THE CITY OF KNOXVILLE
TENNESSEE

NPDES Permit
Annual Report & Reapplication

CITY OF KNOXVILLE
BILL HASLAM, MAYOR

National Pollutant Discharge Elimination System
Stormwater Discharge Permit TNS068055
July 1, 2007 - June 30, 2008

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 31, 2008

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
2007 – 2008 Annual Report & Reapplication

Dear Mr. McAdoo:

The City of Knoxville is pleased to submit the second 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, 2007 through June 30, 2008. 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

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 31, 2008

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
2007 – 2008 Annual Report & Reapplication

Dear Ms. Harris:

The City of Knoxville is pleased to submit the second 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, 2007 through June 30, 2008. 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.

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Signature and Certification

NPDES STORMWATER PERMIT TNS068055
2007/2008 MUNICIPAL ANNUAL REPORT & REAPPLICATION

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
Mayor

12/30/08
Date

Stephen J. King, P.E.
Director of Public Works

12-30-08
Date

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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. The current NPDES Permit was effective July 1, 2004 and will expire on 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, 2007 through June 30, 2008. As specified in the permit, this report will serve as the City's reapplication for a new five-year permit to be effective on July 1, 2009. The proposed new and ongoing stormwater management programs for the new permit are included in Section 5 of this report. Therefore, the narrative report typically found in Section 5 has been replaced to simplify the reapplication report.

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 others. 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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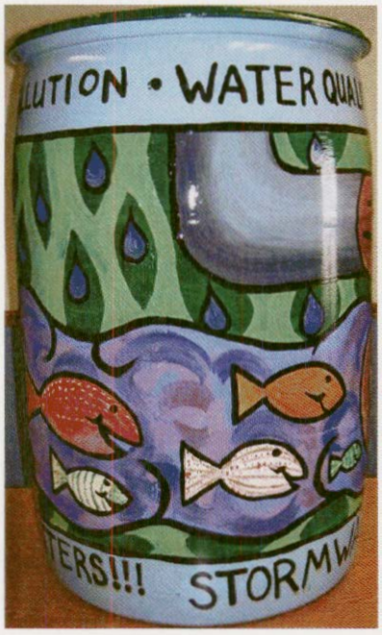
Engineering Department	(865) 215-2148	bjohnson@cityofknoxville.org
David Brace, Director		
Public Service Department & Solid Waste	(865) 215-2060	dbrace@cityofknoxville.org
Stephen J. King, P.E., Director		
Public Works Department	(865) 215-6100	sking@cityofknoxville.org

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 highlight some of the major accomplishments related to the SWMP that occurred during the fourth year of this permit term.

- In 2007, the City along with the Water Quality Forum partners developed the Rainy Day Brush-off Program. Local artists painted Twenty-six 55-gallon rain barrels as part of the event. This program was designed to bring awareness to water conservation and water quality. The event was a huge success. All of the rain barrels were auctioned off and the proceeds went to the Water Quality Forum to help promote more rain barrels for the public. Several workshops were held so residents could make a working rain barrel and take it home to install it.



- 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.

- A total of 5,709.03 tons of recyclables was collected at the City's eleven solid waste drop-off recycling centers in 2007. This number is level with recyclables from 2004-2005, up by 492 tons. This increase comes from the extended operation at the new Park Village Road. The City maintains updated information on the web at http://www.cityofknoxville.org/solidwaste/recycle.asp.

- Rain gardens were installed at two City Recreational Centers to help study the feasibility of infiltration BMPs in clay-dominated soils around Knoxville. The gardens solved a long-standing problem at both recreation centers while providing critical research that may be used for future design standards for BMPs on private development.

- 2007 marked the fifth year for the City's Adopt-A-Stream program. Partnering with Knox County and the Town of Farragut, the program has grown to include over thirty different volunteer groups that adopting over 15 miles of streams.

- The City sponsored year 2008 was the 19th year for the River Rescue, which is coordinated by Ijams Nature Center and the Water Quality Forum partners. The spring 2008 River Rescue attracted 1004 volunteers who collected 14 tons of trash and 35 tires from the shores of the Tennessee River.

- To help promote Low Impact Development and to evaluate the long-term potential for stormwater infiltration, the City allowed a local Credit Union to route all of their stormwater into three infiltration galleries with overflow to the curb and gutter. All of the infiltration areas were lined with filter cloth before backfilling with large riprap and closed with filter cloth on top to protect the void space. River stone and vegetative landscaping topped off the areas to bring the surface up to final grade. The BMPs are attractive, safe, and fully functional to date. Most people can't tell the difference between the infiltration galleries and typical landscaping. This type of BMP may prove to be an economical way to reduce runoff and pollution in our streams while recharging groundwater. Two of the finished infiltration galleries are shown below.

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	20 Outfalls repeated from year six	Yes	10	Each outfall tested at least four times this year
Field Screening Industrial Outfalls	Visits to Industrial outfalls	Yes	63	Continued retesting outfalls from Industrial areas (four times)
Total Field Screening Outfalls	High Parameter repeats + 30 to 40	Yes	228	All field data sheets available for inspection. Outfalls tested four times this year.
Full Suite Stormwater Analysis (one station per year)	One Station pr year	Yes	1 sample	Full Suite sample obtained at First 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	14,017 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	909/477	Complaints are investigated as received and resolved as solutions or resources are available
Stormwater Quality Requests for Service (Received / Resolved)	As Needed	Yes	367/252	Complaints are investigated as received and resolved as solutions or resources are available
Site Develop Workshops	Annually	Yes	126	Included Engineers, contractors, developers, & surveyors involved in land disturbing activities.
Stormwater GIS Field Investigations for Annexations	As Required	Yes	30	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	25,495 Miles	Daily for downtown streets. Frequency varies for other streets.
Litter Pick-up, Hand	As Needed	Yes	56,044 Bags	Routine Schedule
Catch Basin Cleaning and Repair	As Needed	Yes	8,207 Jobs	Per work order and requests
Ditching: Hand, Truck, & Track/Gradall	As Needed	Yes	13,821 Feet	Per work order and requests
Storm Drain Installation & Repair	As Needed	Yes	34 Jobs	Per work order and requests
Brush & Leaf Pick-up	Bi-Weekly	Yes	13,012 Loads	Bi-Weekly curb pick-up
Seed/Sod, ROW	As Needed	Yes	21 Jobs	Per work order and requests
Storm Drain Cleaning	As Needed	Yes	32,590 Feet	Per work order and requests
Grate Replacement	As Needed	Yes	69 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	287 Jobs	Creeks are inspected and cleaned on a routine schedule
Tree and Plant Planting	When Applicable	Yes	385 trees	Trees were planted by the City's Service Department
Total Waste Recycled	As Brought In	Yes	34,914 tons	5,466 tons of paper, metal, plastic, glass, etc. and over 33,085 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	14 tons of trash and 35 tires removed by 1004 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.	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 900 youths, 175 teachers & parents, and 100 volunteers participated.
Pooper Scoopers	As Needed or by volunteers	Yes	11,200	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	631	As Required
Final Inspections	As Required	Yes	177	As Required
Site Development Permits Reviewed	As Required	Yes	304	As Required
Right of Way Permits Issued	As Required	Yes	79	As Required
As-Built Certificications Reviewed	As Required	Yes	162	As Required

5.0 REAPPLICATION PROPOSAL
IMPLEMENTATION SCHEDULE AND NARRATIVE SUMMARY

As required by the City's current NPDES permit, the narrative section of this fourth annual report will serve as the reapplication proposal for the next five-year NPDES permit. If approved, the permit will become effective July 1, 2009. From this point on in this proposal, all references to permit years, timeframes, or schedules will assume July 1, 2009 as day one and the beginning of year one for the new permit cycle.

The reapplication proposal includes the implementation schedules for each of the five major programs listed below. The five-implementation schedules are included on the following pages. The narrative summary for each of the individual tasks listed in the implementation schedules begins on page 14 after the schedules. Where ever appropriate, this proposal will update the original SWMP as described in the program element schedules listed in Part II of the first permit application and Part III of the current permit. Some program tasks are proposed that were not included in the previous permits. These tasks are proposed to help update the overall NPDES program and to better meet our goals of protecting water quality. Other program tasks have been replaced or deleted because they were completed, ineffective or outdated.

The proposed programs for the new permit include:

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).

Each of the above programs are further divided into separate program elements and related tasks that correspond to the requirements listed in 40 CFR 122.26(d)(2)(iv) and will replace the Implementation Schedules listed in Part IV of the current Permit. Each specific task is briefly discussed in accordance with the reporting guidelines outlined in Part VI of the current NPDES Permit. All changes for the new permit term will be effective according to the agreed schedules approved by TDEC after the new permit is issued.

SCHEDULE FOR DEVELOPMENT AND IMPLEMENTATION OF SWMP ELEMENTS AND PROGRAMS

PROGRAM OF STRUCTURAL AND SOURCE CONTROLS FOR REDUCING POLLUTANTS TO THE MUNICIPAL SEPARATE STORM SEWER SYSTEM 122.26(d)(2)(iv)(A)

The Residential and Commercial Program (RC)

Code	Activity	Schedule
RC-1	***Maintenance Activities for Structural Controls***	
	- Continue existing maintenance programs from Part 2 application, pp. 5-5 thru 5-8.	Ongoing
	- Continue improved stream restoration and channel maintenance program.	Ongoing
	- Coordinate program to reduce floating/gross pollutants from entering the river.	Ongoing
	- Require Standard Maintenance Covenants for on-site facilities and Require routine / major maintenance of BMP facilities..	Ongoing
RC-2	***Planning for New Development***	
	- Review current Stormwater & Streets Ordinance to evaluate possible improvements to existing water quality and quantity requirements for new development. Investigate feasibility and standards for reducing runoff via infiltration and low impact design (LID).	Complete within 24 months
	- Revise the Stormwater & Streets Ordinance, Update BMP manual, and Implement any new LID provisions or related mitigation programs.	Full implementation after 42 months
	- Require "No Dumping" message cast into all new curb irons and solid stormwater catch basin covers installed on new developments.	Ongoing
	- Expand SWMM model to include water quality parameters on major watersheds. See MN-4	Complete within 60 months
	- Review, update, and maintain guidance criteria for BMP's on City web page.	Annually
RC-3	***Maintenance for Public Streets, Roads, and Highways***	
	- Continue street maintenance activities outlined in Part 2 application, p. 5-8.	Ongoing
	- Maintain improved deicing program and study alternatives and improvements.	Ongoing
RC-4	***Evaluation of Flood Management Projects***	
	- Continue to evaluate regional BMP facilities for water quality retrofit.	Ongoing
	- Maintain existing GIS inventory of on-site BMP facilities.	Ongoing
RC-5	***Monitoring of Solid Waste Facilities***	
	- See City's management program for industrial areas.	See Code IN-3
RC-6	***Management of Pesticides, Herbicides, and Fertilizer***	
	- Continue existing public education program, including City staff.	Ongoing
	- Reevaluate effect of fertilizers as part of the City's ongoing monitoring program.	60 Months
RC-7	***Annual Reporting***	
	- Annual reporting to TDEC concerning the progress of this program.	Within 6 Months after end of each year

SCHEDULE FOR DEVELOPMENT AND IMPLEMENTATION OF SWMP ELEMENTS AND PROGRAMS

PROGRAM TO DETECT AND REMOVE ILLICIT AND IMPROPER DISCHARGES TO THE MUNICIPAL STORM SEWER SYSTEM 122.26(d)(2)(iv)(B)

The Illicit Discharges and Improper Disposal Program (ILL)

Code	Activity	Schedule
ILL-1	***Ordinances***	
	- Evaluate the prohibitions and exemptions of non-stormwater discharges in the existing Stormwater & Street Ordinance. Maintain authority for $5,000 penalty.	Complete within 24 months
	- Implement any new revisions to the Stormwater & Street Ordinance.	Full implementation after 42 months
ILL-2	***Field Screening***	
	- Investigate at least 150 outfalls four times per year and test any dry weather flow.	Annually
	- Perform follow-up analysis at all high risk field screening sites from previous year.	Annually
ILL-3	***Investigation of Storm Drain System***	
	- Implement procedures for mapping, field surveys and upstream source identification.	Ongoing
	- Evaluate and update enforcement procedures, policies, monitoring and inspections.	Complete within 42 months
	- Inspect stormdrain system and update features on GIS.	Ongoing
ILL-4	***Spill Response Program***	
	- Maintain Spill Response Program and Coordinate with Knoxville Emergency Response Team (KERT), TDEC, and HAZMAT.	Ongoing
ILL-5	***Reporting of Illicit Discharges and Public Education Program***	
	- Maintain and monitor the "Water Quality Hotline" for public reporting.	Ongoing
	- Post and maintain health hazard warning signs on 303(d) listed creeks.	Revise Signage within 24 Months
	- Maintain public education program.	Ongoing
ILL-6	***Used Oil & Toxic Materials Program***	
	- Continue coordination of recycling program (managed by Solid Waste Division (SWD)).	Ongoing
	- Maintain and operate household hazardous waste facility (managed by SWD).	Ongoing
ILL-7	***Annual Reporting***	
	- Annual reporting to TDEC concerning the progress of this program.	Within 6 Months after end of each year

SCHEDULE FOR DEVELOPMENT AND IMPLEMENTATION OF SWMP ELEMENTS AND PROGRAMS

PROGRAM TO MONITOR AND CONTROL RUNOFF FROM TSD AND INDUSTRIAL FACILITIES SUBJECT TO SARA III, SECTION 313 122.26(d)(2)(iv)(C)

The Industrial and Related Facilities Program (IN)

Code	Activity	Schedule
IN-1	***Ordinances***	
	- Evaluate revisions to the prohibitions and exemptions of non-stormwater discharges in the existing Stormwater & Street Ordinance.	Complete within 24 months
	- Implement any new revisions to the Stormwater & Street Ordinance.	Full implementation after 42 months
IN-2	***Inspection Element***	
	- Continue inspection program for non-permitted commercial facilities (i.e. restaurants, service stations, grocery stores, car lots, etc.)	Immediately
	- Identify potential industrial discharges through Illicit Connection and Improper Disposal Program. (Both SW and non-SW discharges)	Ongoing
	- Collect and analyze NOIs from Industrial Permit applicants.	Ongoing
	- Review and update inspection program as part of Pollution Prevention Plans for Municipal Industrial Facilities (MIFs). Conduct annual inspections at MIFs.	Full implementation after 12 months
IN-3	***Monitoring Element***	
	- Collect monitoring data from permitted industrial stormwater dischargers and/or from TDEC. Assess impacts to the stormdrain system.	Ongoing
	- Collect eight (8) wet-weather samples from selected commercial/industrial facility locations. Tests will include the 13 routine parameters plus oil/grease.	Annually
	- 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.	Ongoing
	- Maintain adequate legal authority to require monitoring and reports from TSDs and Industrial Facilities subject to SARA Title III, Section 313. Request monitoring/reports as necessary.	Immediately
	- Collect four (4) wet-weather samples from selected MIFs.	Annually
IN-4	***Annual Reporting***	
	- Annual reporting to TDEC concerning the progress of this program.	Within 6 Months after end of each year

SCHEDULE FOR DEVELOPMENT AND IMPLEMENTATION OF SWMP ELEMENTS AND PROGRAMS

PROGRAM TO IMPLEMENT AND MAINTAIN BMP PLANS TO REDUCE CONSTRUCTION SITE RUNOFF TO THE MUNICIPAL STORM SEWER 122.26(d)(2)(iv)(D)

The Construction Site Runoff Program (CS)

Code	Activity	Schedule
CS-1	***Site Planning***	
	- Require construction sites greater than 10,000 sq.ft. to submit Erosion and Sediment (E&S) Control Plans.	Immediately
	- Require site plan submittals per the City of Knoxville BMP manual or equivalent.	Immediately
	- Review & update minimum criteria for plan review and inspection checklists.	Complete within 12 months
	- Require Preconstruction Assistance Meetings with developer/contractors for any project that requires a performance bond.	Immediately
CS-2	***BMP Requirements***	
	- Require Construction BMPs from the City of Knoxville BMP manual or equivalent.	Immediately
	- Develop improvements for the BMP Manual and Stormwater Ordinance to insure that all minimum construction BMP requirements are equivalent or more protective than the State of Tennessee Construction General Permit.	Complete within 24 months
	- Revise the Stormwater & Streets Ordinance, Update BMP manual, and implement any new provisions or programs.	Implement 24 months or 6 months after CGP
	- Require construction site "good housekeeping" practices.	Immediately
CS-3	***Inspection / Enforcement***	
	- Maintain expanded inspections program including smaller construction sites (single family).	Immediately
	- Implement routine site inspections on commercial and subdivision developments (e.g. rough grading, E&S control installation, final grading, and final stabilization.)	Immediately
	- Require all post-construction Development Certifications from licensed design professionals before bond release to insure the stormwater facilities are built as planned.	Immediately
	- Evaluate and update enforcement procedures, policies, and follow-up monitoring and inspections.	Full implementation after 42 months
CS-4	***Training Programs***	
	- Sponsor Educational Seminar(s) for City staff, developers, engineers, and contractors.	Annually
	- Provide training for Stormwater Division Engineers and Inspectors.	Annually
CS-5	***Annual Reporting***	
	- Annual reporting to TDEC concerning the progress of this program.	Within 6 Months after end of each year

SCHEDULE FOR DEVELOPMENT AND IMPLEMENTATION OF SWMP ELEMENTS AND PROGRAMS

PROGRAM TO COLLECT QUANTITATIVE DATA TO DETERMINE THE IMPACTS OF URBAN STORMWATER ON THE NATURAL ENVIRONMENT 122.26(d)(2)(iii)(A)

The Comprehensive Monitoring Programs (MN)

Code	Activity	Schedule
MN-1	***Seasonal Storm Event Monitoring***	
	- Update the Standard Operating Procedures (SOP) for the Seasonal Sampling program.	Within 12 months
	- Maintain at least five (5) automatic monitoring stations at locations approved by TDEC.	Immediately
	- Collect twenty (20) flow weighted composite samples (one/quarter/station). Test each sample for thirteen (13) routine parameters: pH, BOD, COD, Ammonia Nitrogen, Nitrate-Nitrite, Organic Nitrogen, Ortho Phosphate, Total Phoshorus, Kjeldahl Nitrogen (TKN), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Total Recoverable Lead, Total Recoverable Zinc. Laboratory analysis will be used in accordance with 40 CFR Part 136 for all parameters except pH which will be tested during sample collection.	Annually
	- Collect five (5) full-suite grab samples (One sample/station/permit term). Tests will include the 13 routine parameters listed above plus: oil & grease, and the pollutants listed in tables II & III of 40CFR Part 122 Appendix D (Volatiles, Pesticides, Acids, Base/Neutrals, Toxic Metals, Cyanide, and Total Phenol).	One Station per year
	- Analyze results from Ongoing Monitoring program.	Report in Year 5
MN-2	***Dry Weather Screening & Industrial/Commercial Site Monitoring***	
	- Dry Weather Screening as described in ILL-2.	Annually
	- Implement Commercial/Industrial Monitoring Programs as described in IN-3	Immediately
MN-3	***Ambient, Biological, & Bacteriological Monitoring***	
	- Implement ongoing Ambient sampling program	Quarterly
	- Collect five (5) Wet-weather bacteria samples (fecal coliform and Ecoli). One grab sample/station/year.	Annually
	- Collect five (20) Dry-weather bacteria samples (fecal coliform and Ecoli). One grab sample/station/quarter.	Annually
	- Continue the Biological Monitoring program, including IBI, RBP III and stream surveys.	Ongoing
MN-4	***Related Programs***	
	- Develop and maintain a water quality model to evaluate pollutant loading and transport processes. See RC-2	Within 60 months
	- Implement Training Program for Staff and/or Volunteers.	Ongoing
MN-5	***Annual and Public Reporting***	
	- Annual reporting to TDEC concerning the progress of this program.	Within 6 Months after end of each year

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.
Schedule: 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 division. 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 can 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. The City owns and maintains a fleet that includes heavy trucks, vacuums, backhoes, sewer truck, and other specialized equipment. 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.
Schedule: Ongoing

Stream restoration and channel maintenance have improved since the first permit cycle. The original program included stream bank stabilization projects to reduce erosion and sediment and a creek restoration crew to remove litter, debris, and flow blockages. After a few years of intensive work to remove vast amounts of trash and debris that had built up over many years, the City has now focused on maintaining the system and enforcement to be sure the large trash dumps do not recur.

In the current permit cycle, the City improved this program by contracting with the Fort Loudon Lake Association (FLLA) for removing debris and blockages on the major urban creeks. The summary report for the FLLA's efforts are 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. By keeping these blockages removed as they are identified, erosion and stream degradation are minimized. This contract is expected to be renewed throughout the new permit term. With the addition of the FLLA's work in the creeks, the Public Service Department can now focus their attention on maintaining the stormdrain system to prevent problems in the creek. Obviously, the PSD will still respond on a work order basis for work in the creek when needed.

Many bank stabilization and stream restoration projects have been completed since the City's NPDES permit program began in 1996. The City will continue to focus on stream restoration projects where possible to address the most common impairments in our urban creeks, including sediment, hydromodification, and habitat alteration. Although these projects will certainly vary in scope, biostabilization 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 any work begins. This will be an ongoing program in the future permit term.

SWMP Task: Coordinate program to reduce floating/gross pollutants from entering the river.
Schedule: Ongoing

Since the summer of 1999, the City has coordinated with TVA, UTK, TDEC, USACOE, the Isaac Walton League (IWL), Keep America Beautiful 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 the IWL collect litter and debris along the riverfront in the downtown area. The City will continue to fund replacement of the skimmers (left) as long as they remain effective. The City has contracted with the IWL 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 IWL, the booms have successfully prevented tons of floating material that

would otherwise have been discharged from the creeks into the river. All of the trash skimmers have been purchased with penalty funds collected from polluters.

The City proposes to continue this program in the next permit cycle. The Fort Loudon Lake Association has taken over the contract duties for the IWL and is expected to continue this program as long as it is beneficial. Due to the age of the skimmers, the City will likely replace major portions in the next permit cycle.

SWMP Task: Require Standard Maintenance Covenants for On-site Facilities and Require routine/major maintenance of BMP facilities. Schedule: Ongoing

This is on ongoing program and will be continued in the new permit cycle. Since 1997, either permanent maintenance agreements 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 was replaced with a "Covenant", which does not require the Mayor's signature or council approval. The end result for water quality protection and flood control is the same. Before a site development permit is issued, the Stormwater and Street Ordinance 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.

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.

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.

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 & Street Ordinance to evaluate possible improvements to existing water quality and quantity requirements for new development. Investigate feasibility and standards for reducing runoff via infiltration and low impact design.

Schedule: Within 24 Months

The City of Knoxville originally passed the first Stormwater and Street Ordinance in 1997 and last revised it in 2005 as required by the current NPDES permit. After discussions with TDEC and EPA regarding the future focus and direction of the stormwater programs, the City proposes to use the first 24 months of the new permit to investigate the feasibility of including LID standards and infiltration BMPs as part of the new ordinance requirements. The City has already started full-scale studies on various infiltration techniques. Three recreational centers were retrofitted in the spring of 2008 to help study infiltration potential. Another test was created out of necessity when a combined stormwater and sanitary sewer was identified. The stormwater system was disconnected and routed to a new infiltration area with an overflow to the existing storm drain. A level logger has been installed to track infiltration rates after rainfall events. The City has applied for a grant with TDEC to design and build other BMPs that will help develop standards for future LID and infiltration BMPs. Two years should be sufficient time to demonstrate effectiveness or failure of these BMPs and to develop standards.

The current Stormwater and Street ordinance may be accessed on the City's website 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;

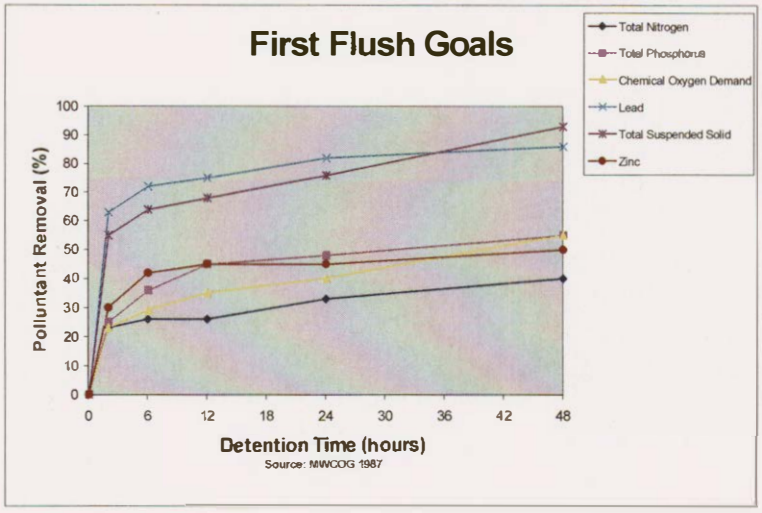
(4) Any site development which contains one-half (1/2) acre or more of additional impervious area.

(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.

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: Revise the Stormwater and Street Ordinance, Update BMP Manual, and Implement any new LID provisions or related mitigation programs.

Schedule: Full Implementation after 42 Months

After evaluating any feasible new LID provisions and analyzing any current deficiencies in the Stormwater and Street Ordinance, the City will develop revisions to the ordinance and BMP Manual. Education and training will likely be needed for plans review staff, the development community, and City Council before the new provisions can be incorporated into the regulations and implemented. The City proposes to fully implement all new provisions within 42 months in the new permit cycle.

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

This is an ongoing requirement that will remain in as a standard throughout the new permit term. 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. 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: Expand SWMM model to include water quality parameters on major watersheds. See MN-4. Schedule: Complete within 60 months

In year three, 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 pilot project focused on flooding, it created 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 is to help identify beneficial locations for regional detention. Three locations of regional detention 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.

During the new permit term, the City proposes to expand the SWMM model to include water quality parameters for each of the major watersheds within the city limits. Any watershed with more than fifty percent of the drainage area contained within the city limits will be included in the model. Additional watersheds will be added if the city limits expand to include more than fifty percent of the area in that watershed.

SWMP Task: Review, update, and maintain guidance criteria for BMPs on City web page. Schedule: Annually

The City has successfully completed a comprehensive BMP manual during the first permit term and published 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 City proposes to review and update the BMP manual at least annually and post the changes to the web.

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

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

Street cleaning is performed daily for the downtown streets and less frequently for all other streets throughout the City. Large Vac-All trucks are used in most service areas while smaller Tymco 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: Maintain improved deicing program and study alternatives and improvements.
Schedule: Ongoing

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 Division 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 as alternatives become available.

RC-4 Evaluation of Flood Management Projects

SWMP Task: Continue to evaluate regional BMP facilities for water quality retrofit.
Schedule: 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 regional pond at Northwest Crossing on Clinton Highway serves the large commercial shopping centers. 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.

The large regional pond (Acker Place) in the Fourth Creek Watershed was built before the first NPDES permit and therefore was only designed for quantity control. In previous reports, the water quality retrofits were detailed along with the restoration of Fourth Creek directly downstream of the pond. During year four of the current permit, the City contracted with a private developer to retrofit the pond once again with significant water quality benefits. The online pond had previously contained a section of channel that had been declassified as a blue line stream. The current retrofit is an attempt to improve the channel and possibly restore the original stream. A weir plate at the exit has been removed to allow full connectivity to the blue line downstream. The channel in the pond has been relocated to create natural meanders and to fully stabilize the eroding banks. Native vegetation is being added to complete the project. The City consulted with TDEC before initiating the project. The City will continue to monitor the pond improvements and detail the results in future reports.

All new ponds that are built for the City will include water quality controls. If the City obtains any old or existing regional ponds in the new permit term, those ponds will be evaluated for water quality retrofit.

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

The City has dedicated one stormwater technician position to mapping and maintenance inspections. Interns and volunteers have also assisted with this task when available. 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. A GIS analyst inspects newly annexed areas in the field to verify the accuracy of the GIS stormwater features and edits the stormwater layers as necessary.

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: Continue existing public education program, including City staff.

Schedule: 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.

These important programs will continue throughout the new permit term.

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

Schedule: 60 Months

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.

The City proposes to report each year's monitoring results in the corresponding annual

report. The fifth year report will include a summary of Event Mean Concentration and Pollutant Loading for the entire permit term. That fifth year annual report will include any analysis of the impact of pesticides, fertilizers, and herbicides.

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 existing Stormwater & Street Ordinance. Maintain authority for $5,000 penalties.

Schedule: Complete within 24 months

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. Since the first ordinance was passed in 1997, it has been revised several times with the latest revision in 2005. The revised ordinance is available on the Internet at www.cityofknoxville.org/engineering/stormwater.

The current 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 the new 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 the first 24 months of the new permit, the City will reevaluate these current exemptions, which are allowed in the CFR and determine any necessary changes that should be made in the revised ordinance.

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

Schedule: Full Implementation within 42 months

Several programs require a reevaluation of the Stormwater and Street Ordinance. After all revisions are determined within the first 24 months of the new permit, the City will begin the process to revise the ordinance with all of the new provisions. The ordinance will be revised and implemented no later than 42 months after the beginning of the new permit.

ILL-2 Field Screening

SWMP Task: Investigate at least 150 outfalls four times per year and test any dry weather flow. Schedule: Annually

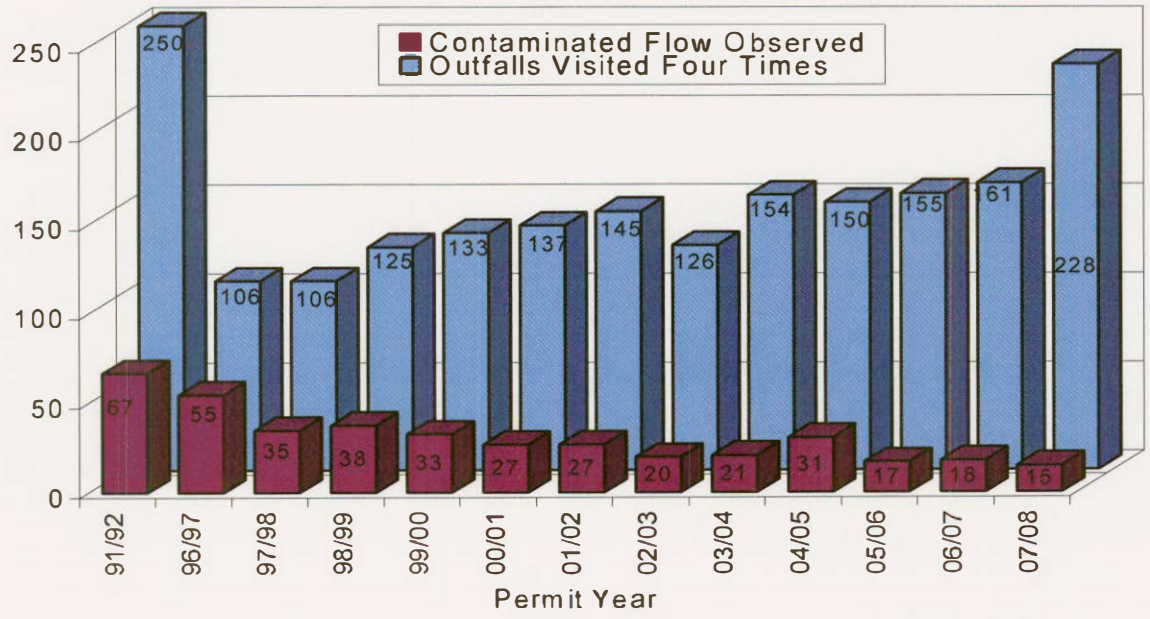
To insure that all outfalls are eventually tested each permit cycle, the City will continue to monitor a minimum of 150 outfalls each year throughout the new permit term. Last year the City visited 228 outfalls four times each and one additional outfall was visited twice. The monitored outfalls consisted of the previous year's 18 high-risk outfall sites plus 210 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 new permit cycle.

SWMP Task: Perform follow-up analysis at all high-risk screening sites. Schedule: Annually

Number of Dry Weather Screening Sites



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 in the past, the City will continue to annually retest all sites that have high parameters or signs of illegal dumping until the outfall is clean during all four annual visits. 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, 7417 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.

ILL-3 Investigation of the Storm Drain System

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

The procedures for mapping, field surveys and upstream source identification were developed and included in the Part II Application section 5.3.5. These procedures were updated and included for TDEC's review in the monitoring section 6.1.3 of the first annual report in 1997. These updated procedures were adopted as policy and successfully implemented during the first permit term. 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 these procedures. Any future updates will be included in the appropriate annual report.

SWMP Task: Evaluate and update enforcement procedures, policies, monitoring and inspections. Schedule: Complete within 42 Months

The schedule for this task appropriately coincides 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 the first 42 months of the new permit term, the City will reevaluate and update the enforcement procedures, policies, monitoring and inspections to be sure they remain effective in the future.

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 usually only issued after the NOV expires so the violation and remedies may be fully evaluated.

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

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

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

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

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

SWMP Task: Inspect stormdrain system and update features on GIS. Schedule: 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. That same analyst personally inspects all new annexations to insure that all existing stormdrain features are added to the system shortly after the parcel becomes part of the city. 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.

During the first permit term, the GIS analyst and two engineering interns began to systematically inspect the entire stormdrain system by grid to find and correct the parts of the stormwater GIS layer that may be in error. Now that much of this work has been verified and the procedures for maintaining accurate data are in place, the grid-by-grid investigations will be conducted as needed or as part of specific updates for areas of significant development. Because maintaining the integrity of the GIS via field verification is extremely time-consuming, it is reasonable to believe this will be an ongoing task. One Stormwater Technician position is dedicated to inspections for mapping accuracy and maintenance needs.

ILL-4 Spill Response Program

SWMP Task: Maintain Spill Response Program and Coordinate with Knoxville Emergency Response Team (KERT), TDEC, and HAZMAT. Schedule: Ongoing

The City of Knoxville Stormwater Section of the Engineering Department will continue to coordinate with KERT, TDEC, and HAZMAT during emergency spills and illicit discharges. Each agency has specific roles to play during an emergency event. When discharges enter the MS4, the City's Stormwater 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 manage remediation efforts for 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 Fire Department and Stormwater management staff contained the small releases

from accidents and illegal dumping. 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 and the responsible party for remediation.

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.

Schedule: Ongoing

The Water Quality Hotline for public reporting of water quality concerns was established as planned during year one of the first permit term. This successful program will continue throughout the new permit term. The hotline is a local Greater Knoxville Area number listed in the blue pages each year as follows:

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

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

The Water Quality Hotline is a dedicated phone line attached to a phone in the Stormwater Section of the Engineering Department. Employees in the section also have the hotline linked as a second line on their individual office phones so anyone may answer the phone during the day. After hours and on weekends, the routine messages are recorded and emergencies are referred to 911. The Fire Department Dispatcher will contact the on-call Stormwater Supervisor for discharges or spills that need immediate response after hours. 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: Post and maintain health hazard warning signs on 303(d) listed creeks.
Schedule: Revise Signage within 24 months

The current permit included TMDL implementation tasks including the following requirement: "...to post and maintain advisory signs at streams that are designated as unsafe for recreation." As required by the TMDL implementation plan, the signs were redesigned to include the Water Quality Hotline for contact and they were installed at the appropriate locations.

The City proposes to revise the signage within the first 24 months of the next permit term and submit the TDEC Environmental Assistance Center in Knoxville for approval. After approval, the City will begin fabricating and installing the new signs at locations approved by TDEC and at strategic locations for maximum public exposure.

SWMP Task: Maintain public education program. Schedule: Ongoing

Rainy Day Brush-off Initiative

The City partnered with the Water Quality Forum and sponsored the Rainy Day Brush-off Initiative. This initiative was intended to bring an environmental awareness about water conservation and water quality. Local artists, along with high school and middle school students, and Knox County and City employee's painted 30 fifty-five gallon plastic barrels that were put on display throughout the City and Knox County. At each barrel location, the bio of the artists and the benefits of using a rain barrel were put on display. The barrels were later sold on e-Bay to help support the Water Quality Forum's future initiatives. You can learn more about the initiative by going to www.waterqualityforum.org under Program and Events.

River Rescue

The year 2008 was the 19th year for the River Rescue. The spring 2008 River Rescue attracted 1004 volunteers who collected 14 tons of trash and 35 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

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.

The message "DUMP NO WASTE, DRAINS TO STREAM" was stenciled on over ten thousand storm drains earlier in the first permit term. In the last few years, the City replaced the stenciling program with plastic curb markers. These brightly colored plastic disks are affixed to the curb irons and carry the message "Dump no Wastes, Drains to Stream". Although the curb markers are a temporary retrofit for the existing storm drains, they are more economical and environmentally friendly since they do not wear off as quickly as the painted stencils. When the disks were first introduced, volunteers and City staff placed several thousands of markers on storm drains in the city. Currently, several hundred of the informational disks are purchased and distributed to volunteers each year to attach to curb irons. A local company recently revised the disks to include the Water Quality Hotline phone number and some Spanish text. Self-adhesive backing also helps volunteers place the disks quickly.

In January 2000, a permanent version of this educational program was initiated. The City has adopted a new development standard for all new curb irons and solid stormwater manhole covers (see task in RC-2). 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 offer long-term educational benefits as citizens become familiar with the message and it's meaning.

Water Quality Forum

The WQF is a consortium of agencies, organizations, academic institutions, public utilities, and interested citizens working to protect and restore the waterways in Knox and the eight surrounding counties. It was initiated by the City of Knoxville in 1990. Currently it has twelve dues paying Partners; the City, TVA, Ijams Nature Center, Knox County, UTK-WRRC, the Town of Farragut, KGIS, the Knox County Soil Conservation District, KUB, the Sevier County Water Board, The League of Women Voters, 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.

Adopt-a-Watershed

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

- Characterizing the school's watershed using, at minimum, two AAW characterization tools (e.g., watershed inventory, watershed mapping, windshield survey, stream walk).

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

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

Adopt-A-Stream

The City of Knoxville, in conjunction with Knox County and The Town of Farragut is in the sixth year of administering the Adopt-A-Stream program. In the past fiscal year we have trained 5 Adopters and ten volunteer coordinators in the AAS program. They have performed over 8 creek clean-ups and other evaluation and education programs on their section of creek. The City has provided the supervision and training in addition to gloves, trash bags, pitchforks, wheelbarrows, waders, and other tools for these activities.

Public Displays And Presentations

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, City's Annual Site Development Seminar, and Earth Day Celebration. Various environmental presentations were also made to citizens through groups such as the University of Tennessee, Several High & Middle Schools, and Neff Corporation.

WaterFest

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

City Employee Training

The City purchased a stormwater pollution prevention video from Excal Visual to train City employees. The eighteen-minute long video outlines BMPs for stormwater pollution prevention and has been shown to two hundred & sixty four City employees in six different departments. To learn more about the video, go to www.excalvisual.com.

ILL-6 Used Oil & Toxic Materials Program

SWMP Task: Continue coordination of Recycling Program. Schedule: 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 throughout the next permit term.

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

The City continues to operate the Household Hazardous Waste (HHW) Collection Center, which first opened on April 22, 1997. Due to the investment and success of this facility, the City proposes to continue this facility throughout the new permit term.

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. Some limited amounts of latex paint are reconditioned at the facility and used by the City in its facility services operation. 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 facility 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 revisions to the prohibitions and exemptions of non-stormwater discharges in the existing Stormwater & Street Ordinance. Schedule: Complete within 24 months

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. Since the first ordinance was passed in 1997, it has been revised several times with the latest revision in 2005. The revised ordinance is available on the Internet at www.cityofknoxville.org/engineering/stormwater.

The current 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 the new 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 the first 24 months of the new permit, the City will reevaluate these current exemptions, which are allowed in the CFR and determine any necessary changes that should be made in the revised ordinance.

SWMP Task: Implement any new revisions to the Stormwater and Street ordinance.
Schedule: Full Implementation within 42 months

Several programs require a reevaluation of the Stormwater and Street Ordinance. After all revisions are determined within the first 24 months of the new permit, the City will begin the process to revise the ordinance with all of the new provisions. The ordinance will be revised and implemented no later than 42 months after the beginning of the new permit.

IN-2 Inspection Element

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

Over the course of the first permit term, 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 permit term, the City added a new Stormwater Technician to perform additional education and inspections for industry and certain commercial areas. The new technician started inspections on sites that have a Special Pollution Abatement Permit (SPAP). A complete list of the 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 SPAPs, the City selects for inspection some existing sites that were built before the SPAP program was implemented. These sites are targeted for education rather than enforcement to bring the sites into compliance using proper BMPs from the City's manual. Other commercial site inspections are performed in direct response to specific complaints from citizens or tips from the water quality hotline. The City decides 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 proposed ongoing 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: Identify potential industrial discharges through Illicit Connection and Improper Disposal Program. (Both stormwater & non-stormwater discharges). Schedule: 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: Collect and analyze NOIs from Industrial Permit applicants. Schedule: 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 will 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: Review and update inspection program as part of Pollution Prevention Plans for Municipal Industrial Facilities. Conduct annual inspections at MIFs.
Schedule: Full Implementation after 12 Months.

During the first permit term, the City developed an inspection and pollution prevention program for municipal industrial facilities. This program will be reviewed and updated in the first year of the new permit and continued. Inspections will still occur each year of the new permit.

Currently only four 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.

Each facility is currently evaluated and inspected regularly by Engineering personnel and will continue to be inspected at least annually in the future. Since the bus terminal is owned by the City but managed by KAT, they developed their own PPP, which was submitted in the first annual report in 1997. A new KAT facility is under construction now. Once completed, their PPP will be updated to include both facilities and reported at the following annual report. The new facility will be LEED certified and include stormwater quality treatment devices for the runoff.

The inspection and monitoring program has been productive at all of the MIFs in the past. Structural and management BMPs have been installed to control pollution and improve the runoff from each facility. All of these improvements were reported as they occurred. The SWMF is currently being retrofitted with structural controls to reduce the solids, sediment, and bacteria in the runoff from the paved areas. These upgrades will be reported in year five after complete.

IN-3 Monitoring Element

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

This program will be continued throughout the new permit term.

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.
Schedule: Ongoing

During the current permit term, the City developed a program to sample commercial 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. This program will continue in the next permit.

The samples from the hotspot land uses are analyzed for a wide range of pollutants. The exact set of parameters vary from one land use to the other due to the expected pollutants from particular land uses. 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 & Street 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 & Street ordinance is updated throughout the permit term.

SWMP Task: Collect eight (8) wet-weather samples from selected commercial/industrial facility locations. Tests will include the 13 routine parameters plus oil/grease. Schedule: Annually

Each year in the new permit term, the City proposes to collect a total of eight samples from sites identified as hotspots. These sites will typically include land uses that are identified in the City's Special Pollution Abatement Permit program. During this permit term, the City has sampled runoff from car lots and restaurants. Other sites may include large shopping center parking lots, car washes, grocery stores, gas stations, etc. throughout the new permit cycle. This data is instrumental in identifying sources of pollution and adequate BMPs to mitigate the runoff.

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

The Stormwater & Street 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 & Street 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: Collect four (4) wet-weather samples from selected MIFs. Schedule: Annually

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. In addition to these four facilities, the new KAT bus facility over James White Parkway may also be sampled after it is completed.

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.

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: Require construction sites greater than 10,000 sq. ft. to submit Erosion and Sediment (E&S) Control Plans. Schedule: Immediately

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 during the new permit term.

SWMP Task: Require Site Plans Submittals per the City of Knoxville BMP Manual or equivalent. Schedule: Immediately

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 throughout the new permit.

SWMP Task: Review and update minimum criteria for plan review and checklists.
Schedule: Complete within 12 months

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. During the first year of the new permit, the City proposes to make any necessary updates.

SWMP Task: Require Preconstruction Assistance Meetings with Developers/Contractors for any project that requires a performance bond. Schedule: Immediately

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 Checklist,
- The Stormwater & Street 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,
- 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 new 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 continued throughout the permit term.

CS-2 BMP Requirements

SWMP Task: Require Construction BMPs from the City BMP manual or equivalent.
Schedule: Immediately

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 proposes to maintain the requirement for compliance with the City's BMP manual or an equivalent BMP throughout the new permit.

SWMP Task: Develop improvements for the BMP Manual and Stormwater Ordinance to insure that all minimum construction BMP requirements are equivalent or more protective than the State of Tennessee Construction General Permit. Schedule: Complete within 24 months

The City of Knoxville's construction regulations and the State of Tennessee's construction regulations have been evolving separately for many years. During the current permit term, the Phase 2 NPDES MS4s began to develop their programs, which largely depend on the State's Construction General Permit (CGP) requirements. In an effort to reduce confusion in the development community and to prepare for the potential of becoming a Local Qualified Program, The City proposes to study our current regulations and develop improvements for the BMP Manual and the Stormwater and Street Ordinance to insure that all minimum construction BMP requirements are either equivalent or more protective than the State's CGP.

SWMP Task: Revise Ordinance, Update BMP Manual, and Implement new provisions.
Schedule: Full Implementation 24 Months or 6 Months after new CGP

After evaluating and analyzing any necessary changes for the Stormwater and Street Ordinance and BMP Manual to insure consistency with the State's CGP, the City will develop revisions to the ordinance and BMP Manual. Education and training will likely be needed for plans review staff, the development community, and City Council before the new provisions can be incorporated into the regulations and implemented. The City proposes to fully implement all new provisions within 24 months in the new permit cycle or no later than 6 months after the State's new CGP is effective if the State's new rules are not in place in the first 24 months.

SWMP Task: Require construction site Good Housekeeping practices. Schedule: Immediately

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 program including smaller construction sites (single family). Schedule: Immediately

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 that require less intensive review. Additional inspectors have been added in the current permit term to allow for inspections on smaller sites. Although the small sites do not require the same type or 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.)

Schedule: Immediately

The Engineering Department will continue 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. 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 Division receives the certification.

During the permit year, some concerned citizens asked that the City review and clarify the policy for inspections and enforcement on newly annexed areas that are developing under plans previously approved by Knox County government. The City has reviewed the policy and will begin implementing the following procedures in year three for County permitted annexed areas:

1. The City will conduct routine inspections for erosion and sediment control.
2. Inspections will not verify compliance with County-approved plans but will determine if sediment is adequately controlled on site.
3. If sediment is not controlled on site, the City will coordinate with Knox County to conduct a joint compliance inspection.
4. If the County declines to inspect the site for any reason, fail to take action, or if their enforcement is ineffective to control sediment from the site, then the City will proceed with standard enforcement procedures consistent with all other sites within the city limits.

Any changes to this policy will be reported as they occur.

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

Schedule: Immediately

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 design professional 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 specifically requires the following components:

- 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
- Complete soil retaining calculations for slopes or retaining walls steeper than 2:1.

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

SWMP Task: Evaluate and update enforcement procedures, policies, and follow-up monitoring/ inspections. Schedule: Full Implementation after 42 months

The schedule for this task appropriately coincides with the implementation schedule for ordinance updates. The existing enforcement procedures and policies have been effective and were not amended when the ordinance was updated in 2005. The City will evaluate necessary changes to be comparable to any State guidelines for Local Qualified Programs. All updates will be implemented when the updated ordinance becomes effective.

CS-4 Training Programs

SWMP Task: Sponsor Educational Seminar(s) for City staff, developers, engineers, and contractors. Schedule: Annually

Each year the Engineering staff have sponsored, planned, and presented a series of workshops/seminars to better educate the staff and development community about the current and updates to regulations and procedures for the entire development process. Some of the topics of the City sponsored development seminars include:

- ***Technical Requirements of the Stormwater & Street 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

Other agencies, including TDEC, TVA, MPC, etc., typically participate by presenting their regulations or new programs that impact the development process in the city.

These seminars have been successful and will be continued throughout the new permit.

SWMP Task: Provide training for Stormwater Division Engineers and Inspectors.
Schedule: Annually

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.

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, EPA 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 and will continue.

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: Update the Standard Operating Procedures (SOP) for the seasonal sampling program. Schedule: Within 12 months

The original SOP was developed and submitted with the first annual report during the first permit cycle. Over time the SOP had become dated and some parts obsolete. The City revised the SOP to make it current and valid for the equipment, software, site locations, and procedures that are currently used. Once again, the City will reevaluate and update the SOP in the first year of the new permit to keep it current with the permit requirements and equipment.

SWMP Task: Maintain at least five (5) automatic monitoring stations at locations approved by TDEC. Schedule: Immediately

Since the NPDES program began, the City purchased, installed, and maintained five ISCO monitoring stations at locations approved by TDEC. Those stations have proven to be valuable for flow and rainfall data over time and will continue to be maintained throughout the new permit. Additional rain gages, level loggers, and stations may be installed to obtain supplemental data for special projects, drainage studies, or modeling.

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. Modems and cell phones were initially installed to allow City staff to remotely monitor the conditions and station activity.

Unfortunately, remote monitoring has not been available via phone since the City upgraded to Windows XP. The City is working towards restoring this capability with upgrades.

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) flow-weighted composite samples (one/quarter/station).
Schedule: Annually

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 at least four (4) 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)	Kjeldahl Nitrogen	Total Recoverable Zinc
Ammonia Nitrogen (as N)	Biochemical Oxygen Demand	Ortho Phosphate
Organic Nitrogen	Chemical Oxygen Demand	Total Phosphorus

SWMP Task: Collect five (5) full-suite grab samples (one sample/station/permit term).
Schedule: One Station per year

Each year, one monitoring station will be selected for a full-suite grab sample. The five stations will be rotated throughout the permit term to allow one sample from each location.

In addition to the 13 routine parameters listed above, the full-suite grab sample will include 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: Year 5

Sampling data will continue to be 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 estimates of the seasonal loading and event mean concentrations will be included in the fifth 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. Schedule: Annually

SWMP Task: Implement Commercial/Industrial Monitoring Programs as described in IN-3.
Schedule: Immediately

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

MN-3 Ambient, Biological, & Bacteriological Monitoring

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

At least twenty (20) ambient samples will be 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 first permit term and will continue in the next term.

The samples may be collected either by a single grab sample or by using the automatic samplers for a timed composite. Each ambient sample collected will be 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: Annually

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

SWMP Task: Collect five (20) Dry-weather bacteria samples. Schedule: Annually

Twenty bacteria samples will be collected each year by one grab sample per station per quarter. Each of the monitoring stations will be 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, including IBI, RBP III and stream surveys. Schedule: 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 Biotic 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 RPB 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.

Each year in the new permit, the City will report the results for IBI and RBP III studies on at least two urban streams. Stream surveys for every major creek will be performed in each permit cycle.

MN-4 Related Programs

SWMP Task: Develop and Maintain a Water Quality Model to Evaluate pollutant loading and transport processes (See RC-2). Schedule: Within 60 Months

During the new permit term, the City proposes to expand the pilot SWMM model to include water quality parameters for each of the major watersheds within the city limits. Any watershed with more than fifty percent of the drainage area contained within the city limits will be included in the model. Additional watersheds will be added if the city limits expand to include more than fifty percent of the area in that watershed.

This data will be useful for watershed planning and developing pollution control strategies to comply with TMDLs.

SWMP Task: Implement Monitoring Training Program for staff and/or volunteers.
Schedule: 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, or volunteers will receive the appropriate training for the monitoring project.

6.0 MONITORING REPORTS SUMMARY

6.1 Dry-Weather Screening Program - New Outfall Inventory.

During the past permit year, four outfalls were removed from the City's outfall inventory and eight 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 removed from the system this year are listed below:

02-100-0135	02-400-0126	05-300-0225	04-300-0327

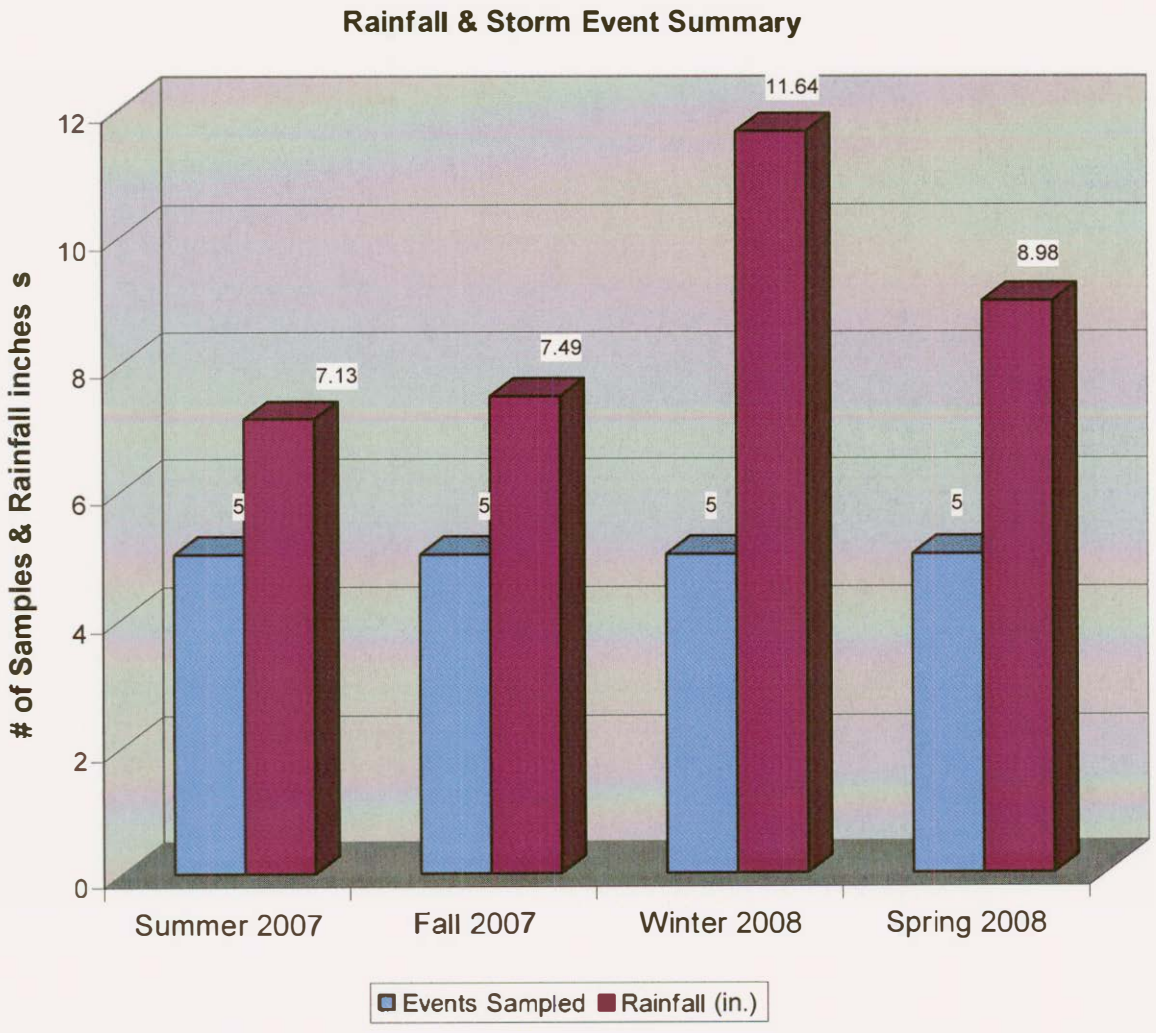
The following outfalls were added to the inventory:

01-300-0916	01-300-0918	02-100-0053	02-200-0437
02-400-0447	02-400-0489	02-300-0164	02-300-0166
02-300-0167	03-100-0374	03-400-0376	03-400-0377
03-400-0378	03-100-0379	03-400-0392	03-400-0393
03-400-0394	03-400-0397	03-300-0398	03-300-0399
03-400-0402	03-100-0403	03-400-0404	03-400-0906
03-200-0907	03-400-0908	04-400-0142	04-100-0143
04-400-0144	04-100-0155	04-400-0187	04-400-0193
04-200-0203	04-400-0213	04-400-0266	04-100-0323
04-400-0338	04-300-0352	04-300-0354	04-300-0359
05-300-0222	06-200-0129	06-400-0136	11-400-0594
11-100-0596	11-400-0597	11-100-0598	11-400-0599
11-100-0601	53-100-0128	53-200-0137	53-100-0139
53-400-0177	53-400-0178	53-400-0179	55-100-0070

6.2 Ongoing Stormwater Monitoring Program.

6.2.1 Area Rainfall Data & Storm Event Summary.

During the July 1, 2007 to June 30, 2008 monitoring period, an average of 35.24 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, 2007 thru June 30, 2008

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
Acker Place Fourth Creek	Sum. '07	7.0	219,639	0.61	BDL	36.0	79	130	0.40	0.30	0.59	BDL	0.010	0.160	BDL	BDL
	Fall '07	7.0	255,106	0.63	BDL	BDL	80	82	0.11	BDL	BDL	BDL	0.006	0.120	0.100	BDL
	Wtr. '08	6.0	69,844	0.32	BDL	BDL	29	59	0.35	BDL	BDL	BDL	BDL	0.100	BDL	0.049
	Spr. '08	6.0	58,865	0.26	BDL	BDL	32	89	0.27	0.15	BDL	BDL	BDL	0.079	BDL	BDL
Average:		**6.5**	**150,864**	**0.46**	**BDL**	**9.0**	**55**	**90**	**0.28**	**0.11**	**0.15**	**BDL**	**0.004**	**0.115**	**0.03**	**0.012**
KAT First Creek	Sum. '07	8.0	973,920	0.26	BDL	33.0	59	240	0.84	0.20	0.63	0.71	BDL	0.047	0.14	BDL
	Fall '07	7.5	555,936	0.37	6.0	BDL	64	160	0.70	0.22	0.69	BDL	0.016	0.075	0.17	0.041
	Wtr. '08	6.5	1,287,673	0.19	BDL	BDL	24	200	0.72	BDL	BDL	BDL	BDL	BDL	0.12	BDL
	Spr. '08	7.0	2,128,544	0.37	BDL	BDL	82	200	0.86	BDL	0.85	0.85	0.0069	0.035	BDL	0.038
Average:		**7.3**	**1,236,518**	**0.30**	**1.5**	**8.3**	**57**	**200**	**0.78**	**0.11**	**0.54**	**0.39**	**0.006**	**0.039**	**0.11**	**0.020**
Love Creek	Sum. '07	8.5	Error	0.09	BDL	BDL	13	300	0.93	BDL	BDL	BDL	BDL	0.031	BDL	BDL
	Fall '07	7.5	164,427	0.34	5.0	BDL	79	230	0.75	BDL	BDL	BDL	0.0088	0.051	0.12	BDL
	Wtr. '08	7.0	6,427,301	0.35	5.4	BDL	60	260	1.20	BDL	0.75	0.75	0.0087	0.041	BDL	BDL
	Spr. '08	7.0	2,630,913	0.55	9.1	26.0	120	260	0.92	BDL	2.40	2.40	0.0190	0.076	0.19	0.028
Average:		**7.5**	**2,305,660**	**0.33**	**4.9**	**6.5**	**68**	**263**	**0.95**	**BDL**	**0.79**	**0.79**	**0.0091**	**0.050**	**0.17**	**0.007**
Walden Drive Fourth Creek	Sum. '07	8.0	285,160	0.14	BDL	29.0	63	230	0.69	BDL	BDL	BDL	BDL	0.066	0.19	0.100
	Fall '07	7.0	238,832	0.20	8.0	39.0	72	180	0.86	0.22	1.30	1.10	BDL	0.084	BDL	BDL
	Wtr. '08	7.0	376196	0.19	BDL	BDL	170	160	0.46	BDL	0.54	0.54	0.0083	0.120	0.19	BDL
	Spr. '08	7.0	657,921	0.47	9.2	38.0	110	180	0.94	0.12	1.60	1.50	0.0082	0.087	0.15	BDL
Average:		**7.3**	**389,527**	**0.25**	**4.3**	**26.5**	**104**	**188**	**0.74**	**0.09**	**0.86**	**0.79**	**0.0041**	**0.089**	**0.13**	**0.025**
Williams Creek	Sum. '07	7.0	108,403	0.51	BDL	28.0	19	210	0.90	BDL	0.74	0.74	0.0064	0.044	BDL	BDL
	Fall '07	7.0	179,926	0.30	7.0	23.0	69	110	0.74	BDL	0.85	0.85	0.0130	0.054	0.16	BDL
	Wtr. '08	6.5	170,180	0.23	8.0	BDL	28	180	0.70	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	Spr. '08	7.0	412,927	0.48	BDL	BDL	12	170	1.10	BDL	0.56	0.56	BDL	BDL	BDL	0.070
Average:		**6.9**	**217,859**	**0.38**	**3.8**	**12.8**	**32**	**168**	**0.86**	**BDL**	**0.54**	**0.54**	**0.0049**	**0.02**	**0.04**	**0.018**
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

* Beaver dam resulted in inaccurate instrument reading

6.2.2 Laboratory Analysis Summary

Fourth Creek Monitoring Station (Acker Place)

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
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
SUMMER 2007	24-Jul	Comp	7.0	219,639	0.61	BDL	36.0	79	130	0.40	0.30	0.59	BDL	0.010	0.160	BDL	BDL
FALL 2007	23-Oct	Comp	7.0	255,106	0.63	BDL	BDL	80	82	0.11	BDL	BDL	BDL	0.006	0.120	0.100	BDL
WINTER 2008	17-Jan	Comp	6.0	69,844	0.32	BDL	BDL	29	59	0.35	BDL	BDL	BDL	BDL	0.100	BDL	0.049
SPRING 2008	16-May	Comp	6.0	58,865	0.26	BDL	BDL	32	89	0.27	0.15	BDL	BDL	BDL	0.079	BDL	BDL
Sample Average			6.5	150,864	0.46	BDL	9.0	55	90	0.28	0.11	0.15	BDL	0.004	0.115	0.03	0.012

***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.

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
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
SUMMER 2007	6-Jul	Comp	8.0	973,920	0.26	BDL	33.0	59	240	0.84	0.20	0.63	0.71	BDL	0.047	0.14	BDL
FALL 2007	19-Oct	Comp	7.5	555,936	0.37	6.0	BDL	64	160	0.70	0.22	0.69	BDL	0.016	0.075	0.17	0.041
WINTER 2008	9-Jan	Comp	6.5	1,287,673	0.19	BDL	BDL	24	200	0.72	BDL	BDL	BDL	BDL	BDL	0.12	BDL
SPRING 2008	9-May	Comp	7.0	2,128,544	0.37	BDL	BDL	82	200	0.86	BDL	0.85	0.85	0.0069	0.035	BDL	0.038
Sample Average			7.3	1,236,518	0.30	1.5	8.3	57	200	0.78	0.11	0.54	0.39	0.006	0.039	0.11	0.020

***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.

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
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
SUMMER 2007	18-Jul	Comp	8.5	Error	0.09	BDL	BDL	13	300	0.93	BDL	BDL	BDL	BDL	0.031	BDL	BDL
FALL 2007	19-Oct	Comp	7.5	164,427	0.34	5.0	BDL	79	230	0.75	BDL	BDL	BDL	0.0088	0.051	0.12	BDL
WINTER 2008	29-Jan	Comp	7.0	6,427,301	0.35	5.4	BDL	60	260	1.20	BDL	0.75	0.75	0.0087	0.041	BDL	BDL
SPRING 2008	9-May	Comp	7.0	2,630,913	0.55	9.1	26.0	120	260	0.92	BDL	2.40	2.40	0.0190	0.076	0.19	0.028
Sample Average			7.5	2,305,660	0.33	4.9	6.5	68	263	0.95	BDL	0.79	0.79	0.0091	0.050	0.17	0.007

***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.

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
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
SUMMER 2007	24-Jul	Comp	7.0	108,403	0.51	BDL	28.0	19	210	0.90	BDL	0.74	0.74	0.0064	0.044	BDL	BDL
FALL 2007	19-Oct	Comp	7.0	179,926	0.30	7.0	23.0	69	110	0.74	BDL	0.85	0.85	0.0130	0.054	0.16	BDL
WINTER 2008	9-Jan	Comp	6.5	170,180	0.23	8.0	BDL	28	180	0.70	BDL	BDL	BDL	BDL	BDL	BDL	BDL
SPRING 2008	9-May	Comp	7.0	412,927	0.48	BDL	BDL	12	170	1.10	BDL	0.56	0.56	BDL	BDL	BDL	0.070
Sample Average			6.9	217,859	0.38	3.8	12.8	32	168	0.86	BDL	0.54	0.54	0.0049	0.02	0.04	0.018
***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.

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
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
SUMMER 2007	11-Jul	Comp	8.0	285,160	0.14	BDL	29.0	63	230	0.69	BDL	BDL	BDL	BDL	0.066	0.19	0.100
FALL 2007	4-Oct	Comp	7.0	238,832	0.20	8.0	39.0	72	180	0.86	0.22	1.30	1.10	BDL	0.084	BDL	BDL
WINTER 2008	9-Jan	Comp	7.0	376196	0.19	BDL	BDL	170	160	0.46	BDL	0.54	0.54	0.0083	0.120	0.19	BDL
SPRING 2008	9-May	Comp	7.0	657,921	0.47	9.2	38.0	110	180	0.94	0.12	1.60	1.50	0.0082	0.087	0.15	BDL
Sample Average			7.3	389,527	0.25	4.3	26.5	104	188	0.74	0.09	0.86	0.79	0.0041	0.089	0.13	0.025

***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.

6.2.2 Laboratory Analysis Summary

Seasonal Ambient Grab Samples 2007-2008

Summer 2007	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.
Acker Place	8/15/07	8.0	BDL	BDL	2.8	260	0.49	BDL	BDL	BDL	BDL	BDL	BDL	BDL	76	124
First Creek	8/15/07	8.0	BDL	BDL	3.7	250	0.84	BDL	BDL	BDL	BDL	BDL	BDL	BDL	866	850
Loves Creek	8/15/07	8.0	BDL	BDL	7.8	300	0.88	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1733	2000
Walden Drive	8/15/07	8.0	BDL	BDL	8.2	260	0.69	BDL	BDL	BDL	BDL	0.15	BDL	BDL	649	960
Williams Creek	8/15/07	8.0	BDL	BDL	4.9	240	1.20	BDL	BDL	BDL	BDL	BDL	BDL	BDL	345	350
Average		**8.0**	**BDL**	**BDL**	**5.5**	**262**	**0.82**	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**	**734**	**857**

Fall 2007	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.
Acker Place	11/1/07	7.0	BDL	BDL	1.0	230	0.43	BDL	0.91	0.91	BDL	BDL	BDL	BDL	219	156
First Creek	11/1/07	7.0	BDL	BDL	1.9	240	0.70	BDL	0.58	0.58	BDL	BDL	BDL	BDL	119	162
Loves Creek	11/1/07	7.0	BDL	BDL	1.4	230	0.81	BDL	0.69	0.69	BDL	BDL	BDL	BDL	261	296
Walden Drive	11/1/07	7.0	BDL	BDL	2.3	250	0.79	BDL	0.62	0.62	BDL	BDL	BDL	BDL	727	460
Williams Creek	11/1/07	6.5	BDL	BDL	12.0	260	1.20	BDL	BDL	BDL	BDL	BDL	BDL	BDL	225	218
Average		**6.9**	**BDL**	**BDL**	**3.7**	**242**	**0.79**	**BDL**	**0.70**	**0.70**	**BDL**	**BDL**	**BDL**	**BDL**	**310**	**258**

Winter 2008	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.
Acker Place	1/8/08	8.0	BDL	BDL	8.2	300	0.70	BDL	BDL	BDL	BDL	BDL	BDL	BDL	96	86
First Creek	1/8/08	7.0	BDL	BDL	1.1	270	0.96	BDL	BDL	BDL	BDL	BDL	BDL	BDL	28	20
Loves Creek	1/8/08	7.5	BDL	BDL	2.0	300	1.10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	152	62
Walden Drive	1/8/08	7.0	BDL	BDL	1.7	240	0.84	BDL	BDL	BDL	BDL	BDL	BDL	BDL	122	114
Williams Creek	1/8/08	7.0	BDL	BDL	BDL	240	1.10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	45	44
Average		**7.3**	**BDL**	**BDL**	**3.3**	**270**	**0.94**	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**	**89**	**65**

Spring 2008	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.
Acker Place	4/24/08	7.0	BDL	BDL	1.4	240	0.75	BDL	BDL	BDL	BDL	BDL	BDL	BDL	44	30
First Creek	4/24/08	7.0	BDL	BDL	3.6	240	1.10	BDL	BDL	BDL	BDL	0.059	BDL	BDL	162	280
Loves Creek	4/24/08	7.0	BDL	BDL	1.8	310	1.50	BDL	BDL	BDL	BDL	BDL	BDL	BDL	326	280
Walden Drive	4/24/08	7.0	BDL	BDL	3.0	250	1.10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	99	168
Williams Creek	4/24/08	7.0	BDL	BDL	1.4	280	1.70	BDL	1.20	1.20	BDL	BDL	BDL	BDL	96	84
Average		**7.0**	**BDL**	**BDL**	**2.2**	**264**	**1.23**	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**	**BDL**	**145**	**168**

U = Analyte requested but not detected

BDL = Below Detection Limit

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
					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
KAT	Annual	11-Sep	Grab	7.0	60.0	330	36	99	0.42	0.67	3.00	2.30	0.010	0.18	0.73	0.720	58.0
Loraine St. Combined	Sum. '07	18-Jul	Grab	7.0	37.0	200	52	130	0.58	0.34	2.30	2.00	0.015	0.29	1.00	0.510	13.0
	Fall '07	12-Dec	Grab	7.0	95.0	370	190	360	0.59	0.54	2.80	2.30	0.023	0.57	0.67	0.094	64.0
	Wtr. '08	4-Mar	Grab	6.0	6.1	39	98	42	BDL	BDL	0.90	0.90	0.010	0.15	BDL	BDL	11.0
	Spr. '08	14-May	Grab	6.0	BDL	37	28	100	BDL	1.00	2.40	1.40	0.008	0.06	0.54	0.230	BDL
Average				**6.5**	**34.5**	**162**	**92**	**158**	**0.29**	**0.47**	**2.10**	**1.65**	**0.014**	**0.27**	**0.55**	**0.278**	**22.0**
Loraine St. East Unit	Sum. '07	18-Jul	Grab	7.0	20.0	130	27	77	0.40	0.23	1.40	1.20	0.007	0.13	0.59	0.260	BDL
	Fall '07	12-Dec	Grab	7.0	10.0	22	10	92	BDL	BDL	1.00	1.00	BDL	0.06	0.10	0.056	BDL
	Wtr. '08	4-Mar	Grab	6.0	7.6	49	58	63	BDL	BDL	0.80	0.80	0.010	0.11	BDL	BDL	7.2
	Spr. '08	14-May	Grab	6.0	52.0	400	100	350	0.69	0.51	6.00	5.40	0.025	0.97	1.30	0.310	18.0
Average				**6.5**	**22.4**	**150**	**49**	**146**	**0.27**	**0.19**	**2.30**	**2.10**	**0.010**	**0.32**	**0.50**	**0.16**	**6.3**
Loraine St. West Unit	Sum. '07	18-Jul	Grab	7.0	50.0	180	52	120	0.34	0.30	1.80	1.40	0.013	0.17	0.63	0.240	5.0
	Fall '07	12-Dec	Grab	7.0	48.0	230	58	210	0.21	BDL	1.90	1.90	0.006	0.40	0.54	BDL	22.0
	Wtr. '08	4-Mar	Grab	6.0	9.2	49	78	68	BDL	BDL	0.76	0.76	0.011	0.13	BDL	BDL	17.0
	Spr. '08	14-May	Grab	6.0	24.0	120	23	210	BDL	0.29	3.20	2.90	0.008	0.35	0.75	0.027	BDL
Average				**6.5**	**32.8**	**145**	**53**	**152**	**0.14**	**0.15**	**1.92**	**1.74**	**0.010**	**0.26**	**0.48**	**0.067**	**11.0**
Transfer Station 1	Sum. '07	10-Jul	Grab	7.0	84.0	400	900	530	0.61	0.82	9.80	9.00	0.340	1.20	1.70	1.200	BDL
	Fall '07	13-Dec	Grab	6.5	38.0	200	160	240	BDL	0.14	1.60	1.60	0.130	0.37	0.41	0.069	48.0
	Wtr. '08	4-Mar	Grab	6.0	51.0	400	440	240	0.11	BDL	4.10	4.10	0.370	0.59	0.61	0.065	110.0
	Spr. '08	14-May	Grab	6.0	250.0	1200	400	2400	0.49	1.20	19.00	18.00	0.180	0.76	1.60	0.520	18.0
Average				**6.4**	**105.8**	**550**	**475**	**853**	**0.30**	**0.54**	**8.63**	**8.18**	**0.255**	**0.73**	**1.08**	**0.464**	**44.0**
*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.

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	
Food City (Kingston Pike)	7/24/07	Grab	6.5	11.0	43	71	77	0.58	0.23	1.6	1.40	0.010	0.19	0.30	0.170	BDL	1,750	9,200
Kroger (Broadway)	3/27/08	Grab	6.0	18	90	47	66	0.46	0.42	2.1	1.70	0.007	0.12	0.34	0.075	BDL	91	150
Save A Lot (Broadway)	3/27/08	Grab	6.5	31.0	200	160	180	1.20	0.33	3.0	2.70	0.024	0.40	1.30	0.280	6.8	1,414	2,200
Kroger (Kingston Pike)	9/11/07	Grab	7.0	320.0	740	140	550	3.00	2.50	22.0	19.00	0.032	0.80	1.90	1.200	14.0	173,290	200,000
Food City (Millertown Pk)	3/27/08	Grab	6.0	30.0	230	180	170	1.70	0.43	2.8	2.40	0.013	0.33	0.25	0.044	-	5	40
Burger King (Northshore)	7/24/07	Grab	6.5	14.0	47	82	56	0.64	0.14	1.1	0.96	BDL	0.20	0.30	0.250	BDL	2,690	37,000
TGI Fridays (Northshore)	7/24/07	Grab	6.0	8.9	43	150	66	0.41	0.43	1.4	0.97	0.011	0.26	0.28	BDL	BDL	2,419	3,900
McDonalds (Magnolia)	8/21/07	Grab	6.0	430.0	1600	100	1200	4.40	4.30	19.0	15.00	0.022	2.20	3.20	1.800	8.3	2,419	4,120
Average			**6.3**	**107.9**	**374**	**116**	**296**	**1.55**	**1.10**	**6.6**	**5.52**	**0.017**	**0.56**	**0.98**	**0.546**	**9.7**	**23,010**	**32,076**
*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.

6.2.3 Noncompliance.

The City did not collect the required wet-weather grab samples for the complete full-suite parameters or bacteria as required by MN-1 on page 18 or 38. We did collect an additional 20 dry-weather bacteria samples with the ambient samples beyond the 5 wet-weather required samples. Some parameters of the full-suite were analyzed including: Volatiles, Pesticides, PCBs, Lead, Zinc, and some Base/Neutrals. This noncompliance did not endanger health or the environment or cause any discharge or pollution at all. The fifth year is turning out to be a much wetter year and should allow extra grab samples to be collected to make up for the missed grabs in the past. The City is fully committed to implementing the sampling program and has already installed an additional sampling monitoring station to anticipate future data needs.

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 35.24 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 42.99 inches/year, the average annual runoff from a single-family residential land use (25% impervious) is 15.05 in/yr (42.99*[(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 ..... $Q_{tot\,07/08}$ = 26,659 Million Gallons

Please find the summary analysis for each watershed and 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, 2007 - June 30, 2008

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 06/07 (in./yr)	Total Runoff for 06/07 (Mgal/yr)
Baker Cr.	412	2	107	640	90	77	32	1	1	3	269	13	27	1,674	1,674	32	0.41	35.24	654
East Fork	313	0	10	475	302	78	73	31	195	235	584	33	180	2,509	2,509	53	0.57	35.24	1,375
First Cr.	724	0	300	3,152	544	501	110	157	127	556	1,412	51	116	7,750	7,750	44	0.50	35.24	3,701
Fourth Cr.	965	57	423	2,026	468	406	93	206	201	568	881	61	414	6,769	5,920	41	0.48	35.24	2,705
Goose Cr.	639	40	126	669	213	67	8	21	77	131	327	34	29	2,381	1,755	35	0.43	35.24	718
Grassy Cr.	2,230	176	561	610	215	24	0	14	31	95	211	39	95	4,301	433	17	0.29	35.24	119
Holston R.	2,362	69	371	1,222	417	45	5	2	219	33	805	32	50	5,632	2,455	28	0.37	35.24	872
Inman Br.	563	33	214	138	4	12	0	0	0	0	145	0	34	1,143	99	21	0.31	35.24	30
Knob Cr.	1,719	195	481	843	125	84	1	19	1	29	296	4	169	3,966	989	19	0.30	35.24	288
Knob Fork	1,659	26	398	675	182	56	5	93	6	124	257	19	252	3,752	823	22	0.33	35.24	258
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	35.24	2,148
Second Cr.	443	0	90	1,281	346	247	29	107	140	542	1,161	35	82	4,503	4,498	53	0.57	35.24	2,458
Sinking Cr.	1,614	146	459	1,266	284	90	17	33	31	267	881	12	347	5,447	2,434	33	0.41	35.24	966
Swanpond C	3,892	303	833	604	121	36	4	79	240	232	457	65	285	7,151	499	19	0.30	35.24	145
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	35.24	1,690
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	35.24	3,598
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	35.24	2,578
Toll Cr.	535	69	154	222	42	26	1	0	37	4	93	42	4	1,229	767	22	0.32	35.24	237
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	35.24	617
Whites Cr.	2,733	154	782	1,298	575	59	31	11	49	126	608	51	578	7,055	1,634	23	0.34	35.24	527
Williams Cr.	358	11	47	561	46	96	125	17	10	61	276	3	30	1,641	1,605	37	0.45	35.24	691
Woods Cr.	1,220	106	281	371	0	26	0	2	140	43	261	1	157	2,608	143	23	0.33	35.24	46
Sink-East	1,226	0		728	9	17	0	17	3	27	0	0	0	2,027	91	12	0.24	35.24	21
Beaver Cr	21,174	0	0	21,230	1,292	845	4	259	283	712	0	160	0	45,959	162	16	0.28	35.24	43
Tuckahoe	4,293	0	0	1,829	18	14	0	8	2	1	0	4	0	6,169	229	8	0.22	35.24	48
Fr.Broad riv	8,954	0	0	2,744	73	40	24	24	497	117	0	166	0	12,639	551	11	0.24	35.24	126
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				**26,659**

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) = 35.24 in./yr. = 2.94 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 One = 26,659 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 current permit term, the pollutant loads and event mean concentrations will be calculated again and compared to the previous results. 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 installing additional 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 Loudoun 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 will create several modifications to the existing SWMP. Those changes have been described in the Schedule and Narrative found in sections 4 and 5 of this report. The City did not make any modifications in the past year for the current SWMP.

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 as needed.

Program Description	Fund Source	Actual FY 07/08	Est. FY 08/09
Solid Waste Recycling (includes: composting, education, staff, etc.)	Fund 230	$1,811,087	$2,077,120
Household Hazardous Waste Facility	Fund 230	$173,631	$175,000
Stormwater Mgmt Operating expenses	Fund 220	$1,696,344	$1,906,300
Public Service operating/maintenance (brush/leaf/litter pickup; street cleaning; curb/gutter repair; catch basin cleaning, repair, & installation; ditching; seed/sod in R.O.W.; grate replacement; water pumping; tree trimming, removal, and planting.)	General Fund 100	$3,175,145	$3,200,000
First Creek Restoration/Improvements	Growth Bdry	$599,839	$1,337,887
Lake Ave. Drainage Improvements	Fund 401	$0	$350,000
MJP/Baker Creek Restoration	Fund 220	$0	$73,000
Emily Avenue Sinkhole Project Emily Avenue Sinkhole Reclamation	Fund 401	$73,302 $0	$198,630 $112,750
Solid Waste Transfer Station – SWPPP	Fund 401	$24,533	$129,467
Loraine St.- Stormwater Improvements	Fund 401	$72,351	$0
Cross Park Dr. Drainage Improvement	Fund 401	$22,319	$1,200,000
Prosser Road Groundwater Study	Fund 401	$0	$90,000
MLK Jr./Chestnut MS4	Fund 401	$0	$322,000
Lower Second Creek Greenway	Fund 401	$968,566	$119,948
Neighborhood Drainage Projects	Fund 401	$148,132	$787,342
Total Estimated Stormwater Program Costs		**$8,765,249**	**$12,079,444**

APPENDIX A

City of Knoxville Solid Waste Office 2007 Annual Report

Solid Waste Section
2007 Annual Report

CITY OF KNOXVILLE
BILL HASLAM, MAYOR

Department of Community & Neighborhood Services
Sam Anderson, Director

Public Service Division
Bob Whetsel, Director

Printed on Recycled Paper

INTRODUCTION

In 2007, 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 tenth full year of operations at the Household Hazardous Waste Collection Center. The Public Service Division is in its sixth 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 2007.

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

* The total waste stream decreased by 1041.95 tons from 2006
* The diversion rate increased to 56.12% from 59.50% in 2006
* The recycling rate decreased to 27.61% from 25.83% in 2006

The total waste stream shows a decrease for the second time in two years. This decrease is attributed to decreased use of the Solid Waste Management Facility (Transfer Station) by large business customers who took their material to the Waste Connections Transfer Station. 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 5,709.03 tons of recyclables was collected at the City's eleven drop-off recycling centers in 2007. This number is level with recyclables from 2004 to 2005, up by 492 tons. The increase is comes from the extended operation at the Parkvillage Rd. center. All commodities showed an increased while mixed paper showed just a slight decrease.

Goodwill Industries is in the fifth year of a 5-year contract to assist in on-site operation of the recycling centers. The contract that was negotiated with SP Recycling to haul newspaper paid the City current market value for material collected in the amount of $110,945.07. This, and the contract with Waste Management for the other materials, combined to save the City $213,817.80.60 in operational costs up $90,466.20. This was the final year extension contract options with both companies. For 2008 a new contract was signed with Advanced Polymer Recycling to handle all of the materials collected at the centers

In 2007, the City extended a pilot project 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 2007 over 62 tons of material was collected. The City will complete a yearly contract for collection in 2008.

II. MUNICIPAL SOLID WASTE (MSW)

A total of 48,413.89 tons of garbage was collected from Knoxville homes in 2007 as part of the weekly garbage collection service the City offers via its contractor, Waste Connections. This

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. Forty three Knox County schools competed for cash prizes donated by the City and County. Over 101 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 2007 which celebrated the 34th anniversary of Earth Day at Worlds Fair Park. Over 13,000 people attended the event which had 100 + exhibitors from the environmental community.

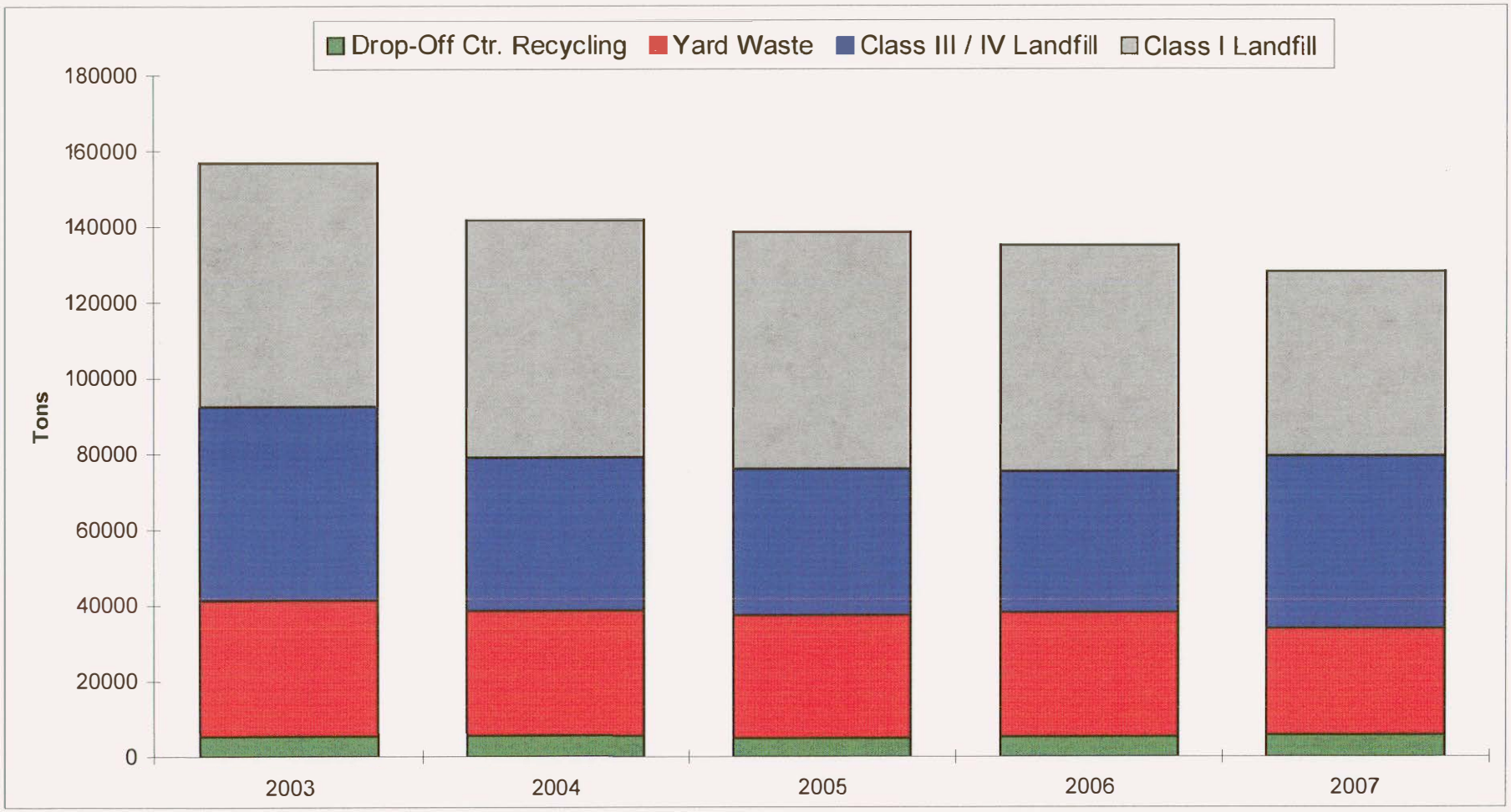
One-Day Computer Collection Events - One-day computer collection events were held in January with ten sponsors contributing to the success of the event. Approximately 1200 residents participated in the events with just over 61 tons of electronic materials collected. The material was recycled at 5R Processors in Clinton, TN.

Used Residential Thermometer Exchange - The Solid Waste Office started an ongoing mercury thermometer exchange program. 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 450 mercury thermometers from City and County residents, containing a total of close 3/4 pound of mercury. New digital thermometers were given out for each used mercury thermometer that was turned in.

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 2007. City of Knoxville residents can call Waste Connections to request the service. Materials collected for recycling are cardboard, glass, aluminum, newspaper, and plastics. 957 tons was collected from 2500 residents signed up for the service in 2007.

Other - In 2007, 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 2007 using our exhibit booth display at events including the Dogwood Arts' House and Garden Show and America Recycles Day Events. Over 200 school children toured the SWMF and listened to a presentation at the HHW facility.

Destination of Knoxville's Residential Waste Stream, 2003 - 2007



	2003	2004	2005	2006	2007
Diversion Rate	54.46%	59.26%	56.25%	56.26%	59.50%
Recycling Rate	27.16%	28.02%	27.61%	28.77%	25.83%

Annual Report 2007	Kroger 5003	Goodwill Magnolia &	Kroger 5425	Kroger 4818	Kroger 2217	Goodwill 225	Kroger 4440	Lowes 210	K-Mart 7428	Food City 5941	Food City 2939	
Drop Off Centers	N. Broadway	Alice	Clinton Hwy	Kingston Pk.	N. Broadway	Moody Av.	Western Av.	N. Peters	Kingston Pk	Kingston Pl	Alcoa Hwy	Totals
Aluminum	10240 lbs	1910 lbs	2897 lbs	16537 lbs	7767 lbs	7972 lbs	4239 lbs	23424 lbs	1518 lbs	1008 lbs	1822 lbs	39.67 tons
Steel	26855 lbs	5031 lbs	7137 lbs	39756 lbs	19324 lbs	19683 lbs	12295 lbs	43250 lbs	4055 lbs	1979 lbs	3726 lbs	91.55 tons
Plastics	100637 lbs	27892 lbs	38528 lbs	132910 lbs	51816 lbs	70434 lbs	43871 lbs	175469 lbs	10752 lbs	4568 lbs	7328 lbs	332.10 tons
Clear Glass	73504 lbs	20532 lbs	25329 lbs	156021 lbs	60594 lbs	73072 lbs	31321 lbs	173542 lbs	15978 lbs	0 lbs	0 lbs	314.95 tons
Brown Glass	57030 lbs	15937 lbs	19298 lbs	120535 lbs	49147 lbs	56247 lbs	24405 lbs	134670 lbs	12174 lbs	0 lbs	0 lbs	244.72 tons
Green Glass	47144 lbs	13181 lbs	15679 lbs	99243 lbs	40490 lbs	46150 lbs	20254 lbs	111349 lbs	9891 lbs	0 lbs	0 lbs	201.69 tons
Newspaper	679520 lbs	184596 lbs	259860 lbs	793760 lbs	284831 lbs	347520 lbs	247740 lbs	728270 lbs	66200 lbs	45305 lbs	51658 lbs	1,844.63 tons
Mixed Paper	528780 lbs	172400 lbs	185330 lbs	1017190 lbs	277790 lbs	361890 lbs	280130 lbs	1008990 lbs	66900 lbs	25640 lbs	57810 lbs	1,991.43 tons
Cardboard	159990 lbs	53574 lbs	76660 lbs	277185 lbs	87630 lbs	105690 lbs	85220 lbs	384658 lbs	20430 lbs	22780 lbs	22780 lbs	648.30 tons
Drop Off Center Totals	841.85 tons	247.53 tons	315.36 tons	1,326.57 tons	439.69 tons	544.33 tons	374.74 tons	1,391.81 tons	103.95 tons	50.64 tons	72.56 tons	5,709.03 tons

KPD / Lorain St. Cardboard / Paper	11.07 tons
Downtown Cardboard Recycling	62.36 tons

Phone Books	222.60 tons

	Leaves	Brush	Total
Mulching Site	5,387.06 tons	22,668.12 tons	28,055.18 tons

	Scrap Metal	Cardboard	Rec. Tlr. / Backing	HHW REC.	HHW Divert.
Transfer Station	595.57 tons	0.00 tons	0.71 tons	27.03 tons	10.48 tons

	C&D	Compacted	Computers	Tires	Total
Transfer Station Cont.	30,007.94 tons	6,009.69 tons	89.49 tons	140.91 tons	36,881.82 tons

	Trash	Misc. Trash	Total
Landfill Class I	48,413.89 tons	321.90 tons	48,735.79 tons

	Transfer Station	Construction	Codes	Total
Landfill ClassIII	30,007.94 tons	8,289.05 tons	7,217.71 tons	45,514.70 tons

Total Waste Recycled	34,913.94 tons	*Recycling*	25.83%
Total Waste Diverted, Class III & Rec.	80,439.12 tons	*Diversion*	59.50%
	54,745.48 tons	** Recycling / Total WS*	6.40%
	135,184.60	* Yard Waste Not Included w/ just residential trash	10.75%

APPENDIX B

Summary of Dry Weather Screening Results

1. List of outfalls tested during the permit year with status (9 pages)
2. Table of testing results for outfalls with dry-weather flow (7 pages)

Dry Weather Screening - Sample Events for 2008

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
00-300-0240	DRY	11/02/2007	11/02/2007	04/07/2008	04/07/2008
00-300-0260	DRY	04/07/2008	04/07/2008	05/13/2008	05/13/2008
00-100-0270	DRY	11/02/2007	11/02/2007	04/07/2008	04/07/2008
00-100-0290	WET	11/02/2007	11/02/2007	04/07/2008	04/07/2008
00-300-0385	ILLICIT CONNECTION	04/07/2008	04/07/2008	05/13/2008	05/13/2008
00-300-0415	DRY	04/07/2008	04/07/2008	05/13/2008	05/13/2008
00-100-0430	DRY	11/02/2007	11/02/2007	04/07/2008	04/07/2008
00-300-0435	DRY	11/02/2007	11/02/2007	04/07/2008	04/07/2008
00-300-0460	DRY	11/02/2007	11/02/2007	04/07/2008	04/07/2008
00-300-0475	DRY	04/07/2008	04/07/2008	05/13/2008	05/13/2008
00-300-0480	DRY	04/07/2008	04/07/2008	05/13/2008	05/13/2008
01-300-0143	DRY	11/01/2007	11/01/2007	04/07/2008	04/07/2008
01-300-0147	DRY	11/01/2007	11/01/2007	04/07/2008	04/07/2008
01-300-0150	WET	11/01/2007	11/01/2007	04/07/2008	04/07/2008
01-300-0160	DRY	11/01/2007	11/01/2007	04/07/2008	04/07/2008
01-100-0550	DRY	07/17/2007	07/17/2007	11/07/2007	11/07/2007
01-100-0855	DRY	07/17/2007	07/17/2007	11/07/2007	11/07/2007
01-100-0860	DRY	07/17/2007	07/17/2007	11/07/2007	11/07/2007
01-100-0875	DRY	07/17/2007	07/17/2007	11/07/2007	11/07/2007
01-100-0905	DRY	07/17/2007	07/17/2007	11/07/2007	11/07/2007
01-100-0907	DRY	07/17/2007	07/17/2007	11/07/2007	11/07/2007
01-400-0910	DRY	07/17/2007	07/17/2007	11/07/2007	11/07/2007
01-100-0920	DRY	07/17/2007	07/17/2007	11/07/2007	11/07/2007
01-400-0930	DRY	07/27/2007	07/27/2007	11/07/2007	11/07/2007
01-100-0940	DRY	07/27/2007	07/27/2007	11/07/2007	11/07/2007
01-200-0945	DRY	07/27/2007	07/27/2007	11/07/2007	11/07/2007

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit#4
02-400-0045	WET	08/03/2007	08/03/2007	02/15/2008	02/15/2008
02-400-0050	ILLICIT CONNECTION	08/03/2007	08/03/2007	02/15/2008	02/15/2008
02-400-0055	ILLICIT CONNECTION	08/03/2007	08/03/2007	02/15/2008	02/15/2008
02-400-0150	DRY	08/03/2007	08/03/2007	12/12/2007	12/12/2007
02-400-0155	DRY	08/03/2007	08/03/2007	12/12/2007	12/12/2007
02-400-0170	DRY	07/30/2007	07/30/2007	12/12/2007	12/12/2007
02-300-0171	DRY	07/30/2007	07/30/2007	12/12/2007	12/12/2007
02-300-0172	DRY	07/30/2007	07/30/2007	12/12/2007	12/12/2007
02-400-0173	DRY	07/30/2007	07/30/2007	12/12/2007	12/12/2007
02-300-0174	DRY	07/30/2007	07/30/2007	12/12/2007	12/12/2007
02-300-0175	DRY	10/08/2007	10/08/2007	12/12/2007	12/12/2007
02-300-0176	DRY	07/30/2007	07/30/2007	12/12/2007	12/12/2007
02-300-0178	DRY	07/30/2007	07/30/2007	12/12/2007	12/12/2007
02-300-0179	DRY	07/30/2007	07/30/2007	12/12/2007	12/12/2007
02-300-0181	DRY	07/30/2007	07/30/2007	12/12/2007	12/12/2007
02-400-0185	DRY	08/14/2007	08/14/2007	12/12/2007	12/12/2007
02-300-0190	WET	10/08/2007	10/08/2007	02/15/2008	02/15/2008
02-400-0194	DRY	08/14/2007	08/14/2007	02/15/2008	02/15/2008
02-400-0200	DRY	08/14/2007	08/14/2007	02/15/2008	02/15/2008
02-300-0230	WET	10/08/2007	10/08/2007	02/15/2008	02/15/2008
02-300-0245	DRY	10/08/2007	10/08/2007	12/12/2007	12/12/2007
02-300-0250	DRY	07/30/2007	07/30/2007	12/12/2007	12/12/2007
02-300-0260	DRY	07/30/2007	07/30/2007	12/12/2007	12/12/2007
02-300-0295	DRY	10/08/2007	10/08/2007	12/12/2007	12/12/2007
02-100-0360	DRY	08/14/2007	08/14/2007	02/15/2008	02/15/2008
02-400-0362	DRY	08/14/2007	08/14/2007	02/15/2008	02/15/2008
02-400-0363	DRY	08/14/2007	08/14/2007	02/15/2008	02/15/2008
02-100-0375	DRY	08/14/2007	08/14/2007	02/15/2008	02/15/2008

Outfall Name	Outfall Status	Visit #1	Visit#2	Visit #3	Visit #4
02-100-0385	DRY	08/07/2007	08/07/2007	02/15/2008	02/15/2008
02-100-0390	DRY	08/07/2007	08/07/2007	02/15/2008	02/15/2008
02-400-0430	DRY	08/06/2007	08/06/2007	04/21/2008	04/21/2008
02-400-0440	DRY	08/06/2007	08/06/2007	04/21/2008	04/21/2008
02-400-0450	DRY	08/06/2007	08/06/2007	04/21/2008	04/21/2008
02-100-0465	DRY	08/06/2007	08/06/2007	04/21/2008	04/21/2008
02-100-0480	WET	08/06/2007	08/06/2007	04/21/2008	04/21/2008
02-200-0490	DRY	08/07/2007	08/07/2007	04/21/2008	04/21/2008
02-100-0495	DRY	08/07/2007	08/07/2007	04/21/2008	04/21/2008
02-400-0504	DRY	08/07/2007	08/07/2007	04/21/2008	04/21/2008
02-100-0515	WET	08/06/2007	08/06/2007	04/21/2008	04/21/2008
02-100-0545	DRY	08/06/2007	08/06/2007	04/21/2008	04/21/2008
03-300-0005	ILLICIT CONNECTION	10/09/2007	10/09/2007	04/09/2008	04/09/2008
03-300-0010	DRY	10/09/2007	10/09/2007	04/09/2008	04/09/2008
03-300-0015	DRY	10/09/2007	10/09/2007	04/09/2008	04/09/2008
03-400-0018	DRY	08/16/2007	08/16/2007	04/09/2008	04/09/2008
03-300-0035	DRY	10/09/2007	10/09/2007	04/09/2008	04/09/2008
03-400-0055	DRY	08/15/2007	08/15/2007	04/09/2008	04/09/2008
03-400-0365	DRY	08/15/2007	08/15/2007	04/09/2008	04/09/2008
03-300-0370	DRY	10/09/2007	10/09/2007	04/09/2008	04/09/2008
03-100-0375	DRY	08/15/2007	08/15/2007	03/09/2008	03/09/2008
03-300-0385	WET	10/09/2007	10/09/2007	04/09/2008	04/09/2008
03-200-0395	WET	08/15/2007	08/15/2007	04/09/2008	04/09/2008
03-300-0400	WET	10/09/2007	10/09/2007	04/09/2008	04/09/2008
03-300-0430	WET	10/09/2007	10/09/2007	04/09/2008	04/09/2008
03-100-0450	ILLICIT CONNECTION	08/20/2007	08/20/2007	04/10/2008	04/10/2008
03-100-0490	DRY	08/15/2007	08/15/2007	04/10/2008	04/10/2008
03-100-0530	DRY	08/28/2007	08/28/2007	03/25/2008	03/25/2008

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
03-100-0553	DRY	09/07/2007	09/07/2007	03/24/2008	03/24/2008
03-200-0555	DRY	08/28/2007	08/28/2007	03/24/2008	03/24/2008
03-200-0580	WET	08/28/2007	08/28/2007	03/24/2008	03/24/2008
03-200-0595	DRY	08/28/2007	08/28/2007	03/24/2008	03/24/2008
03-300-0630	DRY	10/16/2007	10/16/2007	03/25/2008	03/25/2008
03-300-0640	DRY	10/16/2007	10/16/2007	03/25/2008	03/25/2008
03-300-0655	DRY	10/16/2007	10/16/2007	03/24/2008	03/24/2008
03-200-0685	DRY	08/28/2007	08/28/2007	03/24/2008	03/24/2008
03-200-0690	DRY	08/28/2007	08/28/2007	03/24/2008	03/24/2008
03-200-0720	DRY	09/07/2007	09/07/2007	03/24/2008	03/24/2008
03-200-0725	DRY	09/07/2007	09/07/2007	03/24/2008	03/24/2008
03-100-0795	DRY	09/07/2007	09/07/2007	03/24/2008	03/24/2008
03-200-0820	WET	08/02/2007	08/02/2007	03/24/2008	03/24/2008
03-100-0830	DRY	08/02/2007	08/02/2007	03/24/2008	03/24/2008
03-100-0845	DRY	08/02/2007	08/02/2007	02/19/2008	02/19/2008
03-200-0855	DRY	08/02/2007	08/02/2007	02/19/2008	02/19/2008
03-200-0865	DRY	08/02/2007	08/02/2007	02/19/2008	02/19/2008
03-200-0870	DRY	08/02/2007	08/02/2007	02/19/2008	02/19/2008
03-200-0875	WET	08/02/2007	08/02/2007	02/19/2008	02/19/2008
03-200-0900	DRY	08/02/2007	08/02/2007	02/19/2008	02/19/2008
03-200-0905	WET	08/02/2007	08/02/2007	02/19/2008	02/19/2008
03-200-0920	DRY	08/02/2007	08/02/2007	02/19/2008	02/19/2008
03-200-0930	DRY	08/02/2007	08/02/2007	02/19/2008	02/19/2008
03-200-0937	DRY	08/02/2007	08/02/2007	02/19/2008	02/19/2008
03-100-0960	DRY	08/02/2007	08/02/2007	02/19/2008	02/19/2008
04-200-0055	DRY	08/10/2007	08/10/2007	12/06/2007	12/06/2007
04-400-0075	DRY	08/10/2007	08/10/2007	12/06/2007	12/06/2007
04-400-0080	DRY	08/10/2007	08/10/2007	12/06/2007	12/06/2007

Outfall Name	Outfall Status	Visit #1	Visit#2	Visit #3	Visit #4
04-400-0090	DRY	08/10/2007	08/10/2007	12/06/2007	12/06/2007
04-400-0110	DRY	08/10/2007	08/10/2007	12/06/2007	12/06/2007
04-200-0157	DRY	08/10/2007	08/10/2007	12/06/2007	12/06/2007
04-400-0200	DRY	08/10/2007	08/10/2007	12/06/2007	12/06/2007
04-400-0240	DRY	08/10/2007	08/10/2007	12/06/2007	12/06/2007
04-400-0241	DRY	08/10/2007	08/10/2007	12/06/2007	12/06/2007
04-100-0250	DRY	08/14/2007	08/14/2007	12/06/2007	12/06/2007
04-300-0264	DRY	08/14/2007	08/14/2007	12/06/2007	12/06/2007
04-300-0267	DRY	08/14/2007	08/14/2007	12/06/2007	12/06/2007
04-200-0290	DRY	08/14/2007	08/14/2007	12/06/2007	12/06/2007
04-100-0325	DRY	08/14/2007	08/14/2007	12/06/2007	12/06/2007
04-100-0326	DRY	08/16/2007	08/16/2007	12/06/2007	12/06/2007
04-200-0328	WET	08/16/2007	08/16/2007	12/07/2007	12/07/2007
04-300-0337	DRY	10/16/2007	10/16/2007	12/07/2007	12/07/2007
04-300-0345	DRY	10/16/2007	10/16/2007	12/07/2007	12/07/2007
04-300-0355	DRY	10/16/2007	10/16/2007	12/07/2007	12/07/2007
04-300-0375	DRY	08/16/2007	08/16/2007	12/07/2007	12/07/2007
05-200-0010	DRY	09/13/2007	09/13/2007	03/13/2008	03/13/2008
05-300-0035	DRY	09/13/2007	09/13/2007	03/13/2008	03/13/2008
05-200-0130	WET	09/13/2007	09/13/2007	03/13/2008	03/13/2008
05-300-0185	WET	09/13/2007	09/13/2007	03/13/2008	03/13/2008
05-100-0200	WET	09/13/2007	09/13/2007	03/13/2008	03/13/2008
05-300-0210	WET	09/18/2007	09/18/2007	03/13/2008	03/13/2008
05-300-0220	DRY	09/18/2007	09/18/2007	03/13/2008	03/13/2008
06-200-0050	DRY	09/19/2007	09/19/2007	03/17/2008	03/17/2008
06-100-0085	DRY	09/19/2007	09/19/2007	03/17/2008	03/17/2008
06-200-0118	DRY	09/19/2007	09/19/2007	03/17/2008	03/17/2008
06-100-0128	DRY	09/18/2007	09/18/2007	03/17/2008	03/17/2008

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit#4
06-100-0133	DRY	09/19/2007	09/19/2007	03/17/2008	03/17/2008
06-200-0139	DRY	09/19/2007	09/19/2007	03/17/2008	03/17/2008
06-100-0146	WET	09/18/2007	09/18/2007	03/17/2008	03/17/2008
06-200-0155	WET	09/18/2007	09/18/2007	03/17/2008	03/17/2008
06-400-0185	ILLICIT CONNECTION	09/19/2007	09/19/2007	03/17/2008	03/17/2008
06-200-0190	DRY	09/19/2007	09/19/2007	03/17/2008	03/17/2008
07-200-0005	DRY	09/10/2007	09/10/2007	03/18/2008	03/18/2008
07-200-0015	WET	09/10/2007	09/10/2007	03/18/2008	03/18/2008
07-400-0020	DRY	09/10/2007	09/10/2007	03/18/2008	03/18/2008
07-100-0055	ILLICIT CONNECTION	09/10/2007	09/10/2007	03/18/2008	03/18/2008
07-400-0125	DRY	09/10/2007	09/10/2007	03/18/2008	03/18/2008
07-400-0160	DRY	09/12/2007	09/12/2007	03/18/2008	03/18/2008
07-100-0175	DRY	09/12/2007	09/12/2007	03/18/2008	03/18/2008
07-400-0200	ILLICIT CONNECTION	09/10/2007	09/10/2007	03/18/2008	03/18/2008
07-400-0220	DRY	09/10/2007	09/10/2007	03/18/2008	03/18/2008
08-400-0015	DRY	09/12/2007	09/12/2007	03/17/2008	03/17/2008
10-200-0350	DRY	07/09/2007	07/09/2007	01/28/2008	01/28/2008
10-200-0395	DRY	07/09/2007	07/09/2007	01/28/2008	01/28/2008
10-200-0410	DRY	07/09/2007	07/09/2007	01/28/2008	01/28/2008
10-200-0455	DRY	07/09/2007	07/09/2007	01/28/2008	01/28/2008
10-200-0460	DRY	07/09/2007	07/09/2007	01/28/2008	01/28/2008
11-200-0592	DRY	09/11/2007	09/12/2007	03/18/2008	03/18/2008
11-200-0595	DRY	09/11/2007	09/12/2007	03/18/2008	03/18/2008
12-400-0590	DRY	09/11/2007	09/12/2007	01/29/2008	01/29/2008
12-400-0595	DRY	09/11/2007	09/12/2007	01/29/2008	01/29/2008
13-300-0135	ILLICIT CONNECTION	10/10/2007	10/10/2007	04/22/2008	04/22/2008
13-300-0140	WET	10/10/2007	10/10/2007	04/22/2008	04/22/2008
13-300-0145	DRY	09/21/2007	09/21/2007	04/22/2008	04/22/2008

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
13-300-0147	DRY	10/10/2007	10/10/2007	04/22/2008	04/22/2008
13-300-0170	DRY	09/21/2007	09/21/2007	04/22/2008	04/22/2008
13-400-0175	DRY	09/21/2007	09/21/2007	04/22/2008	04/22/2008
13-400-0179	DRY	09/21/2007	09/21/2007	04/22/2008	04/22/2008
13-300-0181	DRY	10/10/2007	10/10/2007	04/22/2008	04/22/2008
13-300-0182	DRY	10/10/2007	10/10/2007	04/22/2008	04/22/2008
13-300-0184	DRY	10/10/2007	10/10/2007	04/22/2008	04/22/2008
13-400-0215	DRY	09/21/2007	09/21/2007	04/22/2008	04/22/2008
13-300-0226	DRY	10/22/2007	10/22/2007	04/22/2008	04/22/2008
13-300-0227	DRY	10/22/2007	10/22/2007	04/22/2008	04/22/2008
13-300-0228	DRY	10/22/2007	10/22/2007	04/22/2008	04/22/2008
13-100-0240	DRY	09/21/2007	09/21/2007	04/22/2008	04/22/2008
13-200-0255	DRY	09/21/2007	09/21/2007	04/22/2008	04/22/2008
13-100-0285	DRY	09/21/2007	09/21/2007	04/10/2008	04/10/2008
13-300-0305	DRY	09/21/2007	09/21/2007	04/10/2008	04/10/2008
13-400-0320	DRY	09/21/2007	09/21/2007	04/10/2008	04/10/2008
13-200-0340	WET	09/21/2007	09/21/2007	04/10/2008	04/10/2008
31-300-0505	DRY	10/22/2007	10/22/2007	03/17/2008	03/17/2008
31-300-0515	DRY	10/22/2007	10/22/2007	03/17/2008	03/17/2008
31-300-0520	DRY	10/22/2007	10/22/2007	03/17/2008	03/17/2008
53-400-0005	DRY	07/16/2007	07/16/2007	01/31/2008	01/31/2008
53-400-0010	DRY	08/09/2007	08/09/2007	01/31/2008	01/31/2008
53-400-0015	DRY	08/09/2007	08/09/2007	01/31/2008	01/31/2008
53-400-0020	DRY	07/16/2007	07/16/2007	01/31/2008	01/31/2008
53-400-0025	DRY	07/16/2007	07/16/2007	01/31/2008	01/31/2008
53-400-0040	DRY	07/02/2007	07/02/2007	01/31/2008	01/31/2008
53-400-0060	DRY	07/16/2007	07/16/2007	01/31/2008	01/31/2008
53-400-0070	DRY	07/16/2007	07/16/2007	01/31/2008	01/31/2008

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
53-100-0075	DRY	07/16/2007	07/16/2007	01/31/2008	01/31/2008
53-400-0080	DRY	08/09/2007	08/09/2007	01/31/2008	01/31/2008
53-100-0090	DRY	08/08/2007	08/08/2007	03/03/2008	03/03/2008
53-400-0095	DRY	08/08/2007	08/08/2007	03/03/2008	03/03/2008
53-200-0105	DRY	08/09/2007	08/09/2007	03/03/2008	03/03/2008
53-200-0115	DRY	08/08/2007	08/08/2007	03/03/2008	03/03/2008
53-100-0130	DRY	08/08/2007	08/08/2007	03/11/2008	03/11/2008
53-100-0135	DRY	08/08/2007	08/08/2007	03/11/2008	03/11/2008
53-400-0140	DRY	08/08/2007	08/08/2007	03/11/2008	03/11/2008
53-400-0145	DRY	08/08/2007	08/08/2007	03/11/2008	03/11/2008
53-400-0150	DRY	08/09/2007	08/09/2007	03/11/2008	03/11/2008
53-400-0155	DRY	08/09/2007	08/09/2007	03/11/2008	03/11/2008
53-200-0160	DRY	08/09/2007	08/09/2007	03/11/2008	03/11/2008
53-400-0165	DRY	08/09/2007	08/09/2007	02/11/2008	02/11/2008
53-200-0170	WET	08/09/2007	08/09/2007	02/11/2008	02/11/2008
53-400-0180	DRY	10/02/2007	10/02/2007	02/11/2008	02/11/2008
53-200-0190	DRY	10/02/2007	10/02/2007	02/11/2008	02/11/2008
53-400-0205	DRY	10/02/2007	10/02/2007	02/11/2008	02/11/2008
53-400-0215	DRY	10/02/2007	10/02/2007	02/11/2008	02/11/2008
53-200-0240	DRY	10/02/2007	10/02/2007	02/11/2008	02/11/2008
53-100-0250	DRY	10/02/2007	10/02/2007	02/11/2008	02/11/2008
53-100-0255	DRY	10/02/2007	10/02/2007	02/11/2008	02/11/2008
53-100-0260	DRY	10/02/2007	10/02/2007	02/11/2008	02/11/2008
53-100-0265	DRY	10/02/2007	10/02/2007	02/11/2008	02/11/2008
55-400-0050	DRY	09/25/2007	09/25/2007	12/11/2007	12/11/2007
55-500-0055	DRY	09/25/2007	09/25/2007	12/11/2007	12/11/2007
55-400-0100	DRY	09/25/2007	09/25/2007	12/11/2007	12/11/2007
56-400-0180	DRY	09/25/2007	09/25/2007	12/11/2007	12/11/2007

Outfall Name	Outfall Status	Visit #1	Visit #2	Visit #3	Visit #4
56-400-0200	DRY	09/25/2007	09/25/2007	12/11/2007	12/11/2007
56-500-0220	DRY	09/25/2007	09/25/2007	12/11/2007	12/11/2007
56-400-0225	DRY	09/25/2007	09/25/2007	12/11/2007	12/11/2007
79-400-0370	DRY	10/11/2007	10/11/2007	12/07/2007	12/07/2007
79-300-0376	DRY	10/11/2007	10/11/2007	12/07/2007	12/07/2007
79-400-0420	DRY	10/11/2007	10/11/2007	12/07/2007	12/07/2007

TYPE CODE	COUNT
100	49
200	48
300	63
400	66
500	2

Dry Weather Screening Data for 2008

Outfall / Permit Year	Date	Visit #	Flow ?	Flow Rate (gpm)	pH (su)	Chlorine (ppm)	Copper (ppm)	Phenol (ppm)	Detergents (ppm)	Ammonia (ppm)	Fecal Sample (mpn/100ml)	Turbidity (ntu)	Color	Odor?	Surface Scum	Oil Sheen
00-100-0290																
2008	11/2/07	1	No								No			No	No	No
2008	11/2/07	2	No								No			No	No	No
2008	4/7/08	3	Yes	0.75	5.0									No	No	No
2008	4/7/08	4	Yes	0.50	5.0									No	No	No
00-300-0385																
2008	4/7/08	1	Yes	10	7.5	0.08								No	No	No
2008	4/7/08	2	Yes	10	7.5	0.09								No	No	No
2008	5/13/08	3	No													
2008	5/13/08	4	No													
01-300-0150																
2008	11/1/07	1	Yes	15	7.0						No			No	No	No
2008	11/1/07	2	Yes	15	7.0						No			No	No	No
2008	4/7/08	3	Yes	10	6.0									No	No	No
2008	4/7/08	4	Yes	10	6.0									No	No	No
02-400-0045																
2008	8/3/07	1	Yes	15	6.0						No			No	No	No
2008	8/3/07	2	Yes	15	6.0						No			No	No	No
2008	2/15/08	3	Yes	25	7.0	0.07	0	0	0	0		0	0		No	No
2008	2/15/08	4	Yes	25	7.0	.06 0.07	0	0	0	0		0	0		No	No
02-400-0050																
2008	8/3/07	1	Yes	23	6.5	1.00					No			No	No	No
2008	8/3/07	2	Yes	23	6.5	1.00					No			No	No	No
2008	2/15/08	3	Yes	12	7.0	7 0.07	0	0	0	0		0	0		No	No
2008	2/15/08	4	Yes	12	7.0	0.07	0	0	0	0		0	0		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
02-400-0055																
2008	8/3/07	1	Yes	15	6.0	0.60				0.40	No			No	No	No
2008	8/3/07	2	Yes	15	6.0	0.60				0.40	No			No	No	No
2008	2/15/08	3	No													
2008	2/15/08	4	No													
02-300-0190																
2008	10/8/07	1	No								No			No	No	No
2008	10/8/07	2	No								No			No	No	No
2008	2/15/08	3	No													
2008	2/15/08	4	No													
02-300-0230																
2008	10/8/07	1	No								No			No	No	No
2008	10/8/07	2	No								No			No	No	No
2008	2/15/08	3	Yes	10	6.0										No	No
2008	2/15/08	4	Yes	10	6.0										No	No
02-100-0480																
2008	8/6/07	1	No								No			No	No	No
2008	8/6/07	2	No								No			No	No	No
2008	4/21/08	3	Yes	1	6.3									No	No	No
2008	4/21/08	4	Yes	1	6.3									No	No	No
02-100-0515																
2008	8/6/07	1	No								No			No	No	No
2008	8/6/07	2	No								No			No	No	No
2008	4/21/08	3	Yes	0.50	6.0									No	No	No
2008	4/21/08	4	Yes	0.50	6.0									No	No	No
03-300-0005																
2008	10/9/07	1	Yes	4	6.0	1.00					No			No	No	No
2008	10/9/07	2	Yes	4	6.0	1.00					No			No	No	No
2008	4/9/08	3	Yes	1	7.5	0.06	0	0	0	0		0	0	No	No	No
2008	4/9/08	4	Yes	1	7.5	0.06	0	0	0	0		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
03-300-0385																
2008	10/9/07	1	No								No			No	No	No
2008	10/9/07	2	No								No			No	No	No
2008	4/9/08	3	No													
2008	4/9/08	4	No													
03-200-0395																
2008	8/15/07	1	No								No			No	No	No
2008	8/15/07	2	No								No			No	No	No
2008	4/9/08	3	Yes	10	6.0									No	No	No
2008	4/9/08	4	Yes	10	6.0									No	No	No
03-300-0400																
2008	10/9/07	1	No								No			No	No	No
2008	10/9/07	2	No								No			No	No	No
2008	4/9/08	3	Yes	5	5.8									No	No	No
2008	4/9/08	4	Yes	5	5.8									No	No	No
03-300-0430																
2008	10/9/07	1	No								No			No	No	No
2008	10/9/07	2	No								No			No	No	No
2008	4/9/08	3	No													
2008	4/9/08	4	No													
03-100-0450																
2008	8/20/07	1	Yes	24	6.5	0.30					No			No	No	No
2008	8/20/07	2	Yes	20	6.5	0.30					No			No	No	No
2008	4/10/08	3	No													
2008	4/10/08	4	No													
03-200-0580																
2008	8/28/07	1	No								No			No	No	No
2008	8/28/07	2	No								No			No	No	No
2008	3/24/08	3	No													
2008	3/24/08	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
03-200-0820																
2008	8/2/07	1	No								No			No	No	No
2008	8/2/07	2	No								No			No	No	No
2008	3/24/08	3	Yes	15	5.8	0	0	0	0	0		0	0	No	No	No
2008	3/24/08	4	Yes	15	6.0	0	0	0	0	0		0	0	No	No	No
03-200-0875																
2008	8/2/07	1	No								No			No	No	No
2008	8/2/07	2	No								No			No	No	No
2008	2/19/08	3	Yes	10	5.5	0	0	0		0		0	0	No		No
2008	2/19/08	4	Yes	10	5.5	0	0	0	0	0	No	0	0	No	No	No
03-200-0905																
2008	8/2/07	1	Yes	150	5.5						No			No	No	No
2008	8/2/07	2	Yes	150	5.5						No			No	No	No
2008	2/19/08	3	Yes	50	6.0	0	0	0	0	0		0				No
2008	2/19/08	4	Yes	50	6.0	0	0	0	0	0		0				No
04-200-0328																
2008	8/16/07	1	No								No			No	No	No
2008	8/16/07	2	No								No			No	No	No
2008	12/7/07	3	No								No			No	No	No
2008	12/7/07	4	No								No			No	No	No
05-200-0130																
2008	9/13/07	1	No								No			No	No	No
2008	9/13/07	2	No								No			No	No	No
2008	3/13/08	3	No													
2008	3/13/08	4	No													
05-300-0185																
2008	9/13/07	1	Yes	14	6.0						No			No	No	No
2008	9/13/07	2	Yes	10	6.0						No			No	No	No
2008	3/13/08	3	Yes	25	5.5	0	0	0	0	0		0	0	No	No	No
2008	3/13/08	4	Yes	25	5.5	0	0	0	0	0		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
05-100-0200																
2008	9/13/07	1	No								No			No	No	No
2008	9/13/07	2	No								No			No	No	No
2008	3/13/08	3	No													
2008	3/13/08	4	No													
05-300-0210																
2008	9/18/07	1	Yes	20	6.0						No			No	No	No
2008	9/18/07	2	Yes	20	6.0						No			No	No	No
2008	3/13/08	3	No													
2008	3/13/08	4	No													
06-100-0146																
2008	9/18/07	1	No								No			No	No	No
2008	9/18/07	2	No								No			No	No	No
2008	3/17/08	3	No													
2008	3/17/08	4	No													
06-200-0155																
2008	9/18/07	1	No								No			No	No	No
2008	9/18/07	2	No								No			No	No	No
2008	3/17/08	3	No													
2008	3/17/08	4	No													
06-400-0185																
2008	9/19/07	1	No								No			No	No	No
2008	9/19/07	2	No								No			No	No	No
2008	3/17/08	3	No													
2008	3/17/08	4	No													
07-200-0015																
2008	9/10/07	1	Yes	10	6.5						No			No	No	No
2008	9/10/07	2	Yes	8	6.5						No			No	No	No
2008	3/18/08	3	No													
2008	3/18/08	4	Yes	2	5.8	0	0	0	0	0		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
07-100-0055																
2008	9/10/07	1	Yes	13	7.5						No			No	No	No
2008	9/10/07	2	Yes	11	7.0						No			No	No	No
2008	3/18/08	3	Yes	10	5.8	0	0	0	0	0		0	0	No	No	No
2008	3/18/08	4	Yes	10	6.3	0	0	0	0	0.50		0	0	No	No	No
07-400-0200																
2008	9/10/07	1	No								No			No	No	No
2008	9/10/07	2	No								No			No	No	No
2008	3/18/08	3	Yes	5	7.0	0.06	0	0	0	0		0	0	No	No	No
2008	3/18/08	4	Yes	50	7.0	0.06	0	0	0	0		0	0	No	No	No
13-300-0135																
2008	10/10/07	1	Yes	15	6.0						No	100	20	No	No	No
2008	10/10/07	2	Yes	15	6.5					1.00	No	100	20	No	No	No
2008	4/22/08	3	Yes	5	7.5	0.06				0		10	20	No	No	No
2008	4/22/08	4	Yes	5	7.5	0.06				0		10	20	No	No	No
13-300-0140																
2008	10/10/07	1	Yes	40	6.0	1.00					No			No	No	No
2008	10/10/07	2	Yes	40	6.5	1.00					No			No	No	No
2008	4/22/08	3	Yes	2	7.0	0.05				0		20	20	No	No	No
2008	4/22/08	4	Yes	2	7.0	0.05				0		20	20	No	No	No
13-200-0340																
2008	9/21/07	1	Yes	4	6.0						No		20	No	No	No
2008	9/21/07	2	Yes	4	6.0						No		20	No	No	No
2008	4/10/08	3	Yes	10	5.5									No	No	No
2008	4/10/08	4	Yes	10	5.5									No	No	No
53-200-0170																
2008	8/9/07	1	No								No			No	No	No
2008	8/9/07	2	No								No			No	No	No
2008	2/11/08	3	Yes	40	6.0	0	0	0	0	0		0			No	No
2008	2/11/08	4	Yes	40	6.0	0	0	0	0	0		0			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

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

APPENDIX C

Summary Report for IBI Studies during permit year

INDEX OF BIOTIC INTEGRITY ON SECOND AND LOVE CREEKS IN THE CITY OF KNOXVILLE FINAL DATA REPORT

CITY OF KNOXVILLE CONTRACT C-08-0184

SEPTEMBER 4, 2008

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 LOVE CREEK AND SECOND CREEK IN THE CITY OF KNOXVILLE SEPTEMBER 4, 2008

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 Second reek were the two streams surveyed for the Index of Biotic Integrity (IBI) May-July, 2008. In this document we will state our plan, describe the study areas, explain methodology, and discuss results.

OBJECTIVES

1. Perform backpack electro-shocking for fish survey.
2. Perform a macroinvertebrate survey.
3. Perform a habitat assessment at each sampling location.
4. Perform water quality testing at each sampling location.
5. Provide photographic evidence of current conditions and environmental pressures at each sampling location.
6. Score IBI and deliver write-up to the city of Knoxville.

STUDY AREAS

FLLA assessed two sites along Love Creek. The down stream site was located within Spring Place Park beginning at the entrance of the park's parking lot at the culvert and working up stream 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 upstream site was located above the artesian well and reached upstream 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 on Love Creek.

FLLA assessed two sites along Second Creek. The downstream site was at Neland Drive near Volunteer Landing and continued upstream to the parking lot of the University of Tennessee on Kingston Pike near the World's Fair Park (see Figure 2). This survey was conducted at approximately 0.1 mile up stream from the confluence with Fort Loudoun Lake. The upstream site was located above World's Fair Park and continued upstream approximately 150 meters (see Figure 3). This survey was conducted at approximately 0.7 miles up stream from the confluence with Fort Loudoun Lake. The approximate drainage area was 3.20 square miles.

Figure 2. Lower site on Second Creek.

Figure 3. Upper site on Second Creek.

METHODS

INDEX OF BIOTIC INTEGRITY OF FISH (IBI-F)

FLLA used 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 fish surveys, 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 2006). 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 Love Creek and Second 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 looking at the instream and out of stream habitat parameters and water quality 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%

For the IBI-F sampling a Xantrex Power 300 backpack shocker, one twenty foot seine, two collection nets and one five gallon bucket were used. 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.

INDEX OF BIOTIC INTEGRITY FOR MACROINVERTEBRATES (IBI-M)

FLLA used the Tennessee Department of Environment and Conservation's (TDEC) Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys (TDEC 2006) for sampling procedures of collecting biological samples. The biological conditions of Love Creek and Second 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 riffles

A semi-quantitative riffle kick (SQKICK) was used to collect samples. A one-meter kick net with 500 micron mesh was used to sample the riffles. At each site, four collection kicks were performed. Two kicks were in slower current velocity and two kicks were 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 micron 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-micron 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. (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 biometrics 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)

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 four 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, pH, temperature and conductivity. Parameters were recorded using YSI meters. The YSI 60 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 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 2006) 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 of Love Creek and Second Creek, June 19, 2008.

	LOVE CREEK		SECOND CREEK	
	Upper Site	Lower Site	Upper Site	Lower Site
IBI-F score	30	36	18	30
Rating	Poor	Poor	Very poor	Poor
IBI-M score	32	32	28	18
Rating	Non-impaired	Non-impaired	Slightly impaired	Moderately impaired
Habitat score	110	87	49	65
Rating	Moderately impaired	Severely impaired	Severely impaired	Severely impaired

Table 3. Densities of fish collected on Love Creek and Second Creek, June 19, 2008.

			LOVE CREEK		SECOND CREEK	
Family	Species	Common Name	Upper Site	Lower Site	Upper Site	Lower Site
Cyprinidae (minnows)	*Capostoma anomalum*	Central stoneroller	35	132	28* (6)	94* (23)
	Cyprinella glalactura	Whitetail shiner	4	42		
	Luxilus coccogenis	Warpaint shiner		13		
	Notropis leuciodus	Tennessee shiner		2		
	Rhinichthys atratulus	Blacknose dace	42	113	9* (6)	1* (1)
	Semotilus atromaculatus	Creek chub		3		
Catostomidae (suckers)	*Hypentelium nigricans*	Northern hogsucker	5	6		1
Poeciliidae (livebearers)	*Gambusia affinis*	Western mosquitofish		7		
Cottidae (sculpins)	*Cottus carolinae*	Banded sculpin				1

Centrachidae (sunfishes)	*Ambloplites rupestris*	Rock bass	**3**	**4**		**2**
	Lepomis cyanellus	Green sunfish	**11**	**2**		
	Lepomis macrochirus	Bluegill	**4**			
	Micropterus dolomieu	Smallmouth bass				**3**
	Pomoxis annularis	White crappie		**2**		
Percidae (perches)	*Etheostoma simoterum*	Snubnose darter	**3**	**34**		**2**
			107	**360**	**37**	**104**
Note: * equals abnormalities such as black spot and number in parenthesis is total number with an abnormality.						

A total of 608 fish were collected, identified to species, and checked for anomalies. The most numerous fish species was *C. anomalum*, central stoneroller, with 289 specimens that represented 48.09% of the total catch. Love Creek's lower site contained the most numerous collection with 360 that represented 59.90% of the total catch. At each of the Second Creek sites, black spot was observed and recorded on both the stoneroller and *R. atratulus*, black nose dace. At the lower site, black spot was present in 24 of 104 fish collected. At the upper site, 32.43% of those collected showed signs of black spot.

Table 4. Fish IBI score of the upper site of Love Creek, June 19, 2008.

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	3	5
Number of sucker species	<0.5	(0.5-1)	>1	1	3
Number of intolerant species	<1	(1-2.5)	>2.5	1	3
Percent of individuals as tolerant species	>40%	20%-40%	<20	53.27	1
Percent of individuals as omnivores and stoneroller species	>50%	25%-50%	<25	32.71	3
Percent of individuals as specialized insectivores	<10%	10%-20%	>20%	4.67	1
Percent of individuals as piscivores	<2%	2%-4%	>4%	2.80	3

Catch rate (average number of fish per 300 sq. ft. sampling unit)	<22	22-43.8	>43.8	7.13	1
Percent of individuals as hybrids	<1%	TR-1%	0%	0.00	1
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 poor.

Table 4. Fish IBI score of the lower site of Love Creek, June 19, 2008.

Metric Description	**Scoring Criteria**			**Observed**	**Score**
	1	3	5		
Total number of native fish species	<5	(5-10)	>10	12	5
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	3	5
Number of sucker species	<0.5	(0.5-1)	>1	1	3
Number of intolerant species	<1	(1-2.5)	>2.5	1	3
Percent of individuals as tolerant species	>40%	20%-40%	<20	32.77	3
Percent of individuals as omnivores and stoneroller species	>50%	25%-50%	<25	36.67	3
Percent of individuals as specialized insectivores	<10%	10%-20%	>20%	1.67	1
Percent of individuals as piscivores	<2%	2%-4%	>4%	1.67	1
Catch rate (average number of fish per 300 sq. ft. sampling unit)	<22	22-43.8	>43.8	21.18	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		36
			IBI Classification		Poor

Fish sampling yielded an IBI score of 36 that equals poor.

Table 5. Fish IBI score of the upper site of Second Creek, June 19, 2008.

Metric Description	Scoring Criteria			Observed	Score
	1	3	5		
Total number of native fish species	<5	(5-10)	>10	2	1
Number of darter species	<1.5	(1.5-2.5)	>2.5	0.00	1
Number of sunfish species, less *Micropterus*	<1.5	(1.5-2.5)	>5	0.00	1
Number of sucker species	<0.5	(0.5-1)	>1	0.00	1
Number of intolerant species	<1	(1-2.5)	>2.5	0.00	1
Percent of individuals as tolerant species	>40%	20%-40%	<20	24.32	3
Percent of individuals as omnivores and stoneroller species	>50%	25%-50%	<25	75.68	1
Percent of individuals as specialized insectivores	<10%	10%-20%	>20%	0.00	1
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	4.11	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%	32.43	1
			IBI		18
			IBI Classification		Very poor

Fish sampling yielded an IBI score of 18 that equals very poor.

Table 6. Fish IBI score of lower site of Second Creek, June 19, 2008.

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	2	3
Number of sucker species	<0.5	(0.5-1)	>1	1	3
Number of intolerant species	<1	(1-2.5)	>2.5	1	3
Percent of individuals as tolerant species	>40%	20%-40%	<20	35.00	3

Percent of individuals as omnivores and stoneroller species	>50%	25%-50%	<25	90.04	1
Percent of individuals as specialized insectivores	<10%	10%-20%	>20%	0.96	1
Percent of individuals as piscivores	<2%	2%-4%	>4%	4.81	5
Catch rate (average number of fish per 300 sq. ft. sampling unit)	<22	22-43.8	>43.8	5.47	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%	23.08	1
			IBI		30
			IBI Classification		Poor

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

Table 7. Densities of macroinvertebrates collected on Love Creek and Second Creek, June 25, 2008.

TAXA				
	LOVE CREEK		SECOND CEEK	
	Upper Site	Lower Site	Upper Site	Lower Site
OLIGOCHAETA (aquatic worms)				
Haplotaxidae				
Haplotaxis gordioides	13			40
EPHEMEROPTERA (mayflies)				
Isonychiidae				
Isonychia sp.	3	2		
TRICHOPTERA (Caddisflies)				
Hydropsychidae				
Certatopsyche sparna	50	48	13	19
Hydropsyche demora	43	45		3
Hydropsyche venularis		4		
COLEOPTERA (beetles)				
Dytiscidae				
Hydaticus modestus			2	
Elmidae				
Optioservus sp. (juv.)	16	23	7	2
Promoresia tardella	1	1		
Stenelmis sp. (adult)	4	6	2	
Haliplidae				
Peltodytes sp.	2			

Psephenidae				
Psephenus herricki	2	24		
DIPTERA (Flies)				
Tabanidae				
Tabanus sp.	1			
Chironomidae				
Paramerina	6			
Tipulidae				
Antocha	6	5		
Tipula abdominalis	2	1		
Tipula Yamatotipula sp.				1
Simuliidae				
Prosimulium rhizophorum		2	1	
Simulium snowi	1			
ODONATA (dragonflies & damselflies)				
Aesheridae				
Boyeria vinosa		2		
Calopteryidae				
Calopteryx maculata/dimidiata			3	
Gomphidae				
Stylurus plagiatus		2		
TOTALS	148	165	28	65

A total of 406 specimens were collected among the four sampling sites. The downstream site at Spring Place Park on Love Creek had the greatest number with 165 specimens. This site was dominated the two hydropsychids, *C. sparna* and *H. demora*. The site with the least number of macroinvertebrates was at the upstream site above World's Fair Park on Second Creek with only 28 specimens collected and identified. The riffle beetle, *Optisoservus* sp., and the hydropsychid, *C. sparna*, were dominant.

Table 8. Summary Table for Macroinvertebrate Index of Four Sampling Sites on Love Creek and Second Creek, June 25, 2008.

		METRIC							
Site		**Taxa Richness**	**EPT Richness**	**% EPT**	**% OC**	**NCBI**	**% Clingers**	**% NUTROL**	**Index Score**
Love Creek, Upper	Value	14	3	64.86	12.84	3.47	82.00	9.46	
	Score	2	0	6	6	6	6	6	**32**
Love Creek,	Value	12	3	57.58	0.00	3.44	81.00	0.00	

Lower									
	Score	2	0	6	6	6	6	6	**32**
Second Creek, Upper	Value	6	3	46.43	0.00	4.01	81.00	0.00	
	Score	0	0	4	6	6	6	6	**28**
Second Creek, Lower	Value	5	3	33.85	61.54	1.32	37.00	61.54	
	Score	0	0	4	2	6	4	2	**18**

	INDEX SCORE	INDEX SCORE RATING
SITE		
Love Creek, Upper	32	Non-impaired (supporting)
Love Creek, Lower	32	Non-impaired (supporting)
Second Creek, Upper	28	Slightly impaired
Second Creek, Lower	18	Moderately impaired

Scores ranged from 18 to 32. Both sites on Love Creek scored "Non-impaired" and both scored 32. The upper site on Second Creek scored "28" meaning it is "Slightly impaired". The lower site on Second Creek scored the lowest of the four sites with an "18" classifying it as "Moderately impaired".

Table 9. Summary of water quality analysis taken on Love Creek and Second Creek, June 25, 2008.

	WATER QUALITY PARAMETERS			
Site	Temperature (°C)	DO (mg/L)	pH	Conductivity (um/hos)
Love Creek, Upper	22.5	5.06	6.30	401.7
Love Creek, Lower	19.6	7.21	6.27	397.9
Second Creek, Upper	20.9	4.77	7.50	458.1
Second Creek, Lower	21.0	3.85	7.63	441.6

Temperatures ranged 19.6 to 22.5 °C on Love Creek and 20.9 to 21.0 °C on Second Creek. Dissolved oxygen ranged from 5.06 to 7.21 mg/L on Baker Creek and 3.85 to 4.77 mg/L on Second Creek. On Love Creek pH ranged 6.27 to 6.30 and 7.50 to 7.64 on

Second Creek. Conductivity ranged from 397.9 to 401.7 on Love Creek and 441.6 to 458.1 on Second Creek.

Table 10. Summary for Habitat Assessment on Love Creek and Second Creek, June 25, 2008.

	SAMPLING SITE			
Habitat Parameter	**Love Creek, Upper**	**Love Creek, Lower**	**Second Creek, Upper**	**Second Creek, Lower**
Latitude	36°01.425'	36°01.257'	N/A	35° 57.369'
Longitude	083°51.611'	083°51.520'	N/A	083° 55.406'
Epifaunal Cover	7	12	2	6
Embeddedness	7	12	3	5
Velocity/Depth Regime	13	13	6	11
Sediment Deposition	11	9	4	5
Channel Flow	13	14	11	6
Channel Alteration	6	8	2	6
Riffle Frequency	13	10	4	5
Bank stability (left/right)	9/3	1/3	1/2	1/2
Vegetative Protection (left/right)	10/6	0/2	5/5	5/5
Riparian Zone Width (left/right)	9/3	1/2	2/2	3/5
Total (200 max.)	**110**	**87**	**49**	**65**

	TOTAL SCORE	TOTAL SCORE RATING
SITE		
Love Creek, Upper	110	Moderately impaired
Love Creek, Lower	87	Severely impaired
Second Creek, Upper	49	Severely impaired
Second Creek, Lower	65	Severely impaired

The upper site on Love Creek scored "Moderately impaired" and the lower site scored "Severely impaired". Both sites on Second Creek scored, "Severely impaired".

At the upper site of Love Creek at Spring Place Park, none of the habitat parameters were scored as "Poor" but five scored as "Marginal". They were epifaunal substrate, embeddedness, channel alteration, and bank stability on the right bank and riparian zone width on the right bank. The right bank was adjacent to Loves Creek Road. Much of the upper site was wooded area with good canopy cover. Riffle – run

complexes and pools were observed throughout but many of the complexes were bedrock only and the pools suffered from siltation issues. Flows were faster and varied and the channel was primarily filled. On the left bank (facing downstream) the bank stability, vegetative protection, and riparian vegetative zone width all scored "Optimal".

At the lower site of Love Creek at Spring Place Park bank stability on the left bank, vegetative protection and riparian vegetative zone width all scored in the "Poor" category. On both sides of the stream the eroding banks were collapsing and the stream channel was expanding. The process should continue. Siltation was occurring in the pools that were mostly under the few trees remaining along the stream banks. There was little to no canopy cover present except for one or two stands of large trees. One drainage pipe was present but water was not following.

The upper site above World's Fair Park on Second Creek had the lowest habitat score and was classified as "Severely impaired". Seven of the habitat parameters were classified as "Poor" including epifaunal substrate, embeddedness, sediment deposition, channel alteration, frequency of riffles, bank stability and riparian vegetative zone width. The entire site had been channelized with impacts due to parking lots on both sides, which limited the vegetative zone width. The site suffered from stormwater runoff and pollution from the parking lots. Because of this bank stability suffered and throughout the site the steep banks were eroding due to limited vegetative bank protection. Insteam habitat was mostly bedroom with some cobble/gravel mix. This substrate was showed severe embeddeness due to siltation. Large amounts of trash were observed and an oily film on the water's surface was present in several locations. Very few riffles were present rather the area was dominated by a run-pool sequence.

The lower site near Volunteer Landing on Second Creek was classified as "Severely impaired." Four categories were classified as "Poor" including embeddedness, sediment deposition, frequency of riffles and bank stability. Vegetative protection and riparian vegetative zone width scored "Marginal" as the result of parking lots along the left bank (downstream). Flows were low and the channel was not entirely wetted. There were several severe erosion sites showing bank failure even though an attempt had been made using riprap to limit erosion. Only four pools were present in the sampling site and they were mostly present around the old railroad concrete foundations. Also present were several invasive plants including knotweed (Family Polygonaceae) and mimosa (Family Fabaceae). Because of the parking lots on University of Tennessee property along the sampling site and Cumberland Avenue running perpendicular to Second Creek, stormwater run-off and additional pollutants are a concern.

DISCUSSION

Both creeks in the current study are listed in the version of the 2008, 303 d list for the state of Tennessee (TDEC 2008). Love Creek's 9.7 impaired miles are listed due to loss of biological integrity due to siltation, and other anthropogenic habitat alterations due to discharges from a MS4 area. Second Creek's 12.8 impaired miles are listed due to nitrates, loss of biological integrity due to siltation, *Echerichia coli,* and other anthropogenic habitat alterations due to discharges from a MS4 area, being located in an urbanized high density area, and collection system failure.

Love Creek was scored as "Poor" according to the IBI-F at both sites. Blacknose dace dominated the fish community at the upper site and the central stoneroller dominated the lower site. According to the IBI-M, both sites scored "Non-impaired". The caddisflies, *C. sparna* and *H. demora* dominated the macroinvertebrate community. The habitat assessment determined different ratings for the two sites. The upper site was scored as "Moderately impaired" and the lower site scored "Severely impaired". Environmental pressures included bank stability, vegetative protection and riparian zone width.

Second Creek was scored as "Very poor" at the upper site and "Poor" for the lower site according to the IBI-F. Central stoneroller dominated the fish community. At the upper site, the caddisfly *C. sparna*, was the most numerous macroinvertebrate collected and at the lower site, the aquatic worm, *H. gordioides* was most numerous. For the habitat assessment nearly every category was suffered due to anthropogenic impacts. The upper site above World's Fair Park scored the lowest of the four sites in the survey.

Overall both streams are suffering due to anthropogenic forces throughout their stream lengths. If these pressures continue the biological community and the physical habitat will continue to degrade. Please refer to Appendix A photos for current conditions and pressures on Love Creek and Appendix B photos for current conditions and pressures on Second Creek.

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APPENDIX D

Summary Report for RBP III Studies during permit year

RAPID BIOASSESSMENT PROTOCOL (III) ON BAKER CREEK AND THIRD CREEK IN THE CITY OF KNOXVILLE FINAL DATA REPORT JUNE – JULY, 2008

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 BAKER CREEK AND THIRD CREEK IN THE CITY OF KNOXVILLE FINAL DATA REPORT JUNE – JULY, 2008

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. Third Creek and Baker Creek were the two streams surveyed for the Rapid Bioassessment Protocol III (RBP III) in May-July, 2008. In this document we will state our plan, describe the study areas, explain methodology, and discuss results.

OBJECTIVES

1. Perform a macroinvertebrate study.
2. Perform a water quality test.
3. Perform a habitat analysis on each stream.
4. Provide photographic evidence of current conditions and pressures at each site. See Appendix A and B.
5. Score the RBP and deliver write-up to the city of Knoxville.

STUDY AREAS

FLLA assessed two sites along Third Creek. The down stream site was located near the intersection of Cox St. and Sutherland Ave. at the Tennessee Stream Mitigation Project (see Figure 1). This survey site was conducted at approximately 3 miles up stream from the confluence with Fort Loudoun Lake. The upstream site was located at the intersection of Middlebrook Pike and Lonas Rd. (see Figure 2). This survey was conducted at approximately 4.75 miles up stream from the confluence with Fort Loudoun Lake. The site near Cox St. and Sutherland Ave. has an approximate drainage area of 10 square miles and the site near Middlebrook Pike and Lonas Rd has an approximate drainage area of 3 square miles.

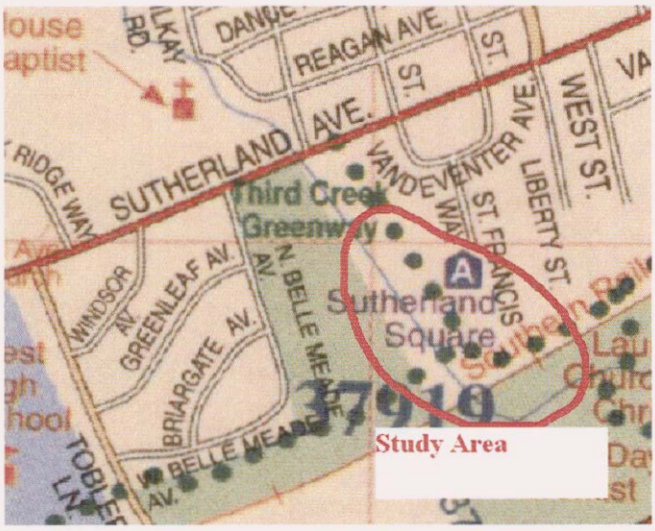

Figure 1. Dwn stream survey site at Cox St and Sutherland Avenue.

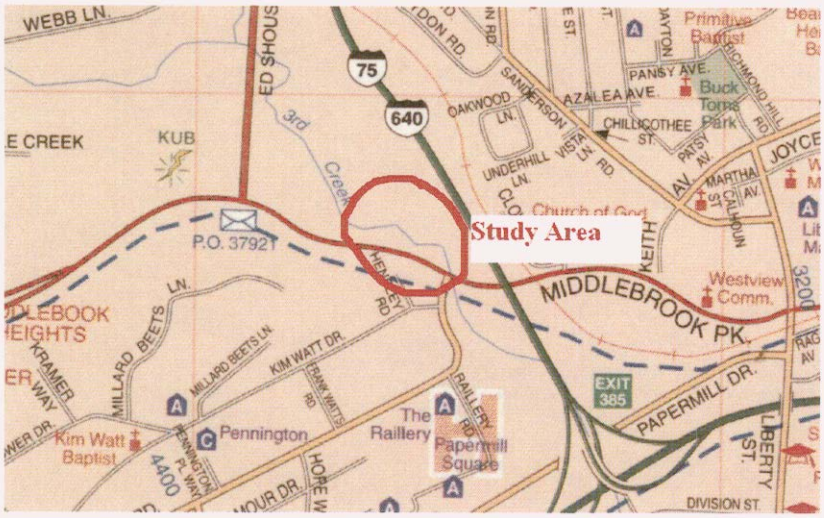

Figure 2. Upstream survey site near Middlebrook Pike and Lonas Road.

FLLA assessed two sites along Baker Creek. One stream site was located on a tributary to Baker Creek at Mary James Park on South Haven Drive (see Figure 3). This survey was conducted at approximately 1 mile up stream from the confluence with Fort Loudoun Lake. The second site was located on Baker Creek at Rock City Park at the intersection near Moody Ave and Sevier Ave (see Figure 4). This survey was conducted at approximately 1.25 miles up stream from the confluence with Fort Loudoun Lake. The Mary James Park site on the tributary of Baker Creek has an approximate drainage area of 2 square miles and the Rock City Park site has a drainage area of approximately 4 square miles.

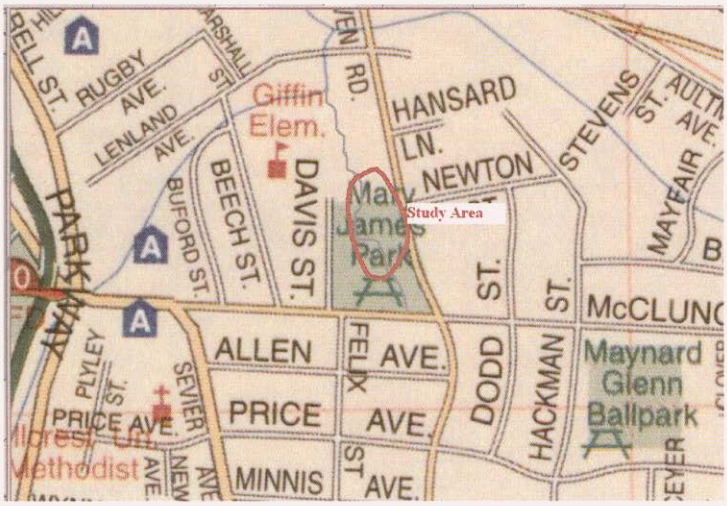

Figure 3. Lower site of the tributary of Baker Creek at Mary James Park on South Haven Dr.

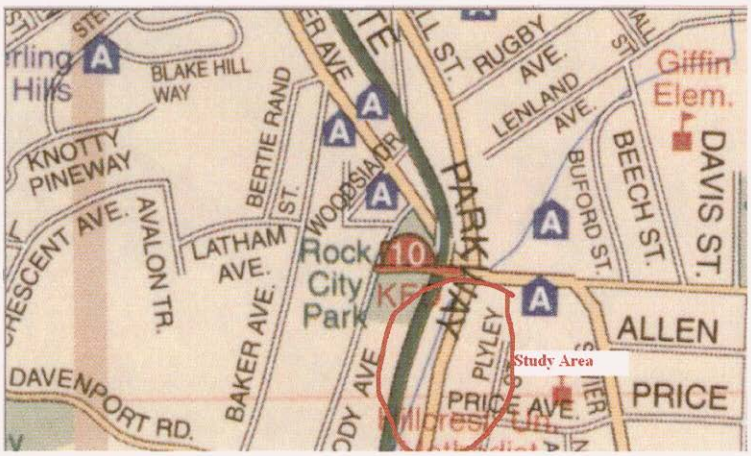

Figure 4. Upper site of Baker Creek at Rock City Park near the intersection of Baker Ave and Latham Ave.

METHODS

FLLA used 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, and 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 2006). 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 Love Creek and Second Creek 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 out of stream habitat parameters and water quality parameters.

IBI-M

FLLA used the Tennessee Department of Environment and Conservation's (TDEC) Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys (Arnwine 2006) for sampling procedures of collecting biological samples. The biological conditions of Love Creek and Second 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 riffles

A semi-quantitative riffle kick (SQKICK) was used to collect samples. A one-meter kick net with 500 micron mesh was used to sample the riffles. At each site, four collection kicks were performed. Two kicks were in slower current velocity and two kicks were 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 micron 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-micron 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. (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 biometrics 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)
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 four 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, pH, temperature and conductivity. Parameters were recorded using YSI meters. The YSI 60 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 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 2006) 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. Densities of Macroinvertebrates Collected on Love Creek and Second Creek, June 25, 2008.

TAXA				
	LOVE CREEK		SECOND CEEK	
	Upper Site	Lower Site	Lower Site	Upper Site
OLIGOCHAETA (aquatic worms)				
Haplotaxidae				
Haplotaxis gordioides	13			
TRICHOPTERA (Caddisflies)				
EPHEMEROPTERA (mayflies)				
Oligoneuriidae				
Isonychia sp.	3	2		
Hydropsychidae				
Certatopsyche sparna	50	48		
Hydropsyche demora	43	45		
Hydropsyche venularis		4		
COLEOPTERA (beetles)				
Elmidae				
Optioservus sp. (juv.)	16	23	3	
Promoresia tardella	1	1		
Stenelmis sp. (adult)	4	6	2	
Haliplidae				
Peltodytes sp.	2			
Psephenidae				
Psephenus herricki	2	24		
DIPTERA (Flies)				
Chironomidae				
Coelotanypus concinnus				
Dolichopodidae				
Tanypodinae				
Paramerina	6			
Tabanidae				
Tabanus sp.	1			
Tipulidae				
Antocha	6	5		
Tipula abdominalis	2	1		
Tipula Yamatotipula sp.				
Simuliidae				
Prosimulium rhizophorum		2		

Simulium snowi	1				
ODONATA (dragonflies & damselflies)					
Aesheridae					
Boyeria vinosa		2			
Boyeria graffiana					
Calopteryidae					
Calopteryx maculata/dimidiata					
Coenagrionidae					
Argia bipunctulata					
Corduliidae					
Somatochlora linearis					
Gomphidae					
Stylurus plagiatus		2			
TOTALS					

A total of 318 specimens were collected among the four sampling sites. The Rock City Park site on Baker Creek had the greatest number with 133 specimens. This site was dominated by the midge, *C. concinnus*, and the two hydropsychids, *C. sparna* and *H. demora*. The least numerous site was at Mary James Park on Baker Creek with only 26 specimens collected and identified. At both sites on Third Creek the dominant taxon was A caddisfly, *C. sparna*.

Table 2. Summary Table for Macroinvertebrate Index of Four Sampling Sites on Baker Creek and Third Creek, June 26, 2008.

		METRIC							
Site		**Taxa Richness**	**EPT Richness**	**% EPT**	**% OC**	**NCBI**	**% Clingers**	**% NUTROL**	**Index Score**
Baker Cr., Upper	Value	8	2	50.04	24.06	5.38	73.68	0.93	
	Score	0	0	6	6	4	6	0	**22**
Baker Cr., Lower	Value	5	1	3.85	57.69	7.36	7.70	0	
	Score	0	0	0	2	2	0	0	**4**
Third Cr., Upper	Value	8	2	76.92	0	3.84	86.54	0	
	Score	0	0	6	6	6	6	0	**24**
4Third Cr., Lower	Value	5	2	71.03	13.08	2.88	86.92	0	

	Score	0	0	6	6	6	6	0	**24**

	INDEX SCORE	INDEX SCORE RATING
SITE		
Baker Cr., Upper	22	Slightly impaired
Baker Cr., Lower	4	Moderately impaired
Third Cr., Upper	24	Slightly impaired
Third Cr., Lower	24	Slightly impaired

Scores ranged from 4 to 24. The lower site on Baker Creek at Mary James Park was classified as "Moderately impaired". Three sites were classified as "Slightly impaired".

Table 3. Summary of water quality analysis taken on Baker Creek and Third Creek, June 26, 2008.

	WATER QUALITY PARAMETERS			
Site	Temperature (°C)	DO (mg/L)	pH	Conductivity (um/hos)
Baker Cr., Upper	19.7	8.40	7.25	361.6
Baker Cr., Lower	18.2	6.76	6.28	320.9
Third Cr., Upper	20.8	8.41	7.30	385.3
Third Cr., Lower	21.0	8.35	7.34	374.1

Temperatures ranged 18.2 to 19.7 °C on Baker Creek and 20.8 to 21.0 °C on Third Creek. Dissolved oxygen ranged from 6.76 to 8.40 mg/L on Baker Creek and 8.35 to 8.41 mg/L on Third Creek. On Baker Creek pH ranged 6.28 to 7.25 and 7.30 to 7.34 on Third Creek. Conductivity ranged from 320.9 to 361.6 on Baker Creek and 374.1 to 385.3 on Third Creek.

Table 4. Summary for Habitat Assessment on Baker Creek and Third Creek, June 26, 2008.

	SAMPLING SITE			
Habitat Parameter	**BAKER CR., UPPER**	**BAKER CR., LOWER**	**THIRD CR., UPPER**	**THIRD CR., LOWER**
Latitude	35°57.144'	35°57.109'	35°57.620'	35°56.914
Longitude	083°53.659'	083°53.282'	083°58.435'	083°57.971'
Epifaunal Cover	1	5	6	3
Embeddedness	1	2	6	2
Velocity/Depth Regime	6	6	16	14
Sediment Deposition	3	2	7	6
Channel Flow	11	6	13	17
Channel Alteration	11	11	11	19
Riffle Frequency	11	7	16	1
Bank stability (left/right)	1/5	1/1	5/5	10/10
Vegetative Protection (left/right)	8/7	1/1	6/6	8/8
Riparian Zone Width (left/right)	6/10	1/1	6/6	10/10
Total (200 max.)	**81**	**45**	**109**	**118**

	TOTAL SCORE	TOTAL SCORE RATING
SITE		
Baker Cr., Upper	81	Severely impaired
Baker Cr., Lower	45	Severely impaired
Third Cr., Upper	109	Moderately impaired
Third Cr., Lower	118	Moderately impaired

Both sites on Baker Creek were scored as "Severely impaired" and both sites on Third Creek were scored as "Moderately impaired".

At the Rock City Park on Baker Creek five of the parameters were scored as "Marginal" to "Poor". The major issues included that the entire site was suffering from heavy siltation and embeddedness was almost 100% throughout the site. This limited the amount of cover available. To add to the siltation pressures bank stability was poor especially near the ball fields. Also there was a film of oil present at the lower end of the sampling site. Further upstream there were several large woody debris weirs that were trapping sediment and altering flow patterns. Slow flowing runs and pools were present above these weirs. One of the few positives of the site was that the riparian vegetative

zone width was intact and relatively undisturbed on the right bank. Beyond the ball fields upstream the riparian zone returned on the left side as well.

Baker Creek at the Mary James Park scored the lowest of all sites with a total score of 45. Of the ten parameters six scored in the "Poor" category and three (bank stability, vegetative protection and riparian vegetative zone width) were scored as "1". Downstream from the park were several homes with large yards or a forested area. Within the park the only riparian vegetation was a few larger trees or well maintained grasses. The creek was very narrow and there was little cover available throughout the area. Little to no gravel was exposed and was severely embedded with fine silt. Sediment deposition was present both in the park and in the residential area. Trash was present throughout the park and would eventually enter the creek. Also the warning sign for bacteria levels was knocked down.

The two sites on Third Creek were scored as "Moderately impaired" with scores of 109 at the South College site and 118 at the Tennessee Mitigation Stream Site.

At the South College site none of the parameters were scored as "Poor" and two of them (velocity/depth regime and frequency of riffles) scored in the "Optimal" category with "16" for each. Flow velocities were higher here than other locations and all four types of flow regime were present. At the lower section bedrock dominated the substrate but moving upstream the bedrock was replaced by cobble/gravel mix. Also the riparian zone had been removed by lawn maintenance by South College on the right bank (downstream) and the apartment complex on the left bank (downstream). Grasses were cut and maintained and only a few larger trees remained. At the upper section the riparian zone was present but there were several areas of bank failure between the two sections. The flows in the upper section were slower and the stream width increased. Two other concerns were noted from the upper section. Both a raw sewage and a petroleum smell were present throughout the sampling site.

The mitigation site on Third Creek scored the highest of the four sites with a total score of 118. Four of the parameters scored in the "Optimal" category (channel flow status, channel alteration, bank stability and vegetative zone width.). The vegetative protection parameter was scored "9" for each bank and would have scored higher if trees had been present along the bank providing much need shade throughout the site. Unfortunately three parameters: epifaunal substrate, embeddedness and frequency of riffles all scored "Poor". Throughout the entire site little to no substrate was present and where present the gravel was severely surrounded by sediment. The biggest concern was the lack of riffles. There were only two present: one at the pedestrian wooden bridge and one next to the parking lot near Sutherland Avenue. Walking in the stream was difficult and often times sinking into the substrate to the knee. Little to no large woody debris was present either but vegetation covered most to all of the banks. Finally large numbers of fish were present.

DISCUSSION

Both creeks in the current study are listed in the draft version of the 2008, 303 d list for the state of Tennessee (TDEC 2008). Baker Creek's 3.3 impaired miles are listed due to nitrates, other anthropogenic habitat alterations, and *Echerichia coli* due to discharges from MS4 areas as well as collection system failure. Third Creek's 20.7 impaired miles are listed due to nitrates, loss of biological integrity due to siltation, other anthropogenic habitat alterations and *E. coli* due to discharges from MS4 area, being located in a urbanized high density area, land development and collection system failure. There is a water contact advisory due to pathogens as well.

Baker Creek was scored as impaired according to the macroinvertebrate survey and the habitat analysis. At the Rock City Park site (upper site) scores were 22 ("Slightly impaired") for the macroinvertebrate survey and 81 (Severely impaired") for habitat assessment. The macroinvertebrate community was dominated by hydropsychid caddisflies and midges. Habitat concerns included epifaunal cover, embeddedness, and bank stability. At the Mary James Park site (lower site), scores were 4 ("Moderately impaired") for macroinvertebrates and 45 ("Severely impaired") for habitat assessment. Very few macroinvertebrates were collected here and the dominant taxon was midge larvae. Habitat concerns included embeddedness, sediment deposition, bank stability, vegetative protection and riparian zone width. There was little to no vegetative protection throughout the park and bank failure was present as well.

Third Creek was scored as impaired from the macroinvertebrate survey and the habitat assessment. The upper site at South College near Middlebrook Pike and Lonas Road scored 24 ("Slightly impaired") for macroinvertebrates and 109 ("Moderately impaired") for habitat assessment. The macroinvertebrate community was dominated by caddisfly larvae. Habitat concerns were present but two were scored in the "Optimal" category. One major concern was the presence of sewage and petroleum odors throughout the site. During sampling, several children were observed playing in the creek and when asked none of them knew of any concerns with water quality. The Tennessee Mitigation site near Cox Street and Sutherland Avenue scored "Slightly impaired" at 24 for macroinvertebrates and the highest for habitat assessment at 118 but still considered "Moderately impaired". Again the macroinvertebrate community was dominated by caddisflies. The greatest habitat pressures included epifaunal cover, embeddedness and riffle frequency. The entire sampling site was inundated with heavy amounts of sediment with little to no gravel/cobble mix present. Also only two riffles were present at the site.

Overall both streams are suffering due to anthropogenic forces throughout their stream lengths. It is believed that these pressures will continue and that the biological community and the physical habitat will continue to suffer as well. Please refer to Appendix A photos for current conditions and pressures on Baker Creek and Appendix B photos for current conditions and pressures on Third Creek.

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

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

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

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APPENDIX E

Stream Restoration/Debris Removal Contract Report

2008 Weir Removal Program

Work Conducted by:
Jake Hudson and Scott Wilson

Fort Loudoun Lake Association
956 Volunteer Landing Lane Box 12
Knoxville, TN 37915

Weir Survey and Removal

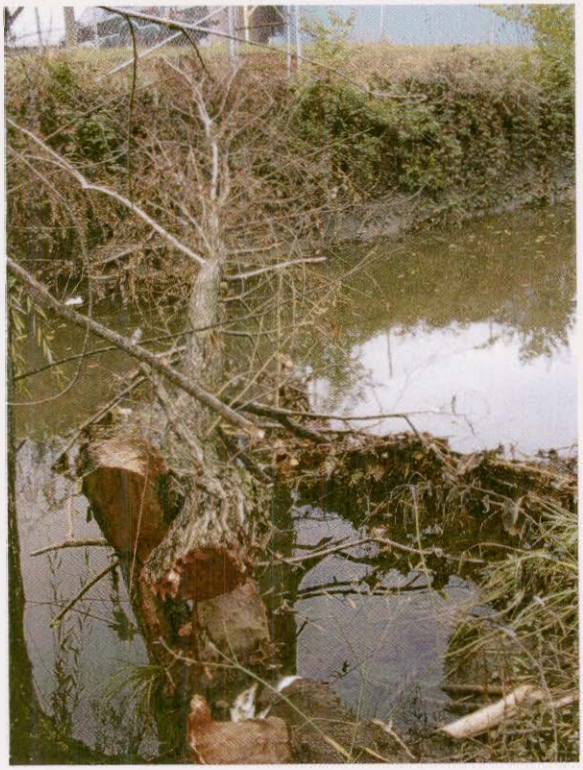
Abstract:

The Weir survey and removal program has been very successful to date. The program entailed a ground survey of urban creeks throughout Knoxville where-in weirs were located, documented, and assessed as to whether they were necessary for removal. Project plans were then composed and the weirs removed.

Weirs Removed:

Second Creek Weir – 01

N 35°59.086' W 083°56.912'

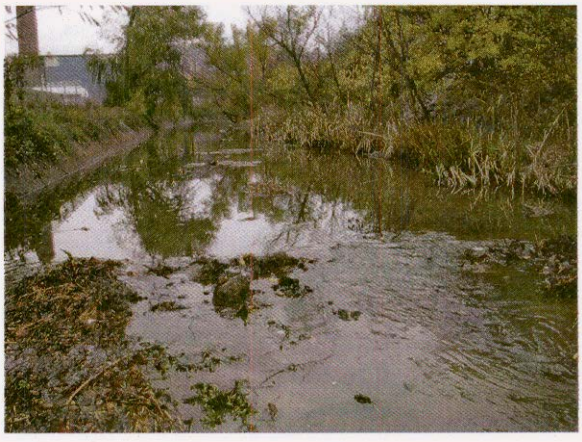


This weir was removed by staff members Jake Hudson and Scott Wilson on November 14, 2007 at the request City of Knoxville Dept. of Engineering. This tree had been dropped by beavers. Trash and debris had begun collecting at the base of the tree. Staff members waded into the creek with a chainsaw and removed the tree and debris build up.

Second Creek Weir – 02
N 35°59.083' W 083°56.908'

This weir was also removed by staff members Jake Hudson and Scott Wilson at the request of the City Engineering Dept. on November 14, 2007. The weir consisted of a large tree that had fallen as a result of beavers. Using a chainsaw, the tree was cut into small pieces and removed from the creek. This was a very time consuming task.

Second Creek Weir -03
N 35°59.059' W 083°56.863'



This weir was removed by staff members Jake Hudson and Scott Wilson on November 14, 2007. The blockage was caused by beavers. The beavers had connected rock masses with trash and debris causing about 90% blockage of the creek. The weir was removed using rakes and a mattock.

Toll Creek Weir – 01

N 35°57.121'
W 083°51.865'

This weir was removed by staff members Jake Hudson and Scott Wilson on December 4, 2007. There was about 70% blockage due to a piece of a fallen tree. Workers removed the blockage using cant hooks. Shovels and rakes were used to restore the natural flow of the stream.

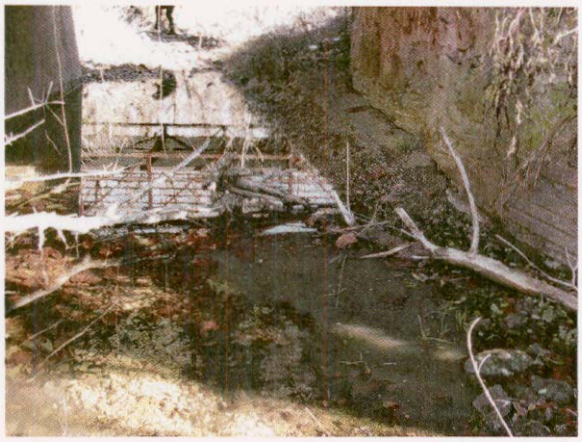
Toll Creek Weir – 02

N 35°57.132'
W 083°51.883'

This weir was removed by staff members Jake Hudson and Scott Wilson on December 4, 2007. A very large rock slid down the steep embankment into a two trunk tree, knocking the tree down and pinning it in the creek. This caused about 90% blockage and deep pooling. The weir was removed using a chainsaw, hand saw and rake and proper stream flow was restored.

Toll Creek Weir – 03

N 35°57.124'
W 083°51.911'



This weir was removed on December 4, 2007 by staff members Jake Hudson and Scott Wilson. Two trees and several large branches were blocking about 40% of the creek and redirecting the flow to the east bank. The trees were removed using a chainsaw. The branches were collected and removed, opening up the flow of the creek.

Toll Creek Weir – 04

N 35°57.123'
W 083°51.917'

Staff members Jake Hudson and Scott Wilson removed this weir on December 5, 2007. Several limbs and debris had collected to cause total blockage of the creek. Using a chainsaw the limbs were cut into small pieces and removed. After the blockage was removed, workers used shovels and rakes to get water flowing back through the area.

Toll Creek Weir – 05

N 35°57.108'
W 083°51.919'

This weir was removed on December 5, 2007 by staff members Jake Hudson and Scott Wilson. The weir consisted of a large piece of corrugated metal that was partially buried in sediment. The metal had collected debris and had caused total blockage. Staff members removed the debris. Using shovels workers dug out the corrugated metal and removed it from site.

Toll Creek Weir – 06

N 35°57.082'
W 083°51.927'

This weir was removed December 5, 2007 by staff members Jake Hudson and Scott Wilson. There was about 50% blockage caused by an 8'x 2' piece of oriented strand board and several limbs. The limbs were cut up and removed. Workers pulled the board from the creek bed and opened up the flow of the creek.

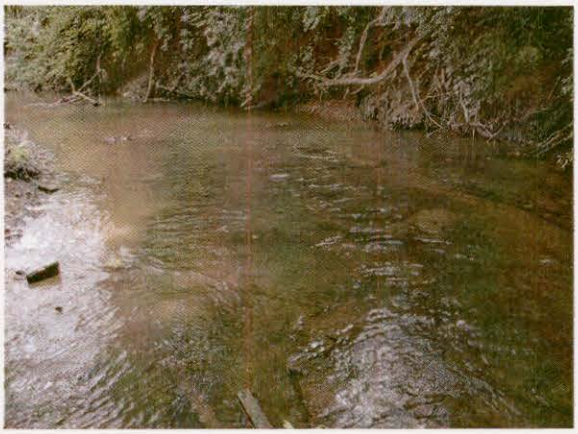
Third Creek Weir – 01

N 35°57.087'
W 083°58.120'


This weir was removed on February 13th, 2008 by FLLA staff member Scott Wilson. A plastic patio chair along with a lot of woody debris had lodged against a pipe under the bridge. The woody debris was removed and placed in the wooded area of the park. The plastic chair was removed from site.

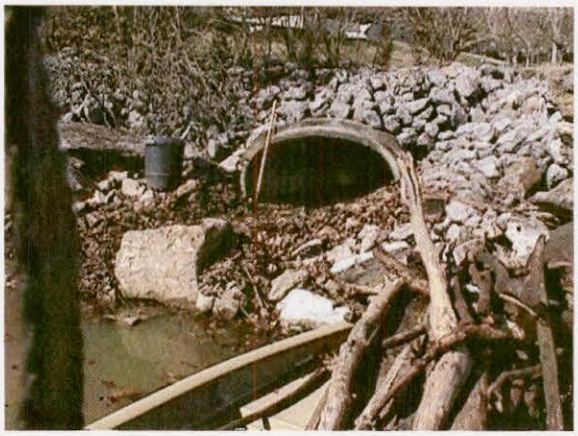
Third Creek Weir – 02

N 35°57.152'
W 083°58.225'

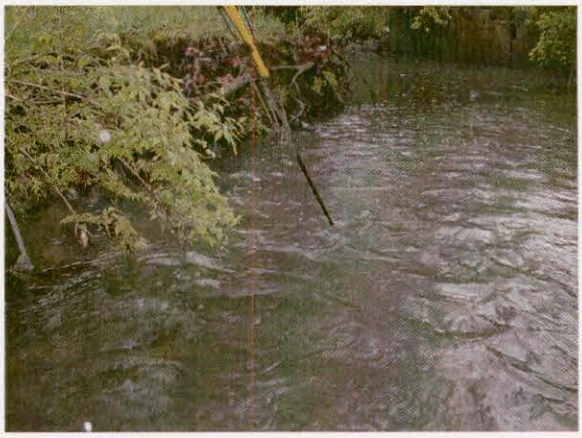
This weir consisted of a fallen tree that stretched the full width of the creek. The tree had collected a bag of trash, a large mass of fabric, a basketball, a bundle of coaxial cable, a large piece of lattice, and woody debris. On September 2, 2008 staff members Jake Hudson and Scott Wilson removed the blockage. The tree was cut up and removed. Trash, lattice, cable and fabric was bagged and removed from site.

Cheowa Circle Weir
N 35°56.611' W 083°57.480'



Staff member Jake Hudson removed this weir on February 7th, 2008, at the request of Ben Swanner of the City of Knoxville Engineering Dept. The blockage consisted of one log measuring 20 feet in length and 2 feet in diameter as the main obstruction. Over 60 smaller logs, a cubic yard of rip-rap, a plywood form, and a bag full of miscellaneous trash were all trapped in the outfall. The smaller objects were removed by hand. The large log was removed using a Fort Loudoun Lake Association work boat. Most of the rip-rap was removed and redistributed on site. Some pieces that are too large and to far back in the pipe, could not be manually removed. The City of Knoxville Engineering Department was notified about this. The logs and the trash were removed from site.

Williams Creek Weir
N 35°59.935' W 083°53.264'



On April 4th, 2008 staff members Jake Hudson and Scott Wilson removed this blockage on Williams Creek. The weir was made up of one large log that stretched from one shoreline to the other, many small limbs, one large sign and one bag of trash. The trash and woody debris was pinned against the guy-wire and blocked a majority of the creek. The wood was removed and the trash and sign were collected and removed from site.

Year after year this guy-wire continues to be a problem. Trash and debris gets pinned and diverts the stream to the east bank causing erosion and pooling. The City of Knoxville Engineering Department is aware of this problem and has requested that Knoxville Utility Board remove the wire.

Baker Creek Weir
N 35°57.131' W 083° 53.675'

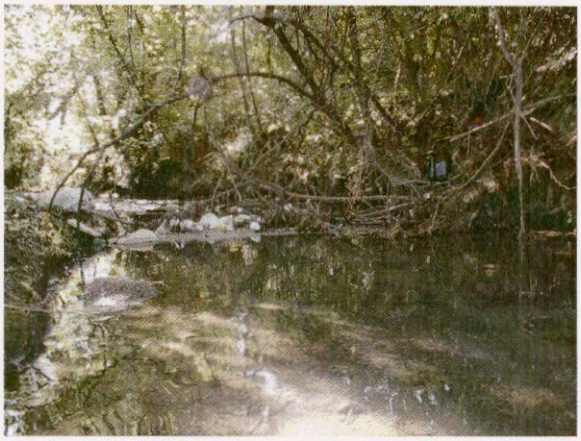
This weir reached all the way across the creek and had started to cause a pool. Jake Hudson and Scott Wilson removed the weir on July 9th, 2008. Using a mattock and rake woody debris was removed and one bag of trash was collected and removed.

Tecoma Drive First Creek Tributary Weir -01

N 36°00.759'
W 083°54.842'

FLLA was notified of this weir by Ben Swanner with City of Knoxville Engineering Dept. The blockage was located on a tributary of First Creek. The weir was caused by a shopping cart and a lot of brush that had been dumped there. On July 9th, 2008 FLLA staff members Jake Hudson and Scott Wilson removed the obstruction using a chainsaw, mattock, machete and rake. The brush and large logs were cut and removed from the stream. One bag of trash and a shopping cart were collected and removed from site.

First Creek Weir – 01
N 36°00.461' W 083°550480'



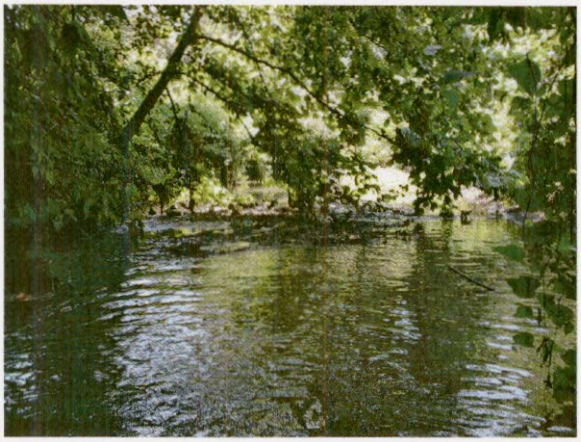
This blockage was caused by tree limbs that protruded out level with the top of the water, low hanging vines, trash and woody debris. The weir was removed on June 23rd, 2008 by FLLA staff members Jake Hudson and Scott Wilson using a chainsaw, rake, trash grabber and bags. The vines and limbs were cut and removed. Four bags of trash and approximately 100' of telephone wire were removed from site.

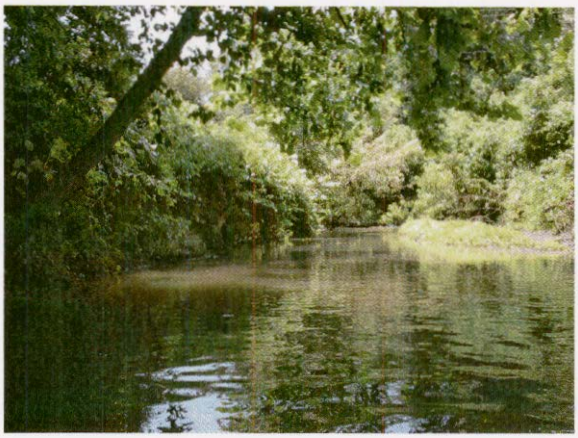
First Creek Weir – 02
N 36°00.461' W 083°55.480'

The blockage was made up of several large limbs growing into the water. The limbs had collected a massive amount of woody debris and some trash. This weir dammed all but a small trickle of water. FLLA staff members Jake Hudson and Scott Wilson removed this weir on June 23rd, 2008, using a chainsaw, mattock, rake, and trash grabber. Many limbs and vines had to be cut out of the way. Woody debris was pulled from the creek and placed high on the bank. One bag of trash was collected and removed from site.

First Creek Weir – 03

N 36°00.445'
W 083°55.463'

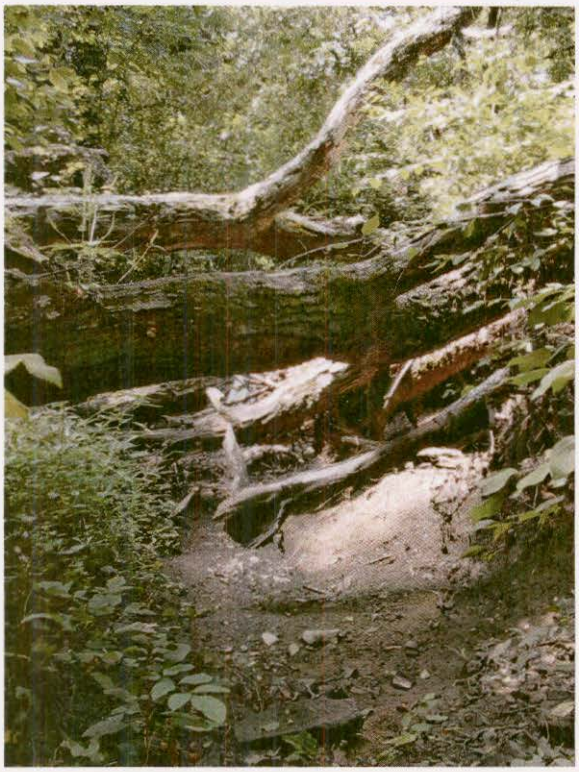


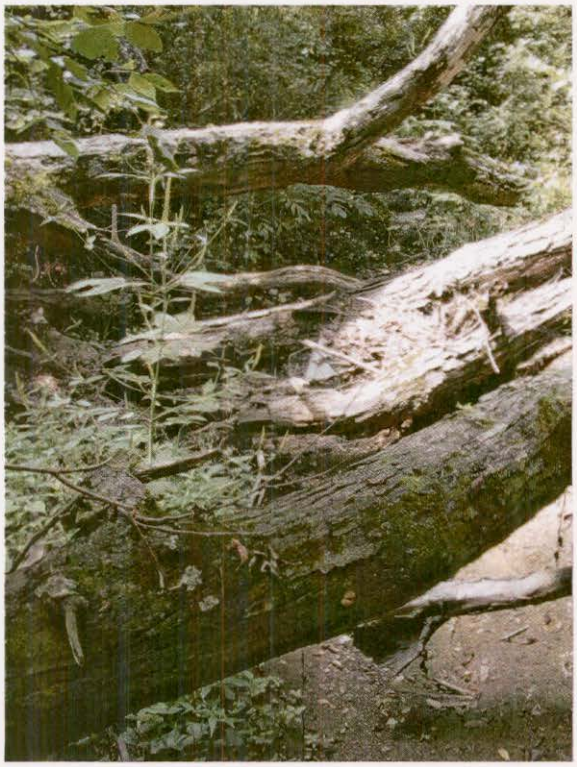


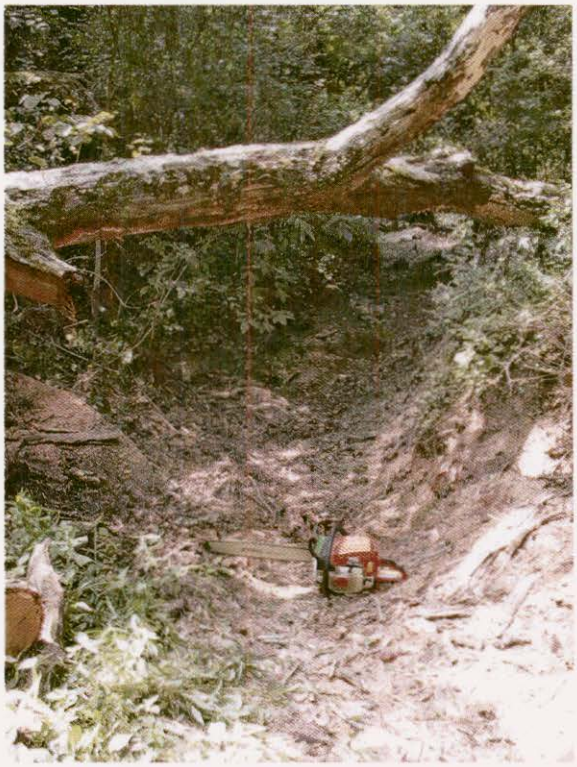
The tree in the upper left corner of the photos had low hanging limbs that hung below the surface of the creek. The limbs had collected a lot of woody debris and trash creating this weir. This blockage was removed June 23rd, 2008. Using a chainsaw, staff member Scott Wilson cut and removed the limbs. Jake Hudson removed the woody debris with a rake and the garbage with a trash grabber.

Tecoma Drive Tributary Weir – 02

N 36°00.797' W 083°54.696'







This weir was also removed at the request of Ben Swanner with City of Knoxville Engineering Dept. As you can see in the photos the stream bed was completely dry at the time of removal. Several large trees had fallen into the bed and collected a large amount of debris. Using a chainsaw Scott Wilson and Jake Hudson cut up the trees and removed them from the stream bed. One bag of trash was also collected and removed from site.

Tecoma Drive Tributary Weir – 03
N 36°00.628' W 083°55.129'

On September 2, 2008 Staff members Jake Hudson and Scott Wilson removed this weir. Tree and shrub clippings had been dumped in the stream. The blockage stretch all the way across the stream and started to cause pooling. The clippings were removed and placed on the sidewalk. The City of Knoxville Public Service Department was contacted about collecting the brush pile.

Conclusion:

As urban runoff has increased within watersheds in the Knoxville area, stream bank scouring and stream widening has increased the frequency of weirs in surrounding urban creeks. Said weirs are a problem in that they can create additional stream bank scouring/erosion, trash and debris buildup, urban flooding, stream-bed sedimentation, Oxygen depletion, biota passage obstruction, mosquito and other pest breeding, and can be a human safety issue causing underpinning and drowning if a person is caught in the stream during a high water event. The removal of these obstructions can help further degradation to the creek, both visually and biologically.

APPENDIX F

Table of SPAP Facility Inspections

Commerical and Industrial Facilities Inspeced During 2007-2008

Permit Number	Project Name	Address	Street Name	Inspection Date	Inspector	Water Quality Device
00-002	Lexus of Knoxville	10315	Parkside Dr	07/28/2007	J. Shubzda	Catch Basin Inserts
00-003	Toyota of Knoxville	10415	Parkside Dr	07/22/2007	J. Shubzda	Catch Basin Inserts
01-003	Transglobal Gas and Oil Co.	3818	Sutherland Ave.	10/25/2007	J. Shubzda	catch basin inserts
01-006-R1	Hewgley US Army Reserve	1334	E. Weisgarber Rd	08/24/2007	J. Shubzda	Suntree grate inlet skimmer box
01-007	Trinity Chapel	309	Deaderick Ave.	10/10/2007	J. Shubzda	grass swale
02-001	Pilot Food Mart	206	Walker Springs Rd	08/15/2007	J. Shubzda	Fossil Filter Flo Guard
02-002	Lee Specialtee LLC	322	Tillery Dr	10/19/2007	J. Shubzda	Pre-cast septic box,
02-003	Finish Line Exxon	5706	Ashville Hwy	11/02/2007	J. Shubzda	CDS PMSU30_30
02-009	FedEx Ground Package	3700	Middlebrook Pk	04/23/2008	J. Shubzda	Crystal Stream 1056
02-011	Kroger Fuel Facility -U525	9501	S. Northshore Dr	10/11/2007	J. Shubzda	Aqua-Swirl AS-4
02-014	Speedy Clean Autowash	7670	S. Northshore Dr	10/11/2007	J. Shubzda	trench insert
03-009	Waste Connections, Inc.	1300	Prosser Rd	05/19/2008	J. Shubzda	CB Inserts
04-005	Outback Steakhouse Strawberry Plains	7400	Sawyer Ln	08/03/2007	J. Shubzda	4 catch basin inserts
04-006	Hooter's	5005	Central Avenue Pike	02/26/2008	J. Shubzda	2 catch basin inserts
04-009	Bonefish Grill	6610	Kingston Pike	07/03/2007	J. Shubzda	Grate Inlet Skimmer Box
04-013	Clayton Body Shop	4600	Clinton Highway	12/12/2007	J. Shubzda	3 catch basin inserts
04-015	Medic Regional Blood Center-Vehicle Maintenance Fa	1705	Ailor Avenue	12/27/2007	Greg Shaw	Aquasheild Catch Basin Insert
04-017	Clayton Motors-CC Used Cars	4316	Clinton Highway	12/14/2007	J. Shubzda	Suntree Catch Basin Inserts
04-018	North Knoxville, TN 161-KV Substation	130	Dante Road	01/03/2008	J. Shubzda	Oil/Water Separtor
04-021	Racetrac #425	6115	Asheville Highway	07/05/2007	J. Shubzda	Demolished
04-023	JD Byrider Motors	8413	Kingston Pike	01/25/2008	J. Shubzda	Aquasheild Catch Basin Inserts
04-024	Five Points Re-Development	2332	Martin Luther King, Jr. Avenue	06/28/2008	J. Shubzda	Catch Basin Inserts
04-025	Speedy Clean of Rocky Hill, II, LLC	7751	S. Northshore Drive	10/11/2007	J. Shubzda	Abtech catch basin inserts
04-026	Peerless Restaurant	318	N. Peters Road	11/02/2007	J. Shubzda	Abtech catch basin inserts
04-027	Ingles Markets Gas Express #399	430	East Emory Road	12/07/2007	J. Shubzda	1 Stormceptor Oil/Water Separator
04-028	Zaxby's Restaurant	607	East Emory Road	12/07/2007	J. Shubzda	4 Suntree Catch Basin & 2 Grease Guards
05-001	Texas Roadhouse @ Turkey Creek	11001	Turkey Drive	11/06/2007	J. Shubzda	2 Suntree Catch Basin Inserts
05-003	Mimi's Café	19045	Parkside Drive	08/10/2007	J. Shubzda	Grease Catcher System & Suntree CB
05-008	Bread Box on Millertown Pike	5340	Millertown Pike	12/20/2007	J. Shubzda	Suntree Catch Basin Inserts
05-009	Starbucks Coffee Company	116	Merchant Drive	08/02/2007	J. Shubzda	4 catch basin inserts
05-010	Texas Avenue Warehouse	2815	Texas Avenue	01/03/2008	J. Shubzda	Catch Basin Inserts
05-014	Stowers Rental & Supply	10616	Lexington Drive	12/26/2007	David Russel	Suntree Nutrient Separating Baffle Box
05-021	Food City	2712	Loves Creek Road	11/02/2007	J. Shubzda	Oil/Water Separtor
05-022	Food City Gas-N-Go	2712	Loves Creek Road	11/02/2007	J. Shubzda	Suntree Oil/water separator
05-023	Gary Swaggerty (Auto-Outlet)	4403	Clinton Highway	12/12/2007	J. Shubzda	2 Suntree Catch Basin Inserts
05-024	Leo's Café	3029	Tazewell Pike	11/08/2007	J. Shubzda	managerial controls
06-003	Couva Calypso Café	7805	Montvue Center Way	01/25/2008	J. Dossett	Secondary Grease Collection
06-005	Ruby Tuesday (Wokhay)	120	Merchants Dr. & Central	10/24/2007	Jeffery Askew	Sun Tree
06-007	Gillespie Import Service	7685	S. Northshore Dr.	01/25/2008	J. Dossett	Oil/water separators
06-009	Tennessee RV	7450	Sawyer Lane	08/02/2007	J. Shubzda	3 catch basin inserts
06-012	Trinity Hills Senior Living Community	4611	Asheville Highway	11/09/2007	J. Shubzda	catch basin inserts-not installed
06-013	Food City Western & 21st	1919	Leslie ave	12/18/2007	J. Shubzda	Suntree Nutrient Baffle Box
06-017	NEFF Rental	1808	Sanderson Rd	12/05/2007	Shubzda/Gerlach	(Drainpac Brand) Drain insert
06-018	Morton Square (Jubilee Center)	1506	Callahan Dr	06/18/2008	J. Shubzda	First Flush @Detention Basin, Vortex model 9000
06-020	Pilot Food Mart #119	2518	N. Broadway	01/03/2008	J. Shubzda	2 Suntree Catch Basin Inserts
06-022	Kelso Oil Company, Inc.	641	Atlantic Ave.	01/03/2008	J. Shubzda	1 Catch basin insert
06-023	Division Street Business Center	501	Cary Street	01/25/2008	J. Dossett	Suntree Technologies fiberglass insert
06-026	Gridiron Burgers	6631	Clinton Hwy, Ste 105	12/12/2007	J. Shubzda	Managerial controls
06-034	Ledbetter's Auto Body Shop	1700	N. Central Street	01/11/2008	J. Shubzda	Managerial Controls
06-035	Starbucks - Emory Rd.	401	E. Emory Rd.	06/04/2008	J. Shubzda	Suntree Technologies
07-006	Sysco Food Services	900	Tennessee Ave	06/26/2008	J. Shubzda	Large Suntree
07-028	Rogers Petroleum	2710	Texas Ave	02/14/2008	J. Shubzda	Oil/Water Separator

APPENDIX G

Stream Assessment Summary Report for permit year

City of Knoxville

Department of Engineering, Stormwater Division

Creek and Stream Assessments

Baker Creek—November 2007

John Livengood and Jason Dossett

The Baker Creek assessment was divided into 48 reaches, spanning from the mouth of Baker Creek into the Tennessee River until the creek reaches parallel to Cruze Rd. The streams and tributaries combined for a length of 5.89 miles

The protocol used to assess Baker Creek was created by the EPA for use in wadeable streams and rivers. There were 12 parameters used to assess the quality of the stream. The parameters and averages for the 48 reaches are shown in Table 1. These parameters were assessed on a quantitative basis, using a scale of 0-20, according to EPA standards. Additional macro observations were also made, such as pollution levels, by recording the amount of trash, livestock, waterfowl, and homeless camps located near the streams. Using these factors, 36 sites were recommended for trash cleanup.

Table 1. Averages of habitat parameters for Baker Creek, Knoxville, TN.

Habitat Parameter	Weighted Average
Epifaunal Substrate	12.3
Pool Substrate	5.3
Pool Variability	12.9
Sediment Deposition	11.6
Channel Flow	11.8
Channel Alteration	11.8
Channel Sinuosity	5.3
Nutrient Enrichment	12.3
Barriers to Fish	13.9
Bank Stability L	6.4
Bank Stability R	6.3
Vegetation Protection L	4.9
Vegetation Protection R	4.3
Riparian Zone Width L	4.5
Riparian Zone Width R	2.5

Outfall inventory was also taken, recording descriptive factors such as type, dimension, location along stream, odor, and discharge. A total of 74 new outfalls and 32 previously recorded outfalls were located along the creek for a sum of 106 outfalls. Of the 106 outfalls, one had discharge.

OBJECTID *	SHAPE *	Inventory#	Type	Size_	material	Location	Odor	Evidence...	POINT_X	POINT_Y
4	Point	64000116	residential	36	RCP	Left	None	Yes	2591572.750136	596013.096748
5	Point	1	Commercial	8	Plastic	Left	None	No	2591557.774772	595998.210623
6	Point	6200118	residential	18	RCP	Right	None	No	2591648.643357	595833.89271
7	Point	6400121	residential	18	RCP	Right	None	No	2591525.513026	595640.090604
8	Point	6400124	residential	24	RCP	Right	None	No	2591369.433614	595280.520785
9	Point	6400127	residential	18	RCP	Right	None	No	2591259.526025	595068.19247
10	Point	6400128	residential	30	RCP	Right	None	No	2591151.8225	594868.048513
11	Point	6400130	residential	18	RCP	Right	None	No	2591061.963428	594664.040719
12	Point	1	residential	48	RCP	Left	None	No	2591010.805722	594473.001731
13	Point	6400134	residential	18	RCP	Left	None	No	2591003.888085	594335.70837
14	Point	6400135	residential	24	RCP	Right	None	No	2591011.551455	594277.616951
15	Point	6400136	residential	18	RCP	Right	None	No	2591011.161364	594072.177401
16	Point	6400137	residential	18	RCP	Right	None	No	2591054.802025	593966.19369
17	Point	6400138	residential	18	RCP	Left	None	No	2590992.536073	593738.946113
18	Point	6400139	residential	18	RCP	Right	None	No	2591009.959595	593685.919316
19	Point	6400142	residential	18	RCP	Right	None	No	2591058.230496	593414.4881
20	Point	6100005	residential	36	RCP	Right	None	No	2593499.846676	598329.046512
21	Point	6400030	residential	24	CMP	Left	None	No	2593024.634043	597761.717595
22	Point	1	residential	24	CMP	Left	None	No	2592994.745652	597843.602601
23	Point	1	residential	24	CMP	Left	None	No	2593034.375166	598019.226266
24	Point	6400090	residential	30	RCP	Left	None	No	2592839.863744	597017.999594
25	Point	6400095	residential	15	RCP	Left	None	No	2592485.229282	596921.151034
26	Point	6400170	Residential	24	RCP	Left	None	Yes	2591921.370502	592286.744293
27	Point	6400175	Residential	36	RCP	Right	None	No	2591970.894681	592347.279933
28	Point	111	Residential	15	CMP	Right	None	No	2591970.894681	592347.279933
29	Point	111	Unknown	6	Other	Right	None	No	2592603.038102	592072.04131
30	Point	6400185	Residential	30	RCP	Right	None	No	2592601.257593	592085.960245
31	Point	1	Unknown	10	Steel	Right	None	No	2592778.546609	591965.379778
32	Point	11	Unknown	4	Steel	Left	None	No	2593113.403879	591769.309304
33	Point	1	Unknown	2	Steel	Left	None	Yes	2593479.030116	591496.83872
34	Point	1	Unknown	4	Clay	Left	None	No	2593658.321424	591466.725263
35	Point	9000		0					2593656.438882	591256.719778
36	Point	1	Residential	24	CMP	Right	None	No	2592740.987301	592013.723841
37	Point	6400195	Residential	24	CMP	Right	None	Yes	2592757.483659	591683.354423
38	Point	6400200	Residential	24	CMP	Left	None	Yes	2592772.116832	591485.235069
39	Point	1	Residential	4	Steel	Left	None	No	2592754.712667	591468.475588
40	Point	1	Residential	2	Steel	Right	None	No	2592739.059155	591462.069761
41	Point	1	Residential	2	Steel	Left	None	No	2592777.043331	591439.828664
42	Point	1	Residential	3	Plastic	Left	None	No	2592763.545983	591424.973706
43	Point	1	Residential	4	Steel	Left	None	No	2592741.575226	591391.124365
44	Point	1	Residential	8	RCP	Left	None	Yes	2592757.918041	591388.442283
45	Point	1	Residential	6	RCP	Left	None	No	2592759.917053	591387.271682
46	Point	1	Residential	6	RCP	Left	None	No	2592764.963959	591404.978668
47	Point	1	Unknown	15	Plastic	Left	None	Yes	2592825.562919	591111.970395
48	Point	1	Unknown	99	Other	Head	None	No	2592769.914408	590259.382534
49	Point	1	Residential	18	RCP	Right	None	No	2591171.432041	592303.38107
50	Point	2	Residential	15	RCP	Head	None	Yes	2590931.855749	590592.42255
53	Point	6400132	Residential	18	RCP	Left	None	No	2590864.352275	594445.580854
54	Point	61000133	Residential	42	CMP	Head	None	No	2590852.285042	594410.125216

OBJECTID *	SHAPE *	Inventory#	Type	Size_	material	Location	Odor	Evidence...	POINT_X	POINT_Y
55	Point	1	Industrial	99	Other	Left	None	No	2589525.757183	594648.656892
56	Point	11	Residential	36	RCP	Head	None	Yes	2588724.760097	595278.376761
57	Point	55	Residential	99	Other	Left	None	No	2590929.168746	593197.501657
58	Point	6100146	Residential	30	RCP	Right	None	No	2590899.913883	593181.095522
59	Point	6400150	Residential	99	Other	Right	None	No	2590827.7116	593142.52703
60	Point	111	Residential	10	Plastic	Right	None	No	2590669.11382	593128.803304
61	Point	11	Residential	4	Plastic	Right	None	No	2590486.983607	593291.770826
62	Point	111	Residential	18	RCP	Left	None	No	2590175.387445	593210.44028
63	Point	11	Residential	4	Plastic	Left	None	No	2590141.211661	593216.381869
64	Point	11	Residential	30	RCP	Right	None	No	2590141.846502	593232.78013
65	Point	111	Residential	15	RCP	Left	None	No	2589758.087427	593294.93847
66	Point	11	Residential	8	CMP	Left	None	No	2589590.489993	593401.787666
67	Point	11	Residential	4	Plastic	Right	None	No	2589337.650276	593341.751697
68	Point	11	Residential	24	RCP	Left	None	No	2589202.640703	593217.491447
69	Point	11	Residential	24	CMP	Left	None	No	2588681.767401	593276.72558
70	Point	11	Residential	18	RCP	Head	None	No	2588337.158838	593285.126154
71	Point	11	Residential	12	CMP	Left	none	No	2591153.049532	595683.054101
72	Point	99	Residential	24	RCP	Head	none	No	2590780.18348	595744.825959
73	Point	99	Residential	18	RCP	Right	none	No	2589986.616169	595269.62481
74	Point	99	Residential	4	Clay	Right	none	Yes	2592982.183341	597076.290488
75	Point	99	Unknown	4	RCP	Right	none	No	2593102.546289	596665.630548
76	Point	6400070	Residential	18	RCP	Left	none	No	2593076.841616	596484.845804
77	Point	6400075	Residential	30	RCP	Right	none	No	2593523.761982	596192.283726
78	Point	99	Residential	4	Plastic	Right	none	No	2593608.063323	595395.506776
79	Point	14	Residential	4	Plastic	Right	none	No	2593602.35861	595362.614453
80	Point	99	Residential	4	Plastic	Right	none	No	2593541.735371	595290.913153
81	Point	99	Residential	4	Plastic	Left	none	No	2593549.892507	595255.892554
82	Point	88	Residential	4	Plastic	Left	none	No	2593552.554903	595246.847624
83	Point	99	Residential	24	RCP	Right	none	No	2593483.280436	595141.583399
84	Point	99	Residential	4	Plastic	Left	none	No	2593505.225602	595153.586984
85	Point	99	Residential	15	CMP	Left	none	No	2593488.932327	595108.329529
86	Point	99	Commercial	2	Plastic	Right	Sewage	Yes	2593504.089777	594977.580118
87	Point	99	Residential	18	RCP	Right	none	No	2593189.144869	597431.505657
88	Point	99	Residential	4	Plastic	Right	none	No	2593308.602307	597520.253511
89	Point	99	Residential	4	Plastic	Right	none	No	2593333.788281	597542.036275
90	Point	99	Residential	4	Plastic	Right	none	No	2593492.212504	597585.506333
91	Point	99	Residential	4	Plastic	Right	none	No	2593499.452647	597592.944638
92	Point	99	Residential	2	Other	Right	none	No	2593513.169155	597597.488592
93	Point	99	Residential	4	Plastic	Right	none	No	2593526.287896	597606.8744
94	Point	9	Residential	0	Ditch	Right	none	No	2594404.194932	597233.212418
95	Point	99	Residential	4	Plastic	Left	none	No	2594529.115286	597137.604998
96	Point	99	Residential	8	Plastic	Left	none	No	2594847.375477	596680.256503
97	Point	6400040	Residential	24	CMP	Left	none	No	2595059.730695	596488.841859
98	Point	99	Residential	4	Plastic	Left	none	No	2595113.116743	596461.475444
99	Point	99	Residential	4	Plastic	Right	none	No	2595117.114766	596459.13457
100	Point	99	Residential	4	Plastic	Right	none	No	2595151.668503	596435.609026
101	Point	6400045	Residential	12	RCP	Right	none	No	2595156.988374	596440.578833
102	Point	99	Residential	6	Plastic	Left	none	No	2595162.885672	596418.860372
103	Point	99	Residential	4	Other	Right	none	Yes	2595169.54642	596407.474568

OBJECTID *	SHAPE *	Inventory#	Type	Size_	material	Location	Odor	Evidence...	POINT_X	POINT_Y
104	Point	99	Residential	4	Other	Left	none	Yes	2595258.853656	596339.014075
105	Point	6400055	Residential	18	RCP	Right	none	Yes	2596120.603901	595757.515238
106	Point	99	Residential	3	Plastic	Left	none	No	2596322.998181	595457.269776
107	Point	99	Residential	4	Plastic	Left	none	No	2596317.980803	595438.348882
108	Point	99	Residential	99	Ditch	Right	none	Yes	2596553.521671	595202.541611
109	Point	99	Residential	4	Plastic	Left	none	No	2596522.766155	595232.823374
110	Point	99	Residential	4	Plastic	Left	none	No	2596519.254679	595212.721708
111	Point	99	Residential	15	RCP	Right	none	No	2596211.715924	596448.250405

City of Knoxville

Department of Engineering, Stormwater Division

Creek and Stream Assessments

Sinking Creek—May 2008

Jason Dossett and Josh Roberts

The Sinking Creek assessment was divided into 2 reaches, from underneath I-140 to Fox Road at Kingston Pike. The streams and tributaries combined for a length of 2,950 ft.

The protocol used to assess Sinking Creek was created by the EPA for use in wadeable streams and rivers. There were 12 parameters used to assess the quality of the stream. The parameters and averages for the 2 reaches are shown in Table 1. These parameters were assessed on a quantitative basis, using a scale of 0-20, according to EPA standards. Additional macro observations were also made, such as pollution levels, by recording the amount of trash, livestock, waterfowl, and homeless camps located near the streams.

Table 1. Averages of habitat parameters for Sinking Creek, Knoxville, TN.

Habitat Parameter	Weighted Average
Epifaunal Substrate	8.1
Pool Substrate	6.6
Pool Variability	8.7
Sediment Deposition	9.2
Channel Flow	7.85
Channel Alteration	7.3
Channel Sinuosity	9.0
Nutrient Enrichment	9.6
Barriers to Fish	7.3
Bank Stability L	4.5
Bank Stability R	4.5
Vegetation Protection L	4.1
Vegetation Protection R	4.1
Riparian Zone Width L	2.4
Riparian Zone Width R	2.4

City of Knoxville

Department of Engineering, Stormwater Division

Creek and Stream Assessments

Love Creek—December 2007

John Shubzda, Jason Dossett, and Josh Roberts

The Love Creek assessment was divided into 14 reaches, from the mouth of the stream to the County line. The streams and tributaries combined for a length of 4.50 miles.

The protocol used to assess Love Creek was created by the EPA for use in wadeable streams and rivers. There were 12 parameters used to assess the quality of the stream. The parameters and averages for the 2 reaches are shown in Table 1. These parameters were assessed on a quantitative basis, using a scale of 0-20, according to EPA standards. Additional macro observations were also made, such as pollution levels, by recording the amount of trash, livestock, waterfowl, and homeless camps located near the streams. Using these factors, 7 sites were recommended for trash cleanup.

Table 1. Averages of habitat parameters for Love Creek, Knoxville, TN.

Habitat Parameter	Weighted Average
Epifaunal Substrate	17.2
Pool Substrate	16.4
Pool Variability	11.9
Sediment Deposition	12.5
Channel Flow	12.6
Channel Alteration	15.6
Channel Sinuosity	12.1
Nutrient Enrichment	15.8
Barriers to Fish	12.9
Bank Stability L	6.8
Bank Stability R	6.6
Vegetation Protection L	8.1
Vegetation Protection R	7.9
Riparian Zone Width L	6.7
Riparian Zone Width R	7.2

Outfall inventory was also taken, recording descriptive factors such as type, dimension, location along stream, odor, and discharge. A total of 23 outfalls were located along the creek. Of the outfalls, 8 had discharge.

City of Knoxville

Department of Engineering, Stormwater Division

Outfall Inventory

Loves Creek—April 2008

GPS Reading	Type of outfall	Outfall Size	Outfall Type	Location	Odor	Discharge
N 36, 00.484 W 83, 49.829		24 in.	CM	R Bank	N	N
N 36, 00.488 W 83, 50.287	Residential	60 in.	RC	L Bank	N	Y
N 36, 00.539 W 83, 50.369		60 in.	RC	R Bank	N	Y
N 36, 00.589 W 83, 50.605		36 in.	CM	R Bank	N	Y
N 36, 00.451 W 83, 50.750	Residential	3 in.	PVC	L Bank	N	N
N 36, 00.450 W 83, 50.742	Residential	1.5 in.	P	L Bank	N	N
N 36, 00.431 W 83, 50.794	Residential	6 in.	PVC	L Bank	N	N
N 36, 00.371 W 83, 50.838	Residential	15 in.	RC	R Bank	N	N
N 36, 00.328 W 83, 51.130	Residential	24 in.	RC	L Bank	N	N
N 36, 00.333 W 83, 51.148	Residential	4 in.	P	R Bank	N	N
N 36, 00.325 W 83, 51.167	Residential	6 in.	PVC	R Bank	N	N
N 36, 00.326 W 83, 51.168	Residential	6 in.	PVC	R Bank	N	N
N 36, 00.330 W 83, 51.172	Residential	4 in.	P	R Bank	N	N
N 36, 00.331 W 83, 51.197	Commercial	24 in.	RC	R Bank	N	N
N 36, 00.356 W 83, 51.087	Residential	8 in.	CM	L Bank	N	Y
N 36, 00.365 W 83, 51.085	Residential	24 in.	RC	R Bank	N	Y
N 36, 00.803 W 83, 50.746	Commercial	15 in.	RC	L Bank	N	N
N 36, 00.978 W 83, 51.105	Commercial	12 in.	RC	L Bank	N	Y
N 36, 00.959 W 83, 51.193	Commercial	18 in.	P	L Bank	N	Y
N 36, 00.959 W 83, 51.193	Commercial	18 in.	P	L Bank	N	Y
N 36, 00.935 W 83, 51.280	Commercial	18 in.	RC	L Bank	N	N
N 36, 01.707 W 83, 52.226	Commercial	15 in.	CM	R Bank	N	N
N 36, 01.707 W 83, 52.226	Commercial	24 in.	P	R Bank	N	N

APPENDIX H

NPDES Permit Program Inventory Map

(Attached separately)

The entire inventory map is not reproduced as part of the online version of the Year 12 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.