Indiana Department of Environmental Management

Fall Creek TMDL Study

September 2003

This study was prepared for the City of Indianapolis for IDEM pursuant to a contract with the State of Indiana.

Final Report

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List of Acronyms

AAC – Acute Aquatic Criterion
AWT- Advanced Wastewater Treatment
BMP- Best Management Practices
CAC – Chronic Aquatic Criterion
CWA – Clean Water Act
CSO – Combined Sewer Overflow
DO- Dissolved Oxygen
EPA – Environmental Protection Agency
IDEM – Indiana Department of Environmental Management
IMAGIS – Indianapolis Mapping and Geographic Infrastructure System
LTCP – Long Term Control Plan
MCHD – Marion County Health Department
MOS – Margin of Safety
NPDES- National Pollutant Discharge Elimination System
OES – Office of Environmental Services
TMDL- Total Maximum Daily Load
TSS- Total Suspended Solids

Executive Summary

Water quality data has been collected from Fall Creek in Marion County since 1991. In 1998, the Indiana Department of Environmental Management (IDEM) determined that segments of Fall Creek do not consistently comply with the state's water quality standards for *E. coli* bacteria. As a result, segments of Fall Creek were listed on the 1998 303(d) list and required to have a Total Maximum Daily Load (TMDL) evaluation for *E. coli* bacteria. This study was prepared for the City of Indianapolis for IDEM pursuant to a contract with the State of Indiana.

A model of Fall Creek was developed and calibrated to the existing instream data for *E. coli* bacteria. A ten-year period of time was simulated to predict resultant instream *E. coli* bacteria counts for each day of the simulation period. Data collected by several agencies was obtained for the water quality model development.

Fall Creek was divided into two segments for analysis purposes as follows:

- Fall Creek Upstream of the Combined Sewer Overflow (CSO) Area
- Fall Creek Within the CSO Area

Sources of *E. coli* in the watershed include CSOs, urban stormwater, failing septic systems, illicit storm drain connections, and pollutants from wildlife and domestic animals. Point sources and nonpoint sources were characterized and represented in the model for evaluation of loadings to determine the required action necessary to attain water quality standards.

The existing daily *E. coli* bacteria loads are presented in **Table E.1** for point and non-point sources. As can be seen from the table, CSO discharges and stormwater runoff contribute the largest *E. coli* bacteria loads into Fall Creek.

Based on the modeled *E. coli* bacteria concentrations, stream flow and data analyzed, the allowable *E. coli* TMDLs for Fall Creek were determined. The TMDL is calculated as 125 cfu *E. coli* bacteria/100 ml multiplied by the average daily flow for the stream segment during the recreational season (April to October.) TMDLs are based on meeting water quality standards. The allowable *E. coli* bacteria TMDLs and required reductions are as follows.

Fall Creek upstream of the CSO area:

Existing Waste Load	= 7.56 $\times 10^{11}$ cfu
Existing Load	= 9.96 $\times 10^{11}$ cfu
Existing Total Load	= 1.75 $\times 10^{12}$ cfu
TMDL	= 8.44 $\times 10^{11}$ cfu
Required Reduction	= 52%

Fall Creek within the CSO area:

Existing Waste Load	= 1.51×10^{14} cfu
Existing Load	= 1.02×10^{12} cfu
Existing Total Load	= 1.52×10^{14} cfu
TMDL	= 7.30×10^{11} cfu
Required Reduction	= 99.5%

Table E.1 presents the loads from the individual *E. coli* bacteria sources.

TABLE E.1: SUMMARY OF EXISTING *E. COLI* BACTERIA LOAD FOR THE APRIL TO OCTOBER RECREATIONAL SEASON
FALL CREEK

Scenario	Point Source -- CSO Discharges (cfu)*	Point Source -- Permitted Stormwater Discharges (cfu)*	Point Source -- Illicit Sanitary Connections (cfu)*	**Total Point Source Load (cfu)**	Nonpoint Source - Unpermitted Stormwater Discharges (cfu)*	Nonpoint Source - Wildlife (cfu)*	Nonpoint Source - Failing Septic Systems (cfu)*	**Total Nonpoint Source Load (cfu)**	**Total Load (cfu)**	TMDL (cfu)	**Required Load Reduction to meet TMDL (%)**
Fall Creek-Upstream Existing	0.00E+00	7.56E+11	1.21E+08	**7.56E+11**	9.31E+11	1.86E+10	4.66E+10	**9.96E+11**	**1.75E+12**	8.44E+11	**52%**
Fall Creek-CSO Existing	1.50E+14	1.19E+12	1.74E+08	**1.51E+14**	8.97E+11	7.67E+10	4.66E+10	**1.02E+12**	**1.52E+14**	7.30E+11	**99.5%**

*Note: All loads presented in are the average daily loads for the recreational season. These loads may be different from the loads presented in Section 5, which are for the entire year.

Section 1
Introduction

The State of Indiana assesses its water bodies for compliance with water quality standards established for their designated uses as required by the Federal Clean Water Act (CWA). Assessed water bodies are placed into five categories depending on water quality assessment results: supporting, partially supporting, water bodies with insufficient or no data, impaired but not requiring TMDLs, and finally, water bodies not supporting their designated uses and requiring TMDLs. These water bodies are found on Indiana's 303(d) list, which is published every two years, as required by section 303 (d) of the CWA.

Some of the 305(b) partially and not supporting water bodies are also assigned to Indiana's 303(d) list, also named after a section of the CWA. Water bodies on the 303(d) list are required to have a TMDL evaluation for the water quality constituent(s) in violation of the water quality standard. The TMDL process establishes the allowable loading of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and instream water quality conditions. This allows water quality-based controls to be developed to reduce pollution and restore and maintain water quality. TMDLs must meet the requirements set forth in federal regulation at 40 CFR 130.2 and 130.7

E. coli bacteria data collected from Fall Creek in Marion County indicate that the *E. coli* bacteria standard is exceeded from Emerson Avenue to the confluence with the West Fork of the White River. As a result, this segment of Fall Creek was added to the State's 1998 303(d) list and scheduled for a TMDL evaluation.

Section 2
Background Information

The stream segment relevant for this TMDL report consists of Fall Creek from Geist Reservoir to the confluence with the White River. The segment from Emerson Way to the confluence with the West Fork of the White River does not consistently meet the Indiana bacteria (*E. coli*) water quality standard both during dry and wet weather.

2.1 Parameter of Concern

The State of Indiana's 1998 Section 303(d) list shows one parameter of concern for Fall Creek within the study area described above: *E. coli* bacteria.

Section 303(d) of the Clean Water Act requires states to list waters for which technology-based limits alone do not ensure attainment of water quality standards. States are to list and set priority rankings for their listed impaired waters. To address water body segments on the 303(d) list, states are required to develop TMDLs that allow these segments to attain water quality standards. This report presents instream data as well as modeling results and load allocations to achieve the standard for *E. coli* bacteria on Fall Creek.

2.2 Water Quality Standards

IDEM has promulgated water quality standards to protect designated uses of waterways. These standards include numeric recreational use standards for *E. coli* bacteria, which can be used as target values for the TMDL.

2.2.1 Bacteria

The applicable standard for *E. coli* bacteria is as follows:

> *… for full body contact recreational uses E. coli bacteria, using membrane filter (MF) count, shall not exceed one hundred twenty-five (125) per one hundred (100) milliliters as a geometric mean based on not less than five (5) samples equally spaced over a thirty (30) day period nor exceed two hundred thirty-five (235) per one hundred (100) milliliters in any one (1) sample in a thirty (30) day period*

E. coli bacteria is used as the water quality indicator and the target values are:

- Monthly geometric mean not to exceed 125 cfu/100 ml
- Monthly maximum count sampled not to exceed 235 cfu/100 ml.

Section 3
Data Sources and Initial Assessment

Data characterizing the amount of *E. coli* bacteria entering Fall Creek from various sources were collected. These sources cause exceedances of the Indiana water quality standard for *E. coli* bacteria. This section describes the sources of the data collected for review and includes an assessment of compliance for *E. coli* bacteria.

3.1 Data Sources

Instream *E. coli* bacteria sampling data were obtained from the following sources:

- City of Indianapolis Department of Public Works Office of Environmental Services (OES),
- Marion County Health Department (MCHD), and
- Indiana Department of Environmental Management (IDEM).

3.2 Sampling Locations

Data for *E. coli* bacteria was collected at various intervals and locations by the three agencies. The sampling locations for each agency are shown on **Figure 3.1**.

The City of Indianapolis OES has collected samples and performed *E. coli* bacteria analysis at two locations on Fall Creek. These samples were analyzed and continue to be analyzed on a monthly basis from May 1991 to present. Sampling locations are:

- 71st Street
- 16th Street

The MCHD has collected samples on a monthly basis at two sites on Fall Creek. Samples were also taken five times per month at seven sites on Fall Creek. The locations of the sampling stations along with their corresponding sampling dates and sampling frequency are shown below.

- Emerson Way – January 1997 to March 2002 – Samples Taken 5 Times per Month
- 38th Street – April 2001 to March 2002 – Samples Taken 5 Times per Month
- 30th Street – January 1997 to March 2002 – Samples Taken 5 Times per Month
- Central Avenue – January 1997 to March 2002 – Samples Taken 5 Times per Month
- Capitol Avenue - January 1997 to March 2002 – Samples Taken 5 Times per Month
- Dr. Martin Luther King Jr. Street– January 1997 to March 2002 – Samples Taken 5 Times per Month
- Stadium Drive - January 1997 to March 2002 – Samples Taken 5 Times per Month

- 5700 Fall Creek Parkway N. Drive – April 1999 to October 2001 – Samples Taken Monthly
- 4500 Fall Creek Parkway N. Drive – June 1997 to October 2001 – Samples Taken Monthly

Additionally, in 2002 OES and MCHD performed sampling at several locations along streams of interest to supplement the existing *E. coli* bacteria data for the TMDL project. Data was collected from these stations five times per month from April 2002 to October 2002. The following is a list of all sites where supplemental *E. coli* bacteria samples were collected:

- 79th Street and Fall Creek
- 71st Street and Fall Creek
- Emerson Way and Fall Creek
- 46th Street and Fall Creek
- Keystone Avenue and Fall Creek
- 39th Street and Fall Creek
- Boy Scout Road and Fall Creek
- 30th Street and Fall Creek
- Central Avenue and Fall Creek
- Capitol Avenue and Fall Creek
- Dr. Martin Luther King Jr. Street and Fall Creek
- 16th Street and Fall Creek
- Stadium Drive and Fall Creek
- Schafer Road and Lawrence Creek in the Fall Creek watershed
- Radnor Road and Devon Creek in the Fall Creek watershed
- Millersville Road and Devon Creek in the Fall Creek watershed
- 96th Street and Mud Creek
- 86th Street and Mud Creek
- 82nd Street and Mud Creek
- Lantern Road and Mud Creek
- Fall Creek Road and Mud Creek

IDEM has also collected monthly data at two sites on Fall Creek from February 1991 to December 2000. These locations are:

- Keystone Avenue near Indianapolis Water Company intake
- Stadium Drive

3.3 Data Review and Initial Findings

MCHD uses the Quanitray 2000 tray-counting method. Samples are prepared with the Colilert reagent and incubated for 24 to 48 hours prior to application on the trays.

The city's OES has used **Standard Methods for the Examination of Water and Wastewater** (prepared and published by the American Public Health Association/American Water Works Association/Water Environment Federation-latest edition) as a reference to determine the method(s) used to enumerate fecal Coliform and *E. coli* bacteria concentrations in surface water samples.

In order to produce as accurate of a value as possible, OES has been using Membrane Filtration (MF) as opposed to Most Probable Number (MPN) methods. The specific method for determining fecal Coliform concentrations is referenced as 9222 D, using mFC broth with Rosolic acid, incubating the samples at 44.5 Deg C (+/- 0.2 Deg C), for a 24 hour period, +/- 2 hours.

OES has been using a slightly modified Membrane Filter method 9222 G as an extension of 9222 D to obtain an *E. coli* bacteria value. This method uses the same filter pad from the fecal Coliform method and reincubates the filter pad on a nutrient agar plate containing the organic salt 4-methyl-umbelliferyl-Beta-D glucuronide (MUG). Reincubation is conducted for 4 hours at 35.0 degrees Celsius (+/- 0.5 deg C). When added to the agar plate, MUG causes *E. coli* bacteria colonies to fluoresce under an ultraviolet light source (366 nm). Extensive comparison testing was performed using the mTEC *E. coli* bacteria method to analyze WWTP and surface water samples. In addition, freeze dried *E. coli* bacteria cultures were obtained and rehydrated to evaluate both methods. The comparison evaluation resulted in a good correlation between the two test methods, and the "pure" *E. coli* bacteria culture sample was determined to be accurately reported. The rehydrated cultures did not have a reference concentration.

CDM has reviewed the available data for Fall Creek within Marion County for use in performing a TMDL for *E. coli* bacteria. All data collected by OES, MCHD, and IDEM is considered to have received quality assurance checks by the respective collecting entity (OES, MCHD, or IDEM). In addition, IDEM has approved the use of OES and MCHD data for this analysis. Additional data checking was not performed as part of this project. Data flagged by the collecting entity as questionable are presented in the attached graphs and noted as being questionable, but they have not been used for determination of compliance.

All accepted data are considered comparable. OES and TMDL sampling (April 2002-October 2002) used the same method for comparison purposes. That is, where data is collected by more than one entity at a particular monitoring location, the data sets are combined for the assessment of compliance with the applicable standard.

Data plots of all stations and compliance plots for Fall Creek are found in **Figures 3.2 through 3.8**. The following paragraphs summarize the findings from each source and the overall percent compliance with Indiana water quality standards for data from January 2000 to December 2001.

A comparison of the available data was made to both the maximum monthly *E. coli* bacteria standard of 235 cfu/100 ml and the monthly geometric mean standard of 125 cfu/100 ml for the recreational season of April to October.

Overall, the major findings are:

- More than 90 percent of the sampling stations exceeded the daily maximum *E. coli* bacteria standard (235 cfu/100 ml) more than 50 percent of the time.
- All of the sampling stations with sufficient data (5 samples in 30 days) exceed the geometric mean *E. coli* bacteria standard (125 cfu/100 ml) 75 percent of the time.

E. coli bacteria exceedances occur at all stations on Fall Creek, as shown in data and compliance plots provided on Figures 3.2 through 3.8. The upstream sampling station at 71st Street has a high percent compliance with the bacteria standard; nearly 78% of the time the instream value is less than the daily maximum limit of 235 cfu/100 ml.

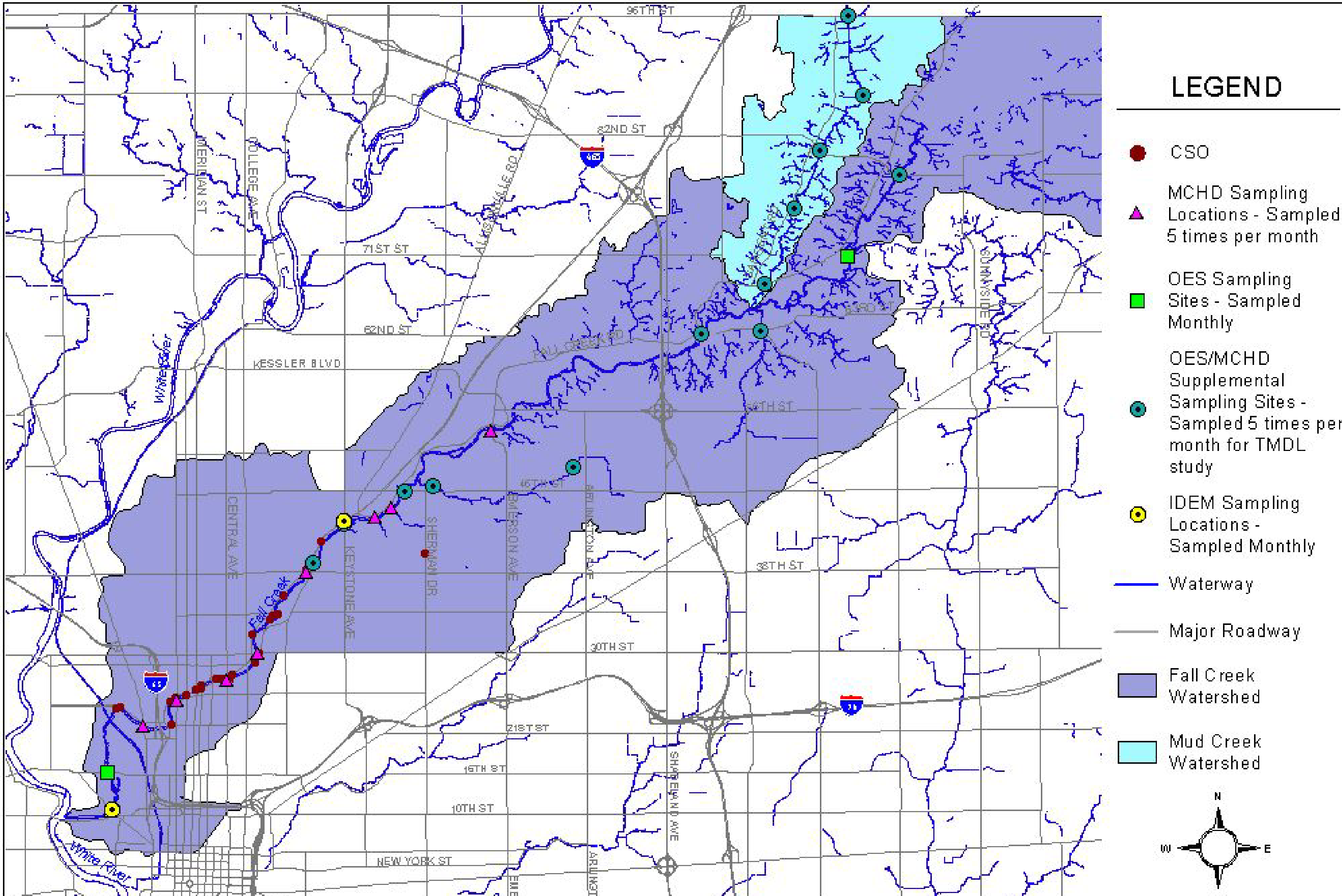
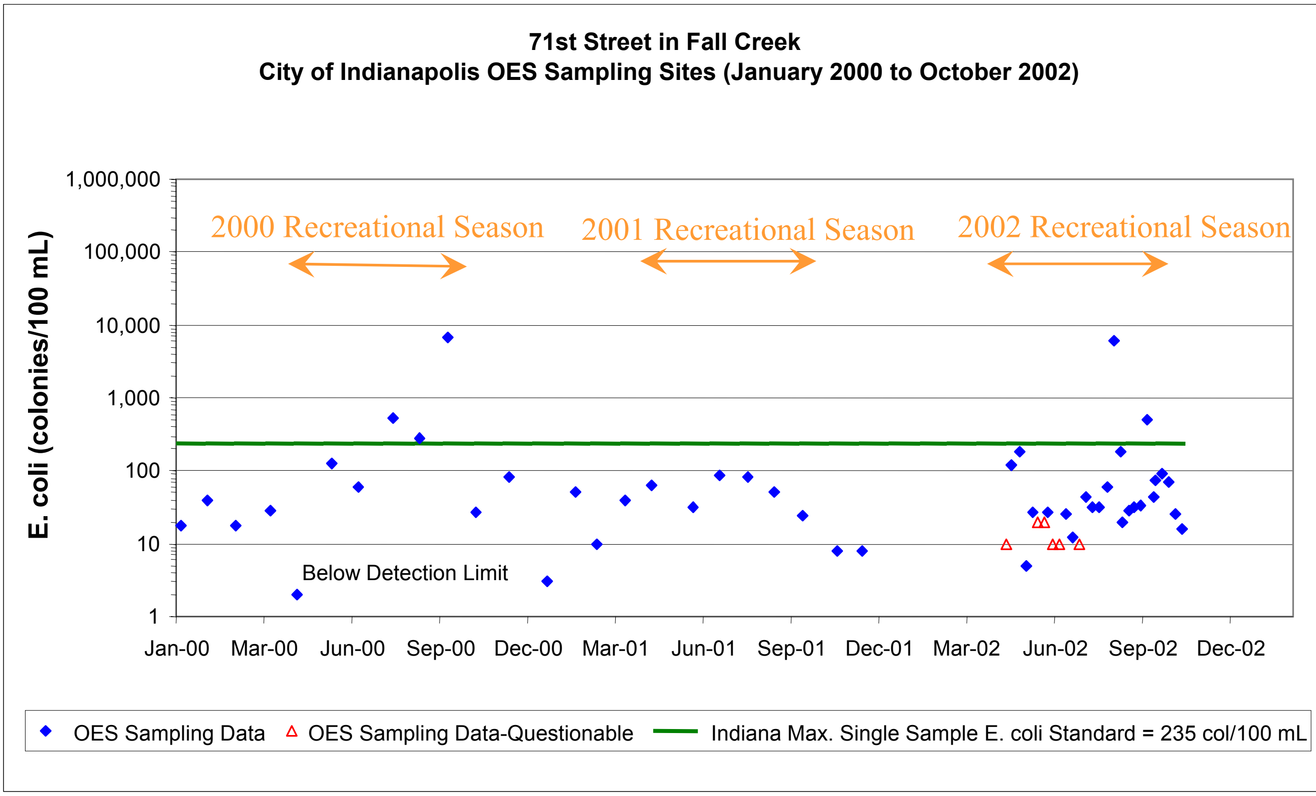


Figure 3.1: Water Quality Sampling Sites on Fall Creek and Mud Creek
City of Indianapolis
As of Spring 2002

Figure 3.2: Fall Creek *E. coli* Data Plots



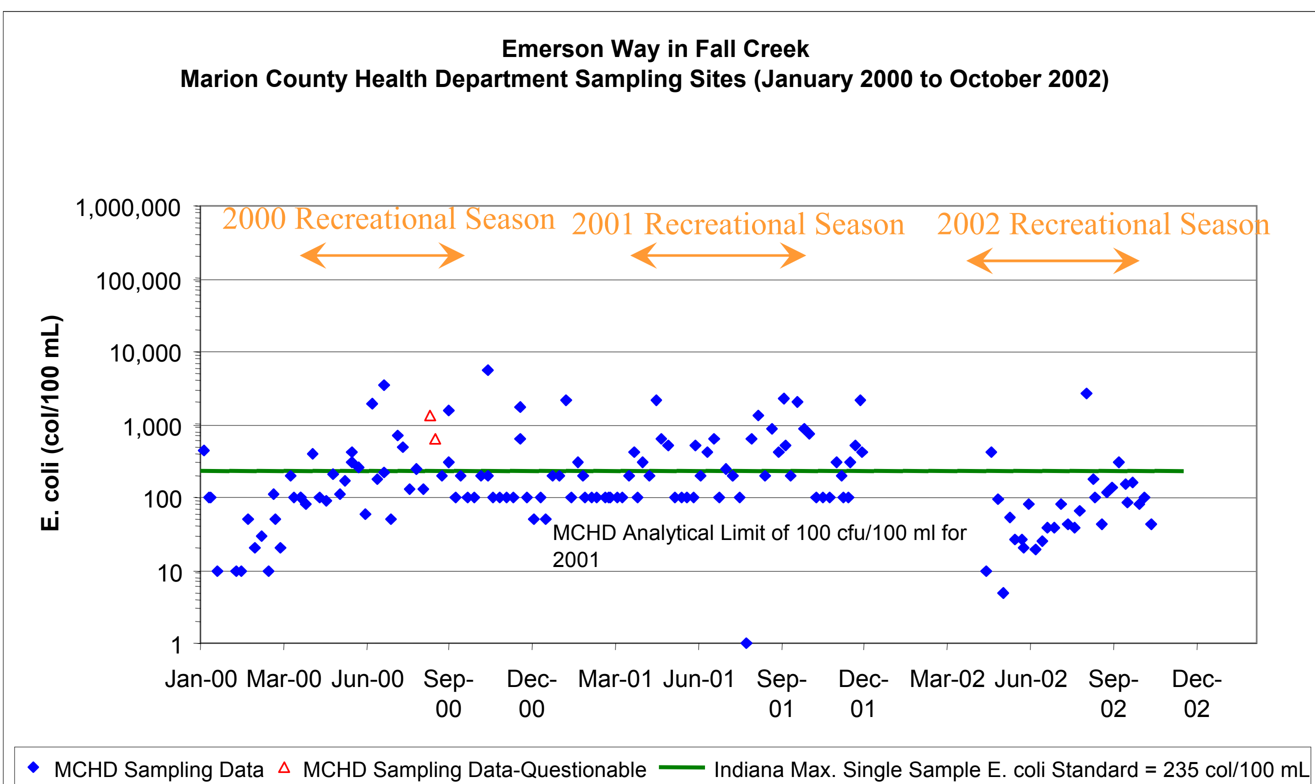
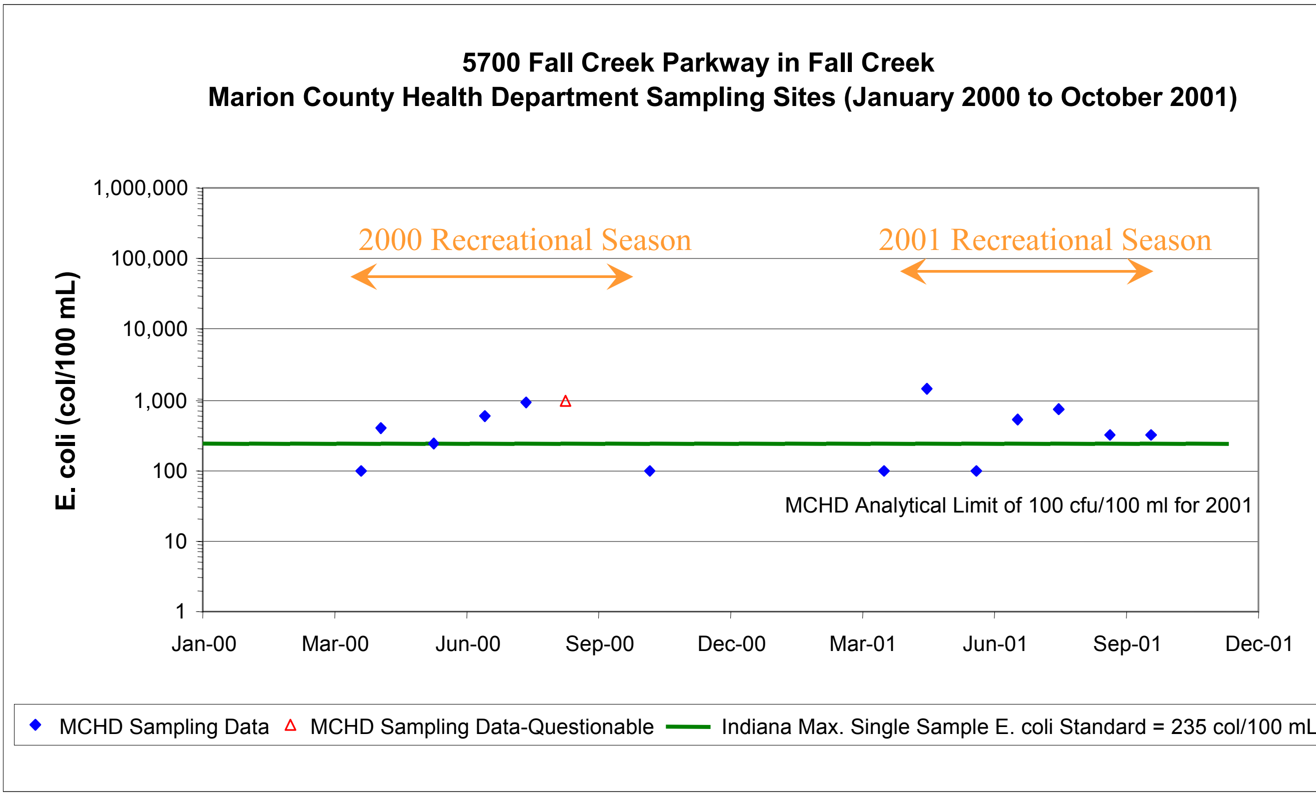


Figure 3.3: Fall Creek *E. coli* Data Plots



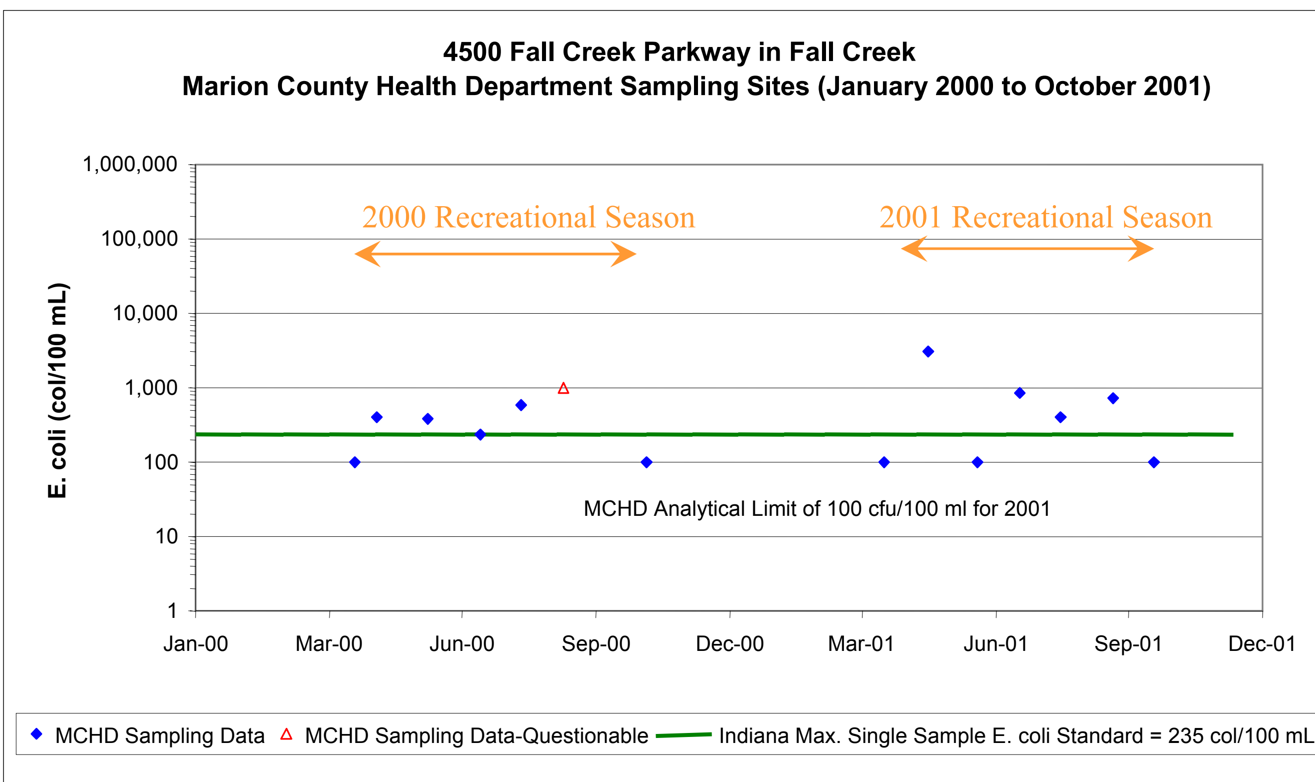
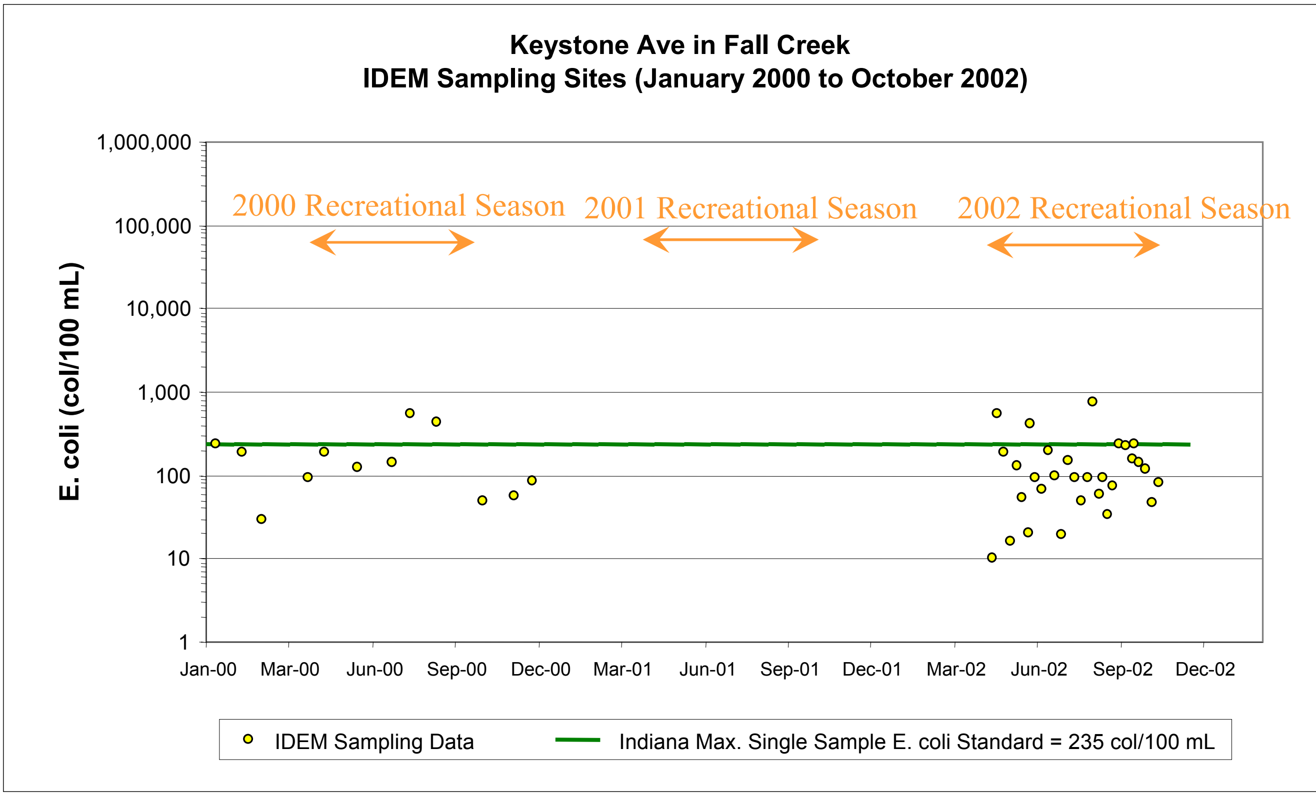


Figure 3.4: Fall Creek *E. coli* Data Plots



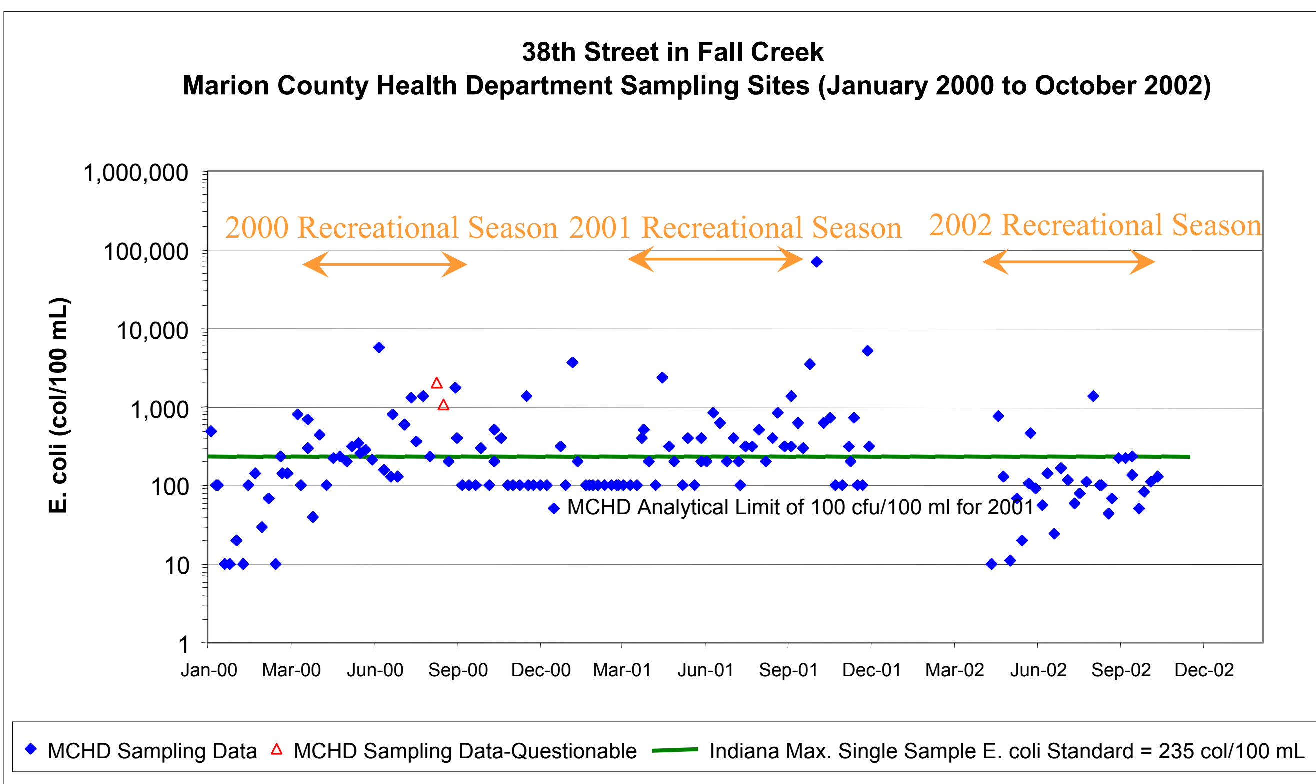
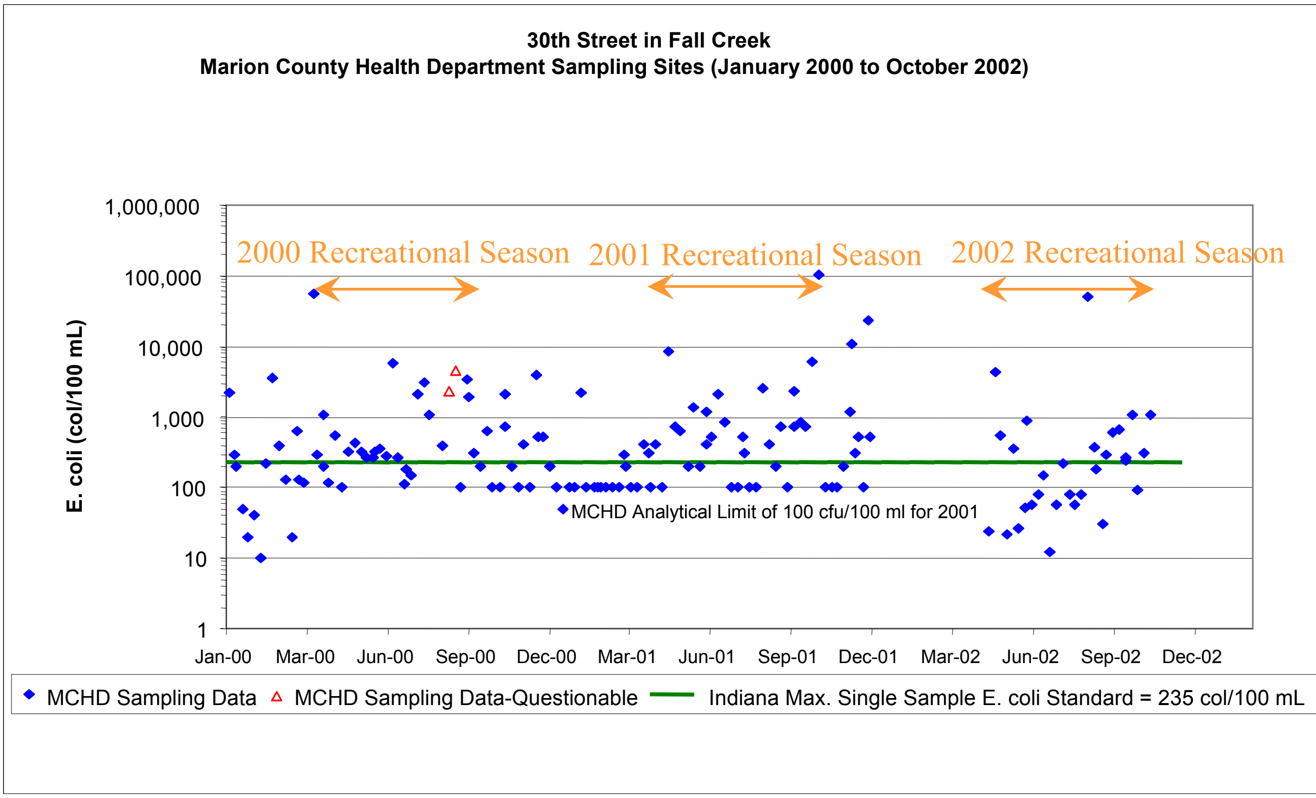


Figure 3.5: Fall Creek *E. coli* Data Plots



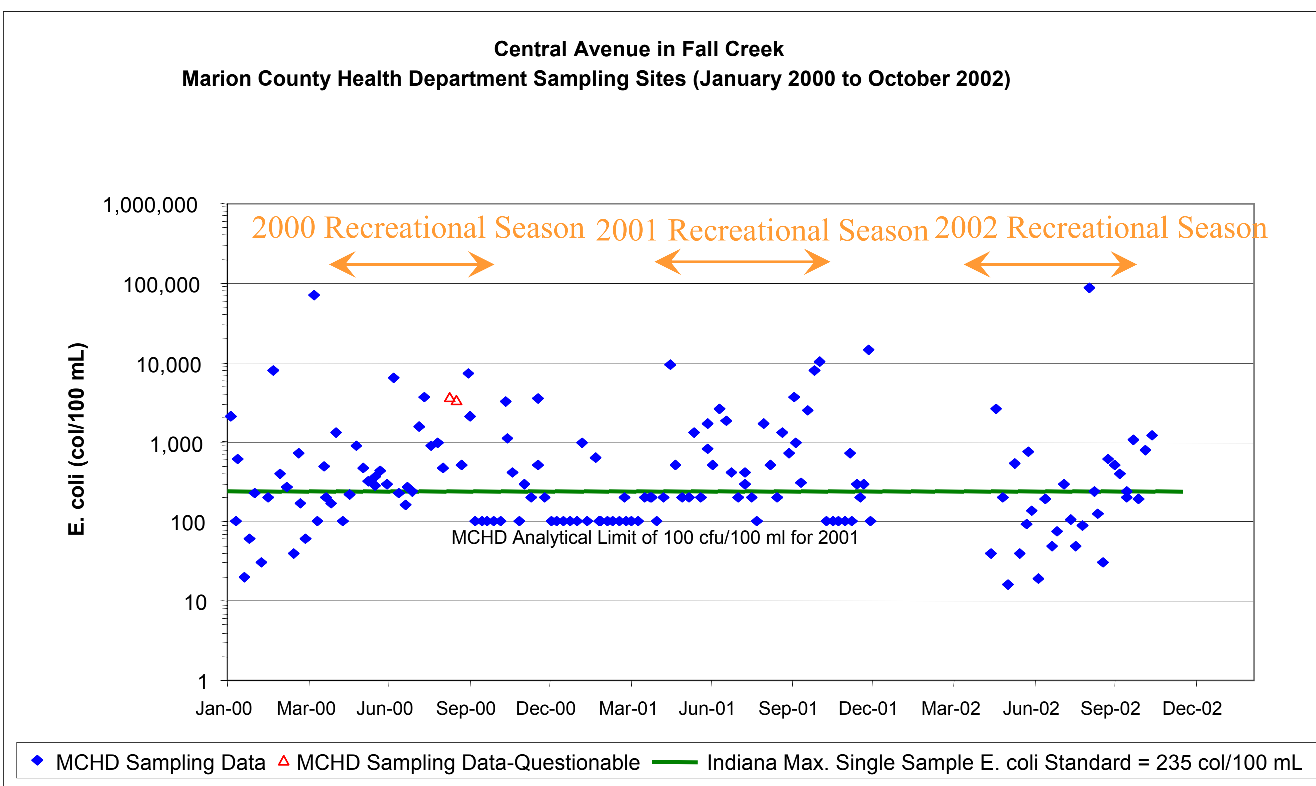
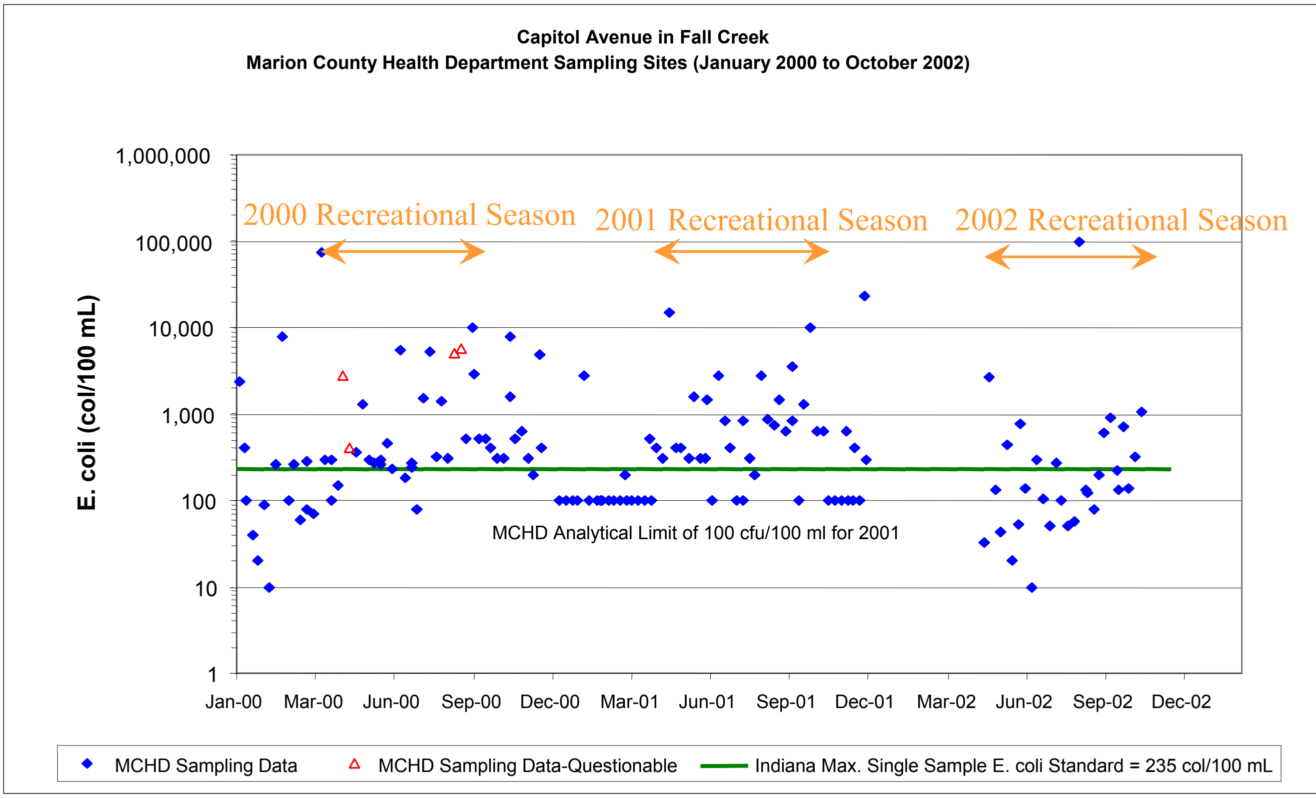


Figure 3.6: Fall Creek *E. coli* Data Plots



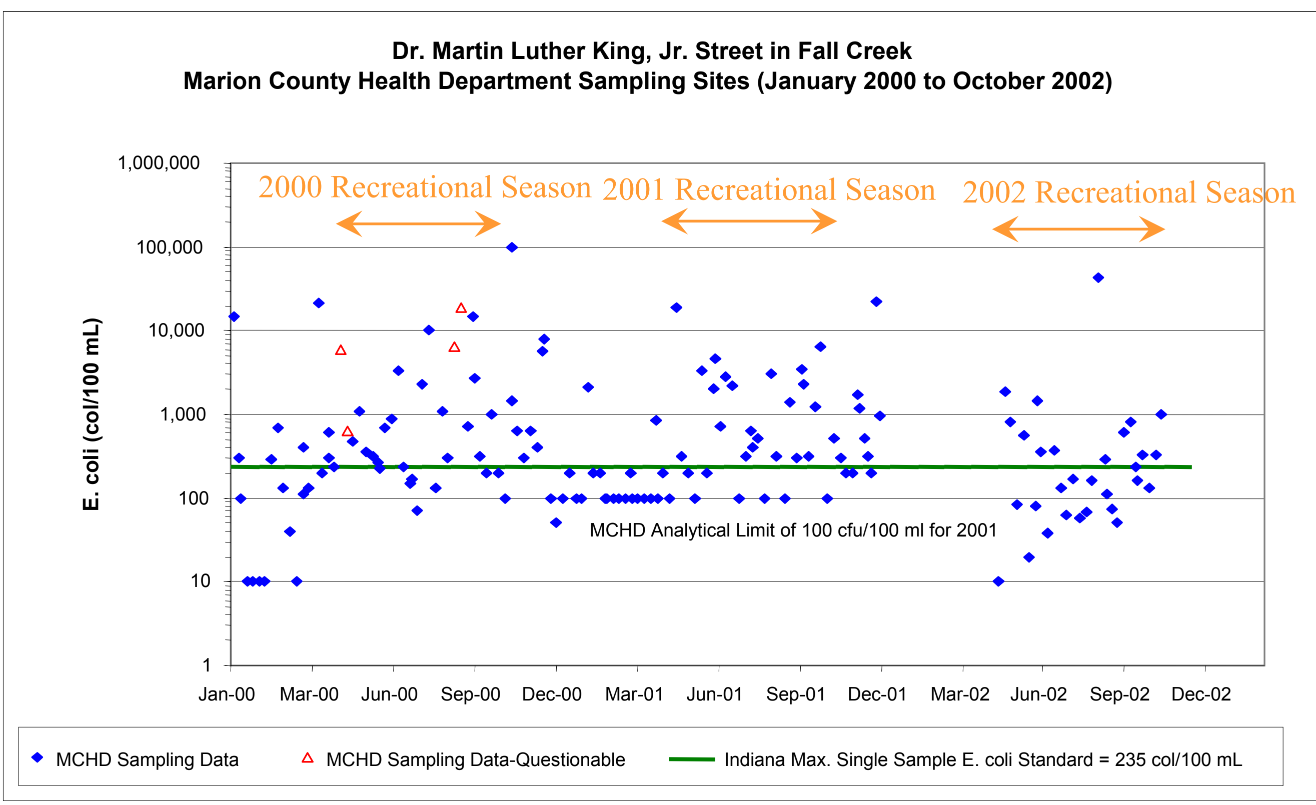
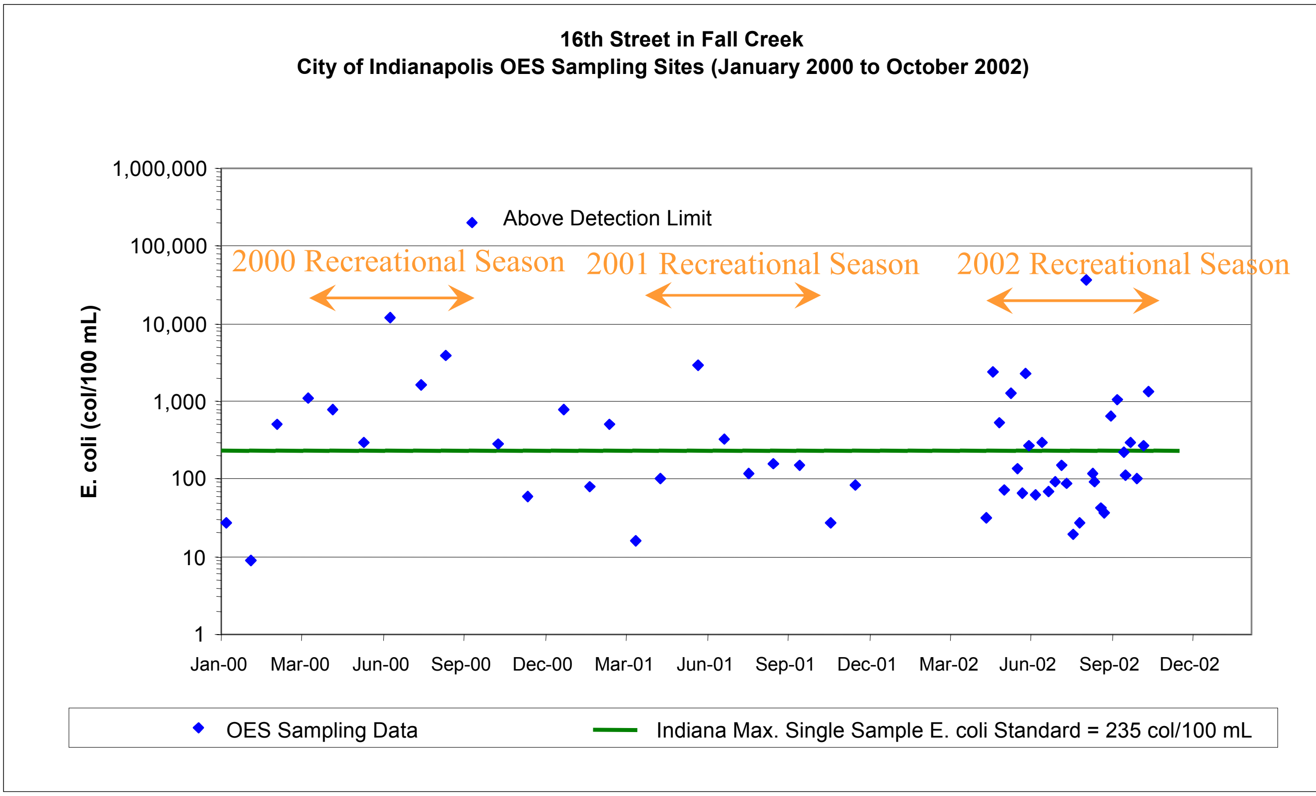


Figure 3.7: Fall Creek *E. coli* Data Plots



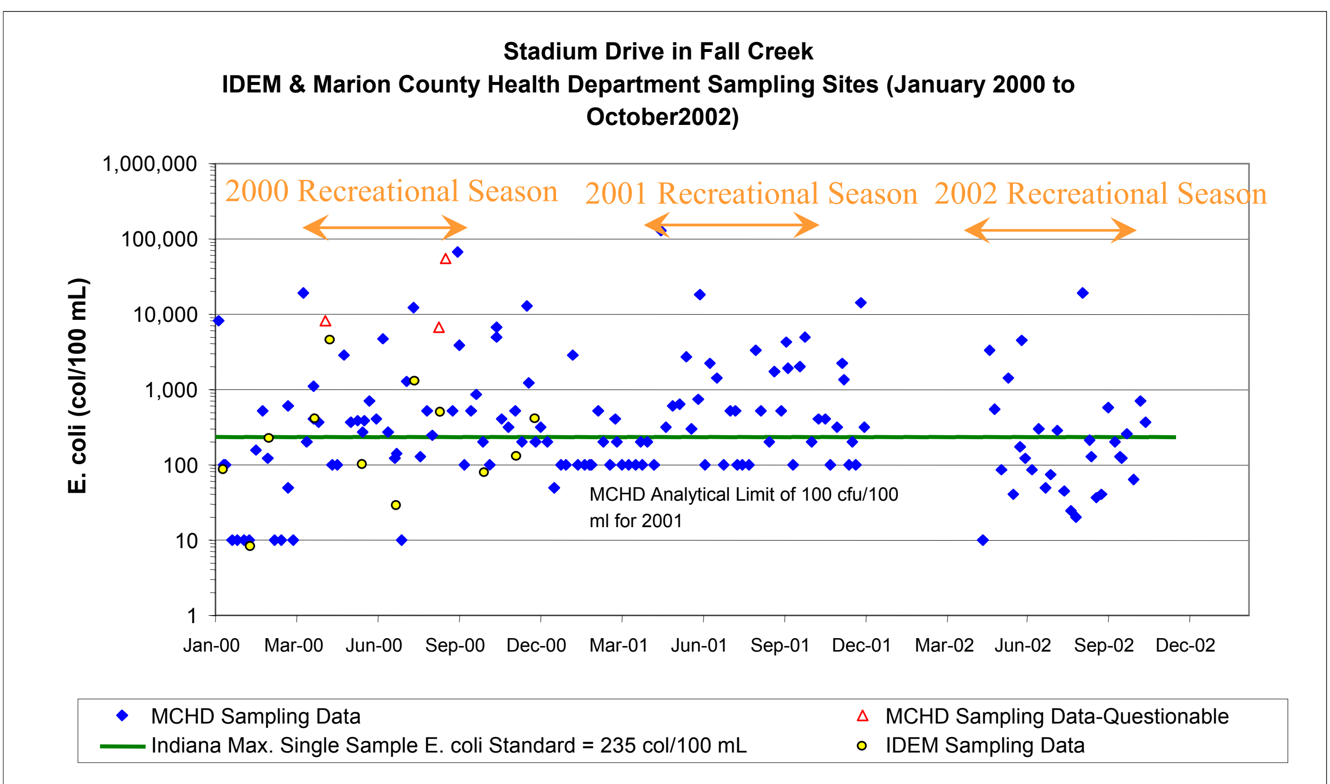
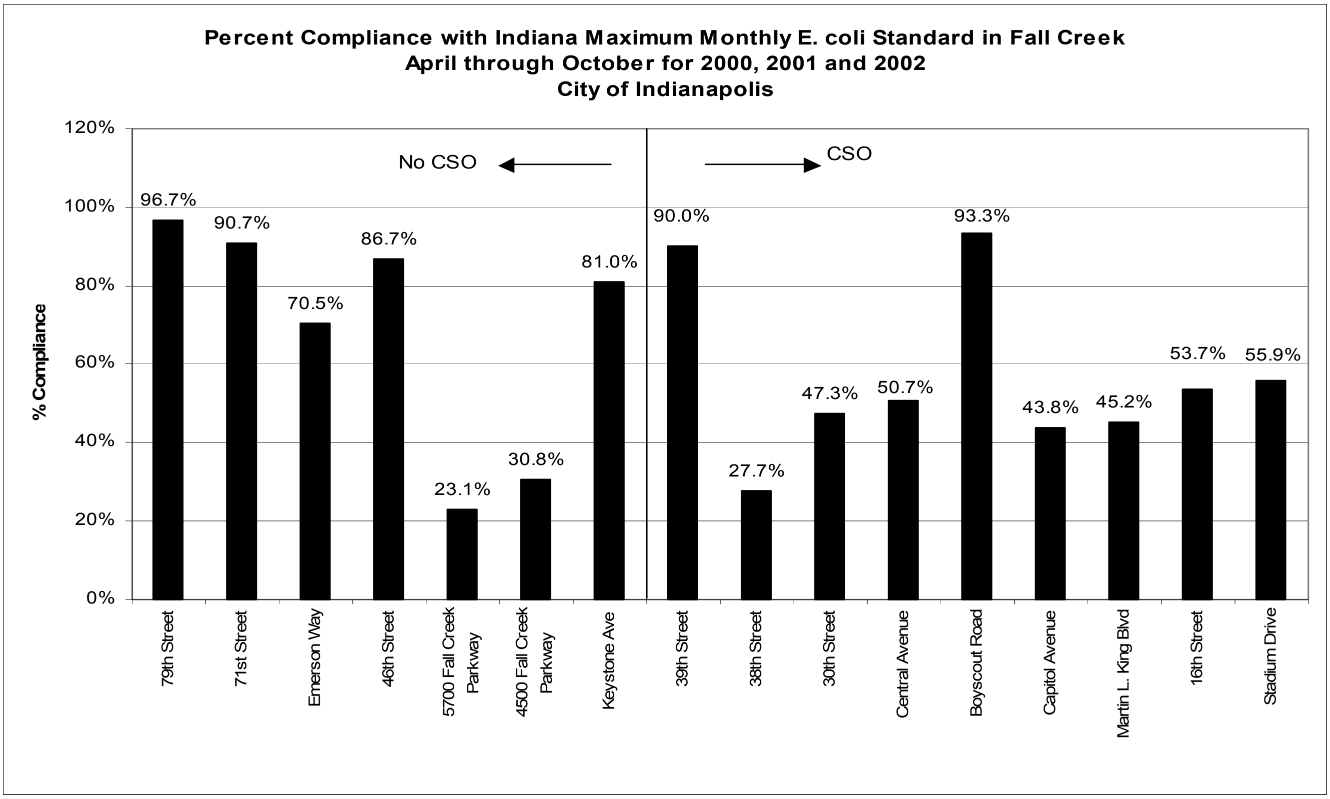
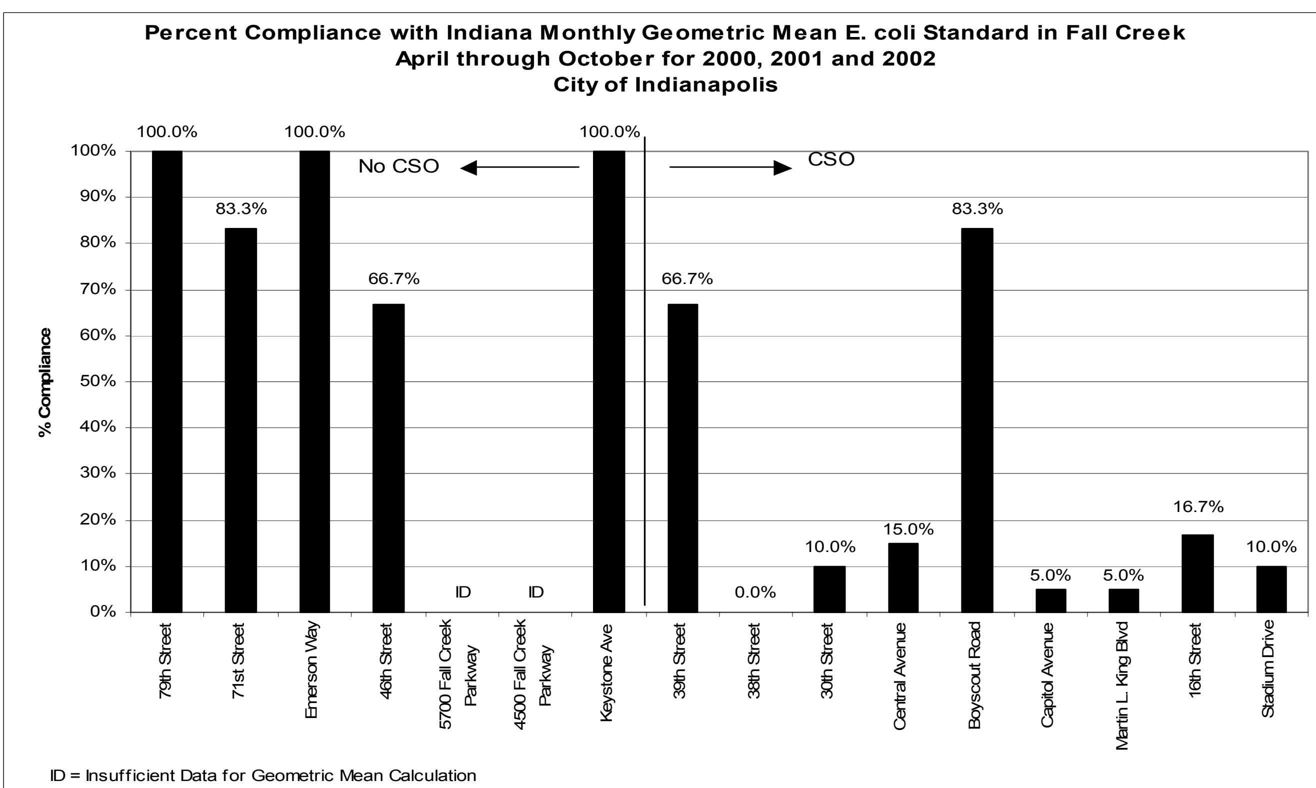


Figure 3.8: Fall Creek *E. coli* Data Plots





Section 4
Water Quality Characterization

The previous section documents the existing water quality for Fall Creek. The analysis indicates that the *E. coli* bacteria standard of 125 cfu/100 ml (geometric mean of five samples collected over 30 days) and 235 cfu/100 ml (maximum day value) are often exceeded on the stream segment from Emerson Way to the confluence with West Fork White River.

4.1 Compliance Evaluation

E. coli bacteria data for 2000, 2001, and 2002 was analyzed for compliance with three reference criteria as follows:

- IDEM's geometric mean water quality standard for *E. coli* bacteria, which is 125 cfu/100 ml or less,
- IDEM's 303(d) Listing Methodology (2002) guidance of no more than 10 percent of samples be above 235 cfu/100 ml, and
- IDEM's 303(d) Listing Methodology (2002) guidance of no sample having an *E. coli* bacteria count greater than 10,000 cfu/100 ml.

For this analysis, the *E. coli* bacteria data was separated into two categories, wet weather and dry weather. Wet weather is defined as any days with precipitation (greater than trace amounts or greater than 0.1 inch) and the three days following that precipitation. The three day period was determined by an analysis of *E. coli* bacteria in stormwater and CSOs as part of the April 2001 LTCP (CDM, 2003.) Dry weather is any time other than wet weather.

In addition, Fall Creek was divided into two stream segments for analysis purposes as follows:

- Fall Creek Upstream of the CSO Area
- Fall Creek Within the CSO Area

Instream *E. coli* bacteria sampling data were grouped for each segment, one group for all data collected upstream of the CSO area and one group for all data collected within the CSO area. For informational purposes, data from major tributaries - Mud Creek, Lawrence Creek and Devon Creek - were also analyzed. **Table 4.1** and **Figure 4.1** show the extent of each stream segment for Fall Creek and its tributaries.

Table 4.2 provides a summary of the *E. coli* bacteria sampling program for the stream segments compared to the three reference *E. coli* bacteria compliance criteria number and presents the findings of the compliance analysis for the two segments on Fall Creek. **Figures 4.2 through 4.6** present the findings graphically.

4.1.1 All Weather Analysis

Two segments, upstream Fall Creek and Mud Creek, have monthly geometric mean values of *E. coli* bacteria lower than the Indiana geometric mean standard of 125 cfu/100 ml. However, neither stream is in compliance with the reference criteria of less than 10% of samples greater than 235 cfu/100 ml, and Mud Creek had an observed count above 10,000 cfu/100 ml. The analysis suggests that Fall Creek upstream of the CSO area and Mud Creek possess sufficient baseflow to absorb the *E. coli* bacteria load on a "typical" day, but receive excessive *E. coli* loadings from stormwater and failed septics during wet weather or low flow, dry weather days. The other three segments, Fall Creek within the CSO area, Devon Creek, and Lawrence Creek, are not in compliance with the geometric mean standard of 125 cfu/100 ml or the reference criteria of less than 10% of samples greater than 235 cfu/100 ml. The analysis suggests that these streams are not able to accept the *E. coli* bacteria load from wildlife, failed septics, and stormwater sources. The 30 samples in excess of 10,000 cfu/100 ml in the Fall Creek CSO area segment in an eighteen-month period imply that CSOs are a significant source of *E. coli* bacteria to the stream.

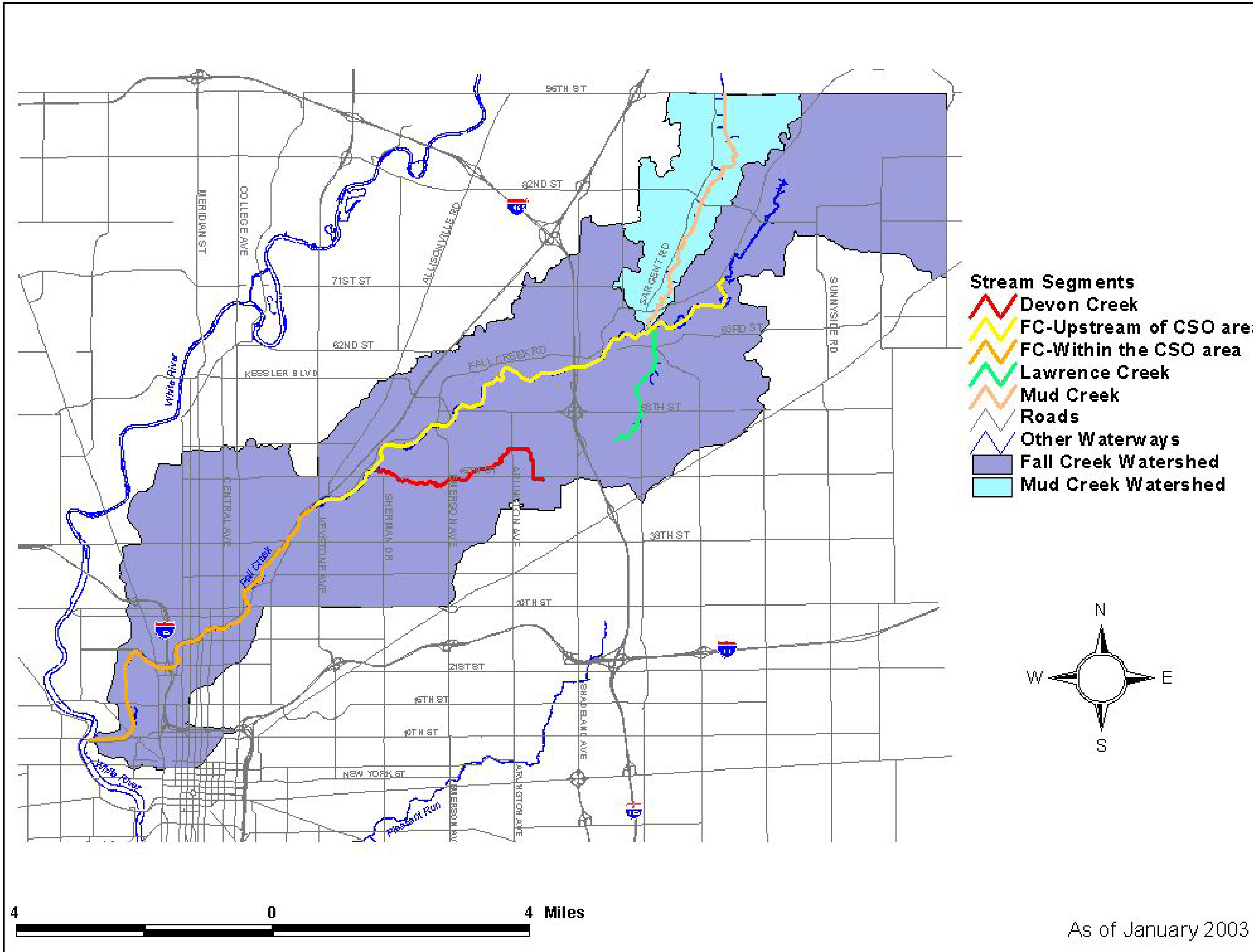
4.1.2 Dry Weather

One stream segment, Mud Creek, is in compliance with all three reference *E. coli* bacteria criteria during dry weather. The analysis suggests that the septic and wildlife *E. coli* bacteria loads to Mud Creek are reasonable for the dry weather baseflow. Two other stream segments, Fall Creek upstream of the CSO area and Lawrence Creek, are in compliance with the geometric mean standard of 125 cfu/100 ml, but not the reference criteria of less than 10% of samples greater than 235 cfu/100 ml. The analysis suggests that although the streams possess sufficient baseflow to absorb the *E. coli* bacteria load during a "typical" dry weather day, frequent low flow conditions or fluctuations in the septic or wildlife loads occur more than 10% of the time during dry weather. Two stream segments, Fall Creek within the CSO area and Devon Creek, are not in compliance with the Indiana geometric mean standard of 125 cfu/100 ml or the reference criteria of less than 10% of samples greater than 235 cfu/100 ml. The analysis suggests that the septic and wildlife loadings are excessive for the stream. The contrast of the performance for Fall Creek upstream and within the CSO area suggests that the water withdrawn by Indianapolis Water at 38th Street has a profound effect on *E. coli* bacteria counts in the stream.

4.1.3 Wet Weather

All five stream segments are not in compliance with the Indiana geometric mean standard of 125 cfu/100 ml or the reference criteria of less than 10% of samples greater than 235 cfu/100 ml. The analysis suggests that each stream segment receives excessive *E. coli* bacteria loadings from stormwater. The observed wet weather geometric mean and the 30 samples in excess of 10,000 cfu/100 ml in the Fall Creek CSO area segment in an eighteen-month period imply that CSOs are a dominant source of *E. coli* bacteria in the watershed.

Figure 4.1: Stream Segments on Fall Creek, Mud Creek, Devon Creek and Lawrence Creek



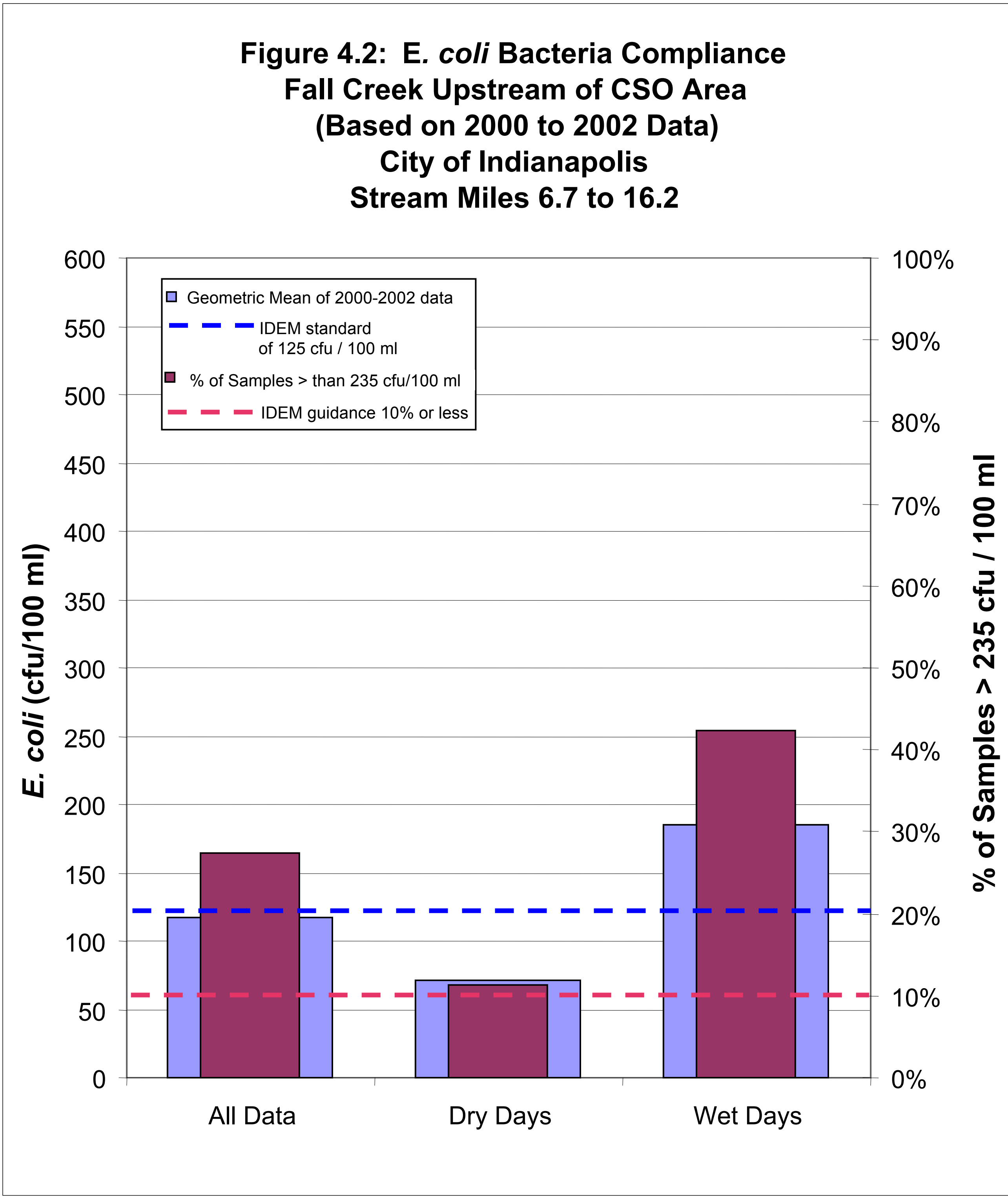


Figure 4.2: E. coli Bacteria Compliance
Fall Creek Upstream of CSO Area
(Based on 2000 to 2002 Data)
City of Indianapolis
Stream Miles 6.7 to 16.2
Geometric Mean of 2000-2002 data
IDEM standard
of 125 cfu / 100 ml
% of Samples > than 235 cfu/100 ml
IDEM guidance 10% or less
E. coli (cfu/100 ml)
% of Samples > 235 cfu / 100 ml
600
550
500
450
400
350
300
250
200
150
100
50
0
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
All Data
Dry Days
Wet Days

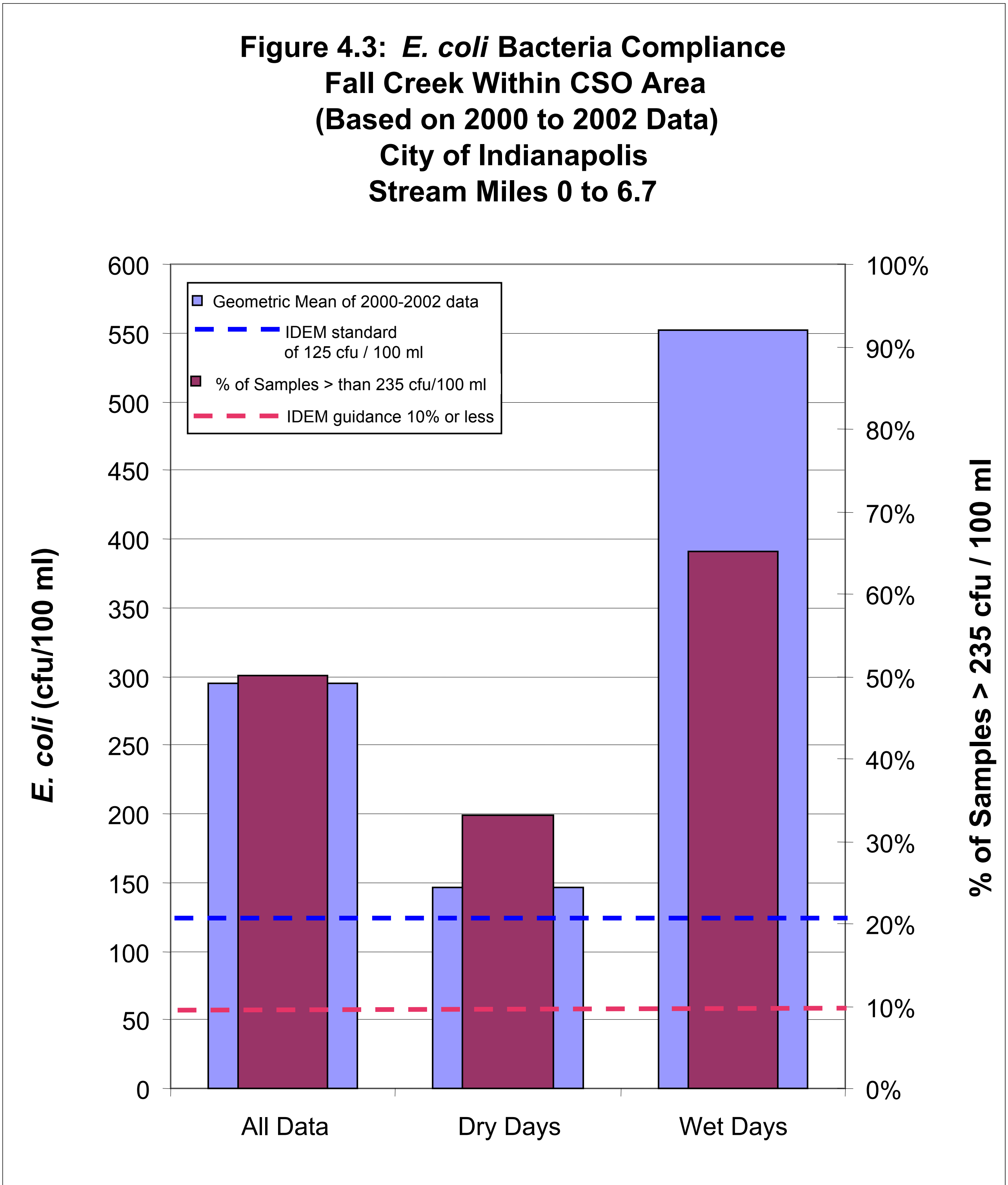
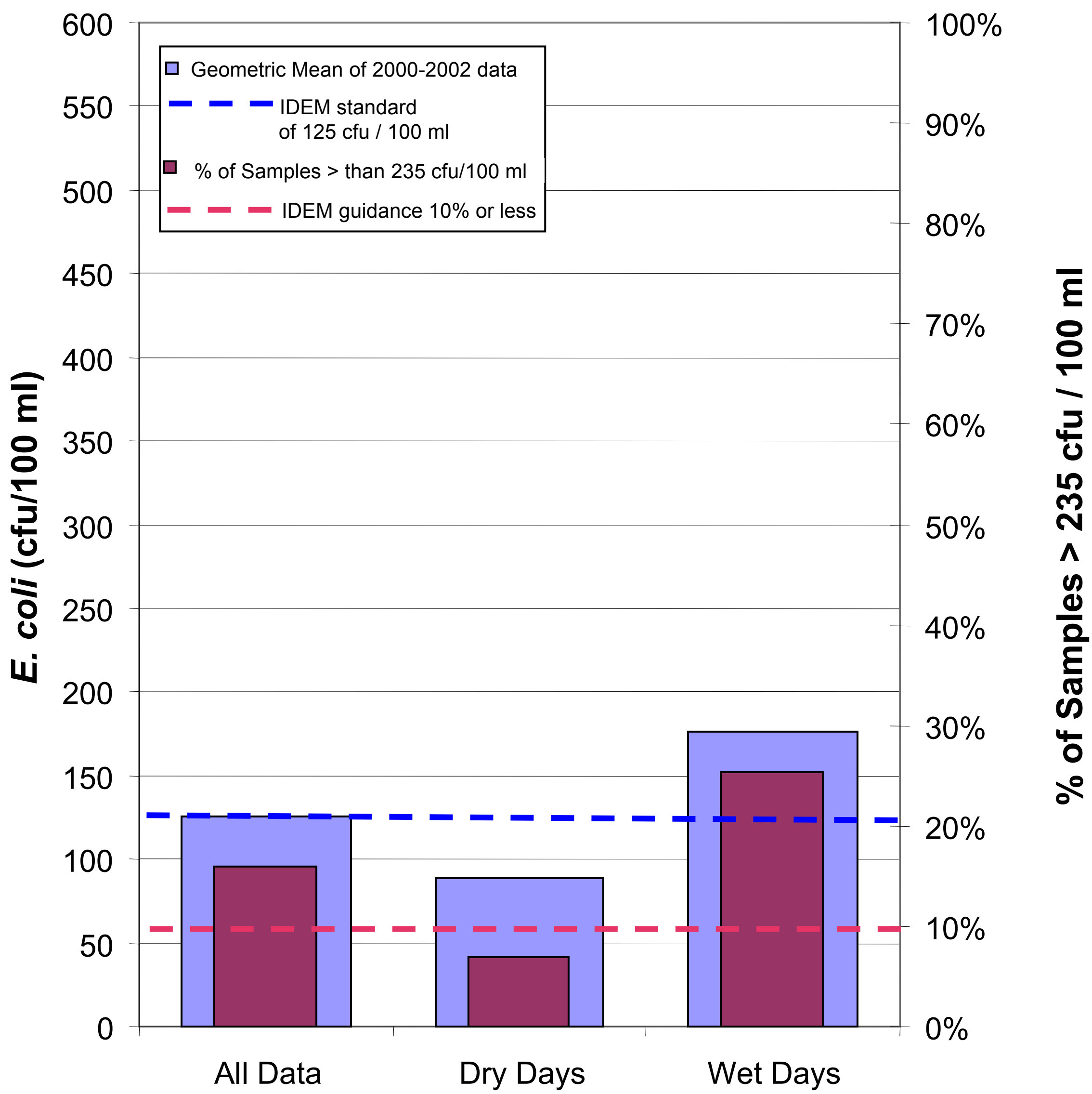


Figure 4.3: E. coli Bacteria Compliance
Fall Creek Within CSO Area
(Based on 2000 to 2002 Data)
City of Indianapolis
Stream Miles 0 to 6.7
Geometric Mean of 2000-2002 data
IDEM standard of 125 cfu / 100 ml
% of Samples > than 235 cfu/100 ml
IDEM guidance 10% or less
E. coli (cfu/100 ml)
% of Samples > 235 cfu / 100 ml
0
50
100
150
200
250
300
350
400
450
500
550
600
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
All Data
Dry Days
Wet Days

Figure 4.4: *E. coli* Bacteria Compliance
Mud Creek
(Based on 2000 to 2002 Data)
City of Indianapolis
Stream Miles 0 to 6.6



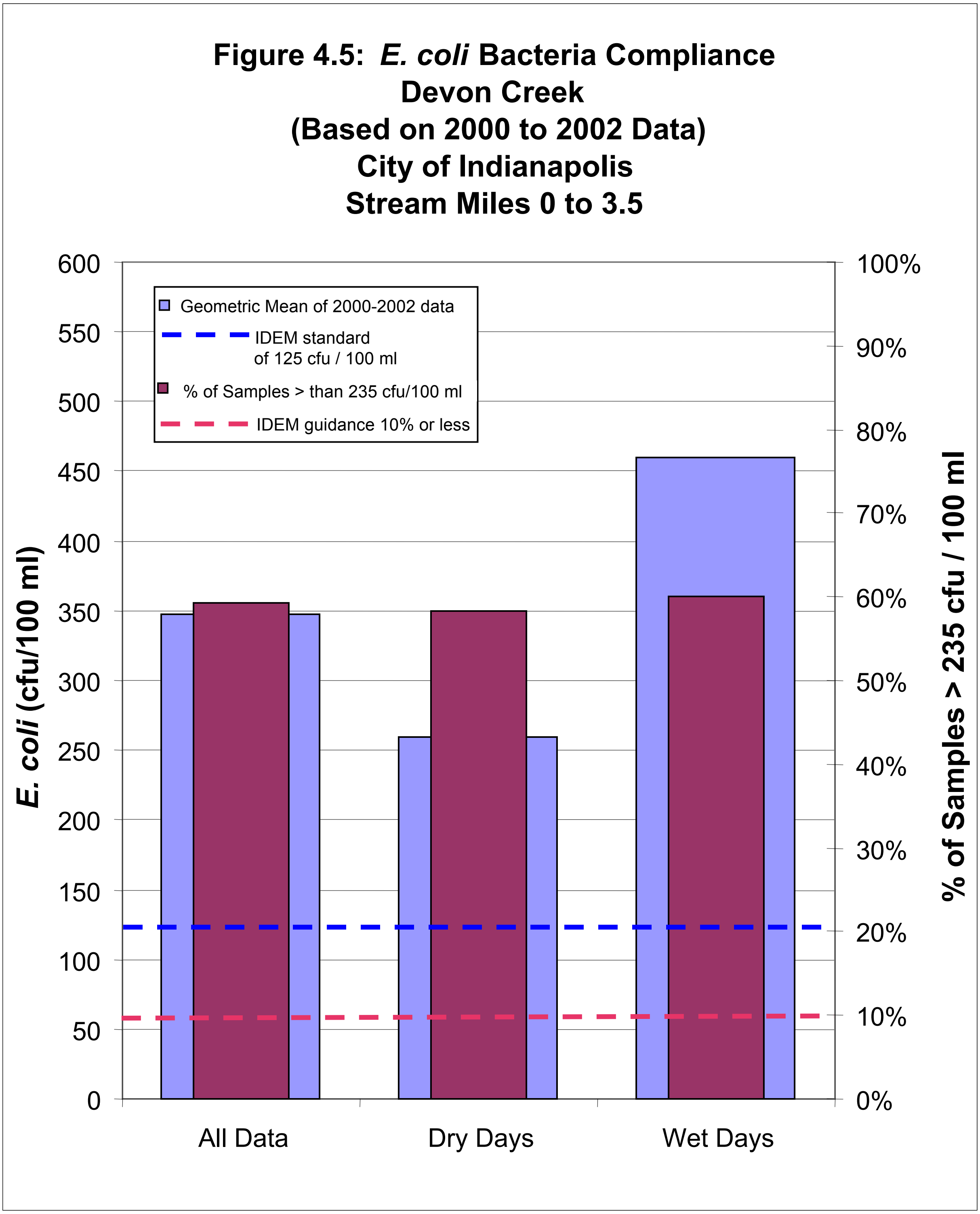


Figure 4.5: *E. coli* Bacteria Compliance
Devon Creek
(Based on 2000 to 2002 Data)
City of Indianapolis
Stream Miles 0 to 3.5
Geometric Mean of 2000-2002 data
IDEM standard of 125 cfu / 100 ml
% of Samples > than 235 cfu/100 ml
IDEM guidance 10% or less
E. coli (cfu/100 ml)
% of Samples > 235 cfu / 100 ml
600
550
500
450
400
350
300
250
200
150
100
50
0
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
All Data
Dry Days
Wet Days

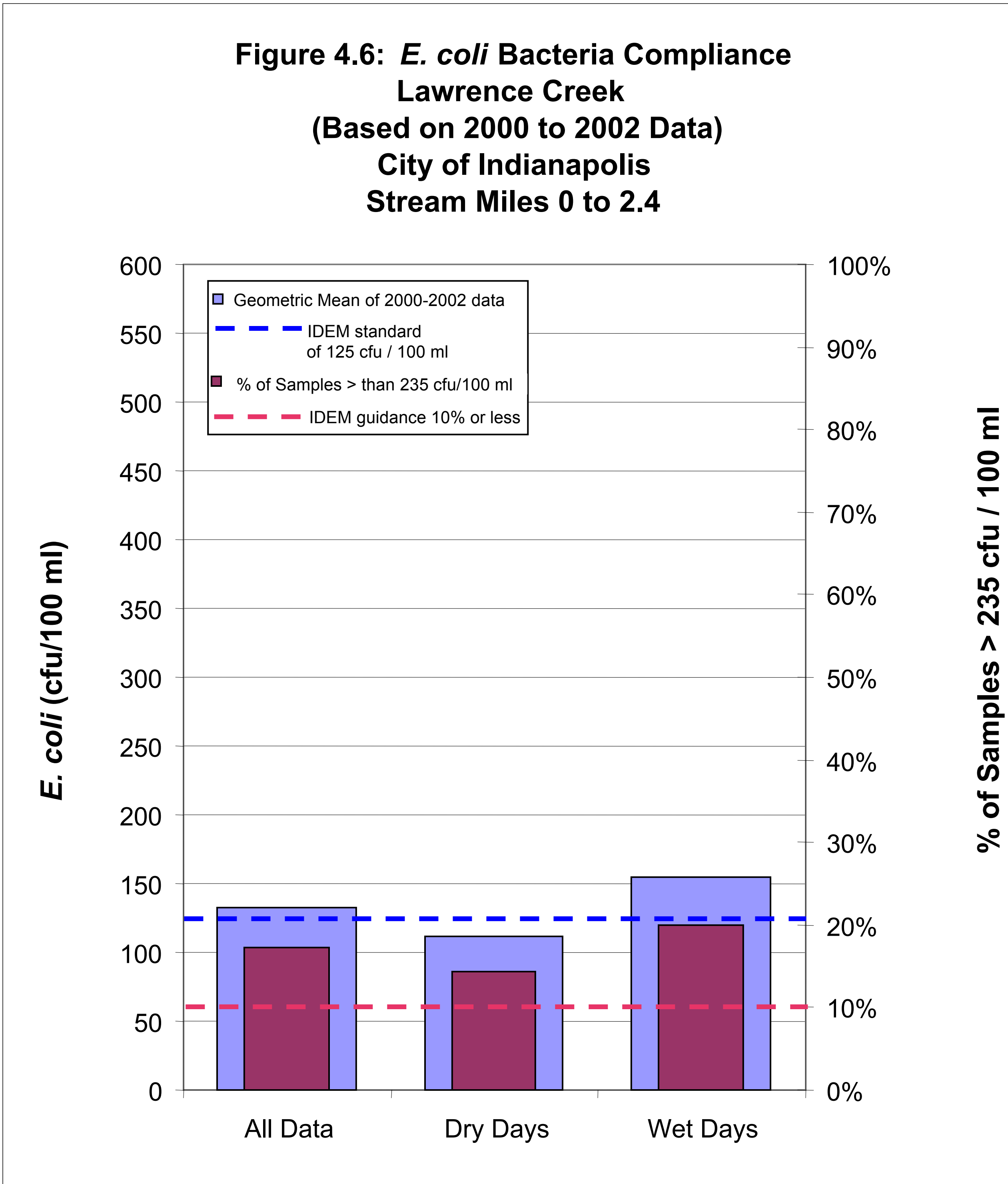


Figure 4.6: *E. coli* Bacteria Compliance
Lawrence Creek
(Based on 2000 to 2002 Data)
City of Indianapolis
Stream Miles 0 to 2.4
Geometric Mean of 2000-2002 data
IDEM standard of 125 cfu / 100 ml
% of Samples > than 235 cfu/100 ml
IDEM guidance 10% or less
E. coli (cfu/100 ml)
% of Samples > 235 cfu / 100 ml
600
550
500
450
400
350
300
250
200
150
100
50
0
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
All Data
Dry Days
Wet Days

Table 4.1: Segment Stream Miles - Fall Creek

Stream Segment	Stream Mile Start	Stream Mile End
Fall Creek - Upstream of CSO Area	6.7	16.2
Fall Creek - Within CSO Area	0	6.7
Mud Creek - Tributary to Fall Creek	0	6.6
Devon Creek - Tributary to Fall Creek	0	3.5
Lawrence Creek - Tributary to Fall Creek	0	2.4

Table 4.2: *E. coli* Bacteria Compliance – Fall Creek

All Data				
River Segment	**Geometric Mean of 2000-2002 data**	**% of Samples > 235 cfu/100 ml**	**Total Number of Samples > 10,000 cfu/100 ml**	**Total Number of Samples**
Fall Creek - Upstream of CSO Area	117	27.4%	0	274
Fall Creek - Within CSO Area	295	50.1%	30	902
Mud Creek - Tributary to Fall Creek	125	16.0%	1	144
Devon Creek - Tributary to Fall Creek	347	59.2%	0	49
Lawrence Creek - Tributary to Fall Creek	132	17.2%	0	29
Dry Weather				
River Segment	**Geometric Mean of 2000-2002 data**	**% of Samples > 235 cfu/100 ml**	**Total Number of Samples > 10,000 cfu/100 ml**	**Total Number of Samples**
Fall Creek - Upstream of CSO Area	72	11.4%	0	132
Fall Creek - Within CSO Area	146	33.2%	0	425
Mud Creek - Tributary to Fall Creek	89	6.8%	0	73
Devon Creek - Tributary to Fall Creek	259	58.3%	0	24
Lawrence Creek - Tributary to Fall Creek	112	14.3%	0	14
Wet Weather				
River Segment	**Geometric Mean of 2000-2002 data**	**% of Samples > 235 cfu/100 ml**	**Total Number of Samples > 10,000 cfu/100 ml**	**Total Number of Samples**
Fall Creek - Upstream of CSO Area	185	42.3%	0	142
Fall Creek - Within CSO Area	552	65.2%	30	477
Mud Creek - Tributary to Fall Creek	176	25.4%	1	71
Devon Creek - Tributary to Fall Creek	460	60.0%	0	25
Lawrence Creek - Tributary to Fall Creek	155	20.0%	0	15
State Guidance [(1)]	**(IDEM standard of 125 cfu/100 ml)**	**(IDEM Guidance 10% or less)**	**(IDEM Guidance None > 10,000 cfu/100 ml)**	

[(1)] **Indiana's 303(d) Listing Methodology for Impaired Waterbodies and Total Maximum Daily Load - September 2002**

Section 5
Source Characterization

A model was developed to simulate the impact of both dry and wet weather *E. coli* bacteria sources in Fall Creek. The model simulates wet weather bacteria sources, including CSOs and urban/residential nonpoint sources. Additionally, work was performed to define the sources of dry weather bacteria and the components of urban/residential nonpoint source wet weather contaminants.

A source assessment is used to characterize the known and suspected sources of *E. coli* bacteria in the watershed for the development of the TMDL. *E. coli* bacteria was characterized for the following sources:

- Septic systems
- Illicit connections to storm drains
- Wildlife/Natural
- Stormwater runoff
- Combined sewer overflows

There are no NPDES wastewater treatment facilities on Fall Creek. All sources of *E. coli* bacteria identified in the two watersheds were assigned a loading rate based on data from the City of Indianapolis programs, literature values, and population in the watershed. Because of varying decay or die-off rates for *E. coli* bacteria, and varying transport assumptions, the *E. coli* bacteria loading from these sources was computed separately as described below.

5.1 Septic Systems

Failing septic systems have been linked to increased *E. coli* bacteria levels in streams throughout the world. In accordance with the City of Indianapolis' Septic Tank Elimination program, a list of neighborhoods with failing septic systems is kept and updated based on new information. Scheduling of sewer projects in each neighborhood is partially based on the degree of system failure that is observed. Priority levels 1 through 3 are assigned, with Priority 1 typically corresponding to neighborhoods with the highest degree of failure. The failure information was obtained for the period of 2000 through 2002 and was compared to sampling data for that same period. As of early 2000, there were eight Priority 1 septic neighborhoods within the Fall Creek and Mud Creek watershed boundaries, as well as three Priority 2 and two Priority 3 septic neighborhoods. The number of septic systems in each watershed was estimated based on the city's GIS data for septic neighborhoods, buildings, and watersheds. *E. coli* bacteria loads were estimated based on an estimated failure rate, flow rate, and *E. coli* bacteria counts for the septic neighborhoods. For purposes of the TMDL analysis, the failure rate for septic systems was related to the priority level of the neighborhood as follows:

- Priority 1: 25% failure rate

- Priority 2: 15% failure rate
- Priority 3: 10% failure rate
- All others: 5% failure rate

The city's reported failure rate is often much higher than the values used in this TMDL, as septic system "failure" may not result in *E. coli* bacteria reaching the stream. Septic system failure rates were validated using the instream *E. coli* bacteria data during development of the model. A flow of 100 gallons/person-day and a concentration of 10,000 cfu/100 ml (Horsley and Whitten, 1996) for each failing septic system were assigned. Leaking septic systems are characterized as a point source having constant flow and concentration. The loading rate attributed to leaking septic systems is estimated to be 4.66×10^{10} cfu per day. **Table 5.1** summarizes the estimated failed septic systems *E. coli* bacteria loadings into Fall Creek. The average daily load is calculated as the average daily septic flow multiplied by the average daily septic *E. coli* bacteria concentration. The average monthly load is the daily load multiplied by 30 days.

5.2 Illicit Connections

Stormwater outfalls often carry *E. coli* bacteria during dry weather because of loadings from illicit sanitary connections to the stormwater collection system. The City of Indianapolis Fifth Annual Report (2002) for the NPDES stormwater permit (AMEC, 2003) reported that approximately 7.7% of the stormwater outfalls sampled contained dry weather flows. This flow is assumed to contain *E. coli* bacteria. For each illicit discharge, a flow of 20 gpd with 10,000 cfu/100 ml for *E. coli* bacteria was assigned. This flow rate and concentration were validated using the instream *E. coli* bacteria data during development of the model. **Table 5.2** summarizes the estimated illicit storm drain *E. coli* bacteria loadings into Fall Creek. The average daily load is calculated as the average daily illicit connection flow multiplied by the average daily illicit connection *E. coli* bacteria concentration. The average monthly load is the daily load multiplied by 30 days.

5.3 Wildlife and Natural Background

Not all *E. coli* bacteria in waterways is the result of man-made sources. Wildlife, both instream and on-bank, can be a source of *E. coli* bacteria to the streams. To estimate the potential load from wildlife, the instream monitoring station at 71st Street on Fall Creek was utilized. The land use above 71st Street indicates natural conditions with the least anthropogenic sources in the study area. The *E. coli* bacteria monitoring data from this station was used as a basis for representing the wildlife or natural *E. coli* bacteria load into the streams**. Table 5.3** summarizes the estimated *E. coli* bacteria concentrations and loadings into Fall Creek that are a result of natural biota in the watersheds. All *E. coli* bacteria concentrations shown in the table received adjustment during model calibration (Section 6.2). This load represents wildlife or natural *E. coli* bacteria during dry weather conditions only. *E. coli* bacteria from wildlife or natural sources that is conveyed to the river by surface runoff is discussed in Section 5.4. The average daily load is calculated as the average daily natural background flow multiplied by the average daily natural background *E. coli* bacteria concentration. The average monthly load is the daily load multiplied by 30 days.

5.4 Stormwater Runoff

Stormwater often carries *E. coli* bacteria because of loadings from domestic animals, wildlife, and agricultural land. Information from the City of Indianapolis' stormwater program and GIS coverages provided insight into the contribution of stormwater to the *E. coli* bacteria exceedance seen in Fall Creek and showed what progress has been made thus far in alleviating that contribution. Due to variations in solid deposits and *E. coli* bacteria loadings in residential, commercial, and other property types, a range of *E. coli* bacteria concentrations was assumed for each land use. Average stormwater *E. coli* bacteria counts were estimated from literature values and based on Indianapolis Mapping and Geographic Infrastructure System (IMAGIS) land use and watershed coverages. These bacteria counts were applied to surface runoff flows from October 1991 to October 2001 as predicted using the city's watershed model. **Table 5.4** contains a summary of the average daily surface runoff flows and *E. coli* bacteria loadings into Fall Creek based on land use. This load contains all sources of *E. coli* bacteria carried in from stormwater runoff, including wildlife. The average daily load is calculated as the average daily stormwater runoff flow multiplied by the average daily stormwater runoff *E. coli* bacteria concentration. The average monthly load is the daily load multiplied by 30 days. **Table 5.5** shows the percentages of stormwater loads into Fall Creek that come from permitted (storm drain outfall), non-permitted (surface runoff), and out-of-county sources. This information is pertinent to the TMDL analysis as the city's stormwater programs only address the control of stormwater *E. coli* bacteria from sources within the county.

5.5 Combined Sewer Overflows

Combined Sewer Overflows (CSOs) can be a large source of *E. coli* bacteria in urban streams. The CSO flows and *E. coli* bacteria loadings were determined using a methodology similar to that being used for the CSO Long Term Control Plan (LTCP). CSO discharges were predicted by the city's collection system model for a ten-year period of time (October 1991 to October 2001). *E. coli* bacteria sampling of CSO discharges was performed by the city in 2001 to characterize CSO discharges. Concentrations ranged from 500,000 cfu/100 ml up to 900,000 cfu/100 ml. The CSO flows and *E. coli* bacteria loads were predicted using the city's models and sampling data. **Table 5.6** contains a summary of the estimated *E. coli* bacteria loadings from CSOs into Fall Creek. The average annual CSO loads and the average CSO *E. coli* bacteria concentrations were determined from hydraulic model simulations. The average daily load is the annual load divided by 365. The average monthly load is the daily load multiplied by 30 days.

TABLE 5.1: FAILING SEPTIC SYSTEMS FALL CREEK										
Watershed	Approximate Count of Septic Systems				Total Septic Systems	Estimated Failing Septic Systems	Approximate Population	Estimated Failing Septic Flow (MGD)	Estimated Failing Septic Daily Load (cfu)	Estimated Failing Septic Monthly Load (cfu)
	Barrett Law Priority 1	Barrett Law Priority 2	Barrett Law Priority 3	Non-Barrett Law						
Assumed Failure Rate	**25%**	**15%**	**10%**	**5%**						
Mud Creek	113	0	0	55	168	31	109	0.01	4.11E+09	1.23E+11
Fall Creek Upstream	899	465	179	165	1708	321	1122	0.11	4.25E+10	1.27E+12
Fall Creek CSO	0	0	0	0	0	0	0	0.00	0.00E+00	0.00E+00
Fall Creek Totals	**1012**	**465**	**179**	**220**	**1876**	**352**	**1231**	**0**	**4.66E+10**	**1.40E+12**

*Assumptions include 3.5 persons per septic system, 100 gpcd septic flow, and 10,000 cfu/100 ml E. coli in the septic flow
**Persons per system and per capita flows taken from May 1989 DPW Design Standards

TABLE 5.2: ILLICIT CONNECTIONS TO STORM DRAINS FALL CREEK						
Watershed	# of Storm Outfalls	Miles of Storm Sewer and Drains	Approximate number of Illicit Connections	Illicit Flow (MGD)	Estimated Illicit Connection Daily Load (cfu)	Estimated Illicit Connection Monthly Load (cfu)
Mud Creek	58	65	4	8.00E-05	3.03E+07	9.08E+08
Fall Creek Upstream	151	244	12	2.40E-04	9.08E+07	2.73E+09
Fall Creek CSO	93	71	7	1.40E-04	5.30E+07	1.59E+09

*Illicit Connections for all watersheds assumed at 7.7% of outfalls (based on 2002 NPDES Stormwater report sampling data)
20 gpd sanitary flow, and 10,000 cfu/100 ml E. coli in the illicit flow

TABLE 5.3: INSTREAM WILDLIFE FALL CREEK				
Watershed	Average Dry-Weather *E. coli* (cfu/100 ml)	Average Dry-Weather stream flow (cfs)	Approximate Instream Wildlife Daily Load (cfu)	Estimated Instream Wildlife Monthly Load (cfu)
Mud Creek*	20	5	2.45E+09	7.34E+10
Fall Creek Upstream*	33	20	1.61E+10	4.84E+11
Fall Creek CSO*	34	70	5.81E+10	1.74E+12

*The 71st Street Sampling Station along Fall Creek is not in close proximity to any septic systems.
Its dry-weather observed *E. coli* bacteria concentrations are assumed to be the result of wildlife.
This concentration is applied to all other streams
*These concentrations received adjustment during model calibration. Calibrated concentrations are shown.

TABLE 5.4: STORMWATER RUNOFF FROM SEPARATE SEWER AREAS FALL CREEK											
	Approximate Percentage of Specified Land use								Approximate Average E. Coli Concentration (cfu/100 ml)	Daily Average Stormwater Flow (cfs)	Daily Average Stormwater Load (cfu)
Land use Type	Commercial	Residential	Historic & Hospital	Industrial	Parks	Highway ROW	Spec. Uses	University			
Zoning Class	All C's	All D's	All H's	All I's	All PK's	ROW, RC	All SU's	All U's			
Assumed E. coli concentration	2500	2000	2500	5000	2000	5000	3000	3000			
Mud Creek	Assumed to be the same as Fall Creek								2300	3	1.79E+11
Fall Creek Upstream	3%	71%	0%	2%	4%	1%	19%	0%	2300	22	1.24E+12
Fall Creek CSO	9%	65%	1%	9%	4%	2%	9%	1%	2300	6	3.40E+11

TABLE 5.5: UNPERMITTED AND PERMITTED STORMWATER RUNOFF SOURCES FALL CREEK							
Watershed	**Permitted Storm Sewer Area (Acres)**	**Area without Storm Sewers (Acres)**	**Area outside County (Acres)**	**Total Area (Acres)**	**% Permitted**	**% Unpermitted**	**% Out of County**
Fall Creek Upstream*	26,000	-	33,000	59,000	45%	0%	55%

*Includes Mud Creek and Indian Creek

TABLE 5.6: COMBINED SEWER OVERFLOWS FALL CREEK							
Watershed	# Of CSO Regulators	# of CSO Outfalls	Annual Average CSO Volume (MG)	Average CSO E. Coli Concentration (cfu/100 ml)	Annual Average CSO E. Coli Load (cfu)	Daily Average CSO E. Coli Load (cfu)	Monthly Average CSO E. Coli Load (cfu)
Fall Creek CSO	35	26	1713	9.33E+05	4.02E+16	1.10E+14	3.30E+15

*Flows and bacteria loadings are from the 50-year rainfall record. Flows and loads presented are model results.

Section 6
Total Maximum Daily Load Analysis

A TMDL is a tool for meeting water quality standards. It is based on the relationship between sources of pollutants and instream water quality conditions. The TMDL establishes the allowable loadings for point nonpoint sources of specific pollutants that a water body can receive without exceeding water quality standards, thereby providing the basis for establishing water quality based pollutant controls.

6.1 Goals

Using the U.S. EPA *Protocol for Developing Pathogen TMDLs* (January 2001), the following steps were followed and utilized to develop a TMDL for *E. coli* bacteria:

- **Problem identification**: Identify key factors and background information for waterbody that describe the nature of the impairment.
- **Water quality indicators and targets**: Identify numeric indicators and target values that can be used to evaluate attainment of water quality standards.
- **Source assessment**: Identify and characterize sources of pollutant to water body.
- **Linkage between water quality targets and sources**: Linkage establishes the cause and effect relationship between the pollutant sources and the instream water quality response. The linkage is further used to estimate the load assimilation capacity of the water body, which is the maximum amount of pollutant loading a water body can assimilate and still attain water quality standards.
- **Load allocation**: Based on the established target/sources linkage, pollutant loadings that will not exceed the load assimilation capacity and will lead to attainment of the water quality standard can be determined.
- **Assembling the TMDL**: The elements of a TMDL submittal are compiled to facilitate TMDL review.
- **Follow-up monitoring and evaluation**: After implementation of the TMDL, follow-up monitoring is used to assess if the TMDL results in attaining water quality standards for the water body.

6.2 Methods

An *E. coli* bacteria model of Fall Creek was developed and calibrated to the existing instream *E. coli* bacteria data. The model simulated the daily instream bacteria counts for each stream segment based on loads from the sources described in Section 5. For the dry weather sources, a constant load was applied. The dry weather sources are failing septics, wildlife and natural background, and illicit storm drain connections. For stormwater runoff and CSO discharges, the *E. coli* bacteria load was based on the city's separate sewer area water quality model for stormwater, and the collection system interceptor model for CSO discharges during wet weather. A ten-year period of time (October 1991 through September 2001) was simulated. Data on stream flow was used to predict the resultant instream *E. coli* bacteria counts for each day for the ten-year period.

Daily flow data for the Fall Creek – Millersville station was obtained from the USGS for the period of October 1, 1991 through September 30, 2001. This flow data was used for the daily *E. coli* bacteria model.

Table 6.1 presents a sample page from the daily *E. coli* bacteria model for the Fall Creek – CSO area. **Figure 6.1** presents the predicted instream bacteria counts for April 1, 1997 to October 31, 1997, the most representative sampling period.

Model calibration consisted of comparisons of the *E. coli* bacteria geometric mean, percent of samples greater than 235 cfu/100 ml, and the number of samples over 10,000 cfu/100 ml per year of sampling. These comparisons were performed for both dry weather and wet weather data. The calibration of the model for *E. coli* bacteria included quality checks of the USGS daily flow data, adjustment for *E. coli* bacteria contributions from wildlife for all reaches, and for *E. coli* contributions from stormwater. **Table 6.2** contains a summary of the observed and modeled *E. coli* bacteria loading parameters from October 1991 through September 2001. The percentage of observed and predicted days in excess of 235 cfu/100 ml for dry, wet, and all weather conditions is reported in the table. **Table 6.3** summarizes the failed septic systems, illicit connections, wildlife, stormwater, and CSO *E. coli* bacteria loadings into Fall Creek and Mud Creek.

6.3 Seasonality

The TMDL for all segments of the White River has been calculated for the recreational season, which is April through October. Calculating a TMDL for this period will be more conservative than a calculation over an entire year.

6.4 Critical Condition

The TMDL for all segments of the White River has been calculated for the recreational season, which is April through October. The recreational season is considered to be the critical condition evaluated for the White River.

6.5 Margin of Safety (MOS)

The Margin of Safety (MOS) is a required component of TMDL development. There are two basic methods for incorporating the MOS: 1) Implicitly incorporate the MOS using conservative model assumptions to develop allocations; or 2) Explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. For this TMDL the MOS was implicitly incorporated into the modeling process by using conservative assumptions.

The assumptions used to represent the various loads from CSOs, stormwater, failed septic systems and other sources are generally conservative. Greater reductions in *E. coli* bacteria will likely occur than those predicted based on the model and analysis.

Additional conservative assumptions in the modeling process include:

- The model has the die-off rate of *E. coli* bacteria set to 0.0 for each model stream segment. In general, the stream segments have short travel times, typically a day or less.
- Inclusion of natural/background contributions in the analysis, which recognizes the presence of *E. coli* bacteria that can not be removed from the stream.
- The model simulation is over a 10-year time period to represent the stream flow variations that occur.
- TMDLs are set on the April through October recreational period, which is the lowest flow period of the year.

6.6 Existing and Allowable *E. coli* Bacteria Load

The existing *E. coli* bacteria loads, both point and nonpoint sources, for Fall Creek are presented in **Table 6.4.** The components of the point source loads include CSOs, permitted stormwater discharges, and illicit storm drain connections. The components of the nonpoint source loads are unpermitted stormwater discharges, wildlife and natural background, and failing septic systems. All *E. coli* bacteria loads presented are calculated for the recreational season.

Based on the modeled *E. coli* bacteria concentrations and stream flow, the allowable *E. coli* TMDLs for Fall Creek were determined. The TMDL is calculated as 125 cfu *E. coli* bacteria/100 ml multiplied by the average daily flow for the stream segment during the recreational season (April to October). TMDLs are based on meeting water quality standards.

The allowable *E. coli* TMDLs and required reductions for Fall Creek are as follows.

Fall Creek upstream of the CSO area:

Existing Waste Load = 7.56×10^{11} cfu
Existing Load = 9.96×10^{11} cfu
Existing Total Load = 1.75×10^{12} cfu

TMDL = 8.44×10^{11} cfu
Required Reduction = 52%

Fall Creek within the CSO area:

Existing Waste Load = 1.51×10^{14} cfu
Existing Load = 1.02×10^{12} cfu
Existing Total Load = 1.52×10^{14} cfu

TMDL = 7.30×10^{11} cfu
Required Reduction = 99.5%

Figure 6.1: Predicted Fall Creek CSO Area Daily *E. coli* Bacteria Counts

April 1, 1997 through October 31, 1997

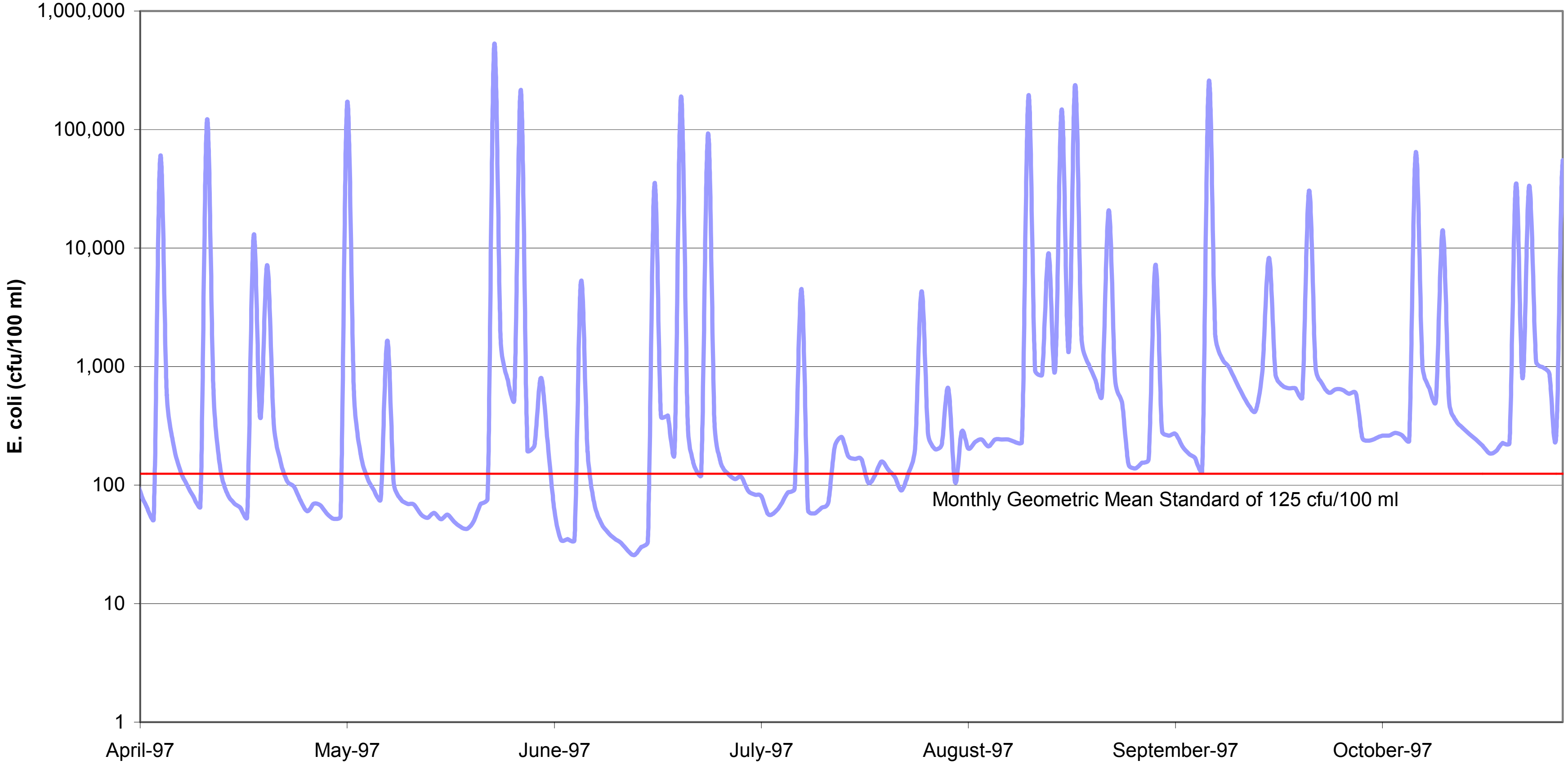


TABLE 6.1: SAMPLE OF FALL CREEK CSO AREA DAILY *E. coli* COUNTS												
Date	**Average Daily Flow (cfs)**	**Water Company Withdrawl (cfs)**	**Stormwater Runoff (cfs)**	**CSO Flow (cfs)**	**Corrected Average Daily Flow (cfs)**	**Septic Load (cfu/day)**	**Illicit Load (cfu/day)**	**Wildlife Load (cfu/day)**	**Stormwater Load (cfu/day)**	**CSO Load (cfu/day)**	**Total Load (cfu/day)**	**Resulting Concentration (cfu/100 ml)**
10/1/1991	54	24	0	0	30	4.66E+10	1.74E+08	7.76E+10	0.00E+00	0.00E+00	1.24E+11	167
10/2/1991	58	24	0	0	34	4.66E+10	1.74E+08	7.76E+10	0.00E+00	0.00E+00	1.24E+11	148
10/3/1991	68	24	23	2	69	4.66E+10	1.74E+08	7.76E+10	1.27E+12	3.84E+13	3.98E+13	23,649
10/4/1991	57	24	6	0	40	4.66E+10	1.74E+08	7.76E+10	3.57E+11	0.00E+00	4.81E+11	494
10/5/1991	75	24	121	30	203	4.66E+10	1.74E+08	7.76E+10	6.81E+12	6.84E+14	6.91E+14	139,433
10/6/1991	68	24	32	0	77	4.66E+10	1.74E+08	7.76E+10	1.80E+12	0.00E+00	1.93E+12	1,030
10/7/1991	58	24	16	0	51	4.66E+10	1.74E+08	7.76E+10	9.03E+11	0.00E+00	1.03E+12	832
10/8/1991	56	24	9	0	42	4.66E+10	1.74E+08	7.76E+10	5.12E+11	0.00E+00	6.36E+11	626
10/9/1991	55	24	5	0	37	4.66E+10	1.74E+08	7.76E+10	3.06E+11	0.00E+00	4.30E+11	477
10/10/1991	58	24	15	1	50	4.66E+10	1.74E+08	7.76E+10	8.41E+11	1.47E+13	1.57E+13	12,791
10/11/1991	58	24	7	0	41	4.66E+10	1.74E+08	7.76E+10	3.83E+11	0.00E+00	5.08E+11	503
10/12/1991	57	24	4	0	37	4.66E+10	1.74E+08	7.76E+10	2.19E+11	0.00E+00	3.43E+11	376
10/13/1991	56	24	2	0	35	4.66E+10	1.74E+08	7.76E+10	1.36E+11	0.00E+00	2.60E+11	305
10/14/1991	57	24	7	0	41	4.66E+10	1.74E+08	7.76E+10	3.83E+11	5.72E+12	6.23E+12	6,286
10/15/1991	56	24	5	0	37	4.66E+10	1.74E+08	7.76E+10	2.54E+11	0.00E+00	3.78E+11	418
10/16/1991	57	24	2	0	36	4.66E+10	1.74E+08	7.76E+10	1.31E+11	0.00E+00	2.55E+11	292
10/17/1991	56	24	1	0	34	4.66E+10	1.74E+08	7.76E+10	7.71E+10	0.00E+00	2.01E+11	243
10/18/1991	55	24	1	0	32	4.66E+10	1.74E+08	7.76E+10	4.54E+10	0.00E+00	1.70E+11	215
10/19/1991	56	24	2	0	34	4.66E+10	1.74E+08	7.76E+10	1.05E+11	0.00E+00	2.29E+11	273
10/20/1991	56	24	1	0	33	4.66E+10	1.74E+08	7.76E+10	5.23E+10	0.00E+00	1.77E+11	216
10/21/1991	56	24	0	0	33	4.66E+10	1.74E+08	7.76E+10	2.41E+10	0.00E+00	1.48E+11	185
10/22/1991	54	24	0	0	31	4.66E+10	1.74E+08	7.76E+10	9.62E+09	0.00E+00	1.34E+11	179
10/23/1991	55	24	0	0	32	4.66E+10	1.74E+08	7.76E+10	2.74E+09	0.00E+00	1.27E+11	165
10/24/1991	58	24	0	317	352	4.66E+10	1.74E+08	7.76E+10	2.96E+09	7.25E+15	7.25E+15	841,649
10/25/1991	67	24	143	0	186	4.66E+10	1.74E+08	7.76E+10	8.03E+12	0.00E+00	8.16E+12	1,791
10/26/1991	368	24	873	0	1217	4.66E+10	1.74E+08	7.76E+10	4.91E+13	0.00E+00	4.92E+13	1,653
10/27/1991	299	24	330	0	605	4.66E+10	1.74E+08	7.76E+10	1.85E+13	0.00E+00	1.87E+13	1,261
10/28/1991	121	24	77	0	174	4.66E+10	1.74E+08	7.76E+10	4.31E+12	0.00E+00	4.44E+12	1,042
10/29/1991	77	24	31	0	84	4.66E+10	1.74E+08	7.76E+10	1.74E+12	0.00E+00	1.87E+12	905
10/30/1991	64	24	15	1	57	4.66E+10	1.74E+08	7.76E+10	8.58E+11	3.16E+13	3.26E+13	23,362
10/31/1991	57	24	9	0	42	4.66E+10	1.74E+08	7.76E+10	4.79E+11	0.00E+00	6.03E+11	588
11/1/1991	66	30	18	0	55	4.66E+10	1.74E+08	7.76E+10	1.02E+12	0.00E+00	1.15E+12	858
11/2/1991	64	30	12	0	46	4.66E+10	1.74E+08	7.76E+10	6.70E+11	0.00E+00	7.95E+11	701
11/3/1991	55	30	6	0	32	4.66E+10	1.74E+08	7.76E+10	3.45E+11	0.00E+00	4.69E+11	607
11/4/1991	51	30	4	0	26	4.66E+10	1.74E+08	7.76E+10	2.34E+11	0.00E+00	3.58E+11	572
11/5/1991	49	30	3	0	22	4.66E+10	1.74E+08	7.76E+10	1.50E+11	0.00E+00	2.74E+11	507
11/6/1991	46	30	2	0	18	4.66E+10	1.74E+08	7.76E+10	9.33E+10	0.00E+00	2.18E+11	492
11/7/1991	46	30	3	0	19	4.66E+10	1.74E+08	7.76E+10	1.50E+11	0.00E+00	2.74E+11	587
11/8/1991	44	30	2	0	16	4.66E+10	1.74E+08	7.76E+10	9.09E+10	0.00E+00	2.15E+11	548
11/9/1991	44	30	1	0	15	4.66E+10	1.74E+08	7.76E+10	4.76E+10	0.00E+00	1.72E+11	460
11/10/1991	44	30	0	0	15	4.66E+10	1.74E+08	7.76E+10	2.46E+10	0.00E+00	1.49E+11	409
11/11/1991	43	30	0	0	14	4.66E+10	1.74E+08	7.76E+10	1.15E+10	0.00E+00	1.36E+11	407
11/12/1991	43	30	3	0	16	4.66E+10	1.74E+08	7.76E+10	1.46E+11	9.89E+11	1.26E+12	3,201
11/13/1991	43	30	2	0	15	4.66E+10	1.74E+08	7.76E+10	9.67E+10	0.00E+00	2.21E+11	596
11/14/1991	43	30	1	0	14	4.66E+10	1.74E+08	7.76E+10	3.98E+10	0.00E+00	1.64E+11	474
11/15/1991	43	30	2	0	15	4.66E+10	1.74E+08	7.76E+10	9.23E+10	0.00E+00	2.17E+11	587

TABLE 6.2: COMPARISON OF OBSERVED AND MODELED E. COLI COUNTS FALL CREEK									
	Geometric Mean of *E. coli* bacteria			% of Days *E. coli* bacteria > 235 cfu/100 ml			# of Days per year *E. coli* bacteria > 10,000 cfu/100 ml		
Watershed	All	Dry**	Wet***	All	Dry**	Wet***	All	Dry**	Wet***
Fall Creek-Upstream Measured*	117	72	185	27%	11%	42%	0	0	0
Fall Creek-Upstream Modeled	139	72	169	37%	12%	41%	0	0	0
Fall Creek-CSO Measured*	295	146	552	50%	33%	65%	20	0	20
Fall Creek-CSO Modeled	372	138	487	51%	34%	54%	38	0	38

*Measured *E. coli* counts are reported in Table 4.2

**The Dry weather geometric mean, % of days over 235 cfu/100 ml, and # of days per year over 10,000 cfu/100 ml are calculated for dry weather days only

***The Wet weather geometric mean, % of days over 235 cfu/100 ml, and # of days per year over 10,000 cfu/100 ml are calculated for wet weather days only

TABLE 6.3: TOTAL AVERAGE E. COLI DAILY LOAD FALL CREEK							
Watershed	Average Daily Septic Load (cfu)	Average Daily Illicit Connection Load (cfu)	Average Daily Wildlife Load (cfu)	Average Daily Stormwater Load (cfu)	Average Daily CSO Load (cfu)	Total Average Daily Load (cfu)	Total Cumulative Daily Load (cfu)
Mud Creek	4.11E+09	3.03E+07	2.45E+09	1.79E+11	0.00E+00	1.85E+11	
Fall Creek Upstream	4.25E+10	9.08E+07	1.61E+10	1.24E+12	0.00E+00	1.30E+12	1.48E+12
Fall Creek CSO	0.00E+00	5.30E+07	5.81E+10	3.40E+11	1.10E+14	1.11E+14	**1.12E+14**

TABLE 6.4: SUMMARY OF EXISTING *E. COLI* BACTERIA LOAD FOR THE APRIL TO OCTOBER RECREATIONAL SEASON FALL CREEK											
Scenario	Point Source -- CSO Discharges (cfu)*	Point Source -- Permitted Stormwater Discharges (cfu)*	Point Source -- Illicit Sanitary Connections (cfu)*	**Total Point Source Load (cfu)**	Nonpoint Source -- Unpermitted Stormwater Discharges (cfu)*	Nonpoint Source - Wildlife (cfu)*	Nonpoint Source - Failing Septic Systems (cfu)*	**Total Nonpoint Source Load (cfu)**	**Total Load (cfu)**	TMDL (cfu)	**Required Load Reduction to meet TMDL (%)**
Fall Creek-Upstream Existing	0.00E+00	7.56E+11	1.21E+08	**7.56E+11**	9.31E+11	1.86E+10	4.66E+10	**9.96E+11**	**1.75E+12**	8.44E+11	**52%**
Fall Creek-CSO Existing	1.50E+14	1.19E+12	1.74E+08	**1.51E+14**	8.97E+11	7.67E+10	4.66E+10	**1.02E+12**	**1.52E+14**	7.30E+11	**99.5%**

*Note: All loads presented in are the average daily loads for the recreational season. These loads may be different from the loads presented in Section 5, which are for the entire year.

Section 7
Public Participation

7.1 Public Meetings

To date, the IDEM has held three public stakeholder meetings to present the progress of the TMDL program for Fall Creek. Information such as a summary of findings, characterization of the river, weather conditions and how results are affected, model introduction, and an overview of the TMDL process were presented. The public participation meetings were held on September 17, 2002; December 17, 2002; and April 1, 2003. The draft findings of this report were presented to community stakeholders on July 8, 2003.

IDEM invited all registered neighborhood organizations in Indianapolis, as well as many major environmental groups. Groups in attendance at the public stakeholder meetings include the Wet Weather Technical Advisory Committee and the Friends of the White River.

In addition to the TMDL process, water quality-related public outreach is a key component of the city's CSO LTCP, Septic Tank Elimination Program, and stormwater program.

Section 8
Implementation Activities and Schedule

The ultimate goal of the TMDL program is to improve water quality in our streams by determining the allowable pollutant load and reducing loads accordingly. While there are no specific activities planned as a result of this TMDL study, results of this TMDL study have been incorporated into the existing programs for control of stormwater, failed septic systems, and CSOs for the City of Indianapolis. Each of these programs is briefly described below.

8.1 Stormwater Program

The city utilizes new construction or redevelopment permitting as an opportunity to control stormwater flows that discharge into receiving streams or the CSO system through the recently revised Chapter 700 to Section 581 of the City of Indianapolis Code (Stormwater Management and Sediment Control). Chapter 700 requires best management practices (BMPs) to improve the quality of the stormwater runoff whenever new construction or redevelopment that disturbs more than 1/2 - acre is proposed anywhere in Marion County. The city is implementing this proactive approach in the CSO area to improve water quality even though it is not required by the NPDES stormwater permit. The city requires that prior to new construction, reconstruction, or remodeling, contractors and developers must submit a stormwater control plan and obtain drainage permits to address stormwater runoff originating from the sites. In the CSO area, controlling stormwater runoff has the added benefit of potentially reducing CSO discharges to the receiving streams. In addition, at locations where the stormwater runoff is controlled and then treated by BMPs before being discharged directly to the receiving streams, the city stormwater programs require developers to improve the urban stormwater quality.

Control of stormwater runoff quality is based on the management of total suspended solids (TSS). The target TSS removal rate is 80%. The requirements apply to all areas of the county except the city limits of Beech Grove, Lawrence, Southport and Speedway. Control of sediment is required for construction site runoff citywide.

The city's current stormwater NPDES Permit program is estimated to reduce the stormwater *E. coli* bacteria load by approximately 10 percent. This reduction is considered to be an estimate of the program's effectiveness, not an objective.

8.2 Septic Tank Elimination Program

Of the 320,000 homes in Marion County, approximately 18,000 are served by septic systems that were targeted for replacement in the Septic Tank Elimination Program. The Septic Tank Elimination Program prioritized 161 unsewered areas for conversion to sewers. The master plan ranks each area based on the following criteria: septic failure rate, stream bacteriological impairment, wellfield protection, presence of residential wells, proximity to greenways, petitions from residents or Marion County Health & Hospital Corp., number of residents in favor of the project, cost, and downstream capacity. These areas are then placed into one of four categories: Priority

1, Priority 2, Priority 3, and other septic areas not immediately projected for conversion to sewers.

8.3 CSO Long Term Control Plan

In 2001, the City of Indianapolis submitted a CSO Long Term Control Plan for review to IDEM and the U.S. EPA. This plan proposed an 85% level of capture to achieve water quality standards within the streams of Indianapolis given financial constraints. The plan consisted of AWT enhancements, various system control alternatives, streambank restoration and sediment removal, and accelerated septic system removal.

Negotiations with IDEM and Region V EPA are ongoing and may affect the final level of capture and pollutant removal rates achieved through the LTCP. A final CSO LTCP is expected in spring 2004. The TMDL reductions from CSOs will reflect the final LTCP.

Section 9
Monitoring Plan

An integral part of managing the progress of a TMDL program is monitoring. The current monitoring programs performed by the City of Indianapolis Office of Environmental Services and the Marion County Health Department will continue throughout the implementation of load allocations. These monitoring programs consist of sampling at the locations and intervals described in Section 3 of this report.

As the city's watershed improvement programs are implemented, this continued monitoring will allow the city and IDEM the opportunity to review progress towards meeting water quality standards. As this monitoring indicates and in accordance with EPA's guidance, IDEM and the City of Indianapolis reserve the right to adapt these projected programs if necessary.

References

AMEC. 2003. *City of Indianapolis Fifth Annual Report (2002)*

Camp Dresser & McKee (CDM). 2003. *CSO Control Technologies Evaluation.*

Camp Dresser & McKee (CDM). 2003. *Fall Creek TMDL Report.*

Horsley & Whitten, Inc. 1996. Identification and Evaluation of Nutrient Bacterial Loadings to Maquiot Bay, Brunswick and Freeport, Maine.

IDEM. 2002. Indiana's 303(d) Listing Methodology for Impaired Waterbodies and Total Maximum Daily Load.

IDEM. 2002. Indiana Water Quality 305(b) Report.

U.S. Environmental Protection Agency (EPA). 2001. *Protocol for Developing Pathogen TMDLs.*

FALL CREEK TMDL REPORT

APPENDICES

Date	OES Sampling Locations						
	Wet or Dry?	16th Street		71st Street		79th Street	
		E. Coli (col/100 mL)	% Compliance	E. Coli (col/100 mL)	% Compliance	E. Coli (col/100 mL)	% Compliance
01/06/00	Dry	27	1	18	1		
02/03/00	Wet	9	1	40	1		
03/02/00	Wet	500	0	18	1		
04/06/00	Dry	1100	0	28	1		
05/04/00	Wet	800	0	**2**	1		
06/08/00	Dry	300	0	124	1		
07/06/00	Wet	12000	0	60	1		
08/10/00	Wet	1639	0	540	0		
09/07/00	Dry	4000	0	280	0		
10/05/00	Wet	**200000**	0	6800	0		
11/03/00	Dry	280	0	27	1		
12/07/00	Dry	59	1	84	1		
01/16/01	Dry	800	0	**3**	1		
02/13/01	Dry	80	1	50	1		
03/07/01	Dry	500	0	10	1		
04/05/01	Dry	16	1	40	1		
05/03/01	Dry	100	1	62	1		
06/14/01	Dry	2900	0	32	1		
07/12/01	Dry	320	0	88	1		
08/09/01	Dry	120	1	84	1		
09/06/01	Dry	160	1	50	1		
10/04/01	Dry	151	1	24	1		
11/08/01	Dry	27	1	8	1		
12/05/01	Dry	84	1	8	1		
05/01/02	Dry	32	1	**10**	1	**10**	1
05/07/02	Wet	2400	0	120	1	53	1
05/14/02	Wet	540	0	187	1	120	1
05/21/02	Wet	72	1	5	1	**4**	1
05/28/02	Wet	1300	0	27	1	**20**	1
06/03/02	Wet	133	1	**20**	1	**20**	1
06/10/02	Dry	67	1	**20**	1	**20**	1
06/12/02	Wet	2250	0	27	1	**20**	1
06/17/02	Wet	273	0	**10**	1	12	1
06/24/02	Dry	62	1	**10**	1	**10**	1
07/01/02	Dry	300	0	25	1	**10**	1
07/08/02	Dry	69	1	12	1	**10**	1
07/15/02	Dry	94	1	**10**	1	**10**	1
07/22/02	Wet	147	1	44	1	173	1
07/29/02	Wet	88	1	32	1	20	1
08/05/02	Dry	19	1	31	1	12	1
08/12/02	Dry	28	1	60	1	30	1
08/19/02	Wet	36500	0	6000	0	840	0
08/26/02	Wet	120	1	180	1	32	1
08/28/02	Dry	93	1	20	1	37	1
09/04/02	Dry	43	1	28	1	8	1
09/09/02	Dry	37	1	31	1	3	1
09/16/02	Wet	660	0	34	1	20	1
09/23/02	Wet	1050	0	500	0	48	1
09/30/02	Dry	220	1	44	1	31	1
10/01/02	Dry	110	1	75	1	40	1
10/07/02	Dry	290	0	90	1	47	1
10/14/02	Wet	100	1	72	1	25	1
10/21/02	Wet	270	0	25	1	22	1
10/28/02	Dry	1350	0	16	1	6	1

Date	MCHD Sampling Locations										
	Emerson Way					38th Street					
	Wet or Dry?	E. Coli (col/100 mL)	% Compliance	Date	Questionable Data (col/100 mL)	Date	Wet or Dry?	E. Coli (col/100 mL)	% Compliance	Date	Questionable Data (col/100 mL)
1/4/2000	Wet	450	0	09/05/00	1340	1/4/2000	Wet	490	0	09/05/00	2030
1/11/2000	Wet	100	1	09/12/00	630	1/11/2000	Wet	100	1	09/12/00	1100
1/12/2000	Dry	100	1			1/12/2000	Dry	100	1		
1/19/2000	Dry	10	1			1/19/2000	Dry	10	1		
1/25/2000	Dry					1/25/2000	Dry	10	1		
2/1/2000	Dry					2/1/2000	Dry	20	1		
2/8/2000	Dry	10	1			2/8/2000	Dry	10	1		
2/15/2000	Wet	10	1			2/15/2000	Wet	100	1		
2/22/2000	Wet	50	1			2/22/2000	Wet	140	1		
2/29/2000	Dry	20	1			2/29/2000	Dry	30	1		
3/7/2000	Dry	30	1			3/7/2000	Dry	70	1		
3/14/2000	Dry	10	1			3/14/2000	Dry	10	1		
3/21/2000	Wet	110	1			3/21/2000	Wet	240	0		
3/22/2000	Dry	50	1			3/22/2000	Dry	140	1		
3/28/2000	Wet	20	1			3/28/2000	Wet	140	1		
4/7/2000	Wet	200	1			4/7/2000	Wet	800	0		
4/11/2000	Wet	100	1			4/11/2000	Wet	100	1		
4/18/2000	Wet	100	1			4/18/2000	Wet	700	0		
4/19/2000	Wet	100	1			4/19/2000	Wet	300	0		
4/25/2000	Wet	80	1			4/25/2000	Wet	40	1		
5/2/2000	Wet	390	0			5/2/2000	Wet	450	0		
5/9/2000	Dry	100	1			5/9/2000	Dry	100	1		
5/16/2000	Wet	90	1			5/16/2000	Wet	220	1		
5/23/2000	Wet	210	1			5/23/2000	Wet	240	0		
5/31/2000	Dry	110	1			5/31/2000	Dry	200	1		
6/6/2000	Wet	170	1			6/6/2000	Wet	320	0		
6/13/2000	Wet	410	0			6/13/2000	Wet	350	0		
6/14/2000	Dry	310	0			6/14/2000	Dry	260	0		
6/20/2000	Dry	260	0			6/20/2000	Dry	290	0		
6/27/2000	Wet	60	1			6/27/2000	Wet	210	1		
7/5/2000	Wet	1900	0			7/5/2000	Wet	5800	0		
7/11/2000	Dry	180	1			7/11/2000	Dry	160	1		
7/18/2000	Dry	220	1			7/18/2000	Dry	130	1		
7/19/2000	Wet	3400	0			7/19/2000	Wet	800	0		
7/25/2000	Dry	50	1			7/25/2000	Dry	130	1		
8/1/2000	Wet	700	0			8/1/2000	Wet	600	0		
8/8/2000	Wet	500	0			8/8/2000	Wet	1300	0		
8/15/2000	Dry	130	1			8/15/2000	Dry	370	0		
8/22/2000	Dry	250	0			8/22/2000	Dry	1400	0		
8/29/2000	Dry	130	1			8/29/2000	Dry	240	0		
9/19/2000	Dry	200	1			9/19/2000	Dry	200	1		
9/26/2000	Wet	1580	0			9/26/2000	Wet	1750	0		
9/27/2000	Wet	310	0			9/27/2000	Wet	410	0		
10/3/2000	Dry	100	1			10/3/2000	Dry	100	1		
10/10/2000	Dry	200	1			10/10/2000	Dry	100	1		
10/17/2000	Wet	100	1			10/17/2000	Wet	100	1		
10/24/2000	Wet	100	1			10/24/2000	Wet	300	0		
11/1/2000	Dry	200	1			11/1/2000	Dry	100	1		
11/7/2000	Wet	5560	0			11/7/2000	Wet	520	0		
11/8/2000	Wet	200	1			11/8/2000	Wet	200	1		
11/14/2000	Wet	100	1			11/14/2000	Wet	410	0		
11/21/2000	Dry	100	1			11/21/2000	Dry	100	1		
11/28/2000	Dry	100	1			11/28/2000	Dry	100	1		
12/5/2000	Dry	100	1			12/5/2000	Dry	100	1		
12/12/2000	Wet	1730	0			12/12/2000	Wet	1350	0		
12/13/2000	Wet	630	0			12/13/2000	Wet	100	1		
12/20/2000	Wet	100	1			12/20/2000	Wet	100	1		
12/27/2000	Wet	50	1			12/27/2000	Wet	100	1		
1/3/2001	Dry	100	1			1/3/2001	Dry	100	1		
1/10/2001	Dry	50	1			1/10/2001	Dry	50	1		
1/17/2001	Dry	200	1			1/17/2001	Dry	310	0		
1/24/2001	Dry	200	1			1/24/2001	Dry	100	1		
1/31/2001	Wet	2160	0			1/31/2001	Wet	3730	0		
2/6/2001	Wet	100	1			2/6/2001	Wet	200	1		
2/14/2001	Wet	310	0			2/14/2001	Wet	100	1		
2/19/2001	Dry	200	1			2/19/2001	Dry	100	1		
2/21/2001	Dry	100	1			2/21/2001	Dry	100	1		
2/28/2001	Dry	100	1			2/28/2001	Dry	100	1		
3/6/2001	Dry	100	1			3/6/2001	Dry	100	1		
3/14/2001	Wet	100	1			3/14/2001	Wet	100	1		
3/19/2001	Dry	100	1			3/19/2001	Dry	100	1		
3/21/2001	Dry	100	1			3/21/2001	Dry	100	1		

Date	MCHD Sampling Locations										
	Emerson Way					38th Street					
	Wet or Dry?	E. Coli (col/100 mL)	% Compliance	Date	Questionable Data (col/100 mL)	Date	Wet or Dry?	E. Coli (col/100 mL)	% Compliance	Date	Questionable Data (col/100 mL)
3/27/2001	Dry	100	1			3/27/2001	Dry	100	1		
4/3/2001	Dry	100	1			4/3/2001	Dry	100	1		
4/10/2001	Wet	200	1			4/10/2001	Wet	100	1		
4/16/2001	Wet	410	0			4/16/2001	Wet	410	0		
4/18/2001	Dry	100	1			4/18/2001	Dry	520	0		
4/24/2001	Wet	310	0			4/24/2001	Wet	200	1		
5/1/2001	Dry	200	1			5/1/2001	Dry	100	1		
5/9/2001	Wet	2160	0			5/9/2001	Wet	2330	0		
5/15/2001	Dry	630	0			5/15/2001	Dry	310	0		
5/22/2001	Wet	520	0			5/22/2001	Wet	200	1		
5/30/2001	Wet	100	1			5/30/2001	Wet	100	1		
6/5/2001	Wet	100	1			6/5/2001	Wet	410	0		
6/12/2001	Dry	100	1			6/12/2001	Dry	100	1		
6/19/2001	Dry	100	1			6/19/2001	Dry	200	1		
6/20/2001	Wet	520	0			6/20/2001	Wet	410	0		
6/26/2001	Dry	200	1			6/26/2001	Dry	200	1		
7/3/2001	Wet	410	0			7/3/2001	Wet	860	0		
7/10/2001	Wet	630	0			7/10/2001	Wet	620	0		
7/17/2001	Dry	100	1			7/17/2001	Dry	200	1		
7/24/2001	Wet	250	0			7/24/2001	Wet	410	0		
7/31/2001	Dry	200	1			7/31/2001	Dry	200	1		
8/1/2001	Dry	200	1			8/1/2001	Dry	100	1		
8/7/2001	Dry	100	1			8/7/2001	Dry	310	0		
8/14/2001	Dry	1	1			8/14/2001	Dry	310	0		
8/21/2001	Wet	630	0			8/21/2001	Wet	510	0		
8/28/2001	Dry	1310	0			8/28/2001	Dry	200	1		
9/5/2001	Dry	200	1			9/5/2001	Dry	410	0		
9/11/2001	Wet	860	0			9/11/2001	Wet	840	0		
9/18/2001	Wet	410	0			9/18/2001	Wet	310	0		
9/25/2001	Wet	2310	0			9/25/2001	Wet	1350	0		
9/26/2001	Dry	520	0			9/26/2001	Dry	310	0		
10/2/2001	Dry	200	1			10/2/2001	Dry	630	0		
10/9/2001	Dry	2010	0			10/9/2001	Dry	300	0		
10/16/2001	Wet	860	0			10/16/2001	Wet	3500	0		
10/23/2001	Wet	740	0			10/23/2001	Wet	68670	0		
10/30/2001	Dry	100	1			10/30/2001	Dry	630	0		
11/6/2001	Dry	100	1			11/6/2001	Dry	740	0		
11/13/2001	Dry	100	1			11/13/2001	Dry	100	1		
11/20/2001	Wet	310	0			11/20/2001	Wet	100	1		
11/26/2001	Wet	200	1			11/26/2001	Wet	310	0		
11/28/2001	Wet	100	1			11/28/2001	Wet	200	1		
12/3/2001	Dry	100	1			12/3/2001	Dry	740	0		
12/6/2001	Wet	310	0			12/6/2001	Wet	100	1		
12/11/2001	Dry	520	0			12/11/2001	Dry	100	1		
12/17/2001	Wet	2180	0			12/17/2001	Wet	5290	0		
12/19/2001	Wet	420	0			12/19/2001	Wet	310	0		
5/1/2002	Dry	**10**	1			5/1/2002	Dry	**10**	1		
5/7/2002	Wet	420	0			5/7/2002	Wet	760	0		
5/14/2002	Wet	93	1			5/14/2002	Wet	133	1		
5/21/2002	Wet	5	1			5/21/2002	Wet	11	1		
5/28/2002	Wet	53	1			5/28/2002	Wet	67	1		
6/3/2002	Wet	27	1			6/3/2002	Wet	**20**	1		
6/10/2002	Dry	27	1			6/10/2002	Dry	107	1		
6/12/2002	Wet	**20**	1			6/12/2002	Wet	460	0		
6/17/2002	Wet	81	1			6/17/2002	Wet	94	1		
6/24/2002	Dry	19	1			6/24/2002	Dry	56	1		
7/1/2002	Dry	25	1			7/1/2002	Dry	140	1		
7/8/2002	Dry	38	1			7/8/2002	Dry	25	1		
7/15/2002	Dry	38	1			7/15/2002	Dry	170	1		
7/22/2002	Wet	80	1			7/22/2002	Wet	120	1		
7/29/2002	Wet	42	1			7/29/2002	Wet	60	1		
8/5/2002	Dry	38	1			8/5/2002	Dry	81	1		
8/12/2002	Dry	64	1			8/12/2002	Dry	112	1		
8/19/2002	Wet	2700	0			8/19/2002	Wet	1400	0		
8/26/2002	Wet	180	1			8/26/2002	Wet	100	1		
8/28/2002	Dry	100	1			8/28/2002	Dry	100	1		
9/4/2002	Dry	43	1			9/4/2002	Dry	43	1		
9/9/2002	Dry	115	1			9/9/2002	Dry	70	1		
9/16/2002	Wet	135	1			9/16/2002	Wet	220	1		
9/23/2002	Wet	310	0			9/23/2002	Wet	220	1		
9/30/2002	Dry	155	1			9/30/2002	Dry	230	1		
10/1/2002	Dry	85	1			10/1/2002	Dry	137	1		
10/7/2002	Dry	160	1			10/7/2002	Dry	50	1		
10/14/2002	Wet	80	1			10/14/2002	Wet	85	1		
10/21/2002	Wet	100	1			10/21/2002	Wet	113	1		
10/28/2002	Dry	44	1			10/28/2002	Dry	130	1		

MCHD Sampling Locations											
30th Street						Central Avenue					
Date	Wet or Dry?	E. Coli (col/100 mL)	% Compliance	Date	Questionable Data (col/100 mL)	Date	Wet or Dry?	E. Coli (col/100 mL)	% Compliance	Date	Questionable Data (col/100 mL)
01/04/00	Wet	2200	0	09/05/00	2280	01/04/00	Wet	2100	0	09/05/00	3730
01/11/00	Wet	300	0	09/12/00	4520	01/11/00	Wet	100	1	09/12/00	3320
01/12/00	Dry	200	1			01/12/00	Dry	600	0		
01/19/00	Dry	50	1			01/19/00	Dry	20	1		
01/25/00	Dry	20	1			01/25/00	Dry	60	1		
02/01/00	Dry	40	1			02/01/00	Dry	230	1		
02/08/00	Dry	10	1			02/08/00	Dry	30	1		
02/15/00	Wet	220	1			02/15/00	Wet	200	1		
02/22/00	Wet	3500	0			02/22/00	Wet	8000	0		
02/29/00	Dry	400	0			02/29/00	Dry	400	0		
03/07/00	Dry	130	1			03/07/00	Dry	270	0		
03/14/00	Dry	20	1			03/14/00	Dry	40	1		
03/21/00	Wet	620	0			03/21/00	Wet	720	0		
03/22/00	Dry	130	1			03/22/00	Dry	170	1		
03/28/00	Wet	120	1			03/28/00	Wet	60	1		
04/07/00	Wet	55000	0			04/07/00	Wet	72000	0		
04/11/00	Wet	300	0			04/11/00	Wet	100	1		
04/18/00	Wet	1100	0			04/18/00	Wet	500	0		
04/19/00	Wet	200	1			04/19/00	Wet	200	1		
04/25/00	Wet	120	1			04/25/00	Wet	170	1		
05/02/00	Wet	560	0			05/02/00	Wet	1300	0		
05/09/00	Dry	100	1			05/09/00	Dry	100	1		
05/16/00	Wet	320	0			05/16/00	Wet	220	1		
05/23/00	Wet	440	0			05/23/00	Wet	900	0		
05/31/00	Dry	320	0			05/31/00	Dry	470	0		
06/06/00	Wet	260	0			06/06/00	Wet	320	0		
06/13/00	Wet	260	0			06/13/00	Wet	280	0		
06/14/00	Dry	330	0			06/14/00	Dry	370	0		
06/20/00	Dry	360	0			06/20/00	Dry	430	0		
06/27/00	Wet	280	0			06/27/00	Wet	290	0		
07/05/00	Wet	5900	0			07/05/00	Wet	6300	0		
07/11/00	Dry	270	0			07/11/00	Dry	230	1		
07/18/00	Dry	110	1			07/18/00	Dry	160	1		
07/19/00	Wet	180	1			07/19/00	Wet	270	0		
07/25/00	Dry	150	1			07/25/00	Dry	240	0		
08/01/00	Wet	2100	0			08/01/00	Wet	1600	0		
08/08/00	Wet	3100	0			08/08/00	Wet	3700	0		
08/15/00	Dry	1100	0			08/15/00	Dry	900	0		
08/22/00	Dry		1			08/22/00	Dry	1000	0		
08/29/00	Dry	390	0			08/29/00	Dry	470	0		
09/19/00	Dry	100	1			09/19/00	Dry	520	0		
09/26/00	Wet	3360	0			09/26/00	Wet	7430	0		
09/27/00	Wet	1870	0			09/27/00	Wet	2110	0		
10/03/00	Dry	310	0			10/03/00	Dry	100	1		
10/10/00	Dry	200	1			10/10/00	Dry	100	1		
10/17/00	Wet	630	0			10/17/00	Wet	100	1		
10/24/00	Wet	100	1			10/24/00	Wet	100	1		
11/01/00	Dry	100	1			11/01/00	Dry	100	1		
11/07/00	Wet	2110	0			11/07/00	Wet	3180	0		
11/08/00	Wet	740	0			11/08/00	Wet	1100	0		
11/14/00	Wet	200	1			11/14/00	Wet	410	0		
11/21/00	Dry	100	1			11/21/00	Dry	100	1		
11/28/00	Dry	410	0			11/28/00	Dry	300	0		
12/05/00	Dry	100	1			12/05/00	Dry	200	1		
12/12/00	Wet	3930	0			12/12/00	Wet	3540	0		
12/13/00	Wet	520	0			12/13/00	Wet	520	0		
12/20/00	Wet	520	0			12/20/00	Wet	200	1		
12/27/00	Wet	200	1			12/27/00	Wet	100	1		
01/03/01	Dry	100	1			01/03/01	Dry	100	1		
01/10/01	Dry	50	1			01/10/01	Dry	100	1		
01/17/01	Dry	100	1			01/17/01	Dry	100	1		
01/24/01	Dry	100	1			01/24/01	Dry	100	1		
01/31/01	Wet	2230	0			01/31/01	Wet	980	0		
02/06/01	Wet	100	1			02/06/01	Wet	100	1		
02/14/01	Wet	100	1			02/14/01	Wet	630	0		
02/19/01	Dry	100	1			02/19/01	Dry	100	1		
02/21/01	Dry	100	1			02/21/01	Dry	100	1		
02/28/01	Dry	100	1			02/28/01	Dry	100	1		
03/06/01	Dry	100	1			03/06/01	Dry	100	1		
03/14/01	Wet	100	1			03/14/01	Wet	100	1		
03/19/01	Dry	300	0			03/19/01	Dry	200	1		
03/21/01	Dry	200	1			03/21/01	Dry	100	1		

MCHD Sampling Locations											
30th Street						Central Avenue					
Date	Wet or Dry?	E. Coli (col/100 mL)	% Compliance	Date	Questionable Data (col/100 mL)	Date	Wet or Dry?	E. Coli (col/100 mL)	% Compliance	Date	Questionable Data (col/100 mL)
03/27/01	Dry	100	1			03/27/01	Dry	100	1		
04/03/01	Dry	100	1			04/03/01	Dry	100	1		
04/10/01	Wet	410	0			04/10/01	Wet	200	1		
04/16/01	Wet	310	0			04/16/01	Wet	200	1		
04/18/01	Dry	100	1			04/18/01	Dry	200	1		
04/24/01	Wet	410	0			04/24/01	Wet	100	1		
05/01/01	Dry	100	1			05/01/01	Dry	200	1		
05/09/01	Wet	8360	0			05/09/01	Wet	9330	0		
05/15/01	Dry	740	0			05/15/01	Dry	520	0		
05/22/01	Wet	620	0			05/22/01	Wet	200	1		
05/30/01	Wet	200	1			05/30/01	Wet	200	1		
06/05/01	Wet	1340	0			06/05/01	Wet	1340	0		
06/12/01	Dry	200	1			06/12/01	Dry	200	1		
06/19/01	Dry	410	0			06/19/01	Dry	830	0		
06/20/01	Wet	1200	0			06/20/01	Wet	1730	0		
06/26/01	Dry	520	0			06/26/01	Dry	520	0		
07/03/01	Wet	2160	0			07/03/01	Wet	2620	0		
07/10/01	Wet	850	0			07/10/01	Wet	1890	0		
07/17/01	Dry	100	1			07/17/01	Dry	410	0		
07/24/01	Wet	100	1			07/24/01	Wet	200	1		
07/31/01	Dry	510	0			07/31/01	Dry	300	0		
08/01/01	Dry	310	0			08/01/01	Dry	410	0		
08/07/01	Dry	100	1			08/07/01	Dry	200	1		
08/14/01	Dry	100	1			08/14/01	Dry	100	1		
08/21/01	Wet	2560	0			08/21/01	Wet	1710	0		
08/28/01	Dry	410	0			08/28/01	Dry	520	0		
09/05/01	Dry	200	1			09/05/01	Dry	200	1		
09/11/01	Wet	740	0			09/11/01	Wet	1340	0		
09/18/01	Wet	100	1			09/18/01	Wet	720	0		
09/25/01	Wet	2310	0			09/25/01	Wet	3680	0		
09/26/01	Dry	740	0			09/26/01	Dry	970	0		
10/02/01	Dry	850	0			10/02/01	Dry	310	0		
10/09/01	Dry	720	0			10/09/01	Dry	2460	0		
10/16/01	Wet	5980	0			10/16/01	Wet	7890	0		
10/23/01	Wet	104624	0			10/23/01	Wet	10500	0		
10/30/01	Dry	100	1			10/30/01	Dry	100	1		
11/06/01	Dry	100	1			11/06/01	Dry	100	1		
11/13/01	Dry	100	1			11/13/01	Dry	100	1		
11/20/01	Wet	200	1			11/20/01	Wet	100	1		
11/26/01	Wet	1190	0			11/26/01	Wet	740	0		
11/28/01	Wet	10810	0			11/28/01	Wet	100	1		
12/03/01	Dry	310	0			12/03/01	Dry	300	0		
12/06/01	Wet	520	0			12/06/01	Wet	200	1		
12/11/01	Dry	100	1			12/11/01	Dry	300	0		
12/17/01	Wet	23590	0			12/17/01	Wet	14550	0		
12/19/01	Wet	520	0			12/19/01	Wet	100	1		
5/1/2002	Dry	24	1			5/1/2002	Dry	40	1		
5/7/2002	Wet	4400	0			5/7/2002	Wet	2650	0		
5/14/2002	Wet	540	0			5/14/2002	Wet	200	1		
5/21/2002	Wet	22	1			5/21/2002	Wet	16	1		
5/28/2002	Wet	360	0			5/28/2002	Wet	540	0		
6/3/2002	Wet	27	1			6/3/2002	Wet	40	1		
6/10/2002	Dry	53	1			6/10/2002	Dry	93	1		
6/12/2002	Wet	880	0			6/12/2002	Wet	750	0		
6/17/2002	Wet	56	1			6/17/2002	Wet	138	1		
6/24/2002	Dry	81	1			6/24/2002	Dry	19	1		
7/1/2002	Dry	150	1			7/1/2002	Dry	190	1		
7/8/2002	Dry	12	1			7/8/2002	Dry	50	1		
7/15/2002	Dry	56	1			7/15/2002	Dry	75	1		
7/22/2002	Wet	220	1			7/22/2002	Wet	300	0		
7/29/2002	Wet	80	1			7/29/2002	Wet	104	1		
8/5/2002	Dry	56	1			8/5/2002	Dry	50	1		
8/12/2002	Dry	80	1			8/12/2002	Dry	88	1		
8/19/2002	Wet	**50500**	0			8/19/2002	Wet	**88500**	0		
8/26/2002	Wet	370	0			8/26/2002	Wet	240	0		
8/28/2002	Dry	183	1			8/28/2002	Dry	125	1		
9/4/2002	Dry	30	1			9/4/2002	Dry	31	1		
9/9/2002	Dry	300	0			9/9/2002	Dry	620	0		
9/16/2002	Wet	600	0			9/16/2002	Wet	520	0		
9/23/2002	Wet	650	0			9/23/2002	Wet	392	0		
9/30/2002	Dry	240	0			9/30/2002	Dry	240	0		
10/1/2002	Dry	260	0			10/1/2002	Dry	200	1		
10/7/2002	Dry	1100	0			10/7/2002	Dry	1050	0		
10/14/2002	Wet	93	1			10/14/2002	Wet	190	1		
10/21/2002	Wet	310	0			10/21/2002	Wet	800	0		
10/28/2002	Dry	1100	0			10/28/2002	Dry	1200	0		

MCHD Sampling Locations											
Capitol Avenue						Martin L. King Blvd					
Date	Wet or Dry?	E. Coli (col/100 mL)	% Compliance	Date	Questionable Data (col/100 mL)	Date	Wet or Dry?	E. Coli (col/100 mL)	% Compliance	Date	Questionable Data (col/100 mL)
01/04/00	Wet	2400	0	05/02/00	2800	01/04/00	Wet	15000	0	05/02/00	5900
01/11/00	Wet	400	0	05/09/00	410	01/11/00	Wet	300	0	05/09/00	630
01/12/00	Dry	100	1	09/05/00	5120	01/12/00	Dry	100	1	09/05/00	6380
01/19/00	Dry	40	1	09/12/00	5710	01/19/00	Dry	10	1	09/12/00	19180
01/25/00	Dry	20	1			01/25/00	Dry	10	1		
02/01/00	Dry	90	1			02/01/00	Dry	10	1		
02/08/00	Dry	10	1			02/08/00	Dry	10	1		
02/15/00	Wet	260	0			02/15/00	Wet	290	0		
02/22/00	Wet	8000	0			02/22/00	Wet	700	0		
02/29/00	Dry	100	1			02/29/00	Dry	130	1		
03/07/00	Dry	260	0			03/07/00	Dry	40	1		
03/14/00	Dry	60	1			03/14/00	Dry	10	1		
03/21/00	Wet	280	0			03/21/00	Wet	410	0		
03/22/00	Dry	80	1			03/22/00	Dry	110	1		
03/28/00	Wet	70	1			03/28/00	Wet	130	1		
04/07/00	Wet	74000	0			04/07/00	Wet	21000	0		
04/11/00	Wet	300	0			04/11/00	Wet	200	1		
04/18/00	Wet	100	1			04/18/00	Wet	600	0		
04/19/00	Wet	300	0			04/19/00	Wet	300	0		
04/25/00	Wet	150	1			04/25/00	Wet	240	0		
05/16/00	Wet	360	0			05/16/00	Wet	470	0		
05/23/00	Wet	1300	0			05/23/00	Wet	1100	0		
05/31/00	Dry	290	0			05/31/00	Dry	360	0		
06/06/00	Wet	270	0			06/06/00	Wet	310	0		
06/13/00	Wet	290	0			06/13/00	Wet	270	0		
06/14/00	Dry	260	0			06/14/00	Dry	230	1		
06/20/00	Dry	450	0			06/20/00	Dry	700	0		
06/27/00	Wet	230	1			06/27/00	Wet	900	0		
07/05/00	Wet	5500	0			07/05/00	Wet	3300	0		
07/11/00	Dry	180	1			07/11/00	Dry	240	0		
07/18/00	Dry	270	0			07/18/00	Dry	150	1		
07/19/00	Wet	240	0			07/19/00	Wet	170	1		
07/25/00	Dry	80	1			07/25/00	Dry	70	1		
08/01/00	Wet	1500	0			08/01/00	Wet	2300	0		
08/08/00	Wet	5200	0			08/08/00	Wet	10000	0		
08/15/00	Dry	320	0			08/15/00	Dry	130	1		
08/22/00	Dry	1400	0			08/22/00	Dry	1100	0		
08/29/00	Dry	310	0			08/29/00	Dry	300	0		
09/19/00	Dry	520	0			09/19/00	Dry	730	0		
09/26/00	Wet	10120	0			09/26/00	Wet	14550	0		
09/27/00	Wet	2850	0			09/27/00	Wet	2750	0		
10/03/00	Dry	520	0			10/03/00	Dry	310	0		
10/10/00	Dry	520	0			10/10/00	Dry	200	1		
10/17/00	Wet	410	0			10/17/00	Wet	980	0		
10/24/00	Wet	310	0			10/24/00	Wet	200	1		
11/01/00	Dry	310	0			11/01/00	Dry	100	1		
11/07/00	Wet	7800	0			11/07/00	Wet	98040	0		
11/08/00	Wet	1580	0			11/08/00	Wet	1450	0		
11/14/00	Wet	520	0			11/14/00	Wet	630	0		
11/21/00	Dry	620	0			11/21/00	Dry	300	0		
11/28/00	Dry	310	0			11/28/00	Dry	630	0		
12/05/00	Dry	200	1			12/05/00	Dry	410	0		
12/12/00	Wet	4960	0			12/12/00	Wet	5730	0		
12/13/00	Wet	410	0			12/13/00	Wet	7980	0		
12/20/00	Wet		1			12/20/00	Wet	100	1		
12/27/00	Wet		1			12/27/00	Wet	50	1		
01/03/01	Dry	100	1			01/03/01	Dry	100	1		
01/10/01	Dry	100	1			01/10/01	Dry	200	1		
01/17/01	Dry	100	1			01/17/01	Dry	100	1		
01/24/01	Dry	100	1			01/24/01	Dry	100	1		
01/31/01	Wet	2750	0			01/31/01	Wet	2110	0		
02/06/01	Wet	100	1			02/06/01	Wet	200	1		
02/14/01	Wet	100	1			02/14/01	Wet	200	1		
02/19/01	Dry	100	1			02/19/01	Dry	100	1		
02/21/01	Dry	100	1			02/21/01	Dry	100	1		
02/28/01	Dry	100	1			02/28/01	Dry	100	1		
03/06/01	Dry	100	1			03/06/01	Dry	100	1		
03/14/01	Wet	100	1			03/14/01	Wet	100	1		
03/19/01	Dry	200	1			03/19/01	Dry	200	1		
03/21/01	Dry	100	1			03/21/01	Dry	100	1		
03/27/01	Dry	100	1			03/27/01	Dry	100	1		
04/03/01	Dry	100	1			04/03/01	Dry	100	1		

MCHD Sampling Locations											
Capitol Avenue						Martin L. King Blvd					
Date	Wet or Dry?	E. Coli (col/100 mL)	% Compliance	Date	Questionable Data (col/100 mL)	Date	Wet or Dry?	E. Coli (col/100 mL)	% Compliance	Date	Questionable Data (col/100 mL)
04/10/01	Wet	100	1			04/10/01	Wet	100	1		
04/16/01	Wet	520	0			04/16/01	Wet	860	0		
04/18/01	Dry	100	1			04/18/01	Dry	100	1		
04/24/01	Wet	410	0			04/24/01	Wet	200	1		
05/01/01	Dry	310	0			05/01/01	Dry	100	1		
05/09/01	Wet	14970	0			05/09/01	Wet	18500	0		
05/15/01	Dry	410	0			05/15/01	Dry	310	0		
05/22/01	Wet	410	0			05/22/01	Wet	200	1		
05/30/01	Wet	310	0			05/30/01	Wet	100	1		
06/05/01	Wet	1560	0			06/05/01	Wet	3280	0		
06/12/01	Dry	310	0			06/12/01	Dry	200	1		
06/19/01	Dry	310	0			06/19/01	Dry	2030	0		
06/20/01	Wet	1460	0			06/20/01	Wet	4570	0		
06/26/01	Dry	100	1			06/26/01	Dry	720	0		
07/03/01	Wet	2780	0			07/03/01	Wet	2780	0		
07/10/01	Wet	850	0			07/10/01	Wet	2160	0		
07/17/01	Dry	410	0			07/17/01	Dry	100	1		
07/24/01	Wet	100	1			07/24/01	Wet	310	0		
07/31/01	Dry	840	0			07/31/01	Dry	630	0		
08/01/01	Dry	100	1			08/01/01	Dry	410	0		
08/07/01	Dry	310	0			08/07/01	Dry	520	0		
08/14/01	Dry	200	1			08/14/01	Dry	100	1		
08/21/01	Wet	2780	0			08/21/01	Wet	3090	0		
08/28/01	Dry	860	0			08/28/01	Dry	310	0		
09/05/01	Dry	740	0			09/05/01	Dry	100	1		
09/11/01	Wet	1460	0			09/11/01	Wet	1420	0		
09/18/01	Wet	630	0			09/18/01	Wet	300	0		
09/25/01	Wet	3500	0			09/25/01	Wet	3450	0		
09/26/01	Dry	850	0			09/26/01	Dry	2280	0		
10/02/01	Dry	100	1			10/02/01	Dry	310	0		
10/09/01	Dry	1280	0			10/09/01	Dry	1220	0		
10/16/01	Wet	10190	0			10/16/01	Wet	6440	0		
10/23/01	Wet	620	0			10/23/01	Wet	100	1		
10/30/01	Dry	630	0			10/30/01	Dry	520	0		
11/06/01	Dry	100	1			11/06/01	Dry	300	0		
11/13/01	Dry	100	1			11/13/01	Dry	200	1		
11/20/01	Wet	100	1			11/20/01	Wet	200	1		
11/26/01	Wet	630	0			11/26/01	Wet	1730	0		
11/28/01	Wet	100	1			11/28/01	Wet	1180	0		
12/03/01	Dry	100	1			12/03/01	Dry	520	0		
12/06/01	Wet	410	0			12/06/01	Wet	310	0		
12/11/01	Dry	100	1			12/11/01	Dry	200	1		
12/17/01	Wet	23590	0			12/17/01	Wet	22240	0		
12/19/01	Wet	300	0			12/19/01	Wet	960	0		
5/1/2002	Dry	32	1			5/1/2002	Dry	**10**	1		
5/7/2002	Wet	2650	0			5/7/2002	Wet	1850	0		
5/14/2002	Wet	133	1			5/14/2002	Wet	800	0		
5/21/2002	Wet	43	1			5/21/2002	Wet	84	1		
5/28/2002	Wet	440	0			5/28/2002	Wet	557	0		
6/3/2002	Wet	**20**	1			6/3/2002	Wet	**20**	1		
6/10/2002	Dry	53	1			6/10/2002	Dry	80	1		
6/12/2002	Wet	757	0			6/12/2002	Wet	1450	0		
6/17/2002	Wet	140	1			6/17/2002	Wet	360	0		
6/24/2002	Dry	**10**	1			6/24/2002	Dry	38	1		
7/1/2002	Dry	300	0			7/1/2002	Dry	367	0		
7/8/2002	Dry	106	1			7/8/2002	Dry	131	1		
7/15/2002	Dry	50	1			7/15/2002	Dry	62	1		
7/22/2002	Wet	267	0			7/22/2002	Wet	170	1		
7/29/2002	Wet	100	1			7/29/2002	Wet	57	1		
8/5/2002	Dry	50	1			8/5/2002	Dry	69	1		
8/12/2002	Dry	56	1			8/12/2002	Dry	163	1		
8/19/2002	Wet	**100000**	0			8/19/2002	Wet	44000	0		
8/26/2002	Wet	130	1			8/26/2002	Wet	290	0		
8/28/2002	Dry	123	1			8/28/2002	Dry	110	1		
9/4/2002	Dry	80	1			9/4/2002	Dry	75	1		
9/9/2002	Dry	200	1			9/9/2002	Dry	50	1		
9/16/2002	Wet	600	0			9/16/2002	Wet	620	0		
9/23/2002	Wet	900	0			9/23/2002	Wet	800	0		
9/30/2002	Dry	220	1			9/30/2002	Dry	240	0		
10/1/2002	Dry	130	1			10/1/2002	Dry	160	1		
10/7/2002	Dry	700	0			10/7/2002	Dry	330	0		
10/14/2002	Wet	137	1			10/14/2002	Wet	130	1		
10/21/2002	Wet	320	0			10/21/2002	Wet	330	0		
10/28/2002	Dry	1050	0			10/28/2002	Dry	1000	0		

MCHD Sampling Locations

Stadium Drive

Date	Wet or Dry?	E. Coli (col/100 mL)	% Compliance
01/04/00	Wet	8000	0
01/11/00	Wet	100	1
01/12/00	Dry	100	1
01/19/00	Dry	10	1
01/25/00	Dry	10	1
02/01/00	Dry	10	1
02/08/00	Dry	10	1
02/15/00	Wet	160	1
02/22/00	Wet	510	0
02/29/00	Dry	120	1
03/07/00	Dry	10	1
03/14/00	Dry	10	1
03/21/00	Wet	620	0
03/22/00	Dry	50	1
03/28/00	Wet	10	1
04/07/00	Wet	19000	0
04/11/00	Wet	200	1
04/18/00	Wet	1100	0
04/19/00	Wet	400	0
04/25/00	Wet	370	0
05/09/00	Dry	100	1
05/16/00	Wet	100	1
05/23/00	Wet	2900	0
05/31/00	Dry	360	0
06/06/00	Wet	390	0
06/13/00	Wet	270	0
06/14/00	Dry	390	0
06/20/00	Dry	690	0
06/27/00	Wet	410	0
07/05/00	Wet	4800	0
07/11/00	Dry	270	0
07/18/00	Dry	120	1
07/19/00	Wet	140	1
07/25/00	Dry	10	1
08/01/00	Wet	1300	0
08/08/00	Wet	12000	0
08/15/00	Dry	130	1
08/22/00	Dry	510	0
08/29/00	Dry	250	0
09/19/00	Dry	520	0
09/26/00	Wet	68670	0
09/27/00	Wet	3890	0
10/03/00	Dry	100	1
10/10/00	Dry	520	0
10/17/00	Wet	860	0
10/24/00	Wet	200	1
11/01/00	Dry	100	1
11/07/00	Wet	6770	0
11/08/00	Wet	5040	0
11/14/00	Wet	410	0
11/21/00	Dry	310	0
11/28/00	Dry	520	0
12/05/00	Dry	200	1
12/12/00	Wet	12740	0
12/13/00	Wet	1220	0
12/20/00	Wet	200	1
12/27/00	Wet	310	0
01/03/01	Dry	200	1
01/10/01	Dry	50	1
01/17/01	Dry	100	1
01/24/01	Dry	100	1
01/31/01	Wet	2920	0
02/06/01	Wet	100	1
02/14/01	Wet	100	1
02/19/01	Dry	100	1
02/21/01	Dry	100	1
02/28/01	Dry	520	0
03/06/01	Dry	200	1
03/14/01	Wet	100	1
03/19/01	Dry	410	0
03/21/01	Dry	200	1
03/27/01	Dry	100	1

Date	Questionable Data (col/100 mL)
05/02/00	8000
09/05/00	6630
09/12/00	54750

MCHD Sampling Locations					
Stadium Drive					
Date	Wet or Dry?	E. Coli (col/100 mL)	% Compliance	Date	Questionable Data (col/100 mL)
04/03/01	Dry	100	1		
04/10/01	Wet	100	1		
04/16/01	Wet	200	1		
04/18/01	Dry	100	1		
04/24/01	Wet	200	1		
05/01/01	Dry	100	1		
05/09/01	Wet	129965	0		
05/15/01	Dry	310	0		
05/22/01	Wet	620	0		
05/30/01	Wet	630	0		
06/05/01	Wet	2780	0		
06/12/01	Dry	300	0		
06/19/01	Dry	730	0		
06/20/01	Wet	17930	0		
06/26/01	Dry	100	1		
07/03/01	Wet	2280	0		
07/10/01	Wet	1450	0		
07/17/01	Dry	100	1		
07/24/01	Wet	520	0		
07/31/01	Dry	520	0		
08/01/01	Dry	100	1		
08/07/01	Dry	100	1		
08/14/01	Dry	100	1		
08/21/01	Wet	3360	0		
08/28/01	Dry	520	0		
09/05/01	Dry	200	1		
09/11/01	Wet	1710	0		
09/18/01	Wet	510	0		
09/25/01	Wet	4220	0		
09/26/01	Dry	1870	0		
10/02/01	Dry	100	1		
10/09/01	Dry	2060	0		
10/16/01	Wet	5040	0		
10/23/01	Wet	200	1		
10/30/01	Dry	410	0		
11/06/01	Dry	410	0		
11/13/01	Dry	100	1		
11/20/01	Wet	310	0		
11/26/01	Wet	2180	0		
11/28/01	Wet	1350	0		
12/03/01	Dry	100	1		
12/06/01	Wet	200	1		
12/11/01	Dry	100	1		
12/17/01	Wet	13960	0		
12/19/01	Wet	310	0		
5/1/2002	Dry	**10**	1		
5/7/2002	Wet	3400	0		
5/14/2002	Wet	540	0		
5/21/2002	Wet	84	1		
5/28/2002	Wet	1400	0		
6/3/2002	Wet	40	1		
6/10/2002	Dry	173	1		
6/12/2002	Wet	4400	0		
6/17/2002	Wet	120	1		
6/24/2002	Dry	88	1		
7/1/2002	Dry	300	0		
7/8/2002	Dry	50	1		
7/15/2002	Dry	75	1		
7/22/2002	Wet	293	0		
7/29/2002	Wet	44	1		
8/5/2002	Dry	25	1		
8/12/2002	Dry	20	1		
8/19/2002	Wet	19000	0		
8/26/2002	Wet	210	1		
8/28/2002	Dry	130	1		
9/4/2002	Dry	37	1		
9/9/2002	Dry	40	1		
9/16/2002	Wet	580	0		
9/23/2002	Wet	200	1		
9/30/2002	Dry	127	1		
10/1/2002	Dry	120	1		
10/7/2002	Dry	260	0		
10/14/2002	Wet	65	1		
10/21/2002	Wet	700	0		
10/28/2002	Dry	367	0		

MCHD Sampling Locations											
46th Street						Boyscout Raod					
Date	Wet or Dry?	E. Coli (col/100 mL)	% Compliance	Date	Questionable Data (col/100 mL)	Date	Wet or Dry?	E. Coli (col/100 mL)	% Compliance	Date	Questionable Data (col/100 mL)
5/1/2002	Dry	**10**	1			5/1/2002	Dry	**10**	1		
5/7/2002	Wet	720	0			5/7/2002	Wet	620	0		
5/14/2002	Wet	133	1			5/14/2002	Wet	200	1		
5/21/2002	Wet	8	1			5/21/2002	Wet	**4**	1		
5/28/2002	Wet	27	1			5/28/2002	Wet	**20**	1		
6/3/2002	Wet	173	1			6/3/2002	Wet	27	1		
6/10/2002	Dry	**20**	1			6/10/2002	Dry	**20**	1		
6/12/2002	Wet	173	1			6/12/2002	Wet	**20**	1		
6/17/2002	Wet	81	1			6/17/2002	Wet	38	1		
6/24/2002	Dry	75	1			6/24/2002	Dry	31	1		
7/1/2002	Dry	106	1			7/1/2002	Dry	75	1		
7/8/2002	Dry	31	1			7/8/2002	Dry	38	1		
7/15/2002	Dry	56	1			7/15/2002	Dry	31	1		
7/22/2002	Wet	56	1			7/22/2002	Wet	140	1		
7/29/2002	Wet	113	1			7/29/2002	Wet	48	1		
8/5/2002	Dry	69	1			8/5/2002	Dry	94	1		
8/12/2002	Dry	80	1			8/12/2002	Dry	84	1		
8/19/2002	Wet	2800	0			8/19/2002	Wet	1300	0		
8/26/2002	Wet	180	1			8/26/2002	Wet	104	1		
8/28/2002	Dry	135	1			8/28/2002	Dry	60	1		
9/4/2002	Dry	51	1			9/4/2002	Dry	45	1		
9/9/2002	Dry	87	1			9/9/2002	Dry	55	1		
9/16/2002	Wet	260	0			9/16/2002	Wet	85	1		
9/23/2002	Wet	280	0			9/23/2002	Wet	200	1		
9/30/2002	Dry	167	1			9/30/2002	Dry	120	1		
10/1/2002	Dry	170	1			10/1/2002	Dry	110	1		
10/7/2002	Dry	180	1			10/7/2002	Dry	160	1		
10/14/2002	Wet	135	1			10/14/2002	Wet	41	1		
10/21/2002	Wet	69	1			10/21/2002	Wet	41	1		
10/28/2002	Dry	28	1			10/28/2002	Dry	78	1		

MCHD Sampling Locations					
Date	Wet or Dry?	5700 Fall Creek Parkway		4500 Fall Creek Parkway	
		E. Coli (col/100 mL)	% Compliance	E. Coli (col/100 mL)	% Compliance
4/18/2000	Wet	100	1	100	1
5/2/2000	Wet	390	0	410	0
6/6/2000	Wet	240	0	390	0
7/11/2000	Dry	580	0	240	0
8/8/2000	Wet	900	0	600	0
9/5/2000	Wet	970	0	980	0
11/1/2000	Dry	100	1	100	1
4/10/2001	Dry	100	1	100	1
5/9/2001	Wet	1450	0	3090	0
6/12/2001	Dry	100	1	100	1
7/10/2001	Wet	520	0	840	0
8/7/2001	Dry	740	0	410	0
9/11/2001	Wet	310	0	740	0
10/9/2001	Dry	310	0	100	1

IDEM Sampling Data					
		Keystone Ave		Stadium Drive	
Date	Wet or Dry?	E. Coli (col/100 mL)	% Compliance	E. Coli (col/100 mL)	% Compliance
1/11/2000	Wet	240	0	87	1
2/10/2000	Wet	190	1	8	1
3/2/2000	Wet	29	1	220	1
4/20/2000	Wet	96	1	410	0
5/8/2000	Wet	190	1	4600	0
6/13/2000	Wet	125	1	100	1
7/20/2000	Wet	140	1	29	1
8/9/2000	Wet	550	0	1300	0
9/7/2000	Dry	430	0	490	0
10/26/2000	Dry	50	1	78	1
11/30/2000	Dry	56	1	130	1
12/20/2000	Wet	86	1	410	0
5/1/2002	Dry	**10**	1		
5/7/2002	Wet	560	0		
5/14/2002	Wet	187	1		
5/21/2002	Wet	16	1		
5/28/2002	Wet	133	1		
6/3/2002	Wet	53	1		
6/10/2002	Dry	**20**	1		
6/12/2002	Wet	420	0		
6/17/2002	Wet	94	1		
6/24/2002	Dry	69	1		
7/1/2002	Dry	200	1		
7/8/2002	Dry	100	1		
7/15/2002	Dry	19	1		
7/22/2002	Wet	148	1		
7/29/2002	Wet	96	1		
8/5/2002	Dry	50	1		
8/12/2002	Dry	92	1		
8/19/2002	Wet	760	0		
8/26/2002	Wet	60	1		
8/28/2002	Dry	95	1		
9/4/2002	Dry	34	1		
9/9/2002	Dry	75	1		
9/16/2002	Wet	240	0		
9/23/2002	Wet	230	1		
9/30/2002	Dry	160	1		
10/1/2002	Dry	240	0		
10/7/2002	Dry	143	1		
10/14/2002	Wet	120	1		
10/21/2002	Wet	47	1		
10/28/2002	Dry	80	1		

Date	OES Sampling Locations						
	Wet or Dry?	16th Street		71st Street		79th Street	
		E. Coli (col/100 mL)	% Compliance	E. Coli (col/100 mL)	% Compliance	E. Coli (col/100 mL)	% Compliance
01/06/00	Dry	27	1	18	1		
02/03/00	Wet	9	1	40	1		
03/02/00	Wet	500	0	18	1		
04/06/00	Dry	1100	0	28	1		
05/04/00	Wet	800	0	**2**	1		
06/08/00	Dry	300	0	124	1		
07/06/00	Wet	12000	0	60	1		
08/10/00	Wet	1639	0	540	0		
09/07/00	Dry	4000	0	280	0		
10/05/00	Wet	**200000**	0	6800	0		
11/03/00	Dry	280	0	27	1		
12/07/00	Dry	59	1	84	1		
01/16/01	Dry	800	0	**3**	1		
02/13/01	Dry	80	1	50	1		
03/07/01	Dry	500	0	10	1		
04/05/01	Dry	16	1	40	1		
05/03/01	Dry	100	1	62	1		
06/14/01	Dry	2900	0	32	1		
07/12/01	Dry	320	0	88	1		
08/09/01	Dry	120	1	84	1		
09/06/01	Dry	160	1	50	1		
10/04/01	Dry	151	1	24	1		
11/08/01	Dry	27	1	8	1		
12/05/01	Dry	84	1	8	1		
05/01/02	Dry	32	1	**10**	1	**10**	1
05/07/02	Wet	2400	0	120	1	53	1
05/14/02	Wet	540	0	187	1	120	1
05/21/02	Wet	72	1	5	1	**4**	1
05/28/02	Wet	1300	0	27	1	**20**	1
06/03/02	Wet	133	1	**20**	1	**20**	1
06/10/02	Dry	67	1	**20**	1	**20**	1
06/12/02	Wet	2250	0	27	1	**20**	1
06/17/02	Wet	273	0	**10**	1	12	1
06/24/02	Dry	62	1	**10**	1	**10**	1
07/01/02	Dry	300	0	25	1	**10**	1
07/08/02	Dry	69	1	12	1	**10**	1
07/15/02	Dry	94	1	**10**	1	**10**	1
07/22/02	Wet	147	1	44	1	173	1
07/29/02	Wet	88	1	32	1	20	1
08/05/02	Dry	19	1	31	1	12	1
08/12/02	Dry	28	1	60	1	30	1
08/19/02	Wet	36500	0	6000	0	840	0
08/26/02	Wet	120	1	180	1	32	1
08/28/02	Dry	93	1	20	1	37	1
09/04/02	Dry	43	1	28	1	8	1
09/09/02	Dry	37	1	31	1	3	1
09/16/02	Wet	660	0	34	1	20	1
09/23/02	Wet	1050	0	500	0	48	1
09/30/02	Dry	220	1	44	1	31	1
10/01/02	Dry	110	1	75	1	40	1
10/07/02	Dry	290	0	90	1	47	1
10/14/02	Wet	100	1	72	1	25	1
10/21/02	Wet	270	0	25	1	22	1
10/28/02	Dry	1350	0	16	1	6	1

Supplemental Sampling Performed by MCHD and OES					
Date	Dry/Wet?	Fall Creek Rd - Mud Creek		96th Street - Mud Creek	
		E coli	Compliance	E coli	Compliance
5/1/2002	Dry	**10**	1	32	1
5/7/2002	Wet	900	0	920	0
5/14/2002	Wet	213	1	400	0
5/21/2002	Wet	**4**	1	5	1
5/28/2002	Wet	227	1	860	0
6/3/2002	Wet	67	1	107	1
6/10/2002	Dry	40	1	253	0
6/12/2002	Wet	93	1	187	1
6/17/2002	Wet	94	1	210	1
6/24/2002	Dry	88	1	170	1
7/1/2002	Dry	290	0	310	0
7/8/2002	Dry	12	1	75	1
7/15/2002	Dry	38	1	44	1
7/22/2002	Wet	88	1	140	1
7/29/2002	Wet	128	1	84	1
8/5/2002	Dry	200	1	150	1
8/12/2002	Dry	88	1	84	1
8/19/2002	Wet	5500	0	8333	0
8/26/2002	Wet	130	1	120	1
8/28/2002	Dry	100	1	110	1
9/4/2002	Dry	120	1	57	1
9/9/2002	Dry	157	1	57	1
9/16/2002	Wet	125	1	160	1
9/23/2002	Wet	180	1	280	0
9/30/2002	Dry	120	1	260	0
10/1/2002	Dry	150	1	190	1
10/7/2002	Dry	115	1	115	1
10/14/2002	Wet	70	1	110	1
10/21/2002	Wet	59	1	66	1
10/28/2002	Dry	65	1	80	1

Supplemental Sampling Performed by MCHD and OES					
Date	Dry/Wet?	86th Street - Mud Creek		82nd Street - Mud Creek	
		E coli	Compliance	E coli	Compliance
5/1/2002	Dry	32	1	**10**	1
5/7/2002	Wet	1550	0	1500	0
5/14/2002	Wet	340	0	227	1
5/21/2002	Wet	38	1	38	1
5/28/2002	Wet	980	0	500	0
6/3/2002	Wet	53	1	53	1
6/10/2002	Dry	147	1	107	1
6/12/2002	Wet	67	1	**20**	1
6/17/2002	Wet	94	1	106	1
6/24/2002	Dry	100	1	12	1
7/1/2002	Dry	44	1	230	1
7/8/2002	Dry	69	1	56	1
7/15/2002	Dry	44	1	50	1
7/22/2002	Wet	48	1	60	1
7/29/2002	Wet	64	1	96	1
8/5/2002	Dry	81	1	94	1
8/12/2002	Dry	80	1	112	1
8/19/2002	Wet	6500	0	7500	0
8/26/2002	Wet	120	1	72	1
8/28/2002	Dry	120	1	85	1
9/4/2002	Dry	26	1	300	0
9/9/2002	Dry	70	1	173	1
9/16/2002	Wet	133	1	117	1
9/23/2002	Wet	150	1	220	1
9/30/2002	Dry	170	1	163	1
10/1/2002	Dry	137	1	130	1
10/7/2002	Dry	135	1	130	1
10/14/2002	Wet	125	1	130	1
10/21/2002	Wet	95	1	100	1
10/28/2002	Dry	47	1	47	1

Supplemental Sampling Performed by MCHD and OES			
Date	Dry/Wet?	Lantern Rd - Mud Creek	
		E coli	Compliance
5/1/2002	Dry	40	1
5/7/2002	Wet	950	0
5/14/2002	Wet	253	0
5/21/2002	Wet	27	1
5/28/2002	Wet	267	0
6/3/2002	Wet	27	1
6/10/2002	Dry	107	1
6/12/2002	Wet	93	1
6/17/2002	Wet		1
6/24/2002	Dry	138	1
7/1/2002	Dry	112	1
7/8/2002	Dry	38	1
7/15/2002	Dry	44	1
7/22/2002	Wet		1
7/29/2002	Wet	84	1
8/5/2002	Dry	140	1
8/12/2002	Dry	64	1
8/19/2002	Wet	15000	0
8/26/2002	Wet	104	1
8/28/2002	Dry	100	1
9/4/2002	Dry	117	1
9/9/2002	Dry	50	1
9/16/2002	Wet	65	1
9/23/2002	Wet	200	1
9/30/2002	Dry	120	1
10/1/2002	Dry	115	1
10/7/2002	Dry	120	1
10/14/2002	Wet	70	1
10/21/2002	Wet	70	1
10/28/2002	Dry	56	1

Supplemental Sampling Performed by MCHD and OES					
Date	Dry/Wet?	Radnor Rd - Devon Creek		Millersville Rd - Devon Creek	
		E coli	Compliance	E coli	Compliance
05/01/02	Dry	24	1	**10**	1
05/07/02	Wet	7400	0	5800	0
05/14/02	Wet	480	0	460	0
05/21/02	Wet	49	1	24	1
05/28/02	Wet	5400	0	700	0
06/03/02	Wet	213	1	53	1
06/10/02	Dry	720	0	280	0
06/12/02	Wet	2150	0	2053	0
06/17/02	Wet	420	0	500	0
06/24/02	Dry	340	0	330	0
07/01/02	Dry	2200	0	700	0
07/08/02	Dry	150	1	333	0
07/15/02	Dry	120	1	187	1
07/22/02	Wet	220	1	84	1
07/29/02	Wet	320	0		
08/05/02	Dry	560	0		
08/12/02	Dry	580	0		
08/19/02	Wet	6500	0	9000	0
08/26/02	Wet	200	1		
08/28/02	Dry	267	0		
09/04/02	Dry	135	1		
09/09/02	Dry	293	0		
09/16/02	Wet	183	1		
09/23/02	Wet	120	1	240	0
09/30/02	Dry	283	0	110	1
10/01/02	Dry	220	1	220	1
10/07/02	Dry	308	0	290	0
10/14/02	Wet	330	0		
10/21/02	Wet	70	1		
10/28/02	Dry	160	1	123	1

Supplemental Sampling Performed by MCHD and OES			
Date	Dry/Wet?	Schafter Rd - Lawrence Creek	
		E coli	Compliance
05/01/02	Dry	16	1
05/07/02	Wet	2600	0
05/14/02	Wet	147	1
05/21/02	Wet	19	1
05/28/02	Wet	80	1
06/03/02	Wet	120	1
06/10/02	Dry	**20**	1
06/12/02	Wet	173	1
06/17/02	Wet	25	1
06/24/02	Dry	44	1
07/01/02	Dry	160	1
07/08/02	Dry	180	1
07/15/02	Dry	100	1
07/22/02	Wet	55	1
07/29/02	Wet	313	0
08/05/02	Dry	150	1
08/12/02	Dry	120	1
08/19/02	Wet	7000	0
08/26/02	Wet	64	1
08/28/02	Dry	105	1
09/04/02	Dry	48	1
09/09/02	Dry	293	0
09/16/02	Wet	200	1
09/23/02	Wet	150	1
09/30/02	Dry	226	1
10/01/02	Dry	240	0
10/07/02	Dry	167	1
10/14/02	Wet	75	1
10/21/02	Wet	133	1
10/28/02	Dry	100	1