.5	6.91/6.34	7.68/7.81	301.6/289.3
Baker Creek, Lower	16.9/17.1	5.71/5.63	6.88/6.97	230.9/241.6
First Creek, Upper	20.5/20.0	6.2/6.3	7.98 /7.90	386.3/381.3
First Creek, Lower	20.2/19.9	6.9/6.8	8.20/7.83	373.9/380.4

*Fish survey/macroinvertebrate survey.

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 Baker Creek and First Creek.

	SAMPLING SITE			
Habitat Parameter	**Baker Creek, Upper**	**Baker Creek, Lower**	**First Creek, Upper**	**Fourth Creek, Lower**
Latitude	35° 57'06.91"	35° 57' 08.41"	36° 01'51.82"	35° 59'22.30"
Longitude	83° 53'40.30"	83° 53'18.26"	83° 55'53.67"	83° 54'58.85"
Epifaunal Cover	15	9	11	15
Embeddedness	13	9	13	14
Velocity/Depth Regime	16	10	16	16
Sediment Deposition	11	9	10	10
Channel Flow	16	9	11	16
Channel Alteration	11	10	6	11
Riffle Frequency	10	10	10	11
Bank stability (left/right)	5/8	4/4	5/5	7/7
Vegetative Protection (left/right)	9/6	3/3	6/6	6/6
Riparian Zone Width (left/right)	9/5	2/2	7/4	5/5
Total (200 max.)	**134**	**84**	**110**	**129**

Table 11. Continued.

	TOTAL SCORE	TOTAL SCORE RATING
SITE		
Baker Creek, Upstream	134	Not impaired
Baker Creek, Downstream	84	Severely impaired
First Creek, Upstream	110	Moderately impaired
First Creek, Downstream	129	Moderately impaired

Habitat assessments determined varying physical habitat conditions at the four locations. Baker Creek demonstrated two extremes of the scoring. The Rock City Park site was rated as not impaired and had the highest score. Though this area experiences the same pressures as the other three, it is believed that the relatively undisturbed riparian zone helps buffer and offset some of these issues. Bank failure and eroding stream banks were present but these areas have not changed since the last sampling effort by FLLA. Riffles were dispersed throughout the sampling effort and there were areas of clean substrate. Several deep pools were also present. First Creek also received a high score of 129 at the downstream site. The biggest difference between this site and Rock City Park was some of the riparian zone had been altered or removed due to the area being a park and part of the city's greenway.

First Creek's upper site was impacted as well. Issues included channelization and the amount of development along North Broadway that could be considered non-point pollution sources during rain events. The upper most section had a buffer zone, though small but as the survey moved downstream that zone decreased and became more fragmented. One outfall was observed behind the apartment complex. A metal corrugated pipe had flowing water discharging directly in the stream. The source of the flow is unknown but flows have been observed throughout the year and during drier conditions.

Unfortunately, Baker Creek's Mary James Park received the lowest score at 84 classifying it as severely impaired. The park has received similar scores in the past and it was not much of a surprise. There were some changes to the site however. The rain garden has matured and appears to still function. Also the tennis court has been removed and the soil disturbed. It is believed that the area is being prepared for additional plantings as was observed along the riparian zone in other parts of the park. Willows and other tree species had been planted recently along with several grass species. Walking through the area the additional wetted areas could be viewed and believe that once the riparian zone matures the stream will return to its natural meanders and the physical habitat will improve allowing for additional colonization for fish and macroinvertebrates. Oddly the few mature trees that were present within the park at the last survey had been cut down and removed instead of being used to help stabilize bank conditions.

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 2008, 303 d list for the state of Tennessee (TDEC 2008). Baker Creek's 3.3 impaired miles are listed because of nitrates, other anthropogenic habitat alterations and *Escherichia coli* due to discharges from MS4 area and collection system failure. First Creek's 16.1 impaired miles are listed because of nitrates, other anthropogenic habitat alterations and *Escherichia coli* due to MS4 area discharges, urbanized high density areas, and collection system failures.

These conditions and pressures were observed at each of the sampling sites both for instream characters as well as along the stream channel in the riparian zone and beyond. The landscape has been altered due to human development and the effects to both the physical habitat and biological communities are evident.

Of the two creeks, Baker Creek demonstrated large variations in habitat conditions and the macroinvertebrate community. At Rock City Park the habitat was classified as not impaired. The conditions of the riparian zone seem to alleviate some of the pressures even though conditions have degraded overall. The macroinvertebrate community has been impacted though as evident by only four EPT taxa identified with caddisflies being the only abundant EPT group. At the Mary James Park site conditions were worse and scores revealed additional pressures and impacts. This site was the only one classified as seriously impaired for the habitat and moderately impaired for the macroinvertebrate community. The lack of riparian zone and instream conditions led to the current conditions. Though the macroinvertebrate community was classified as moderately impaired the site received a low score of 14. Only one EPT taxon was identified with 13 specimens collected. At both sites the fish community was classified as poor and both sites received a score of 30. Once again this was misleading because only three species were collected at Mary James Park compared to seven at Rock City Park.

First Creek's assessment scores were more similar at the sampling sites. Both were moderately impaired according to the habitat assessment, both slightly impaired according to the IBI-M data, and both were classified as poor according to the IBI-F data. The biggest differences between the two sites were the upper site paralleled North Broadway and with the development the riparian zone had been impacted with disturbed areas due to roadways and parking lots. The lower site was slightly naturalized because it ran through the greenway and was isolated from future development. However being located at the park some of the riparian zone had been reduced at the upper most area of this reach where North Broadway traveled over First Creek.

Unlike previous IBI-F surveys FLLA has conducted for the City of Knoxville, it was observed that very few fish had abnormalities. Only three species, blacknose dace, creek chub, and blue gill had issues. Black spot was present on the dace but in low numbers. Two creek chubs had spine deformities and one bluegill had fin parasites present. In the past large percentages of dace and chub had black spot and/or body lesions.

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. Even though the upstream location on Baker Creek was classified as not impaired according to the habitat data, both communities scored in the same range as the moderately and severely impaired sites.

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 Baker Creek and Appendix B photos for current conditions and pressures on First Creek.

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APPENDIX A: PHOTOS OF BAKER CREEK

Upper Site

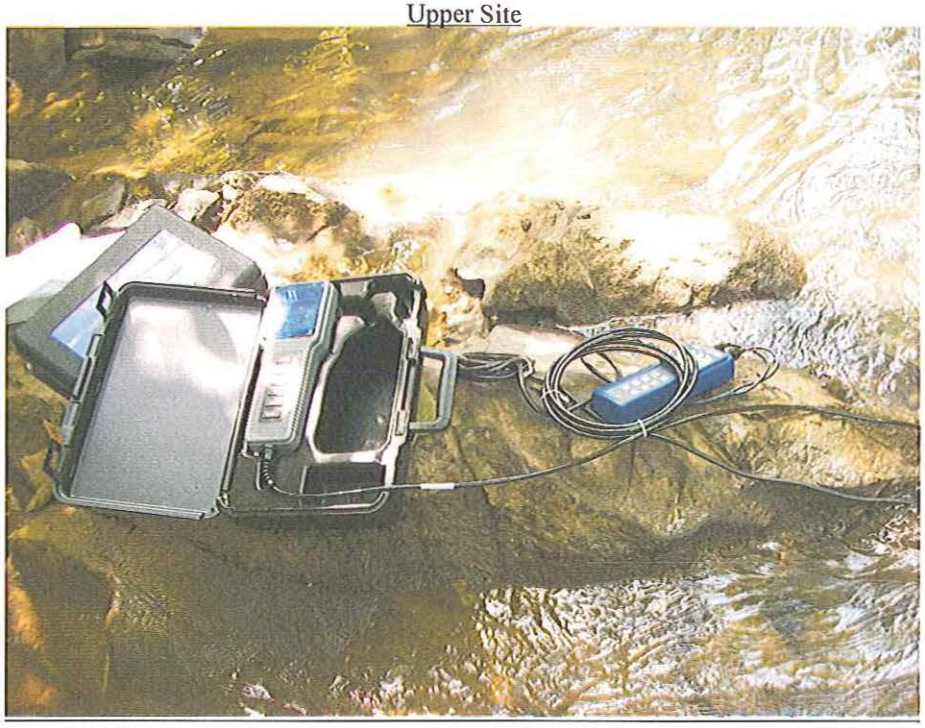

Photo 1. Recording water parameters using YSI meters.

Photo 2. Riffle area at Rock City Park.

Photo 3. Upper area at Rock City Park with the baseball field to the right of the photo.

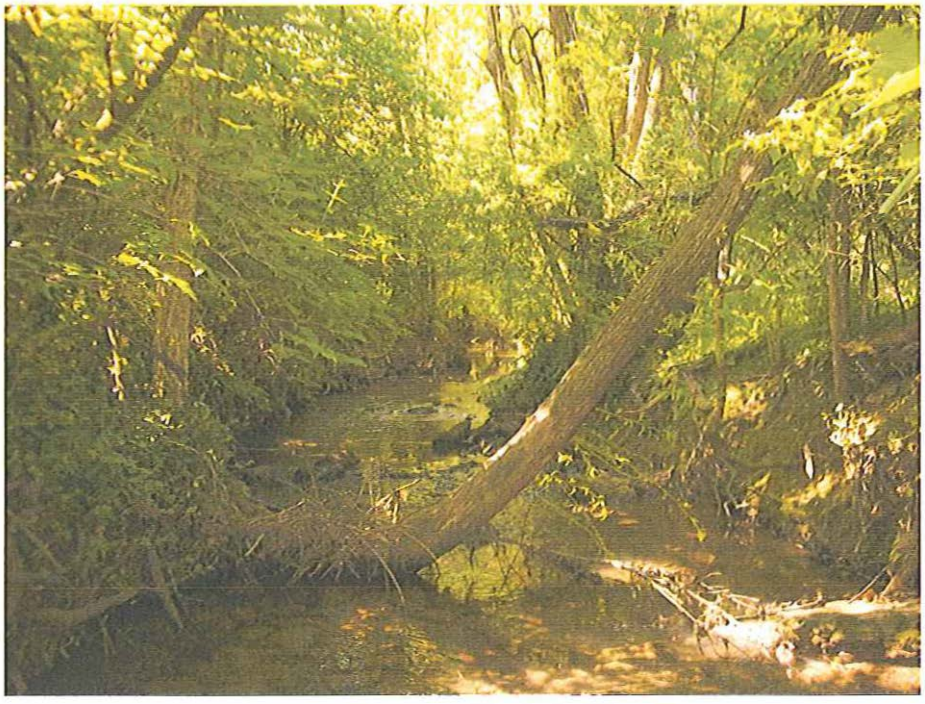

Photo 4. Stream habitat at Rock City Park.

Lower Site

Photo 5. Substrate located at Mary James Park.

Photo 6. The Mary James Park rain garden is maturing.

Photo 7. Example of flooding at Mary James Park.

Photo 8. Wetted riparian zone at Mary James Park.

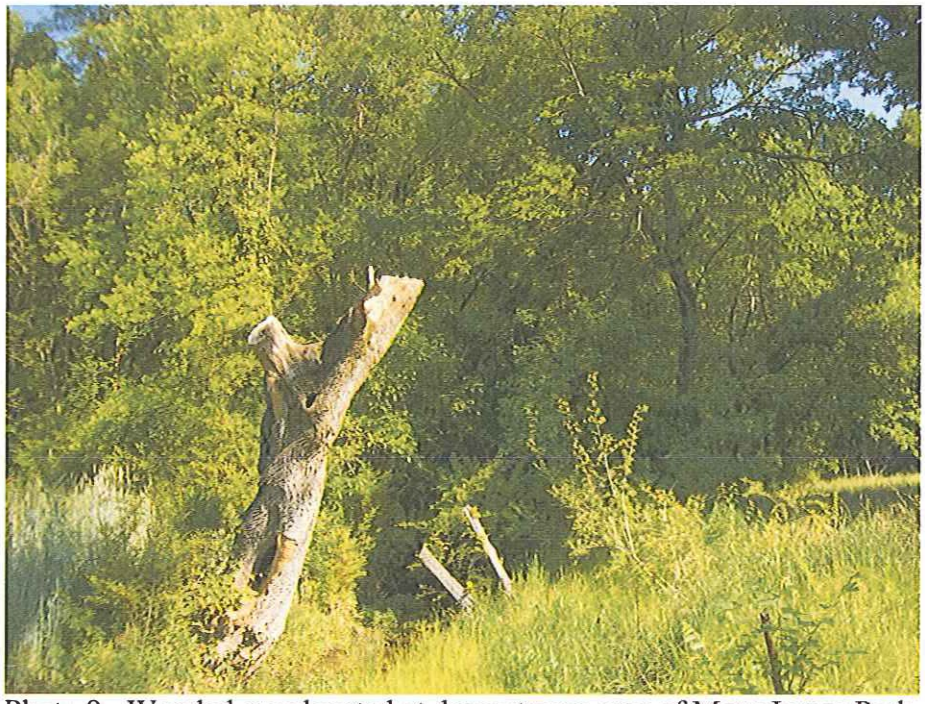

Photo 9. Wooded area located at downstream area of Mary James Park.

APPENDIX B: PHOTOS OF FIRST CREEK

Upper Site

Photo 10. First Creek's stream bed.

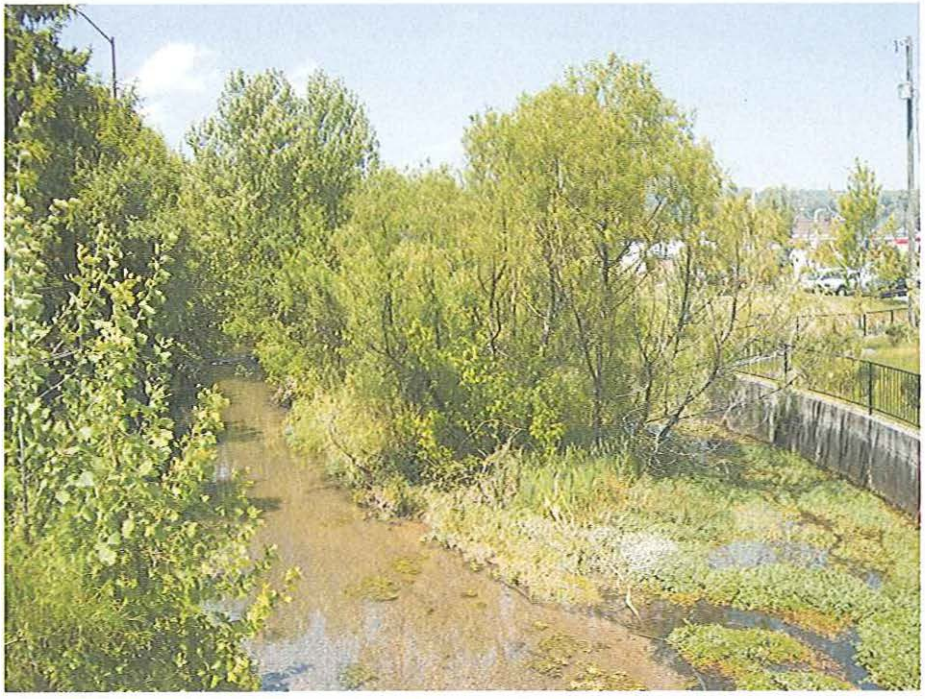

Photo 11. First Creek upper site with North Broadway on the right.

Photo 12. First Creek at downstream section showing the stream bed.

Photo 13. Run at First Creek.

Photo 14. Outfall at First Creek.

Photo 15. Stream bed at outfall in photo #14,

Photo 16. Evidence of sediment entering First Creek from a parking lot.

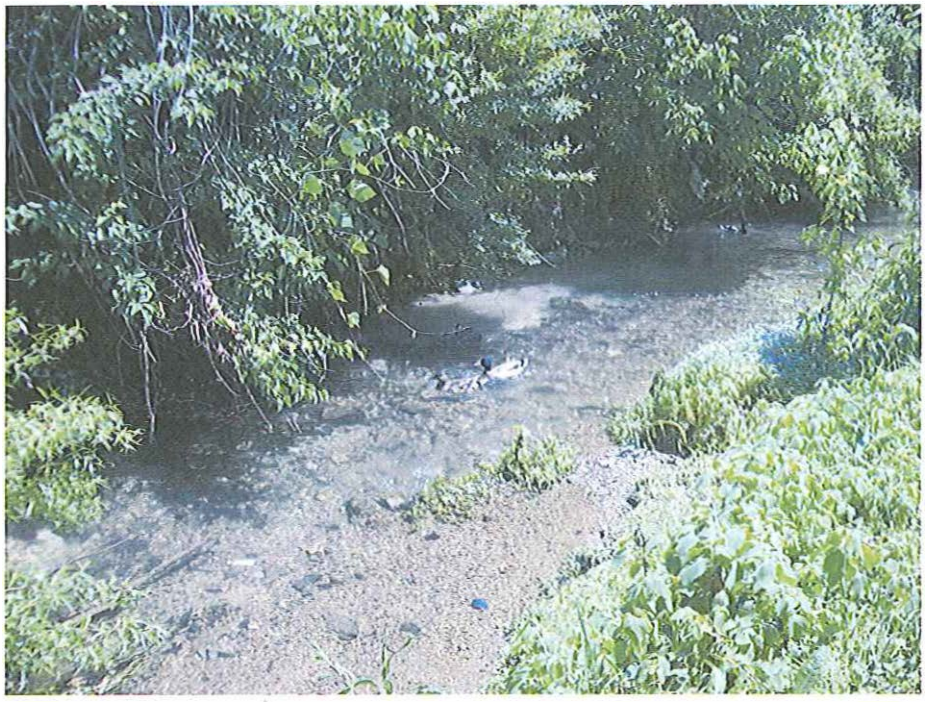

Photo 17. First Creek.

Lower Site

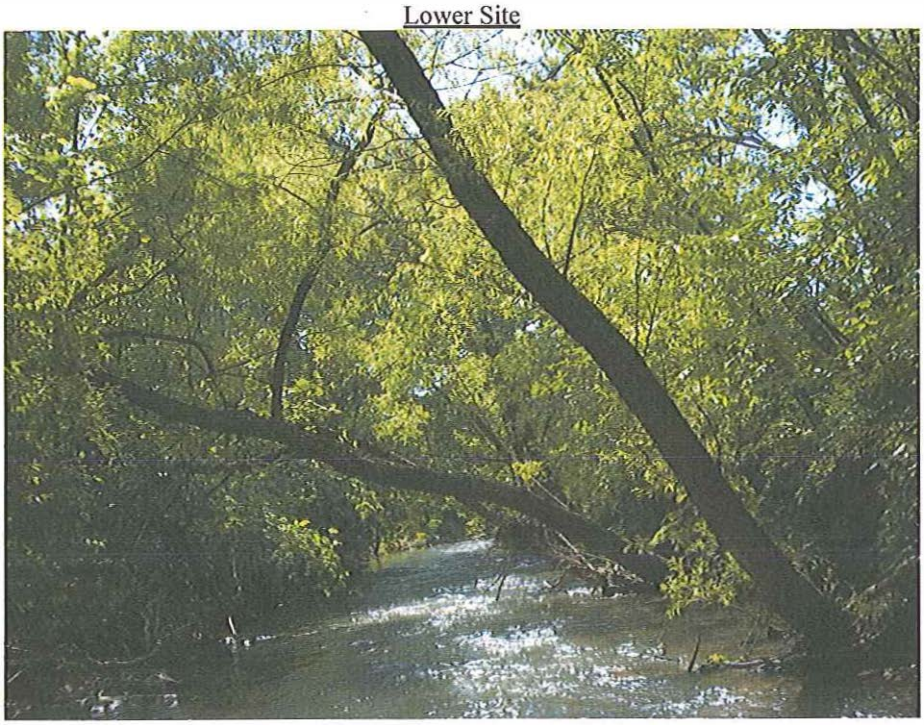

Photo 18. Canopy cover at First Creek.

Photo 19. Stream bed.

Photo 20. Riffle area.

Photo 21. First Creek.

APPENDIX C

Summary Report for RBP III Studies

RAPID BIOASSESSMENT PROTOCOL (III) ON LOVE CREEK AND WILLIAMS CREEK IN THE CITY OF KNOXVILLE FINAL DATA REPORT

MAY – JUNE, 2010

CITY OF KNOXVILLE CONTRACT C-08-0185

CONDUCTED BY:

FORT LOUDOUN LAKE ASSOCIATION

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

RBP DATA PROVIDED BY:
Michael S. Gaugler

MACROINVERTEBRATE DATA PROVIDED BY:
Michael S. Gaugler

RAPID BIOASSESSMENT PROTOCOL (III) ON LOVE CREEK AND WILLIAMS CREEK IN THE CITY OF KNOXVILLE FINAL DATA REPORT MAY – JUNE, 2010

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. Love Creek and Williams Creek were the two streams surveyed for the Rapid Bioassessment Protocol III (RBP III) in May-June, 2010. In this document we 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

FLLA assessed two sites along Love Creek. The lower was located within Spring Place Park beginning at the entrance of the park's parking lot at the culvert and continued working upstream to below the pavilion covered artesian well. This site was near the intersection of Loves Creek Road and Parker Drive (see Figure 1). This survey site was conducted at approximately river mile (RM) 2.5. The upper site was located above the artesian well and sampling continued into the wooded area past the paved walking trail. This site paralleled Loves Creek Road (see Figure 1). This survey was conducted at approximately RM 2.6. The drainage area is approximately 8.01 square miles.

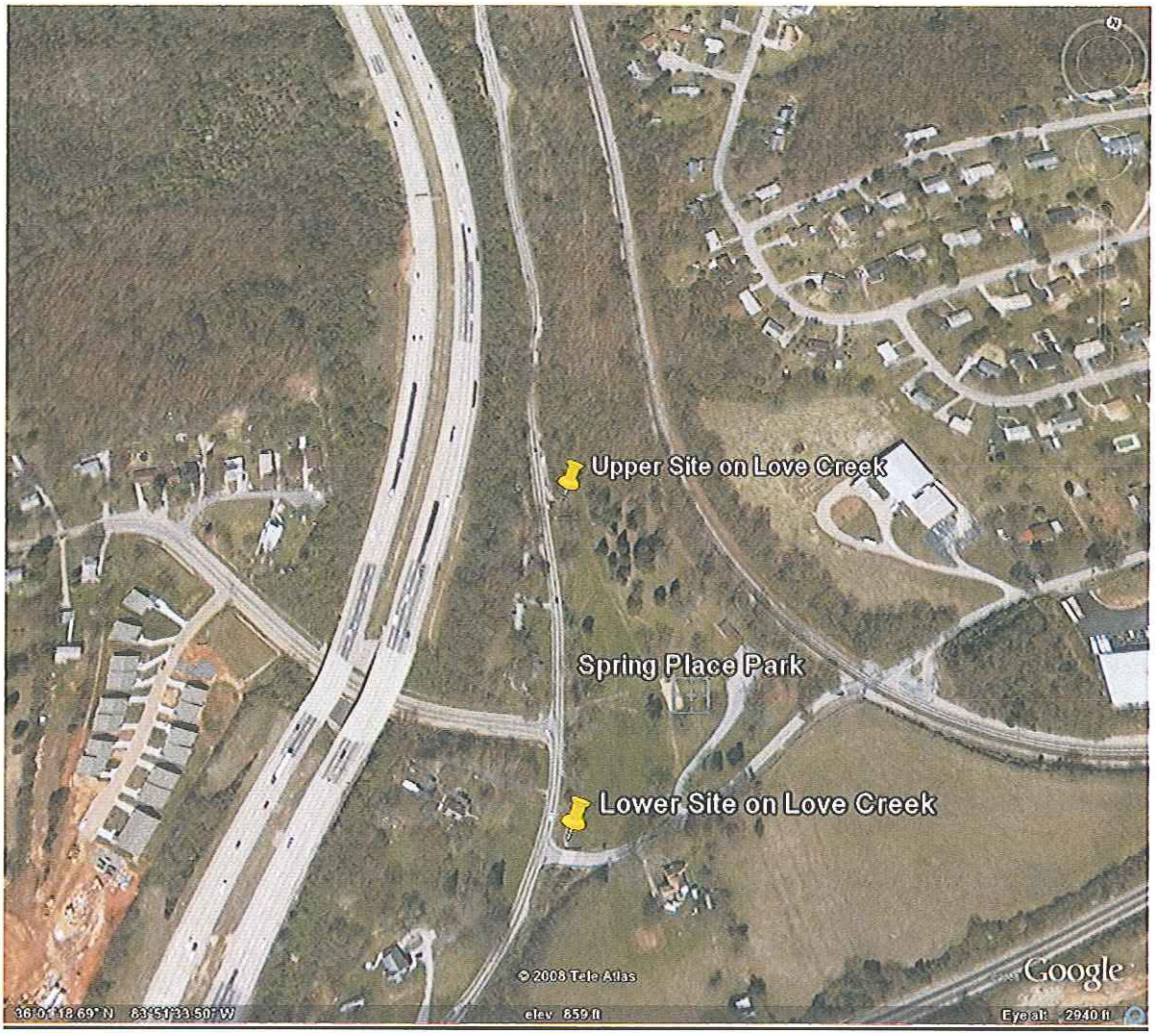

Figure 1. Sampling sites located on Love Creek for the RBP3 assessment.

Williams Creek is a 1,641.22 acre (664.2 hectare) drainage area that flows south 2.8 miles through East Knoxville and empties into the Tennessee River at two miles up stream of the waterfront development in downtown Knoxville. The upper half of the watershed is impacted by typical urban runoff, including a section of Interstate 40 and the heavily traveled Magnolia Avenue. The upper half is developed but flows through a riparian zone with large trees atypical of an urban stream. This section suffers from poorly maintained sewage laterals and large amounts of trash and debris. The lower half flows through a newly developed golf course, past the Vulcan materials plant and Knoxville Utilities Board before emptying into the Tennessee River. This section contains a well-established riparian zone adjacent to the Vulcan Materials Plant.

Two sites were sampled on Williams Creek. The upper site was located upstream of the intersection of Brooks Avenue and Biddle Street SE (see Figure 2). The lower site was located on Riverside Drive upstream of the Vulcan Materials Plant (see Figure 3).

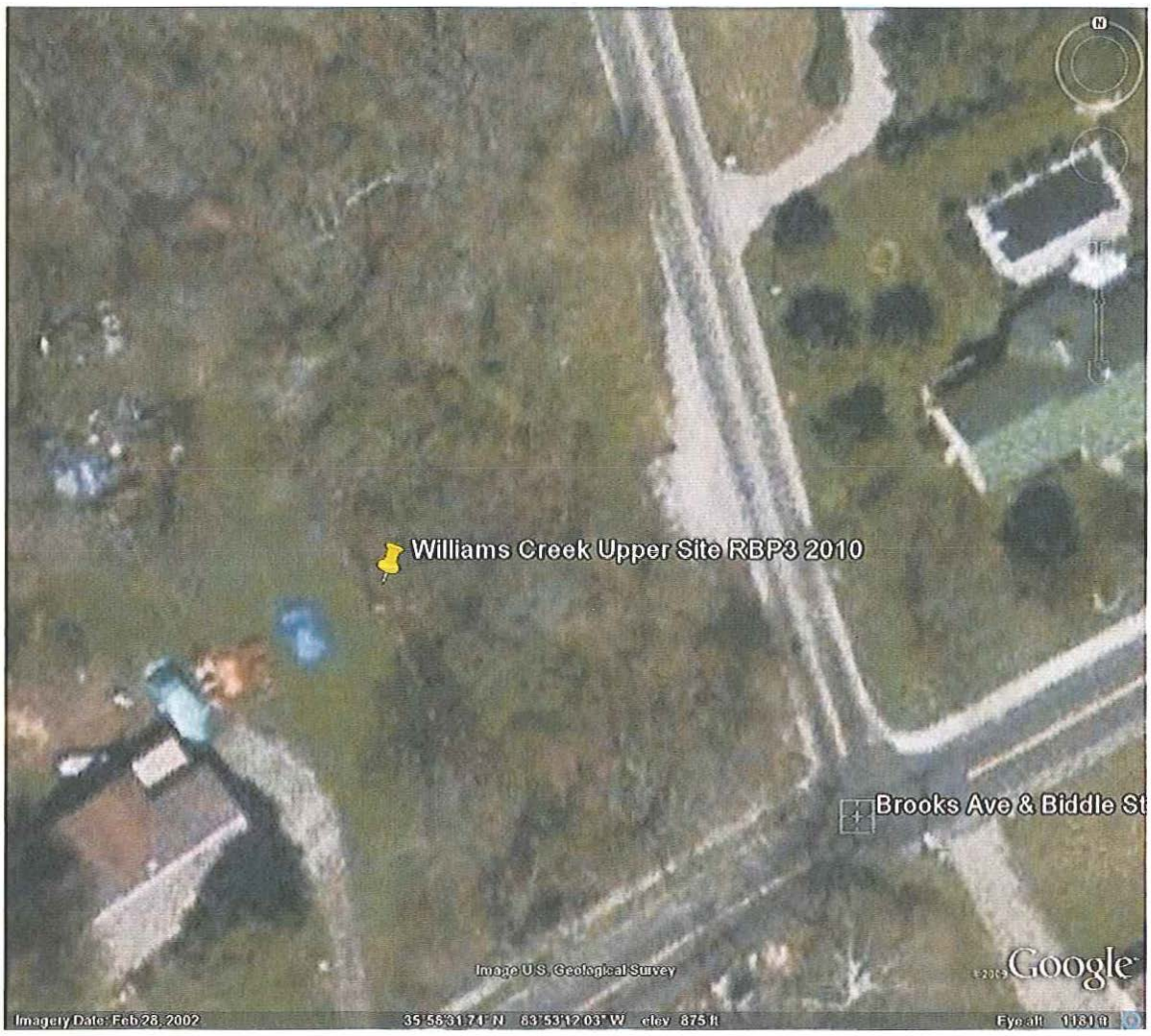

Figure 2. Upper site on Williams Creek located at the intersection of Brooks Avenue and Biddle Street.

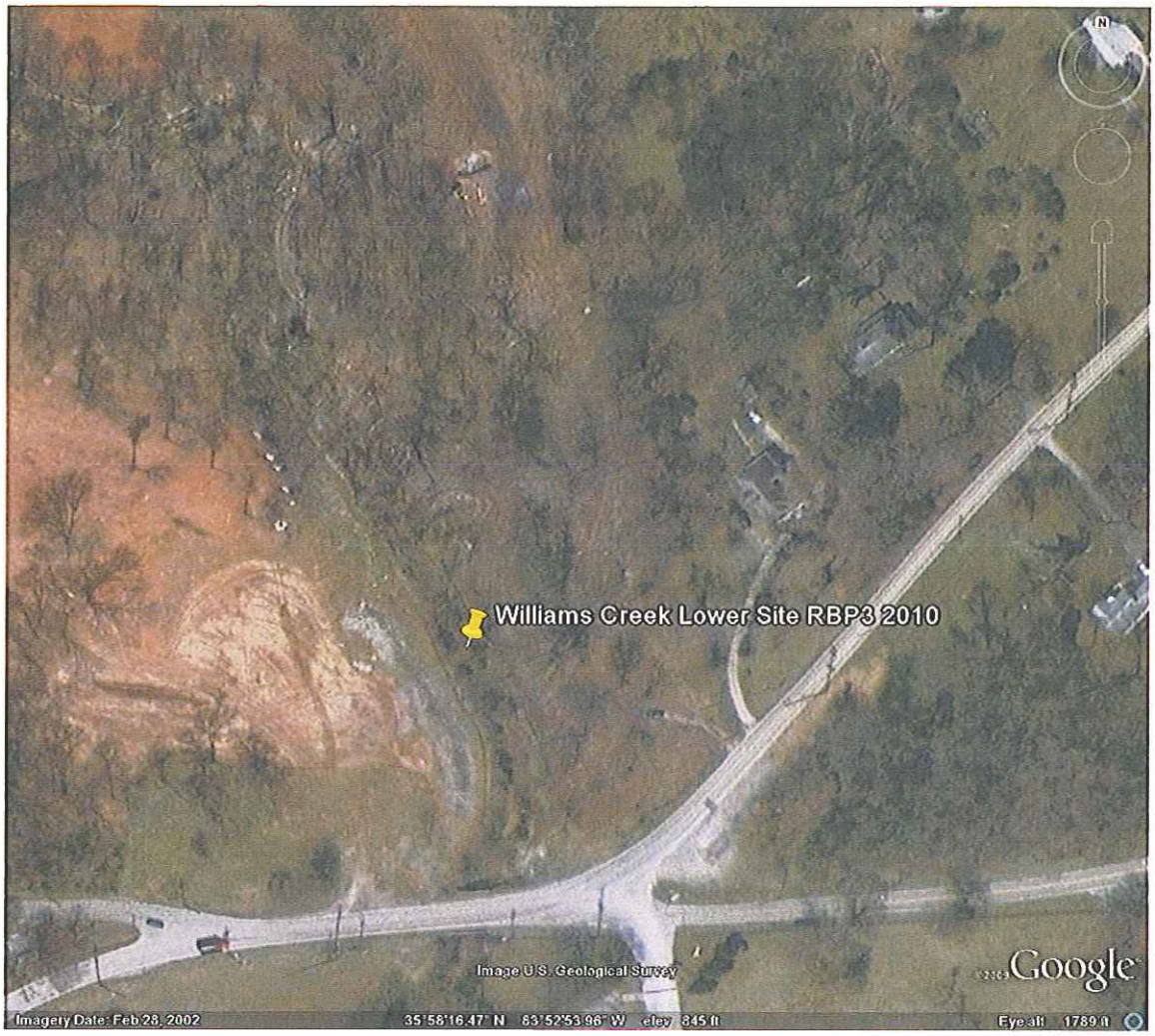

Figure 3. Lower site on Williams Creek located upstream of the Vulcan Materials Plant on Riverside Drive.

METHODS

FLLA utilized 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 2007). 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 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 (°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 2007) 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 Love Creek and Williams Creek collected on June 21, 2010.

	LOVE CREEK		WILLIAMS CREEK	
	Upper Site	Lower Site	Upper Site	Lower Site
IBI-M score	28	26	26	28
Rating	Slightly impaired	Slightly impaired	Slightly impaired	Slightly impaired
Habitat score	116	97	120	138
Rating	Moderately impaired	Severely impaired	Moderately impaired	Not impaired

Table 2. Abundances of macroinvertebrates Love Creek and Williams Creek collected on June 21, 2010.

TAXA				
	LOVE CREEK		WILLIAMS CREEK	
	Upper	Lower	Upper	Lower
OLIGOCHAETA (Aquatic worms)				
Haplotaxidae				
Haplotaxis gordioides		6	3	5
ODONATA (Dragonflies & damselflies)				
Calopterygidae				
Calopteryx maculata				2
Aeshnidae				
Aeshna umbrosa	2	1		
Hylogomphus brevis	1	6		
Gomphidae				
Stylurus plagiatus			1	
EPHEMEROPTERA (Mayflies)				
Baetidae				
Baetis tricaudatus				4
Heptageniidae				
Stenonema femoratum	11	9		
TRICHOPTERA (Caddisflies)				
Hydropsychidae				
Certatopsyche sparna	30	22	41	69
Hydropsyche demora	10	36	37	
Cheumatopsyche spp.	12	25	15	46

	LOVE CREEK		WILLIAMS CREEK	
	Upper	**Lower**	**Upper**	**Lower**
COLEOPTERA (Beetles)				
Dytiscidae				
Hydaticus modestus			5	
Elmidae				
Optioservus spp.	10	2		
Stenelmis spp.			26	25
Psephenidae				
Psephenus herricki	16	33	4	6
HETEROPTERA (True bugs)				
Gerridae				
Halobates micansi	1			
Metrobates hesperius			1	
Veliidae				
Paravelia brachialis	1			
DIPTERA (Flies)				
Ceratopogonidae				
Dasyhelea grisca				3
Chironomidae				
Conchapelopia spp.			10	
Polypedilum spp.	12	23	42	15
Rheotanytarsus exiguus	20		3	7
Tanytarsus spp.	11	31	2	
Tipulidae				
Antocha spp.	4	1	6	5
Dicranota spp.	1			2
Pedicia sp.		1		
Tipula abdominalis		1	1	
Simuliidae				
Simulium snowi		5	27	6
TUBIFICIDA (Aquatic worms)				
Naididae				
Nais sp.				1
AMPHIPODA (Crustaceans)				
Crangonyctidae				
Crangonyx sp.			16	16

	LOVE CREEK		WILLIAMS CREEK	
	Upper	Lower	Upper	Lower
BASOMMATOPHORA (Snails)				
Pleuroceridae				
Elimia spp.	42	14		
VENEROIDA (Bi-valves)				
Corbiculidae				
Corbicula fluminea	13			22
TOTALS	197	216	240	234

A total of 887 specimens were collected among the four sampling sites. Hydropsychid caddisflies and midges dominated each location.

Table 3. Summary table for macroinvertebrate RPB3 Index of four sampling sites on Love Creek and Williams Creek collected on June 21, 2010.

		METRIC							
Site		**Taxa Richness**	**EPT Richness**	**% EPT**	**% OC**	**NCBI**	**% Clingers**	**% NUTROL**	**Index Score**
Love Creek, Upper	Value	17	4	31.98	21.82	3.39	49.24	51.78	
	Score	2	2	4	6	6	4	4	**28**
Love Creek, Lower	Value	16	4	42.59	27.78	4.38	46.30	49.53	
	Score	2	2	4	4	6	4	4	**26**
Williams Creek, Upper	Value	17	3	38.75	20.83	4.82	64.58	50.00	
	Score	2	0	4	6	4	6	4	**26**
Williams Creek, Lower	Value	16	3	50.85	11.54	4.81	67.52	48.72	
	Score	**2**	**0**	**6**	**6**	**4**	**6**	**4**	**28**

	INDEX SCORE	INDEX SCORE RATING
SITE		
Love Cr., Upper	28	Slightly impaired
Love Cr., Lower	26	Slightly impaired
Williams Cr., Upper	26	Slightly impaired
Williams Cr., Lower	28	Slightly impaired

Scores ranged from 26 to 28. Each sampling location was classified as slightly impaired according to the macroinvertebrate index scores.

Table 4. Summary of water quality analysis taken on Love Creek and Williams Creek collected on June 21, 2010.

	WATER QUALITY PARAMETERS			
Site **LOCATION**	Temperature (°C)	DO (mg/L)	pH	Conductivity (um/hos)
Love Cr., Upper	20.9	6.32	6.17	416.3
Love Cr., Lower	19.4	7.04	6.41	403.7
Williams Cr., Upper	21.0	7.81	8.31	444.8
Williams Cr., Lower	20.6	6.98	7.76	431.6

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 Love Creek and Williams Creek recorded on June 21, 2010.

	SAMPLING SITE			
Habitat Parameter	**Love Creek, Upper**	**Love Creek, Lower**	**Williams Creek, Upper**	**Williams Creek, Lower**
Latitude	36° 01'20.19"	36° 01'12.53"	35°58'31.74"	35°58'16.47"
Longitude	83°51'33.40"	83°51'31.65"	83°53'12.03"	83°52'53 96"
Epifaunal Cover	8	13	13	16
Embeddedness	9	13	14	15
Velocity/Depth Regime	14	13	14	15
Sediment Deposition	11	11	11	13
Channel Flow	12	12	13	12
Channel Alteration	7	7	14	15
Riffle Frequency	14	11	13	14
Bank stability (left/right)	9/4	5/1	5/5	7/7
Vegetative Protection (left/right)	10/6	2/5	6/6	6/8
Riparian Zone Width (left/right)	9/3	2/2	3/3	5/5
Total (200 max.)	**116**	**97**	**120**	**138**

Table 5. Continued

	TOTAL SCORE	TOTAL SCORE RATING
SITE		
Love Cr., Upper	116	Moderately impaired
Love Cr., Lower	95	Severely impaired
Williams Cr., Upper	120	Moderately impaired
Williams Cr., Lower	138	Not impaired

Habitat scores ranged from 95 at Love Creek's lower site to a high score of 138 at Williams Creek's lower site. These scores included each category of the rating system. Parameter scores were similar at each sampling site with the exception of epifaunal cover and the amount of embeddedness at the Love Creek upper site, the channel alterations, and the differences in the levels of disturbance and width of the riparian zones.

Though sampling on Love Creek was geographically close to one another, there were noticeable differences between sites. The upper site was relatively undisturbed with a heavy forest canopy blanketing the left bank the entire sampling reach. On the right side the Loves Creek Road impacted disturbance levels and riparian zone width. It was evident in several areas sources of nonpoint pollution due to run off slots.

Williams Creek demonstrated variation as well. The upper site was in a residential neighborhood yet the riparian zone still remained undisturbed in most of the sampling reach. The lower site on Williams Creek at Riverside Drive was rated as not impaired. The surrounding land was forest and fellow fields. Though sedimentation and embeddedness was evident the levels were reduced at this site. Riffles were clean and the pools had some level of deposits.

DISCUSSION

Both Love Creek and Williams Creek are listed in the State of Tennessee's Final Version of the 2008, 303(d) list for impaired water bodies (TDEC 2008). Love Creek's 9.7 impaired miles have loss of biological integrity due to siltation and anthropogenic habitat alterations because of discharges from a MS4 area. Though Love Creek is within the City of Knoxville it is in the Holston River Basin (USGS HUC 06010104) unlike Williams Creek that is within the Upper Tennessee River Basin (USGS HUC 06010201). Williams Creek's 2.8 impaired miles are state listed because of anthropogenic habitat alterations and high levels of *Escherichia coli* because of MS4 discharges and collection system failures.

Love Creek was sampled by TDEC in 2004. Love Creek failed to meet the target score for Ecoregion 67f with a score of 26 for the macroinvertebrate community assessment. The dominant organism was the freshwater snail, *Elimia* with 48 of 192 specimens collected at the site. Nutrient tolerant organisms represented 50.5% of the community thus the failing collection system is having an impact on this group.

TDEC surveyed Williams Creek in 2007 including a duplicate survey. The macroinvertebrate survey utilized the SQKICK method of a single habitat survey. The survey identified 224 individuals and the TMI score was 32. Williams Creek met the minimum score of 32. The macroinvertebrate community was dominated by hydropsychid caddisflies. Unlike the current study the rapid bioassessment identified specimens to genus only. The duplicate sample also scored 32 but contained 179 specimens.

The habitat score was 143 and it met the score for habitat guidelines for the ecoregion. Of the ten habitat parameters, four were classified as optimal: epifaunal substrate, embeddedness, sediment deposit and channel alteration. Five others were scored at suboptimal and were scored at 14 or higher. Riparian vegetative zone width was classified as poor with scores of 2 for each bank.

Similar trends were observed for both creeks in the current study. Love Creek was rated as slightly impaired according to the macroinvertebrate data and was rated as moderately impaired at the upper site and severely impaired at the lower site according to the habitat assessment. Williams Creek was rated as slightly impaired at both sites as well but the lower site was the only one classified as not impaired and met the score for habitat guidelines for this ecoregion.

The macroinvertebrate community changed little between sampling years. Both efforts collected and identified four EPT taxa however the current study had a higher percentage of those groups with 31.98% and 42.59% vs. 23.4% in the past. The EPT percentage was higher in the current study but the total number of taxa decreased from 26 to 17 and 16 taxa collected and identified. Most of the taxa identified in the 2004 survey were rare abundances with only one to five specimens. Yet both sampling years resulted in the same most numerous taxa including *Elimia, Cheumatopsyche, Hydropsyche, Stenelmis* and *Tanytarsus*.

Habitat assessments demonstrated similar trends as well. TDEC's habitat score of 100 in 2004 and the current scores of 116 and 95 both rate the stream reaches as failing to meet habitat guidelines for the region (Arnwine 2007). Embeddedness, channel

alteration, bank stability and changes to the riparian zone have all influenced these lowered scores.

The macroinvertebrate community data and scores were different between sampling years on Williams Creek. TDEC's assessment determined that the macroinvertebrate community met the requirements of a minimum score of 32 for the region (Arnwine and Denton 2001). Both sites in 2010 were classified as slightly impaired.

Though the surveys determined different classifications there were similar trends between years. Of the metrics, NCBI and percentage of nutrient tolerant organisms were the only ones different in value. Both were scored as 6 by TDEC and both were scored as 4 by FLLA. The most influential difference in community composition at the Riverside Drive sites between years was an increase in the number of *Cheumatopsyche* caddisflies present in 2010. In 2007 they represented 3.57% of all specimens collected compared to 19.66% of all specimens collected in 2010. Because of this community composition change, scores were lowered and a lower score was assessed.

In both years, habitat assessments on Williams Creek at Riverside Drive determined that the habitat was not impaired and it met the minimum score of 130 for the ecoregion (Arnwine 2007). All parameters except the riparian vegetative zone width were classified in the optimal to highly suboptimal condition categories. The upper site on Williams Creek received a lower score than the lower site with 120. Some issues at the upper site included epifaunal cover, sediment deposition, bank stability, and riparian zone disturbance due to residential housing.

Overall both creeks are being influenced by localized activities and these are altering both the biological community and the physical environment. It is believed that water quality issues are affecting the current conditions. Both creeks have the ability to return to a more naturalized stream system and the community could rebound over time based upon the past and current scores. Though the future is yet to be determined it seems that the community and environment of both creeks are maintaining conditions over time.

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APPENDIX A: PHOTOS OF LOVE CREEK

Upper Site

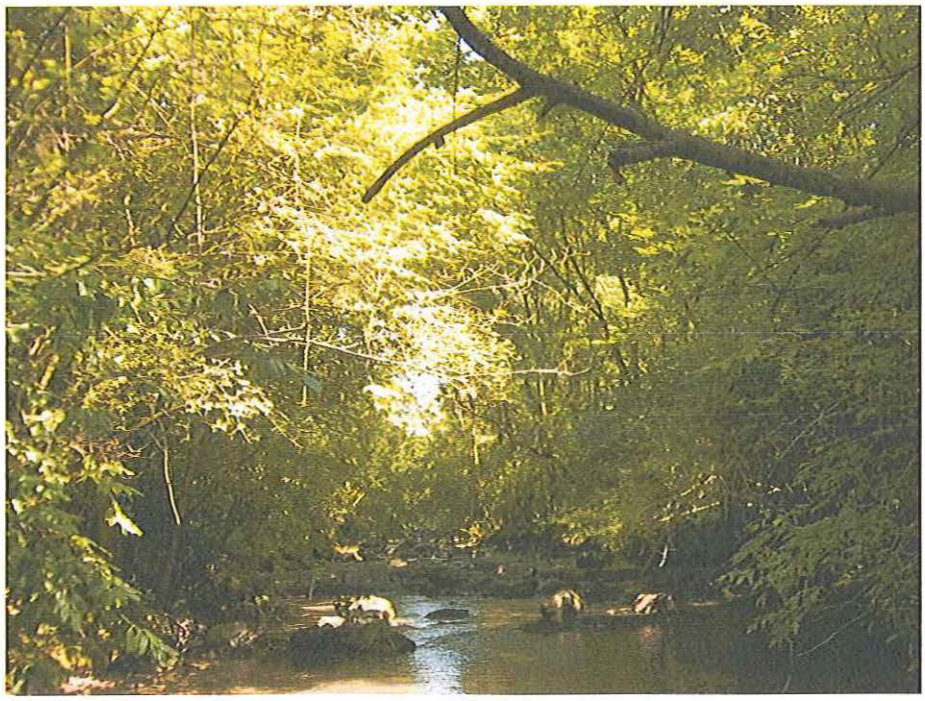


Photo 1. Canopy cover at the upper site.

Photo 2. Stream substrate located in a run.

Photo 3. Riffle habitat.

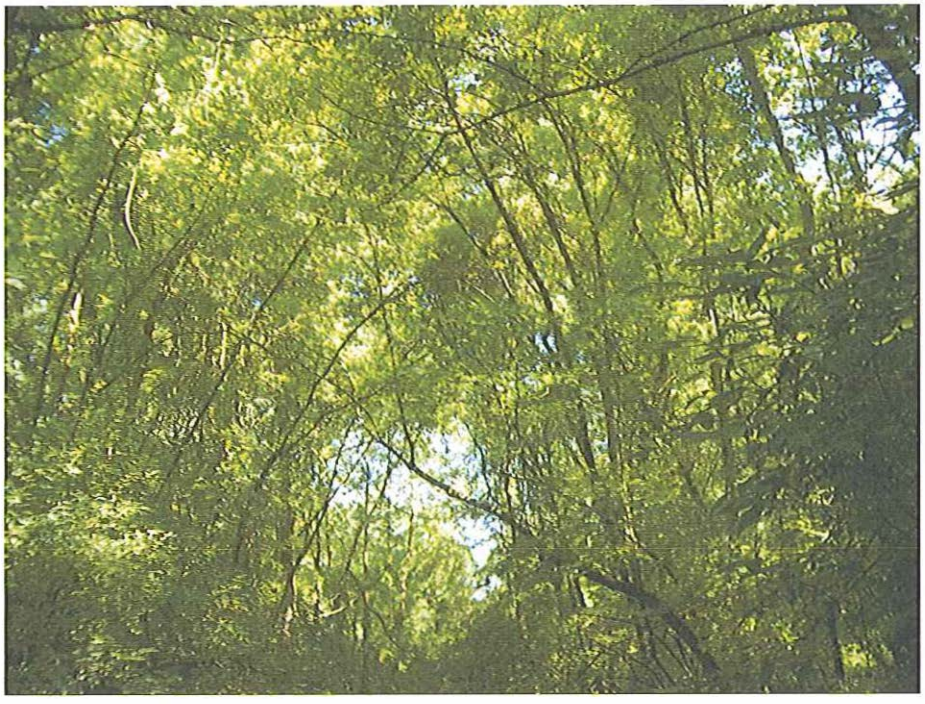


Photo 4. Canopy cover.

Lower Site

Photo 5. Substrate located at the lower site.

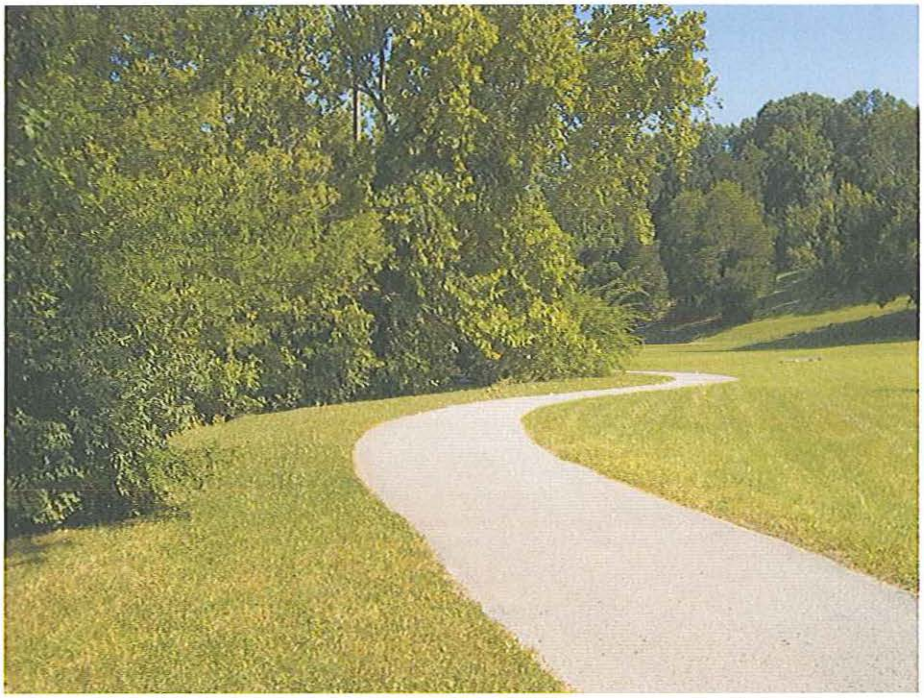


Photo 6. Walking path within the park with a reduced riparian zone.

Photo 7. Bank failure located along the walking path.

Photo 8. Root wad sampled.

APPENDIX B: PHOTOS OF WILLIAMS CREEK

Upper Site

Photo 9. Riffle area.

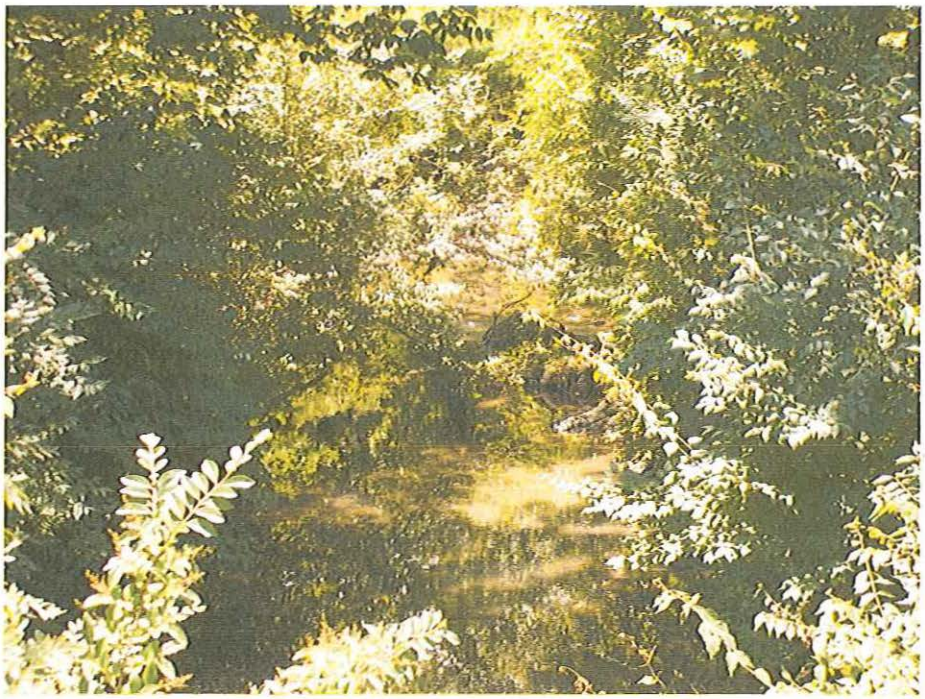


Photo 10. Stream view.

Photo 11 Level of embeddedness.

Photo 12. Sedimentation.

Lower Site

Photo 13. Stream view.

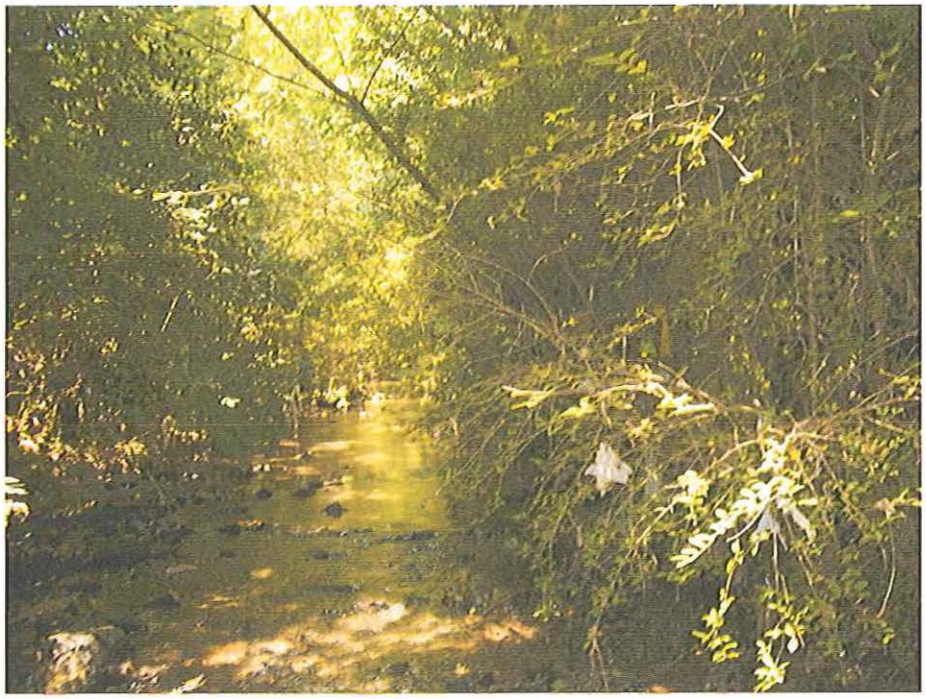


Photo 14. Stream view at the upstream of sampling area.

Photo 15. Sediment deposition.

Photo 16. Debris deposited in the trees during high flow conditions.

APPENDIX D

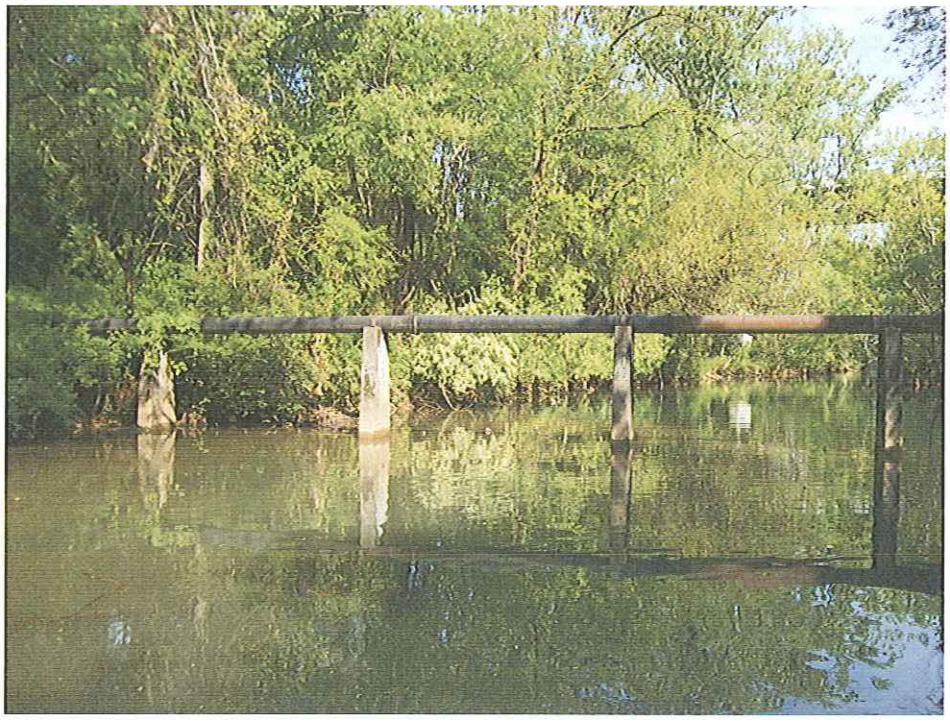
Stream Restoration/Weir Removal Contract Report

2010
City of Knoxville
Weir Removal Program

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

Third Creek 01

N 35°56.505'
W 83°56.166'



This weir was reported by the City of Knoxville intern Matt Butzlaff and by the Americorps. On April 4, 2010, it was removed by Jake Hudson and Kirk Forgety. A tree had fallen just upstream of the pipe supports behind the U T Ag School and then trapped numerous logs and trash on the upstream side. Using a 20' johnboat and a chain saw, the logs were removed and taken ashore. The trash was placed in bags and removed.

Baker Creek Tributary 01

N 35°57.132'
W 83°53.683'

This weir was removed by Jake Hudson and Kirk Forgety from a tributary of Baker Creek between the Rock City Ball Field and the Fire Station on June 30, 2010. The weir consisted of a tree that had fallen across the trib with some trash. The tree was cut with a chainsaw and the trash and tree removed.

Baker Creek Tributary 02

N 35°57.129'
W 83°53.683'

This weir was removed by Jake Hudson and Kirk Forgety from a tributary of Baker Creek between the Rock City Ball Field and Fire Station on June 30, 2010. The weir consisted of three trees that had fallen across the trib with some trash. The trees were cut with a chainsaw and the trash and trees removed.

Baker Creek Tributary 03

N 35°57.128'
W 83°53.679'

This weir was removed by Jake Hudson and Kirk Forgety from a tributary of Baker Creek between the Rock City Ball Field and Fire Station on June 30, 2010. The weir consisted of riprap that had been placed across the trib with some trash. The rock, trash and bicycle were removed.

Baker Creek 01

N 35°57.132'
W 83°53.677'

This weir was removed by Jake Hudson and Kirk Forgety from Baker Creek behind the Rock City Ball Field on June 30, 2010. The weir consisted of tree limbs and trash caught on several large rocks. The tree limbs and trash were removed and the rocks were reconfigured to prevent further problems.

Baker Creek 02

N 35°57.128'
W 83°53.679'

This weir was removed by Jake Hudson and Kirk Forgety from Baker Creek behind the Rock City Ball Field on June 30, 2010. The weir consisted tires, a pallet and trash caught on them. The tires, pallet and trash were removed.

Baker Creek 03

N 35°57.128'
W 83°53.679'

This weir was removed by Jake Hudson and Kirk Forgety from Baker Creek behind the Rock City Ball Field on June 30, 2010. The weir consisted of a downed tree and other woody debris. The material was cut up and placed on the bank above high water.

Debris Removal

This is a view of some of the trash collected at the Baker Creek weirs being hauled off.

Williams Creek 01

N 35°58.338'
W 83°52.964'

This weir, in Williams Creek on the Wee Golf Course, was removed by Kirk Forgety And Jake Hudson on July 7, 2010. It consisted of rocks, logs and trash. The rocks were reconfigured and the logs and trash removed.

Williams Creek 02

N 35°58.335'
W 83°52.978'

This weir, in Williams Creek on the Wee Golf Course, was removed by Kirk Forgety And Jake Hudson on July 7, 2010. It consisted of logs and trash. The logs and trash were removed.

Williams Creek 03

N 35°58.339'
W 83°52.981'

This weir, in Williams Creek on the Wee Golf Course, was removed by Kirk Forgety And Jake Hudson on July 7, 2010. It consisted of logs, brush and trash. The logs, brush and trash were removed.

Love Creek 01

N 36°01.238'
W 83°51.530'

This weir was removed by Kirk Forgety and Jake Hudson from Love Creek beside the Spring Place Park, on July 7, 2010. The weir consisted of riprap that had been placed across the creek as a dam with some trash and debris caught behind it. The rock was redistributed up and down the stream and the trash was removed.

Love Creek 02

N 36°01.249'
W 83°51.533'

This weir was removed by Kirk Forgety and Jake Hudson from Love Creek beside the Spring Place Park, on July 7, 2010. The weir consisted of riprap that had been placed across the creek as a dam with some trash and debris caught behind it. The rock was redistributed up and down the stream and the trash was removed.

Love Creek 03

N 36°01.311'
W 83°51.562'

This weir was removed by Kirk Forgety and Jake Hudson from Love Creek beside the Spring Place Park, on July 7, 2010. The weir consisted of logs brush and trash that had accumulated on the supports for the footbridge at the spring. The logs and debris were removed to the bank …

… and then removed from the bank by truck.

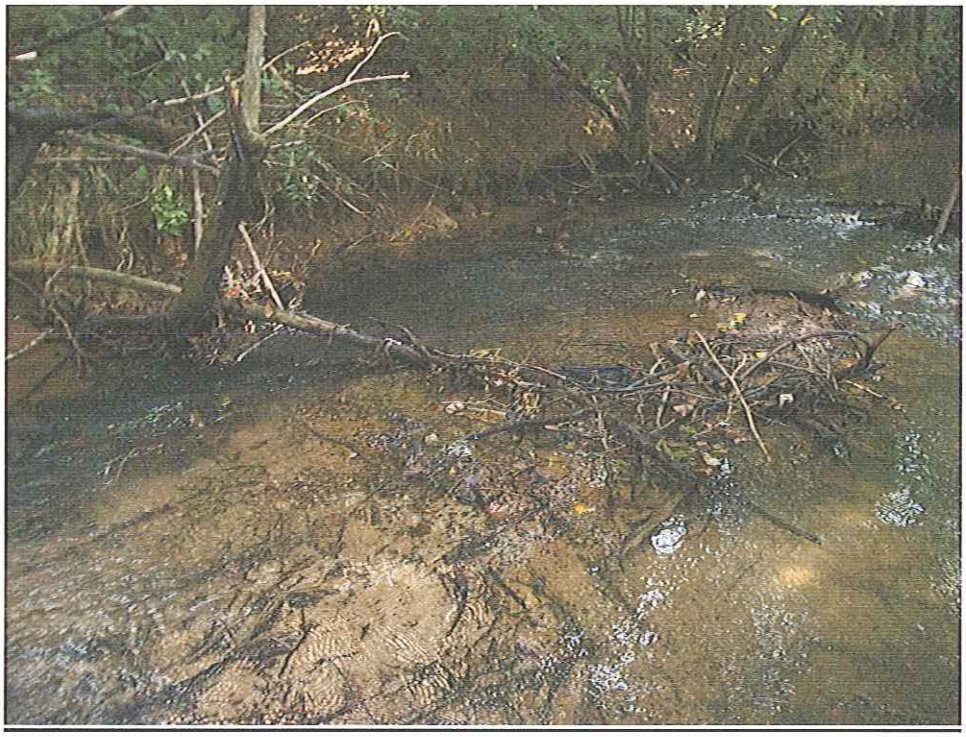
Ten Mile Creek 01

N 35°55.317'
W 84°04.554'

This weir was removed by Kirk Forgety and Jake Hudson from Ten Mile Creek beside the Greenway, on August 6, 2010. The weir consisted of logs across the creek with some debris caught behind it. The logs were removed.

Ten Mile Creek 02

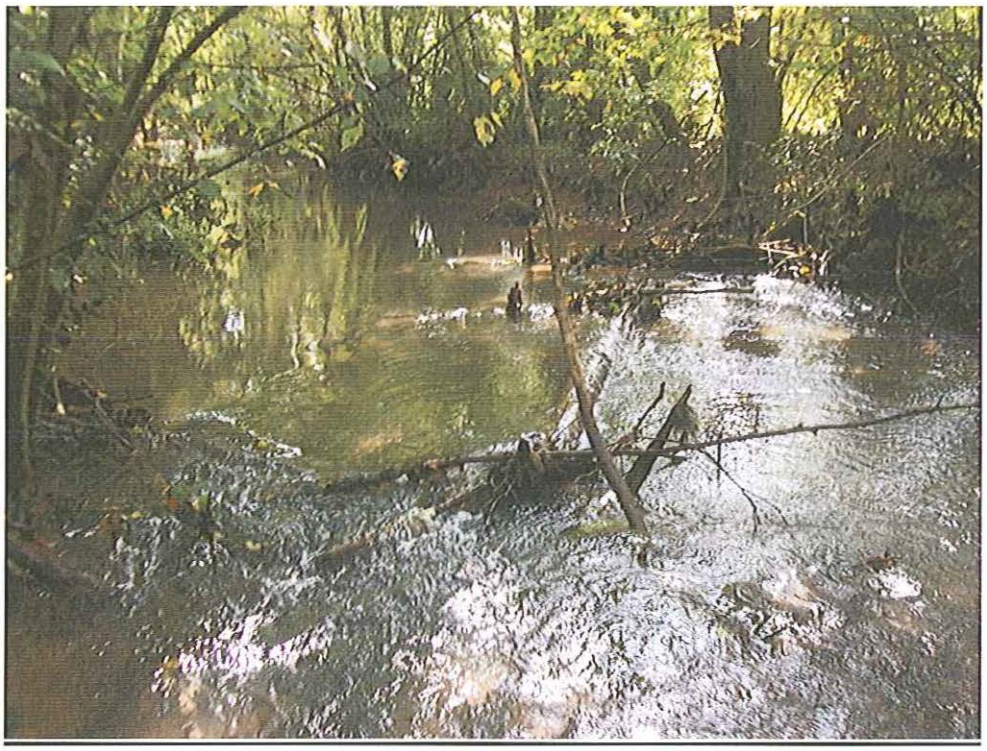
N 35°55.317'
W 84°04.554'



This weir was removed by Kirk Forgety and Jake Hudson from Ten Mile Creek beside the Greenway, on August 6, 2010. The weir consisted of logs across the creek with some debris caught behind it. The logs and debris were removed.

Ten Mile Creek 03

N 35°55.317'
W 84°04.554'



This weir was removed by Kirk Forgety and Jake Hudson from Ten Mile Creek beside the Greenway, on August 6, 2010. The weir consisted of logs across the creek with some debris caught behind it. The logs and debris were removed.

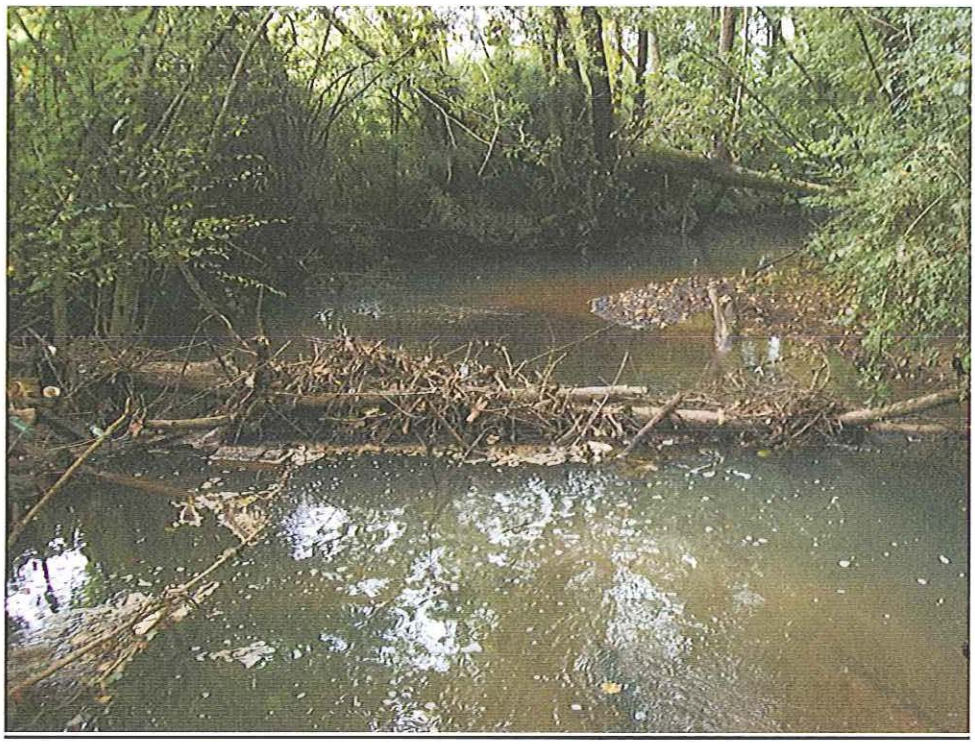
Ten Mile Creek 04

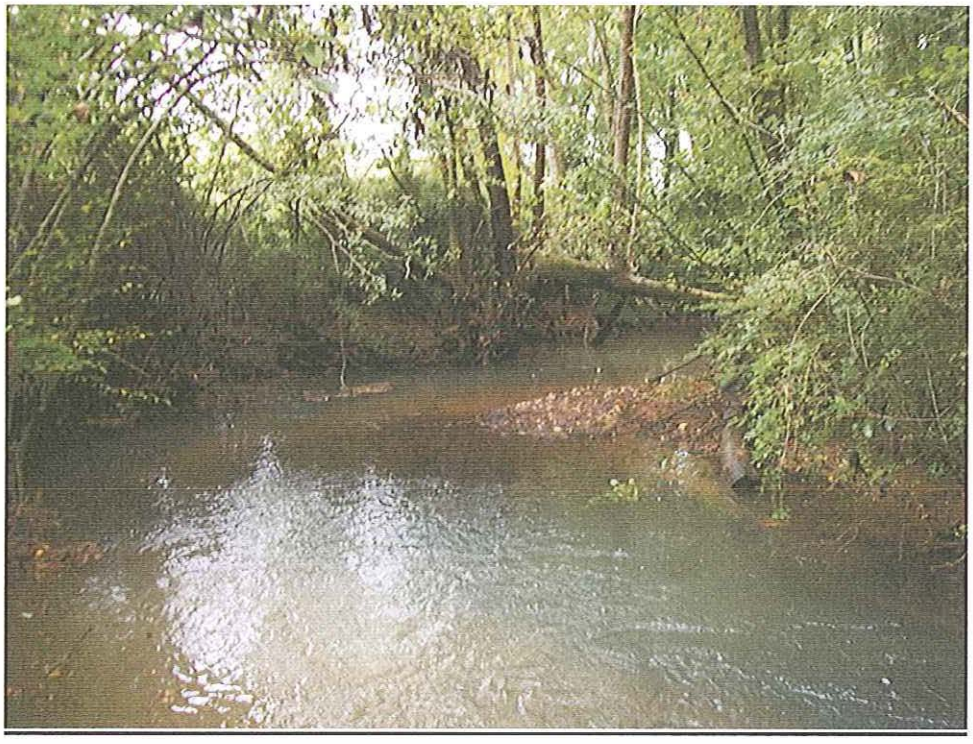
N 35°55.337'
W 84°04.503'

This weir was removed by Kirk Forgety and Jake Hudson from Ten Mile Creek beside the Greenway, on August 6, 2010. The weir consisted of logs across the creek with some debris caught behind it. The logs and debris were removed.

Ten Mile Creek 05

N 35°55.337'
W 84°04.503'

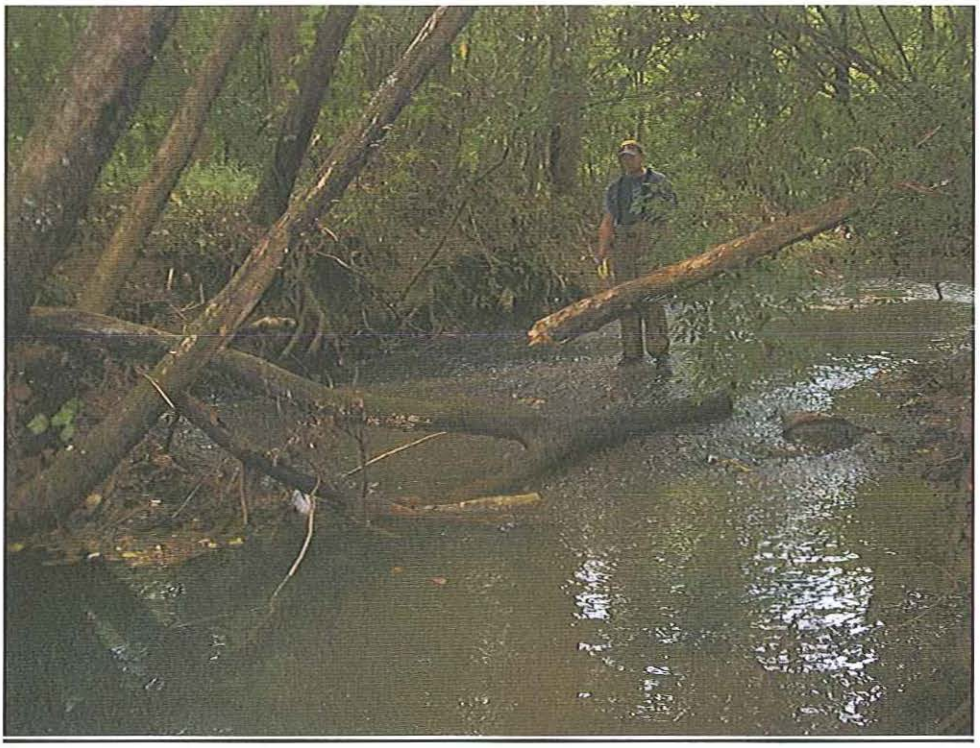




This weir was removed by Kirk Forgety and Jake Hudson from Ten Mile Creek beside the Greenway, on August 6, 2010. The weir consisted of logs across the creek with some debris caught behind it. The logs and debris were removed.

Ten Mile Creek 06

N 35°55.430'
W 84°04.459'



This weir was removed by Kirk Forgety and Jake Hudson from Ten Mile Creek beside the Greenway, on August 6, 2010. The weir consisted of logs across the creek with some debris caught behind it. The logs and debris were removed.

Ten Mile Creek 07

N 35°55.440'
W 84°04.434'

This weir was removed by Kirk Forgety and Jake Hudson from Ten Mile Creek beside the Greenway, on August 6, 2010. The weir consisted of logs across the creek with some 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 "Logzilla" Forgety and Jake Hudson, using chain saws, a one-ton come along winch, rakes, and machetes.

APPENDIX E

Table of SPAP Facilities Inspections

Commerical and Industrial Facilities Inspected During 2090-2010

Permit Number	Project Name	Address	Street Name	Inspection Date	Inspector	Water Quality Device
06-008	The Webb School of Knoxville	9800	Webb School Drive	07/10/2009	J. Shubzda/L. Marcum	Flo-guard, catch basins insert filters
04-013	Clayton Body Shop	4600	Clinton Highway	07/30/2009	J. Shubzda	3 catch basin inserts
03-015	Murphy Oil @ Wal-Mart Supercenter	120	Green Rd.	07/31/2009	J. Shubzda	Downstream Defender
01-008	Lowes of East Knoxville	4927	Millertown Pk	08/05/2009	S&ME	CDS PMSU30_28 X (2)
08-042	Lowe's East of Knoxville	3100	South Mall Rd	08/05/2009	S&ME	CDS PMSU30-28
02-010	Duncan Automotive	10631	Parkside Dr	08/06/2009	J. Shubzda/L. Marcum	Fossil Filter Flo Guard
03-012	Earthfare and Shops	10921	Parkside Dr	08/06/2009	J. Shubzda/L. Marcum	3 Catch basin inserts
04-002-Closed	Johnny Carino's	210	Lovell Road	08/06/2009	J. Shubzda	Catch Basin Inserts
05-007	Krystal	8901	Kingston Pike	08/06/2009	J. Shubzda/L. Marcum	2 Suntree Catch Basin Inserts
07-029	SoHo Asian Bistro	10901	Parkside Dr. # 105	08/07/2009	J. Shubzda/L. Marcum	Suntree Catch Basin Inserts
01-013	Armstrong Relocation Co.	1812	Prosser Rd	08/13/2009	J. Shubzda	sand filter
02-004	CarMax	11225	Parkside Dr	08/13/2009	J. Shubzda/L. Marcum	Aqua-Swirl AS-9
04-011	Connor Seafood	10915	Turkey Drive	08/13/2009	J. Shubzda/L. Marcum	Catch Basin Inserts
04-014	Colonial Pinnacle-Phase I	11325	Parkside Drive	08/13/2009	J. Shubzda/L. Marcum	Oil water separators
03-004	Chapman Hwy Wal-Mart Supercenter	7420	Chapman Hwy	08/14/2009	DGC Environmental	Oil and grit seperator
07-004	Sonic Drive-In	7519	Mountain Grove Rd.	08/14/2009	J. Shubzda/L. Marcum	Catch Basin Inserts-Kristar
05-001	Texas Roadhouse @ Turkey Creek	11001	Turkey Drive	08/18/2009	J. Shubzda/L. Marcum	2 Suntree Catch Basin Inserts
05-010	Texas Avenue Warehouse	2815	Texas Avenue	08/18/2009	J. Shubzda/L. Marum	Suntree Catch Basin Inserts
01-011	Knoxville News Sentinel	2332	News Sentinel Dr	08/25/2009	J. Shubzda/L. Marcum	Vortechnics
05-004	Aubrey's Restaurant	1111	Northshore Drive	08/25/2009	J. Shubzda/L. Marcum	Catch Basin Inserts
05-028	The Chop House South	7417	Chapman Hwy	08/25/2009	J. Shubzda/L. Marcum	Abtech Catch Basin Insert
06-010	Lovell Pointe Phase II	114	Lovell Road	08/25/2009	J. Shubzda/L. Marcum	Suntree Vault
07-010	Superior Ice Company	2729	Middlebrook Pike	08/25/2009	J. Shubzda/L. Marcum	Suntree Catch Basin Insert
04-003	Ruby Tuesday Restaurant	7406	Chapman Highway	08/26/2009	J. Shubzda/L. Marcum	Crystal Stream
05-011	Home Depot	140	Green Rd	08/26/2009	J. Shubzda	Suntree Nutrient Separating Baffle Box
08-043	South Knoxville Carwash	7525	Mountain Grove Rd	08/26/2009	J. Shubzda/L. Marcum	2 Kristar Catch Basin Inserts
03-007	Knoxville Zoological Gardens	3540	Knoxville Zoo Dr	08/28/2009	J. Shubzda/L. Marcum	Management Controls
03-009	Waste Connections, Inc.	1300	Prosser Rd	08/28/2009	J. Shubzda/L. Marcum	CB Inserts
03-013	Turner's Euro Service	317	Pelham Rd.	08/28/2009	J. Shubzda/L. Marcum	vegetated buffer strip
05-008	Bread Box on Millertown Pike	5340	Millertown Pike	08/28/2009	J. Shubzda/L. Marcum	Suntree Catch Basin Inserts
04-005	Outback Steakhouse Strawberry Plains	7400	Sawyer Ln	08/29/2009	J. Shubzda	4 catch basin inserts
04-009	Bonefish Grill/Bearden Station	6610	Kingston Pike	08/29/2009	J. Shubzda	Grate Inlet Skimmer Box
06-009	Tennessee RV	7450	Sawyer Lane	08/29/2009	J. Shubzda	3 Catch Basin Inserts
00-004	SuperTarget and Retail Center	10922	Parkside Dr	09/17/2009	J. Shubzda	Downstream Defender
00-006	Sam's Club Fueling Station	8435	Walbrook Rd	09/17/2009	J. Shubzda	Aqua-Swirl AS-8
04-001	Blue Skies Car Wash	321	Gallaher View Rd.	09/17/2009	J. Shubzda	Catch Basin Inserts
04-015	Medic Regional Blood Center-Vehicle Maintenance Fa	1705	Ailor Avenue	09/17/2009	Greg Shaw	Aquasheild Catch Basin Insert
02-005	The Car Spa	435	E. Emory Rd	09/18/2009	J. Shubzda	Baysaver
05-025	Cars Inc.	1106	Callahan Rd	09/18/2009	J. Shubzda	Grassy Swale
02-015	Cedar Bluff 24 Hour Towing, Inc.	623	Simmons Rd	09/28/2009	J. Shubzda/L. Marcum	O/W seperator
05-003	Mimi's Café	10945	Parkside Drive	09/28/2009	J. Shubzda	Grease Catcher System & Suntree CB
06-019	Lexus of Knoxville	10315	Parkside Drive	09/28/2009	J. Shubzda/L. Marcum	5 Suntree Catch Basin Inserts
06-030	Century Park at Pellissippi Bldg 4	0	Investment Dr. off Ce	09/28/2009	J. Shubzda/L. Marcum	Suntree Vault
06-032	Knoxville PDI Center	10416	Parkside Drive	09/28/2009	J. Shubzda/L. Marcum	Suntree Vault
07-016	Toyota of Knoxville-Service Bay Addition	10415	Parkside Drive	09/28/2009	J. Shubzda/L. Marcum	AquaGuardian Catch Basin insert AG-18
09-040	Grayson BMW	10671	Parkside Drive	09/28/2009	J. Shubzda/L. Marcum	Downstream Defender
03-016	Century Park	10127	Sherrill Blvd.	09/29/2009	J. Shubzda/L. Marcum	Grassy Swale
00-005	Pilot Food Mart-111	1826	Western Ave	10/01/2009	J. Shubzda	grass swale

Commerical and Industrial Facilities Inspected During 2090-2010 cont.

Permit Number	Project Name	Address	Street Name	Inspection Date	Inspector	Water Quality Device
01-005	Pilot Food Mart 166	4603	Chapman Hwy.	10/01/2009	Dynamis Inc.	catch basin inserts
01-010	Pilot Food Mart-158	405	Lovell Rd	10/01/2009	Dynamis Inc.	Fossil Filter Flo Guard
02-001	Pilot Food Mart-105	206	Walker Springs Rd	10/01/2009	Dynamis Inc.	Fossil Filter Flo Guard
04-004	Pilot Food Mart-187	100	Merchant Drive	10/01/2009	Dynamis Inc.	Catch Basin Inserts
05-020	Pilot Food Mart #217	4800	N. Broadway & Adair I	10/01/2009	Dynamis Inc.	media filtration inserts
05-027	Pilot Food Mart #138	136	N. Northshore Dr.	10/01/2009	Dynamis Inc.	Flow Guard-Plus/filtrtn inserts
06-004	Pilot Foodmart # 215	410	Merchants Drive	10/01/2009	Dynamis Inc.	Flow Guard-Plus Filtration insrts
06-020	Pilot Food Mart #119	2518	N. Broadway	10/01/2009	Dynamis In.	2 Suntree Catch Basin Inserts
09-012	Pilot Food Mart 244	2218	Cumberland Ave	10/01/2009	Dynamis In.	Catch Basin Inserts
02-009	FedEx Ground Package	3700	Middlebrook Pk	11/11/2009	Storm System Services	Crystal Stream 1056
03-005	Shops	7420	Chapman Hwy	11/11/2009	Storm System Services	Oil and grit seperator
05-015	Three Minute Express Car Wash	300	Simmons Road	11/11/2009	J. Shubzda	Grassy Swale
06-011	Human's BP Service Station	3309	Western Ave	11/11/2009	J. Shubzda	Management Controls
07-001	Chick-Fil-A Kingston Overlook	9646	Kingston Pike	11/11/2009	J. Shubzda	Catch Basin Inserts
07-021	Diamond Mobil Car Wash	2908	E. Magnolia Ave.	11/11/2009	J. Shubzda	Management Controls
08-016	Just Jeeps and More	2335	Piney Grove Church F	11/11/2009	J. Shubzda	Grassy Swale
09-014	Chick-Fil-A West Town Mall	7063	Kingston Pike	11/11/2009	J. Shubzda	Suntree Catch Basin Insert
07-009	Guthrie's Restaurant	2135	Cumberland Ave	11/12/2009	J. Shubzda/L. Marcum	Suntree Tech grate inlet skimmer box, GIS-NK-32-32
06-031	Harvest Park Shopping Center	5517	Washington Pike	11/13/2009	Storm System Services	Suntree Vault
04-023	JD Byrider Motors	8413	Kingston Pike	11/25/2009	J. Shubzda	Aquasheild Catch Basin Inserts
05-014	Stowers Rental & Supply	10616	Lexington Drive	12/31/2009	J. Shubzda/L. Marcum	Suntree Vault
03-002	Ft. Sanders Park West Med. Cnt.	9352	Park West Blvd	01/28/2010	Jeffery Askew-CrystalSteam	Crystal Stream-Oil and grit seperator
04-012	Ruby Tuesday Restaurant	508	East Emory Road	01/28/2010	Jeffery Askew-CrystalStream	Crystal Stream
08-009	The Magnolia Specialty Bakery & Cafeteria	4108	Asheville Hwy	02/18/2010	J. Shubzda	Managerial Controls
05-009	Starbucks Coffee Company	116	Merchant Drive	06/02/2010	J. Shubzda	4 Suntree catch basin inserts
07-003	Tint Master Inc.	1920	Grand Ave	06/02/2010	J. Shubzda/L. Marcum	Managerial Controls
08-028	Ingles Car wash	430	E. Emory Rd	06/02/2010	J. Shubzda/L. Marcum	Oil and grit seperator
08-046	Kinder Morgan Southeast Terminals	5009	Middlebrook Pike	06/02/2010	J. Shubzda	Oil Water Separtor
09-005	The Hill	1105	ForestAve	06/02/2010	J. Shubzda/L. Marcum	Not finished
09-051	The Parlor	726	Chickamauga Ave	06/02/2010	J. Shubzda/L. Marcum	Managerial Controls, Grease control
09-054	Ryder LC-0159	5951	Middlebrook Pike	06/02/2010	J. Shubzda	Inserts not installed.
10-003	Dadu Mart Gas Station	1025	Heiskell Avenue	06/02/2010	J. Shubzda/L. Marcum	Suntree Box
06-017	NEFF Rental	1808	Sanderson Rd	06/11/2010	J. Shubzda/L. Marcum	(Drainpac Brand) Drain insert
09-037	Corner Variety	105	W Baxter Ave	06/20/2010	J. Shubzda/L. Marcum	Managerial Controls

APPENDIX F

City of Knoxville Solid Waste Office 2009 Annual Report

Solid Waste Section
2009 Annual Report

CITY OF KNOXVILLE
BILL HASLAM, MAYOR

Department of Public Works
Steven King, Director

Public Service Division
David Brace, Deputy Director

Printed on Recycled Paper

INTRODUCTION

In 2009, we continued to show positive progress in the development of our solid waste programs. We continued active enforcement of the solid waste ordinances and completed our twelfth full year of operations at the Household Hazardous Waste Collection Center. The Public Service Division is in its eighth year of garbage collection service and recycling in the Central Business District at a cost savings of $30,000 per year. All of these programs have been successful and reflect the continued interest in and growth of our comprehensive solid waste management program.

The following pages summarize our activities for the calendar year 2009.

The last page is a residential waste stream analysis of data such as:

* The total waste stream increased by 1,330.54 tons from 2008
* The diversion rate increased to 63.52% from 61.74% in 2008
* The recycling rate increased to 32.50% from 30.72% in 2008

The total waste stream shows an increase for the second time in three years. This increase is largely attributed to yard was collection. Diversion and recycling rates have remained level over the last five years, varying a few points up or down each year.

I. RECYCLING

A total of 5762.62 tons of recyclables was collected at the City's eleven drop-off recycling centers in 2009. This number is level with recyclables from 2005 to 2008. Aluminum, Plastics, Mixed Paper and Cardboard showed an increased.

Goodwill Industries is in the 3rd year of three 1 year extensions of a contract to assist in on-site operation of the recycling centers. For 2009 new contracts were signed with Rock-Tenn Recycling to handle recycling of all of the materials collected at the centers and pay the City current market value for material collected. A contract extension was signed with Waste Connections to haul the materials from the centers to Rock-Tenn Recycling.

In 2009, 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 and of the material. During the 2009 over 95 tons of material was collected from the down town area up from 79 tons in 2008.

II. MUNICIPAL SOLID WASTE (MSW)

A total of 46,930.81 tons of garbage was collected from Knoxville homes in 2009 as part of the weekly garbage collection service the City offers via its contractor, Waste Connections. This number reflects a less than1% decrease from the previous year. The City is currently in a five year contract with Waste Connections that expires in 2011. Current collection costs per this contract are:

Curbside Collection	$6.59 / house/month	41,349 residents
Backdoor Collection	$8.24 / house/month	14,646 residents

All garbage is disposed of at the Chestnut Ridge Landfill operated by Waste Management of Knoxville. The City is currently in a 10 year contract with Waste Management that expires in 2010. Contract prices change in October of each year. Disposal costs for 2009 were as follows:

- Oct. '08 - Sep. '09 $27.04 / ton
- Oct. '09 - Sep. '10 $27.76 / ton

III. YARD WASTE COLLECTION / MULCHING

A total of 39,417.81 tons of yard waste was collected by City crews in 2009. This number is up by 2,734.57 tons from last year. The Solid Waste Department sees this increase based on extremely dry weather conditions during the entire year of 2008 and 2009. All yard waste is taken to Shamrock Organic Products where it is turned into mulch products. The City is currently in a 5 year contract with Shamrock that expires in 2011. Costs for disposal in 2009 at Shamrock were:

- Oct. 08 - Sept. 09 $28.93 / ton
- Oct. 09 - Sept. 10 $29.94 / ton

IV. SOLID WASTE MANAGEMENT FACILITY

Transfer Station

The design of the 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 2009, we diverted 28,764.87 tons of C&D waste to a Class III landfill. This was 84% of the waste received at the Transfer Station. The total number of vehicles using the facility in 2009 was just over 56,683 down 747 from 2008 including City of Knoxville vehicles. Total revenue from charge and cash customers was $531,646.50 down $18,213.87 from 2008 549,860.34

Household Hazardous Waste (HHW) Collection Center

Staffed by City Solid Waste personnel, the HHW Facility is operated jointly by the City and County for all residents. Based on approximately 50/50 usage by City and County residents, the County contributes 50% of the operating and disposal cost. In 2009, this facility was visited by 5,205 vehicles, up by 540 from 2008, and processed 166 tons of HHW, 69% of which was latex paint.

V. EDUCATION

The Solid Waste Office engaged in many activities and special programs throughout 2009 to educate Knoxvillians 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 tenth 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 eight Knox County schools competed for cash prizes donated by the City and County. Over 92 tons of old phone books were collected from the schools and from eight City of Knoxville drop-off centers.

Earth Day - The Solid Waste Office was a part of a city-wide steering committee that developed EarthFest 2009 which celebrated the 36th anniversary of Earth Day at Pellissippi State Tech. Comm. College. Over 9,000 people attended the event which had 100 + exhibitors from the environmental community.

One-Day Computer Collection Events - One-day computer collection events were held in January with ten sponsors contributing to the success of the event. Approximately 3000 residents participated in the events with just over 212 tons of electronic materials collected. The material was recycled at Southeast Recycling, Johnson City, 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 Division, and the Safe Kids Coalition of the Greater Knox Area, collected over 708 mercury thermometers from City and County residents, containing a total of 1.5 pounds of mercury in 2009. New digital thermometers were given out for each used mercury thermometer that was turned in.

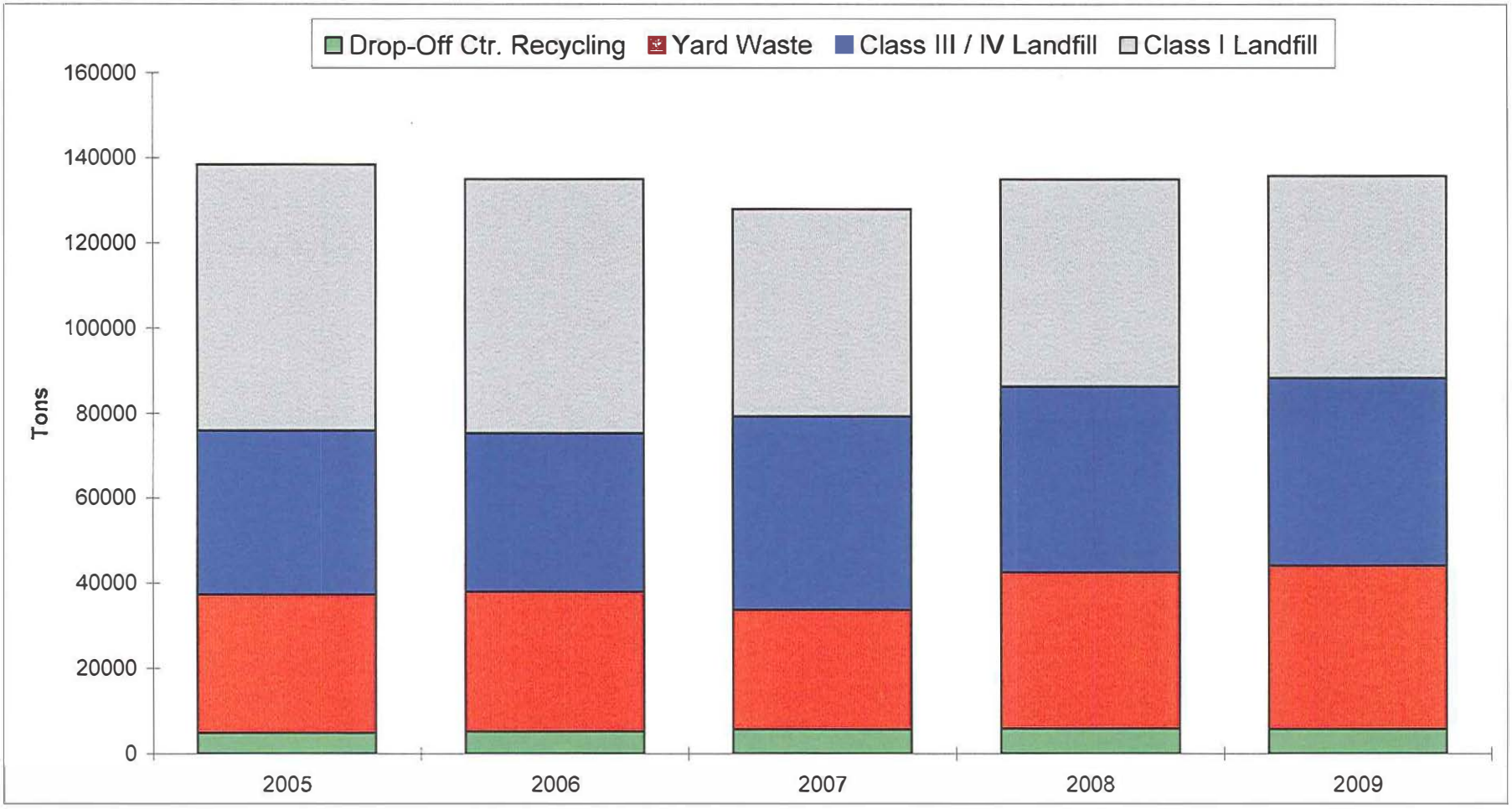
Unwanted Medicines Collection Event

The City Solid Waste Coordinated a unwanted medicines collection event in cooperation with the City of Knoxville Police Department, Knox County Solid Waste Office and Health Department and UT Student Pharmacy Association. Over 1,108.74 pounds of medications were collected at the during 2009 and properly disposed of by the KPD. Other collection events are in the planning stages for 2010.

Curbside Recycling – The City's contractor for the collection of residential solid waste, Waste Connections, began a subscription curbside recycling program in the city. The program started in November of 2004 and Waste Connections provided statistics on participation rates to the Solid Waste Office throughout 2009. City of Knoxville residents can call Waste Connections to request the service. Materials collected for recycling are cardboard, glass, aluminum, newspaper, and plastics. 603 tons was collected from 1300 residents signed up for the service in 2009. The City received a grant from a Model Cities Project from the American Beverage Association to conduct a study on the possibility of implementing a residential curbside program. A presentation by a contractor, DSM Environmental Services for Model Cities presented results from a study conducted in Knoxville to Council. The cost analysis to such a project will be incorporated into the budget planning process for approval by Council.

Other - In 2009, 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 2009 using our exhibit booth display at events including the Dogwood Arts' House and Garden Show and America Recycles Day Events.

Destination of Knoxville's Residential Waste Stream, 2005 - 2009



	2005	2006	2007	2008	2009
Diversion Rate	56.25%	56.26%	59.50%	61.74%	63.52%
Recycling Rate	27.61%	28.77%	25.83%	30.72%	32.50%

Annual Report 2009	Kroger 5003	Goodwill Magnolia &	Kroger 4818	Kroger 2217	Goodwill 225	Kroger 4440	Goodwill 341	Goodwill 820	Downtown 400	Food City 5941	Food City 2939	
Drop Off Centers	N. Broadway	Alice	Kingston Pk.	N. Broadway	Moody Av.	Western Av.	Parkvillage	Mettler	State St.	Kingston Pk.	Alcoa Hwy.	Totals
Aluminum	19610 lbs	5640 lbs	26750 lbs	15350 lbs	19400 lbs	13280 lbs	49690 lbs	7300 lbs	6080 lbs	3820 lbs	15160 lbs	91.04 tons
Steel	28700 lbs	8080 lbs	39430 lbs	19830 lbs	24820 lbs	17620 lbs	65010 lbs	11180 lbs	15820 lbs	1020 lbs	0 lbs	115.76 tons
Plastics	161310 lbs	52040 lbs	239060 lbs	133030 lbs	125420 lbs	107160 lbs	383070 lbs	75060 lbs	36140 lbs	7540 lbs	23210 lbs	671.52 tons
Clear Glass	64733 lbs	22594 lbs	151380 lbs	71267 lbs	62473 lbs	44460 lbs	180600 lbs	32660 lbs	44911 lbs	0 lbs	0 lbs	337.54 tons
Brown Glass	62773 lbs	21234 lbs	148010 lbs	72147 lbs	64793 lbs	44440 lbs	173220 lbs	31120 lbs	48251 lbs	0 lbs	0 lbs	332.99 tons
Green Glass	62053 lbs	20754 lbs	149170 lbs	68447 lbs	56813 lbs	42100 lbs	166960 lbs	27920 lbs	46531 lbs	0 lbs	0 lbs	320.37 tons
Newspaper	390700 lbs	141300 lbs	351300 lbs	207960 lbs	240038 lbs	229518 lbs	615150 lbs	178320 lbs	84840 lbs	20102 lbs	25106 lbs	1,242.17 tons
Mixed Paper	457590 lbs	149400 lbs	908890 lbs	415400 lbs	384880 lbs	291640 lbs	1123010 lbs	267270 lbs	162840 lbs	20560 lbs	48701 lbs	2,115.09 tons
Cardboard	132160 lbs	56640 lbs	232070 lbs	139510 lbs	127150 lbs	127150 lbs	82740 lbs	82740 lbs	68640 lbs	920 lbs	22560 lbs	536.14 tons
Drop Off Center Totals	669.81 tons	238.84 tons	1,123.03 tons	571.47 tons	552.89 tons	458.68 tons	1,419.73 tons	356.79 tons	257.03 tons	26.98 tons	67.37 tons	5,762.62 tons

KPD / Lorain St. Recycling	26.04 tons
Cardboard / Paper Downtown Collection	95.56 tons

Phone Books School Contest	92.80 tons

	Leaves	Brush	Total
Mulching Site	8,640.91 tons	30,776.90 tons	39,417.81 tons

	Scrap Metal	City Recycling Trailer	HHW REC.	HHW Divert.	Compacted Trash	Computers	Tires	Total
Solid Waste Transfer Station	477.43 tons	20.83 tons	20.83 tons	2.61 tons	4,427.40 tons	250.31 tons	102.30 tons	5,301.69 tons

	Household Trash	Misc. Trash	Total
Landfill Class I Trash/Garbage	46,930.81 tons	583.32 tons	47,514.13 tons

	Transfer Station	Construction	Codes	Total
Landfill Class III Construction Demolition	28,764.87 tons	4,079.25 tons	11,315.81 tons	44,159.93 tons

Total Waste Recycled and Mulched	46,266.50 tons	*Recycling*	32.50%
Total Waste Diverted, Class III & Recycling	90,429.04 tons	*Diversion*	63.52%
Total Waste Landfilled, Class I	51,041.53 tons	** Recycling / Total WS*	6.65%
Total Waste Stream	142,370.57 tons	* Yard Waste Not included w/ just residential trash	10.58%

APPENDIX G

NPDES Permit Program Inventory Map

(Attached separately)

The entire inventory map is not reproduced as part of the online version of the Year 14 Annual Report. The entire map is approximately 66 inches by 32 inches (covering an area of approximately 33 miles by 16 miles) at a scale of 1-inch equals one-half mile.

To view the entire map, please contact the Stormwater Engineering Division at (865) 215-2148.