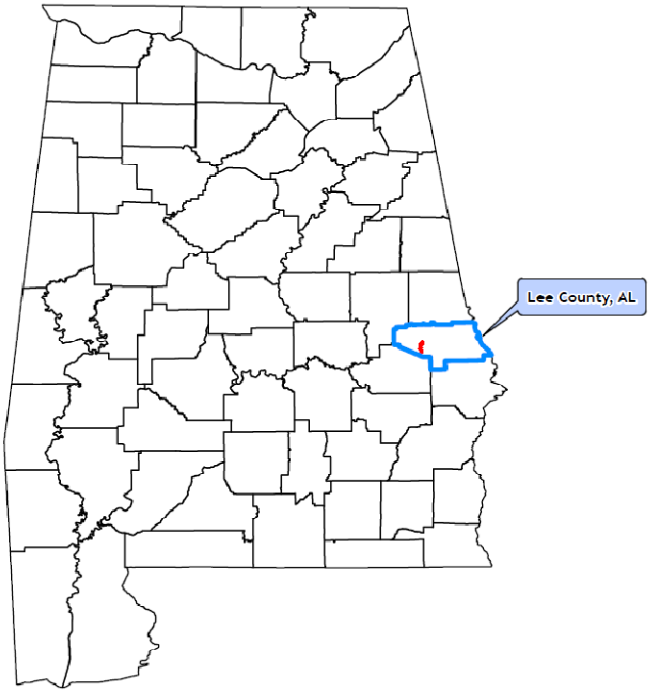
DRAFT

TOTAL MAXIMUM DAILY LOAD (TMDL) FOR PARKERSON MILL CREEK FOR PATHOGENS (*E. coli*)

Assessment Unit ID #: AL03150110-0202-200
Lee County, Alabama



Alabama Department of Environmental Management
Water Quality Branch
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Useful Acronyms & Abbreviations

A

A&I - Agriculture and Industry Use Classification
AAF - Average Annual Flow
ACES - Alabama Cooperative Extension Service
ADEM - Alabama Department of Environmental Management
ADPH - Alabama Department of Public Health
AEMC - Alabama Environmental Management Commission
AFO - Animal Feeding Operation
AL - Alabama; Aluminum (Metals)
AS - Arsenic
ASWCC - Alabama Soil & Water Conservation Committee
AWIC - Alabama Water Improvement Commission

B

BAT - Best Available Technology
BCT - Best Conventional Pollutant Control Technology
BMP - Best Management Practices
BOD - Biochemical Oxygen Demand
BPJ - Best Professional Judgment

C

CAFO - Confined Animal Feeding Operation
$CBOD_5$ - Five-Day Carbonaceous Biochemical Oxygen Demand
$CBOD_u$ - Ultimate Carbonaceous Biochemical Oxygen Demand
CFR - Code of Federal Regulations
CFS - Cubic Feet per Second
CMP - Coastal Monitoring Program
COD - Chemical Oxygen Demand
COE - Corps of Engineers (US Army)
CPP - Continuing Planning Process
CWA - Clean Water Act
CY - Calendar Year

D

DA - Drainage Area
DEM - Digital Elevation Model
DMR - Discharge Monitoring Report
DNCR - Department of Conservation & Natural Resources
DO - Dissolved Oxygen

E

E. coli - Escherichia Coliform Bacteria
EOP - End of Pipe
EPA - Environmental Protection Agency (US)

F

F&W - Fish and Wildlife Use Classification
FDA - Food and Drug Administration
Fe - Iron
FO - Field Operations
FS - Forestry Service (US)
FY - Fiscal Year

G

GIS - Geographic Information Systems
GOMA - Gulf of Mexico Alliance
GPS - Global Positioning System
GSA - Geological Survey of Alabama

H

HCR - Hydrographic Controlled Release
Hg - Mercury
HUC - Hydrologic Unit Code

I

IBI - Index of Biotic Integrity
IF - Incremental Flow
IWC - Instream Waste Concentration

L

LA - Load Allocation
Lat/Long- Latitude / Longitude
LDC - Load Duration Curve
LIDAR - Light Detection & Ranging
LWF - Limited Warmwater Fishery Use Classification

M

m^3/s - Cubic Meters per Second
MAF - Mean Annual Flow (MAF = AAF)
mg/l - Milligrams per Liter
MGD - Million Gallons per Day
mi - Miles
MOS - Margin of Safety
MS4s - Municipal Separate Storm Sewer Systems
MZ - Mixing Zone

N

N - Nitrogen
NA - Not Applicable
NASS - National Agricultural Statistics Service
$NBOD_x$ - Nitrogenous Biochemical Oxygen Demand
NED - National Elevation Database
NH_3-N - Ammonia Nitrogen
NHD - National Hydrography Database
NLCD - National Land Cover Dataset
NO_3+NO_2-N -Nitrate + Nitrite Nitrogen
NOAA - National Oceanic and Atmospheric Administration
NOV - Notice of Violation
NPDES - National Pollutant Discharge Elimination System
NPS - Non-Point Source
NRCS - National Resource Conservation Service
NTUs - Nephelometric Turbidity Units
NWS - National Weather Service

O

OAW – Outstanding Alabama Water Use Classification
OE - Organic Enrichment
ONRW - Outstanding National Resource Water Designation

P

P - Phosphorus
Pb - Lead
PCBs - Polychlorinated Biphenyl
pH - Concentration of Hydrogen Ions Scale
POTW - Publicly Owned Treatment Works
ppb - Parts per Billion
ppm - Parts per Million
ppt - Parts per Trillion
PS - Point Source
PWS - Public Water Supply Use Classification
PWSS - Public Water Supply System

Q

Q - Flow (MGD / m^3/s)
QA/QC - Quality Assurance / Quality Control
QAPP - Quality Assurance Project Plan

R

RRMP - River and Reservoirs Monitoring Program
RSMP - River and Streams Monitoring Program

S

S - Swimming and Other Whole Body Waters Contact Sports Use Classification
SH - Shellfish Harvesting Use Classification
SID - State Indirect Discharge
SMZ - Streamside Management Zone
SOD - Sediment Oxygen Demand
SOP - Standard Operating Procedure
SRF - State Revolving Fund
SSO - Sanitary Sewer Overflow
STP - Sewage Treatment Facility
SW - Surface Water
SWMP - Stormwater Management Plan
SWQM - Spreadsheet Water Quality Model (AL)
SWQMP - Surface Water Quality Monitoring Program

T

TBC - Technology-Based Controls
TBD - To be Determined
TDS - Total Dissolved Solids
TKN - Total Kjeldahl Nitrogen
TMDL - Total Maximum Daily Load
TON - Total Organic Nitrogen
TOT - Time of Travel
Total P - Total Phosphorus
TSS - Total Suspended Solids
TVA - Tennessee Valley Authority

U

UAA - Use Attainability Analysis
UIC - Underground Injection Control
USDA - United Stated Department of Agriculture
USGS - United States Geological Survey
USFWS - United States Fish & Wildlife Services
UV - Ultraviolet Radiation

W

WCS - Watershed Characterization System
WET - Whole Effluent Toxicity
WLA - Wasteload Allocation
WMA - Wildlife Management Area
WPCP - Wastewater Pollution Control Plant
WQB - Water Quality Branch
WRDB - Water Resources Database
WTP - Water Treatment Plant
WWTF - Wastewater Treatment Facility
WWTP - Wastewater Treatment Plant
WY - Water Year

1.0 Executive Summary

Section §303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) requires states to identify waterbodies which are not meeting their designated uses and to determine the Total Maximum Daily Load (TMDL) for pollutants causing the use impairment. A TMDL is the maximum amount of pollutant a waterbody can assimilate while meeting all applicable water quality standards for the pollutant of concern. All TMDLs include a wasteload allocation (WLA) for all National Pollutant Discharge Elimination System (NPDES) regulated discharges, a load allocation (LA) for all nonpoint sources, and an explicit and/or implicit margin of safety (MOS).

1.1 TMDL at a Glance

- ***Water Quality Limited?*** **Yes**
- ***Hydrologic Unit Code:*** **AL03150110-0202-200**
- **County:** **Lee**
- **Size of Watershed:** **9.3 mi² (5981 acres)**
- **Listing Date:** **2008**
- ***WQ Standard in Violation:*** **Pathogens (*E. coli*)**
- ***Designated Uses Affected:*** **Fish & Wildlife (F&W) - water recreation; growth and propagation of fish, shellfish, and other aquatic life, and wildlife**
- ***Environmental Indicator:*** ***E. coli* bacteria**
- ***Major Source(s):*** **Urban runoff, including domestic animal and wildlife waste, SSOs, illicit discharges**
- ***Loading Capacity:*** ***3.08E+09* colonies / day (*E. coli*)**
- ***Wasteload Allocation:*** **Point sources meeting permitted discharge limitations; wasteload allocation set at the E. coli criteria, end-of-pipe**
- ***Load Allocation:*** ***2.65E+09* colonies / day (*E. coli*)**
- ***Margin of Safety:*** **Explicit MOS set to 10%**

1.2 §303(d) Listing of the Impairment

The Parkerson Mill Creek segment was originally placed on Alabama's 2008 §303(d) list of impaired waters for pathogens based on data collected by ADEM in 2007. The listed segment spans 6.85 miles (from its source to its confluence with Chewacla Creek) in Lee County, just south of Auburn, AL. The entire segment holds a Fish & Wildlife (F&W) use classification.

1.3 Data Capture and Results Summary

Following its listing in 2007, a §303(d) sampling study was performed by ADEM on the listed segment of Parkerson Mill Creek for additional water quality assessment. ADEM collected samples from several different surface water quality stations, including stations along the entire length of the impairment. It should be noted that this segment was originally listed while fecal coliform was the indicator bacteria used for Alabama's listing methodology. Since that time, *E. coli* has been adopted as the bacteriological indicator of choice. Consequently, the load reductions within this TMDL are entirely based on the *E. coli* criteria and data, though the fecal coliform data was also scrutinized in order to formulate the most practical and effective way to implement this TMDL. Further review of the general water quality and intensive *E. coli* study revealed that the listed segment of Parkerson Mill Creek was still not meeting the pathogen criterion applicable to its most stringent use classification (F&W). Each station was carefully examined and the data compiled to identify specific areas of impairment and possible sources. All stations with the exception of station PKML-1 (just upstream of H.C. Morgan WWTP) had both geometric mean and single sample exceedances. Therefore, a TMDL has been developed for the listed segment of Parkerson Mill Creek specific to the data collected and any other pertinent information available.

1.4 TMDL Calculation Summary

For some pollutants, TMDLs are expressed on a mass loading basis (e.g. pounds per day). However, for pathogens, TMDL loads are typically expressed in terms of organism counts per day (colonies/day), in accordance with 40 CFR 130.2(i). In this instance, flow was taken into consideration, even though the reduction was calculated on a percent reduction basis. This percent reduction was based solely on the highest exceedance value and the percent reduction required in order to meet the criterion applicable to the Fish & Wildlife (F&W) use classification.

After calculating the percent reduction, a mass balance approach was used for calculating the pathogen TMDL for Parkerson Mill Creek. The mass balance approach utilizes the conservation of mass principle. Existing loads were calculated by multiplying the *E. coli* concentrations by their respective in-stream flows and a conversion factor. The mass loading was calculated using the single or geometric mean sample exceedance event which resulted in the highest percent reduction. In this case it was determined that the highest percent reduction was a geometric mean (geomean) violation of 294.42 colonies/100 mL calculated from values measured during an intensive pathogen study in August 2010 at station PM-3. This station is located just prior to the confluence of Parkerson Mill Creek and Chewacla Creek. As a result, this violation calls for a pathogen load reduction of 61%. There were also three other geomean violations and four single sample violations, but these resulted in less stringent reductions and will have no bearing in this TMDL document. In the same manner as existing loads were calculated, an allowable load was calculated for the single sample E. coli criterion of 113.4 colonies/100 mL (126 colonies/100 mL – 10% Margin of Safety).

An *E. coli* geomean concentration of 294.42 colonies/100 mL was measured August 2010 with an average measured stream flow of 1.11 cubic feet per second (cfs) during the time of the study. This does not include waste flow from the treatment facility (H.C. Morgan WPCF) just prior to the sampling station. Low flow estimates based on USGS gage data using the ratio method, as well as Bingham Equation estimates both yielded similar results, so the on-the-ground measured data was utilized for this TMDL.

The existing pathogen loading for this TMDL was calculated using the highest geomean exceedance of 294.42 colonies/100 mL that was collected by ADEM. The allowable loading, defined by the geomean criterion including a margin of safety, was calculated using the same flow value multiplied by the *E. coli* geomean target of 113.4 colonies/100 mL. The reduction required to meet the allowable loading was then calculated by subtracting the allowable loading from the existing loading.

The table on the following page is a summary of the estimated existing load, allowable load, and percent reduction for the geomean. The subsequent table lists the TMDL defined as the maximum allowable *E. coli* loading under critical conditions (June-September) for Parkerson Mill Creek. Using critical conditions for TMDL development and implementation will ensure that water quality is maintained throughout the year.

Table 1: *E. coli* Load Reduction Requirements

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
Nonpoint Source Load Geometric Mean	8.00E+09	3.08 E+09	4.92E+09	61%
Point Source Load[a]	4.44E+08	6.83E+09	0	0%

a. PS loads and load reductions based on current permit limits of Fecal coliform as well as a design flow of 9.0 MGD for HC Morgan WPCF. Therefore, units are actually fecal coliform colonies/day vs. Escherichia coli colonies/day as in the NPS load reductions. Based on these figures, one can conclude that no reductions are necessary to achieve appropriate pathogen loading for the permitted facility.

Table 2: *E. coli* Pathogen TMDL Summary for Parkerson Mill Creek

TMDL[e]	Margin of Safety (MOS)	Waste Load Allocation (WLA)[a]			Load Allocation (LA)	
		WWTPs[b]	MS4s[c]	Leaking Collection Systems[d]		
(col/day)	(col/day)	(col/day)	(% reduction)	(col/day)	(col/day)	(% reduction)
3.42E+09	3.42E+08	4.30E+08	61%	0	2.65E+09	61%

a. There are no CAFOs in the Parkerson Mill Creek watershed. Future CAFOs will be assigned WLA of zero.
b. WLAs for WWTPs are expressed as a daily maximum. Any future WWTPs (and expansions of existing facilities) must meet the applicable in-stream water quality criteria for *E. coli* at the point of discharge.
c. Future MS4 areas would be required to demonstrate consistency with the assumptions and requirements of this TMDL.
d. The objective for leaking collection systems is a WLA of zero. It is recognized, however, that a WLA of 0 colonies/day may not be practical. For these sources, the WLA is interpreted to mean a reduction in *E. coli* loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality criteria *for E. coli*.
e. TMDL was established using the geometric mean criterion of 126 colonies/100ml.

Compliance with the terms and conditions of existing and future NPDES permits will effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. Required load reductions in the LA portion of this TMDL can be implemented through voluntary measures and may be eligible for CWA §319 grants.

The Department recognizes that adaptive implementation of this TMDL will be needed to achieve applicable water quality criteria and we are committed towards targeting the load reductions to improve water quality in the Parkerson Mill Creek watershed. As additional data and/or information become available, it may become necessary to revise and/or modify the TMDL accordingly.

2.0 Introduction to TMDLs

Total Maximum Daily Loads (TMDLs) were created as a tool to improve water quality and provide a roadmap for sustainable, productive, and healthy water resources. The term TMDL was introduced in the U.S. Clean Water Act and is used extensively by the EPA in collaboration with state environmental agencies such as ADEM. Each state has a TMDL program which submits all TMDLs to the respective regional office of the EPA for approval. The following contains information concerning Alabama's TMDL Program.

2.1 Alabama's TMDL Program Overview

2.1.1 What is a TMDL?

Water quality monitoring data is collected and compared with state water quality standards. If any standard is violated, the waterbody is placed on the state's §303(d) List of Impaired Waters. Once a waterbody is placed on this list, a TMDL is developed in order to determine the amount of the pollutant(s) of concern that the waterbody can assimilate and still meet all applicable water quality standards. In essence, a TMDL establishes a "pollution budget" or allocation for each pollutant causing a water quality impairment.

A single waterbody or stream/river segment may have several TMDLs developed if it is impaired by more than one pollutant. A TMDL will be developed to address pathogens, dissolved oxygen, nutrients, pH, metals, turbidity, or other impairments, separately and distinctly. The ultimate goal of a TMDL is to identify specific pollutants, link them to their sources, and set a numeric criterion or targets in order to reduce pollution loadings and ensure the waterbody is meeting all water quality standards for its use classification. A TMDL addresses both point source discharges and nonpoint sources.

Once a TMDL has been developed, the next step is implementation through load reductions and watershed management practices that aim to improve and protect water quality throughout the entire watershed.

2.1.2 §303(d) List of Impaired Waters

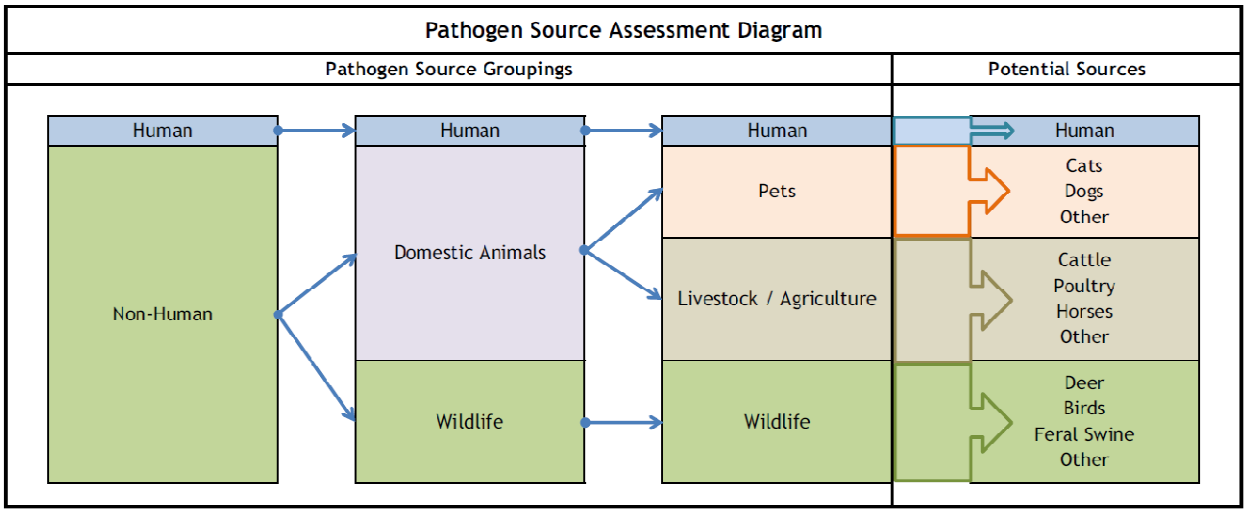
As mentioned before, each state is tasked with developing a comprehensive list of impaired waterbodies. Moreover, the state also prioritizes these lists for developments of TMDLs which are then submitted to EPA for approval. Alabama's §303(d) list and additional TMDL information can be found online at http://www.adem.state.al.us/programs/water/waterquality.cnt.

2.1.3 Causes of Impairment & Source Assessment Overview

Pollutants may enter waterbodies from municipal wastewater treatment facilities, industrial or agricultural discharges, waste disposal sites, stormwater runoff, etc. These types of sources are labeled point sources because the pollutants are discharged from a distinct end-of-pipe location point. In addition to point sources, pollutants may also enter waterbodies from many and varied sources. As rainfall runoff and overland flow moves over the surface of the ground, pollutants such as animal waste, litter, pathogens, sediment, and so forth are transported to a receiving waterbody. This is called nonpoint source pollution. In some instance the distinction between these two types of pollution are unclear (such as failing onsite waste treatment systems).

Pathogen impairments can be effectively remediated if comprehensive source assessments are performed in order to pinpoint where problems lie. The most prominent source of pathogens is human and animal waste. Below is an illustration of what types of waste cause pathogen impairments:

Figure 1: Pathogen Source Assessment Diagram



There are many types of waterborne pathogens, but indicator bacteria are used to gauge the presence of similar bacteria such as Fecal Coliform, Giardia, etc. These pathogens can cause harm when humans come into contact with untreated or improperly treated water. Periods of low flow, high temperatures, and other variables create critical periods where risk of pathogen impairment is at its highest, thus this critical period is used for TMDL analysis and development.

2.1.4 TMDL Establishment & Implementation Overview

First, a mathematical water quality model of the waterbody is constructed. The model is used to predict how various pollutants affect water quality and also provides a maximum pollutant loading target in order for the waterbody to meet or exceed water quality standards pursuant to their respective use classification(s). A TMDL has three basic components: a wasteload allocation (WLA) for point sources, a load allocation (LA) for nonpoint sources and natural background conditions, and an implicit or explicit margin of safety (MOS). Thus, A TMDL can be denoted by this equation:

$$\mathbf{TMDL = WLAs + LAs + MOS}$$

After a TMDL is established and approved, an implementation plan will be developed. The plan identifies sources and causes of the pollutant(s) of concern and provides a strategy for implementation of practical management measures required to return the waterbody to compliance with respect to water quality standards. Industry cooperation, citizen involvement, education, outreach, and pollution prevention are all important components of successful TMDL implementation.

2.2 Parkerson Mill Creek TMDL Introduction

2.2.1 Basis for Original Listing

Parkerson Mill Creek was originally placed on Alabama's §303(d) List of Impaired Waterbodies for pathogens in 2008. The listing was based exclusively on an intensive fecal coliform study performed in 2007 by ADEM. Potential sources of the impairment were listed as sanitary sewer overflows (SSOs) and urban runoff.

Due to quality assurance and policy protocol, intradepartmental data was utilized, but many groups contributed to the data collection process (both pre- and post-listing), including, but not limited to: Alabama Water Watch, the City of Auburn, Auburn University, and Parkerson Mill Creek Feasibility Study group.

2.2.2 Watershed Description

2.2.2.1 Watershed Geography & Mapping

Parkerson Mill Creek is located in the City of Auburn in Lee County, Alabama. This area is part of the Lower Tallapoosa River Basin, one of three sub-basins of the Tallapoosa River Basin. Parkerson Mill Creek's headwaters begin on the campus of Auburn University located within the city limits of Auburn, AL. The 9.3 mi^2 watershed

of Parkerson Mill Creek drains into Chewacla Creek, a tributary of Uphapee Creek, which eventually joins the Tallapoosa River below Tallassee, AL in Macon County. This watershed has a diverse mix of land types - though it is predominantly urban, it also has agricultural lands, recreational lands, and various other land types.

Due to the expanding university and urban sprawl, the watershed has undergone many changes over the years. The headwaters are primarily urban, but as Parkerson Mill Creek flows towards Chewacla Creek, the landscapes change dramatically. The following maps give a geographical reference for the location and features associated with Parkerson Mill Creek.

Figure 2: Parkerson Mill Creek Topographic Map

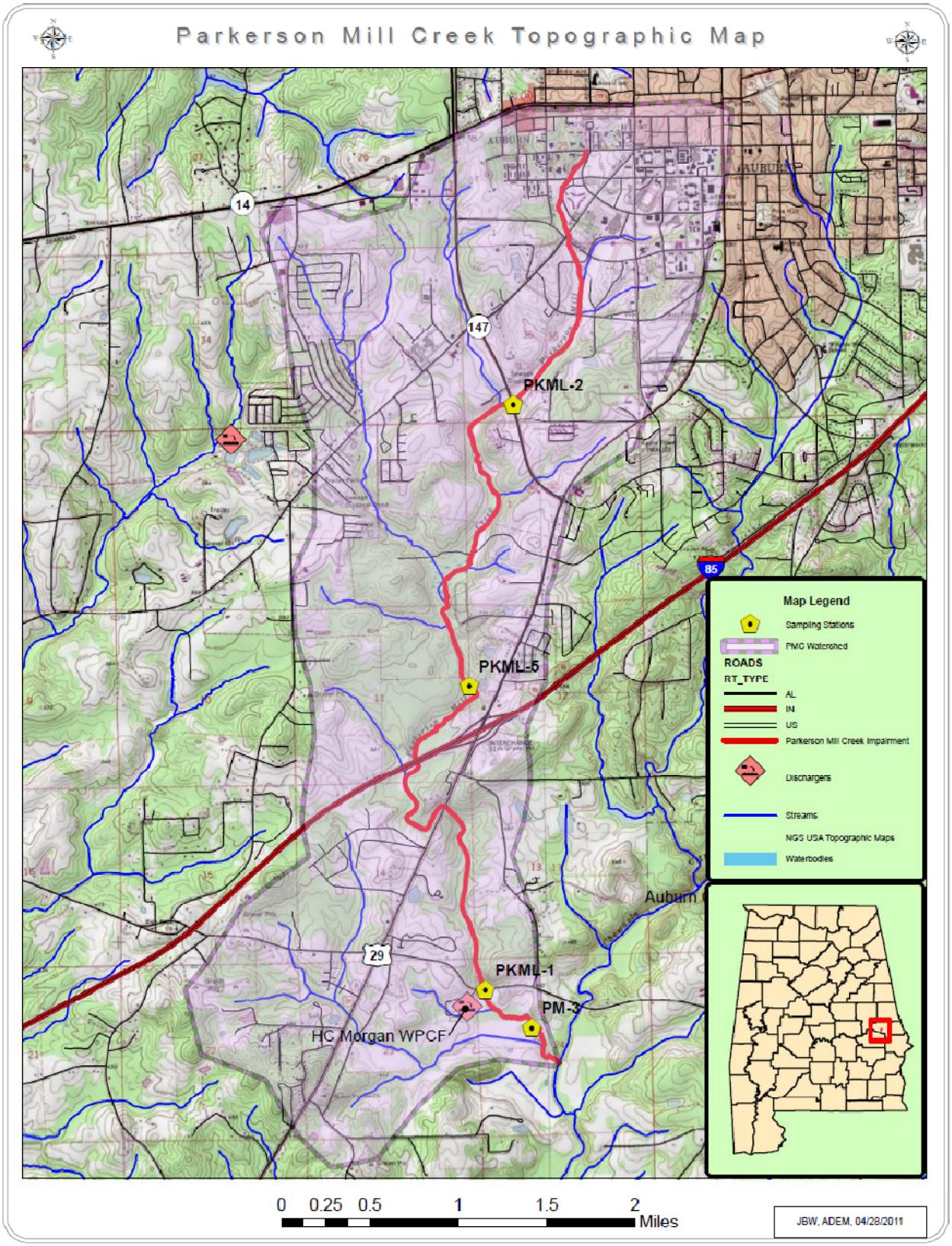
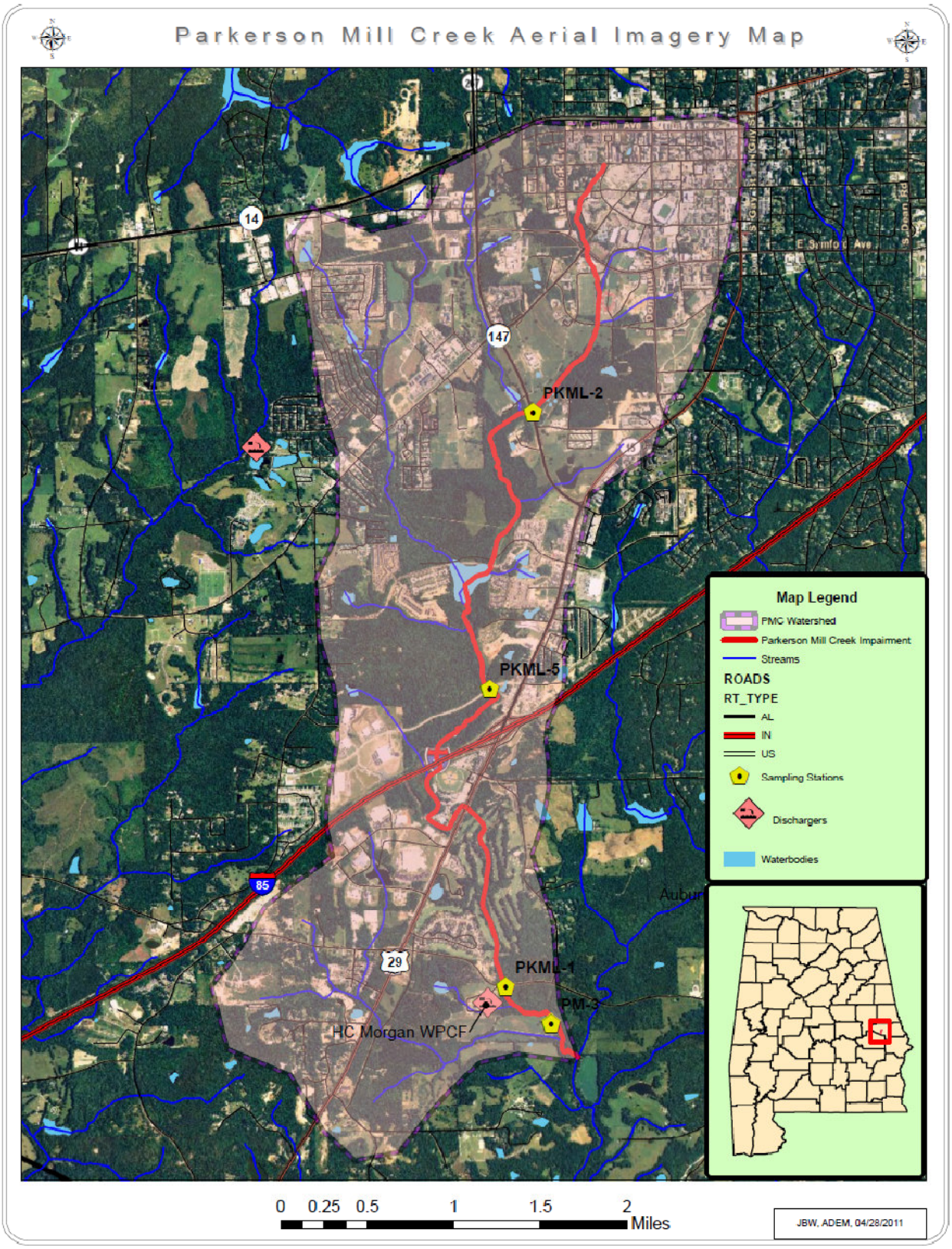


Figure 3: Parkerson Mill Creek Aerial Imagery Map



2.2.2.2 Hydrology & Flow Regimes

Parkerson Mill Creek is a perennial stream that begins near the City of Auburn and flows 6.85 miles southeast until it joins Chewacla Creek. It is typical of many small upland Alabama streams; characterized by coarse sediments, cobble, sections of slight riffle, and slow to moderate flow patterns in a meandering stream channel. The creek has a network of 8 small tributaries that drain into the mainstem creating the ~9.3 mi^2 drainage area (watershed).

Parkerson Mill Creek has undergone many hydrological changes as urbanization and development have changed drainage systems, altered flow path, and made other significant transformations to the natural hydrology. Furthermore, much of the stream channel has become incised and straightened, which can contribute to decreased water quality and habitat.

2.2.2.3 Physiographic Regions

As mentioned before, the Parkerson Mill Creek watershed is a diverse mix of land types, ecosystems, and physical features. The entire watershed lies within ecoregion 65i (Fall Line Hills – See Ecoregion Map) and is characterized by rolling plains just south of the foothills of the Appalachian Mountains.

Figure 4: Alabama Ecoregions Map

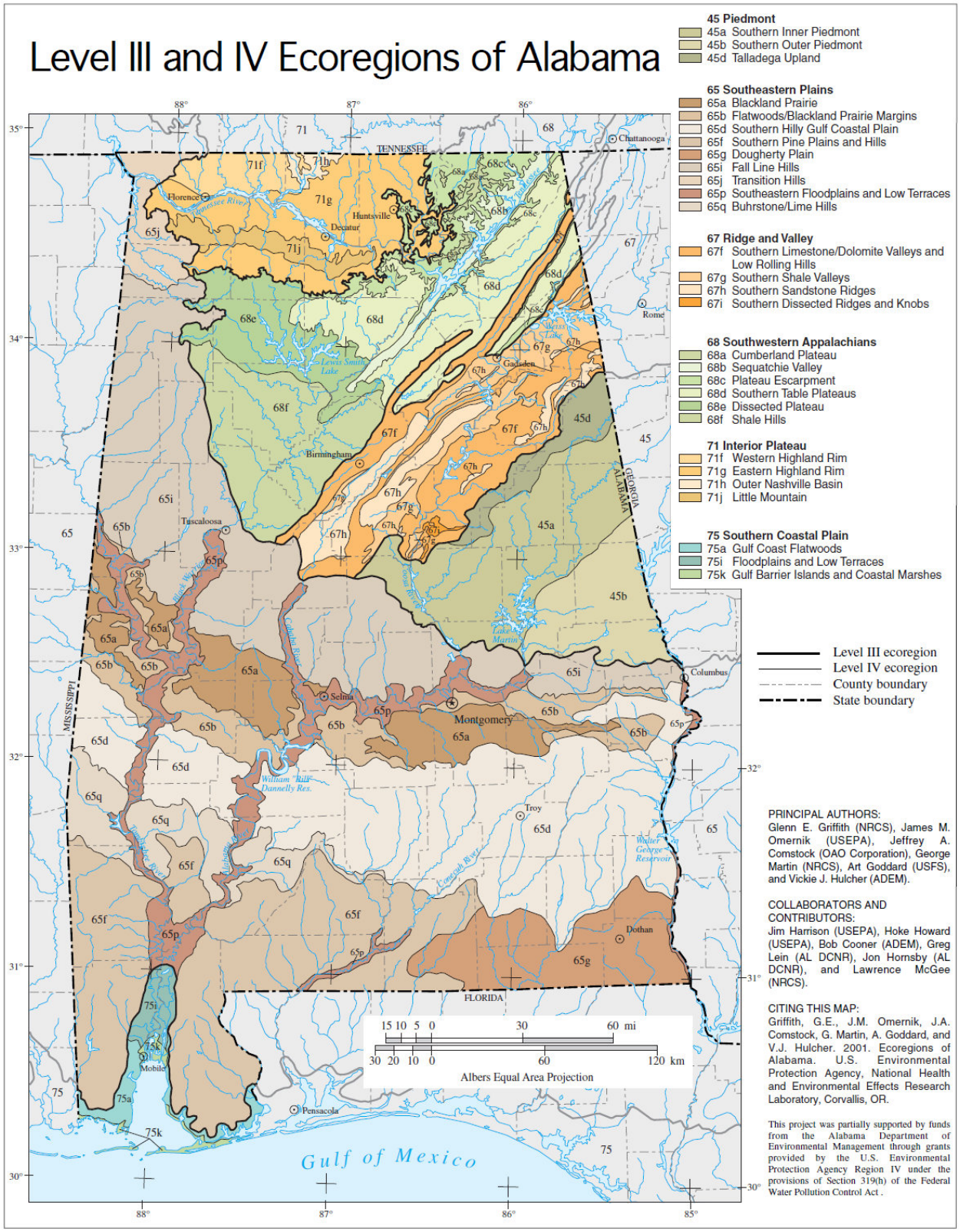
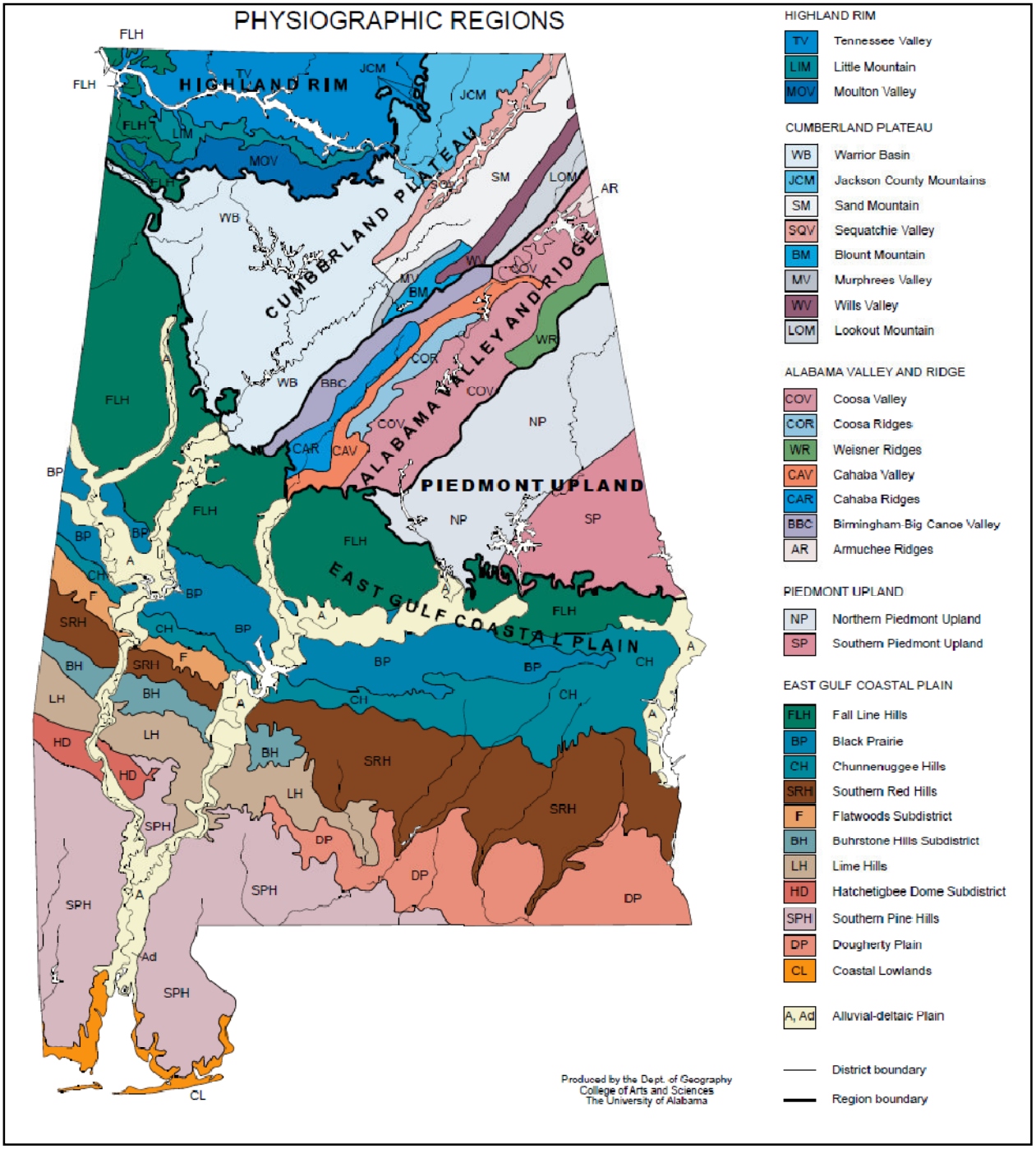


Figure 5: Alabama Physiographic Regions Map



2.2.2.4 Soil Types

The Parkerson Mill Creek Watershed is comprised of mostly loamy sands and sandy loams in hydrologic soil group B, which have the following characteristics: 1. Average infiltration rates, 2. Low surface runoff values, & 3. A water table at a depth of > 6.0 feet. The illustration below shows the various soil types along with their respective slope characteristics.

Figure 6: Soil Types in Parkerson Mill Creek Watershed

Soil	Slope
Blanton Loamy Sand	0-5%
Blanton Loamy Sand	5-10%
Cartecay Silt Loam	0-1%
Cecil Cobbly Loam	10-25%
Cowarts Loamy Sand	2-6%
Cowarts Loamy Sand	6-10%
Kinston Silt Loam	0-1%
Louisburg Sandy Loam	10-25%
Marvyn Loamy Sand	1-6%
Marvyn Loamy Sand	6-10%
Marvyn-Urban Land Complex	1-8%
Pacolet Sandy Loam	1-6%
Pacolet Sandy Loam	6-10%
Pits	-
Sacul Silt Loam	1-4%
Toccoa Sandy Loam	0-1%
Uchee Loamy Sand	0-6%
Uchee Loamy Sand	6-10%
Urban Land	-
Water	-

(Courtesy of Parkerson Mill Creek Watershed Management Plan)

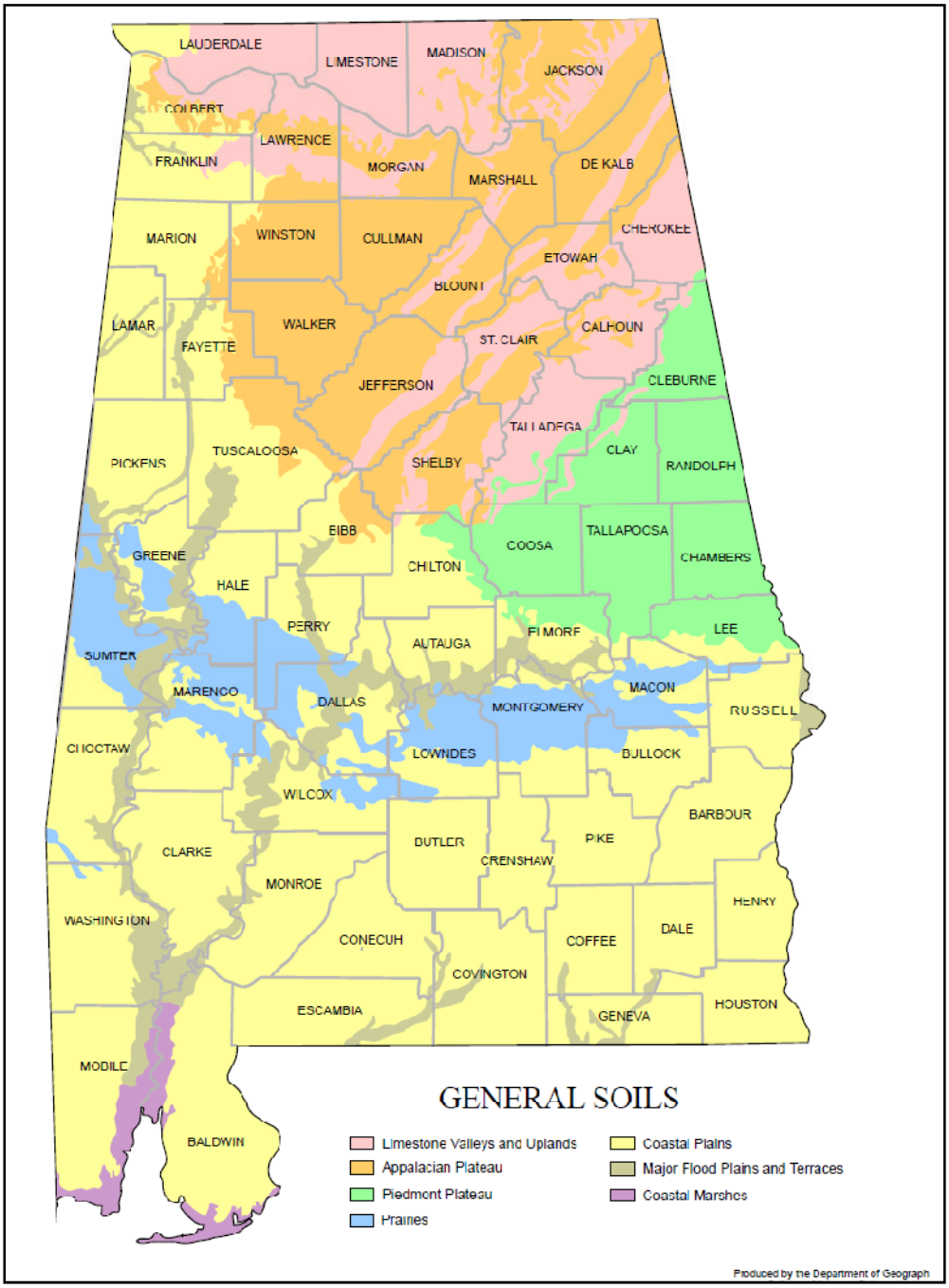
There are six soil orders occur in Alabama. In order of decreasing abundance they are Ultisols, Inceptisols, Vertisols, Entisols, Alfisols and Mollisols. The Inceptisols and Entisols are immature soils, the rest are mature.

Ultisols, which include the Parkerson Mill Creek Watershed, are the most common and are characterized by well-developed horizons, a clay-rich B-horizon, and typically red or yellow colored due to the presence of iron. Often leached of

nutrients, these soils require fertilizers for optimum plant growth. These are the soils of most forested areas in Alabama.*

*(Courtesy of http://www.mikeneilson.com/Alabama%20Landscapes%201/Soils/Al%20soils.htm)

Figure 7: Soil Types of Alabama



2.2.2.5 *Slope & Erodibility*

In the previous section, soil characteristics were discussed. The type of soil and topography play a large role in how susceptible soil waterbodies and their watersheds are to erosion issues. This watershed has a moderate erodibility factor ($0.10 < k < 0.40$) and previous development, current construction, and other activities can dramatically affect the physical properties of these soils and their susceptibility to erosion. (*Parkerson Mill Creek Watershed Management Plan, 2010*)

2.2.2.6 *Climate & Rainfall*

The climate in Auburn, Al is typical of the southern temperate rainforests, which are characterized by long growing seasons, periods of intense rainfall, and generally mild temperatures. The average temperatures can be seen in the illustration below:

Figure 8: Average Temperatures for Auburn, Al

CLIMATE

Auburn enjoys a warm and sunny climate with mild winters.

AVERAGE SEASONAL TEMPERATURES

Season	Avg. High	Avg. Low
Winter	58°F (14°C)	36°F (2°C)
Spring	74°F (23°C)	52°F (11°C)
Summer	89°F (32°C)	69°F (21°C)
Fall	78°F (26°C)	54°F (12°C)
Annual	*75°F (24°C)*	*53°F (12°C)*

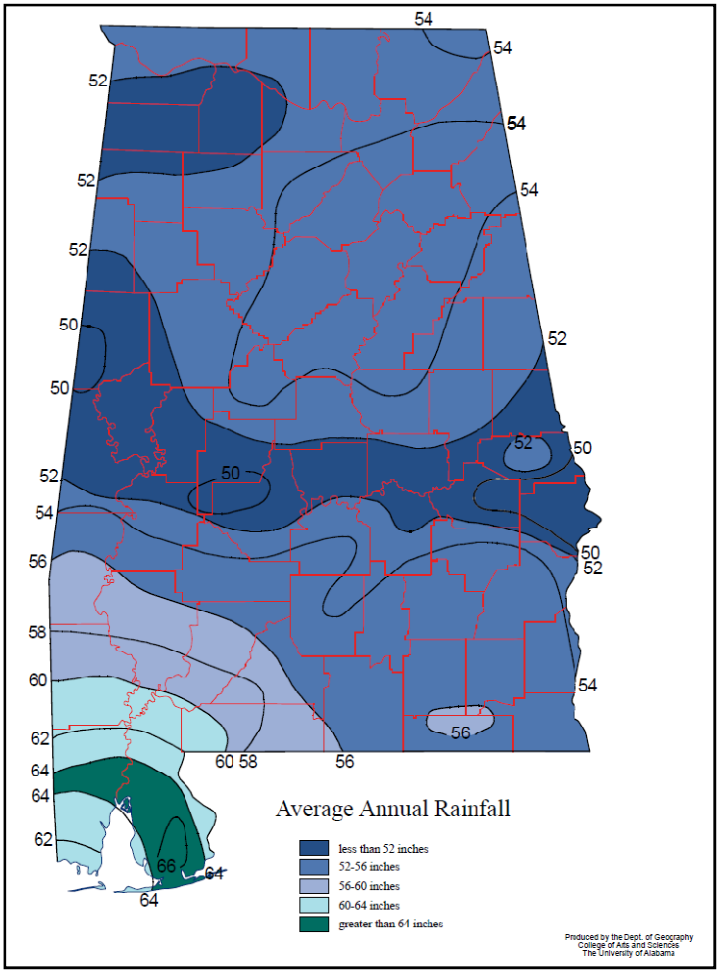
AVERAGE ANNUAL RAINFALL 53 in (1,346 mm)

THE AVERAGE ANNUAL TEMPERATURE IN AUBURN IS 64° F.

(Courtesy of the City of Auburn Community Profile, 2011)

Stream temperatures vary, of course, based on ambient temperature, storms, and other climatic events. As a rule of thumb, 20˚C is used for winter water temperatures and 30˚C for the summer months. These values are conservative estimates used in modeling and water quality calculations. Actual water temperatures for Parkerson Mill Creek during the sampling run can be found within the "Appendices" section of this report.

Figure 9: Alabama Average Rainfall Map



2.2.2.7 Special Conditions

It should be noted that this stream is unique in that the human population density has large swings throughout the year due to the university, sporting events, etc. An increase in population density often means increase in use of resources, the potential for possible pollution sources, and other concerns.

2.3 Problem Statement

2.3.1 Original Listing Information

This Parkerson Mill Creek segment was originally placed on Alabama's 2008 §303(d) list of impaired waters for pathogens based on data collected by ADEM in 2007. The listed segment spans 6.85 miles (from its source to its confluence with Chewacla Creek) in Lee County, just south of Auburn, AL. This entire segment holds a Fish & Wildlife (F&W) use classification.Through intensive water quality monitoring

plans and submission of data by citizen-driven environmental stewardship groups, this area has been identified as impaired for pathogens. This not only affects the biota that rely on this stream for habitat and sustenance, but it also fails to meet water quality criteria specific to the F&W use classification. Thus, a TMDL is warranted.

2.4 Water Quality Standards

2.4.1 Use Classification Information(ADEM 335-6-10-.09)

(5) **FISH AND WILDLIFE**

(a) Best usage of waters: fishing, propagation of fish, aquatic life, and wildlife, and any other usage except for swimming and water-contact sports or as a source of water supply for drinking or food-processing purposes.

(b) Conditions related to best usage: the waters will be suitable for fish, aquatic life and wildlife propagation. The quality of salt and estuarine waters to which this classification is assigned will also be suitable for the propagation of shrimp and crabs.

(c) Other usage of waters: it is recognized that the waters may be used for incidental water contact and recreation during June through September, except that water contact is strongly discouraged in the vicinity of discharges or other conditions beyond the control of the Department or the Alabama Department of Public Health.

(d) Conditions related to other usage: the waters, under proper sanitary supervision by the controlling health authorities, will meet accepted standards of water quality for outdoor swimming places and will be considered satisfactory for swimming and other whole body water-contact sports.

(e) Specific criteria: ***(abridged)***

7. Bacteria:

(i) In non-coastal waters, bacteria of the *E. coli* group shall not exceed a geometric mean of 548 colonies/100 ml; nor exceed a maximum of 2,507 colonies/100 ml in any sample. In coastal waters, bacteria of the enterococci group shall not exceed a maximum of 275 colonies/100 ml in any sample. The geometric mean shall be calculated from no less than five samples collected at a given station over a 30-day period at intervals not less than 24 hours.

(ii) For incidental water contact and recreation during June through September, the bacterial quality of water is acceptable when a sanitary survey by the controlling health authorities reveals no source of dangerous pollution and when the geometric mean *E. coli* organism density does not exceed 126 colonies/100 ml nor exceed a maximum of 487 colonies/100 ml in any sample in non-coastal waters. In coastal waters, bacteria of the enterococci group shall not exceed a geometric mean of 35 colonies/100 ml nor exceed a maximum of 158 colonies/100 ml in any sample. The geometric mean shall be calculated from no less than five samples collected at a given station over a 30-day period at intervals not less

than 24 hours. When the geometric bacterial coliform organism density exceeds these levels, the bacterial water quality shall be considered acceptable only if a second detailed sanitary survey and evaluation discloses no significant public health risk in the use of the waters. Waters in the immediate vicinity of discharges of sewage or other wastes likely to contain bacteria harmful to humans, regardless of the degree of treatment afforded these wastes, are not acceptable for swimming or other whole body watercontact sports.

2.4.2 Criteria Exceeded

The highlighted text above states the updated pathogen criteria for the F&W use classification. Please note that summer is June – September, and winter is October – May. The chart below summarizes this criterion.

Table 3: Freshwater *E. coli* Criteria

	F&W	
	Summer	**Winter**
Geometric Mean, cfu/100 ml	**126**	**548**
Single Sample Max, cfu/100 ml	**487**	**2507**
Illness Rate, per 1000	**8**	**14**

2.4.2.1 Data Assessment & Listing Methodology

For the four stations used in the intensive study, both single sample and geomean exceedances were observed. Only station PKML-1 had no exceedances during the sampling period. Out of the 59-samples collected, there were a total of 4 single sample exceedances (see full dataset in the "Appendices" section within this report). Moreover, the data also showed a total of 4 geomean exceedances on 3 of the 4 stations sampled.

During the intensive study, the City of Auburn requested side-by-side sampling at the same four stations. Their data yielded similar results, with 3 of the 4 stations showing exceedances. This data is also accessible in the "Appendices" section within this report. During the time this TMDL was developed, a comprehensive watershed management plan was also being put together by stakeholders within the Tallapoosa River Basin and the State of Alabama. This is a useful resource and data clearinghouse. Visit http://www.aces.edu/waterquality/PMC/index.php

2.4.2.2 *Data Assessment & Listing Methodology*

Table 4: Listing Methodology

Minimum Number of Samples Exceeding the Numeric Criterion Necessary for Listing*

Sample Size	Number of Exceedances	Sample Size	Number of Exceedances
8 thru 11	2	97 thru 104	14
12 thru 18	3	105 thru 113	15
19 thru 25	4	114 thru 121	16
26 thru 32	5	122 thru 130	17
33 thru 40	6	131 thru 138	18
41 thru 47	7	139 thru 147	19
48 thru 55	8	148 thru 156	20
56 thru 63	9	157 thru 164	21
64 thru 71	10	165 thru 173	22
72 thru 79	11	174 thru 182	23
80 thru 88	12	183 thru 191	24
89 thru 96	13	192 thru 199	25

* - For conventional parameters, including bacteria, at the 90 percent confidence level

Table 5: Delisting Requirements

Maximum Number of Samples Exceeding the Numeric Criterion Necessary for Delisting*

Sample Size	Number of Exceedances	Sample Size	Number of Exceedances
8 thru 21	0	104 thru 115	7
22 thru 37	1	116 thru 127	8
38 thru 51	2	128 thru 139	9
52 thru 64	3	140 thru 151	10
65 thru 77	4	152 thru 163	11
78 thru 90	5	164 thru 174	12
91 thru 103	6	175 thru 186	13

* - For conventional parameters, including bacteria, at the 90 percent confidence level

*Complete datasets for both pathogen indicator and water quality parameters can be found within the "Appendices" section of this report.

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification & Establishment

On December 11, 2009, the Alabama Environmental Management Commission (EMC) adopted the E. coli criteria as the bacterial indicator to assess the levels of bacteria in freshwater. Prior to the adoption of the E. coli criteria, the fecal coliform criteria were used by ADEM as the bacterial indicator for freshwater. The E. coli criteria was recommended by the EPA as a better correlation to swimming and incidental water contact associated health effects than fecal coliform in the 1986 publication Quality Criteria for Water, (EPA 440/5-86-001). As a result of this bacterial indicator change, this TMDL will be developed from E. coli data collected at Station PM-3 in 2010; even though the 2007 data that prompted the listing of Parkerson Mill Creek was based on the fecal coliform criteria.

For the purpose of this TMDL a geomean maximum E. coli target of 113.4 colonies/100 mL will be used. This target was derived by using a 10% explicit margin of safety from the geomean maximum of 126 colonies/100 mL criterion. This target is considered protective of water quality standards and should not allow the geomean maximum of 126 colonies/100 mL (June-September F&W criteria) to be exceeded.

3.2 Pollutant Source Assessment

3.2.1 Point Source Discharges

A point source can be defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Point source contributions can typically be attributed to municipal wastewater facilities, illicit discharges, and leaking sewer systems in urban areas. Municipal wastewater treatment facilities are permitted through the National Pollutant Discharge Elimination System (NPDES) process administered by ADEM. In urban settings sewer lines typically run parallel to streams in the floodplain. If a leaking sewer line is present, high concentrations of *E. coli* can flow into the stream or leach into the groundwater. Illicit discharges are found at facilities that are discharging *E. coli* bacteria when not permitted, or when *E. coli* criterion established in the issued NPDES permit is not being upheld.

3.2.1.1 Continuous Point Source Discharges (NPDES)

The NPDES program permits all individual, municipal, industrial, and mining operations that discharge to waters of the State of Alabama. Each of these types of discharges can impact water quality, but usually waste treatment facilities are the

most important with regards to pathogen impairments. Therefore, these facilities will be closely looked at to ensure they are meeting their permitted limits required to meet water quality standards.

The Parkerson Mill Creek watershed and most of Auburn is serviced by H.C. Morgan Water Pollution Control Facility (Southside) or Auburn Northside WPCF. These facilities are maintained by the City of Auburn. H.C. Morgan WPCF serves over 70% of Auburn's population, currently around 58,000 people. The city is tasked with managing and maintaining over 220 miles of sewer lines, more than 5000 manholes, and thirteen lift stations. (*Parkerson Mill Creek Watershed Management Plan, 2011*)

An updated water quality model for the H.C. Morgan WPCF was recently performed by ADEM's Water Quality branch to create an updated wasteload allocation. This model request asked for limits at a design flow rate of 11.25 MGD. Currently, the facility has a permitted discharge of 9.0 MGD. The current value will be used since the permitting process has not been completed.

Sanitary Sewer Overflows (SSOs) are fairly common, but have a dramatic effect on water quality. Most of the time, these overflows are detected and fixed quickly, and any resulting spills are attempted to be remediated. Although H.C. Morgan has had some SSOs within the PMC watershed (See "Appendices" section), all applicable water quality standards have been successfully met with regards to their treated effluent. Thus, no load reduction is required for this point source.

3.2.1.2 Municipal Separate Storm Sewer Systems (MS4s)

Polluted stormwater runoff is commonly transported through Municipal Separate Storm Sewer Systems (MS4s), from which it is often discharged untreated into local waterbodies. To prevent harmful pollutants from being washed or dumped into an MS4, operators must obtain a NPDES permit and develop a stormwater management program.

Phase I, issued in 1990, requires *medium* and *large* cities or certain counties with populations of 100,000 or more to obtain NPDES permit coverage for their stormwater discharges. Phase II, issued in 1999, requires regulated small MS4s in urbanized areas, as well as small MS4s outside the urbanized areas that are designated by the permitting authority, to obtain NPDES permit coverage for their stormwater discharges.

Generally, Phase I MS4s are covered by individual permits and Phase II MS4s are covered by a general permit. Each regulated MS4 is required to develop and

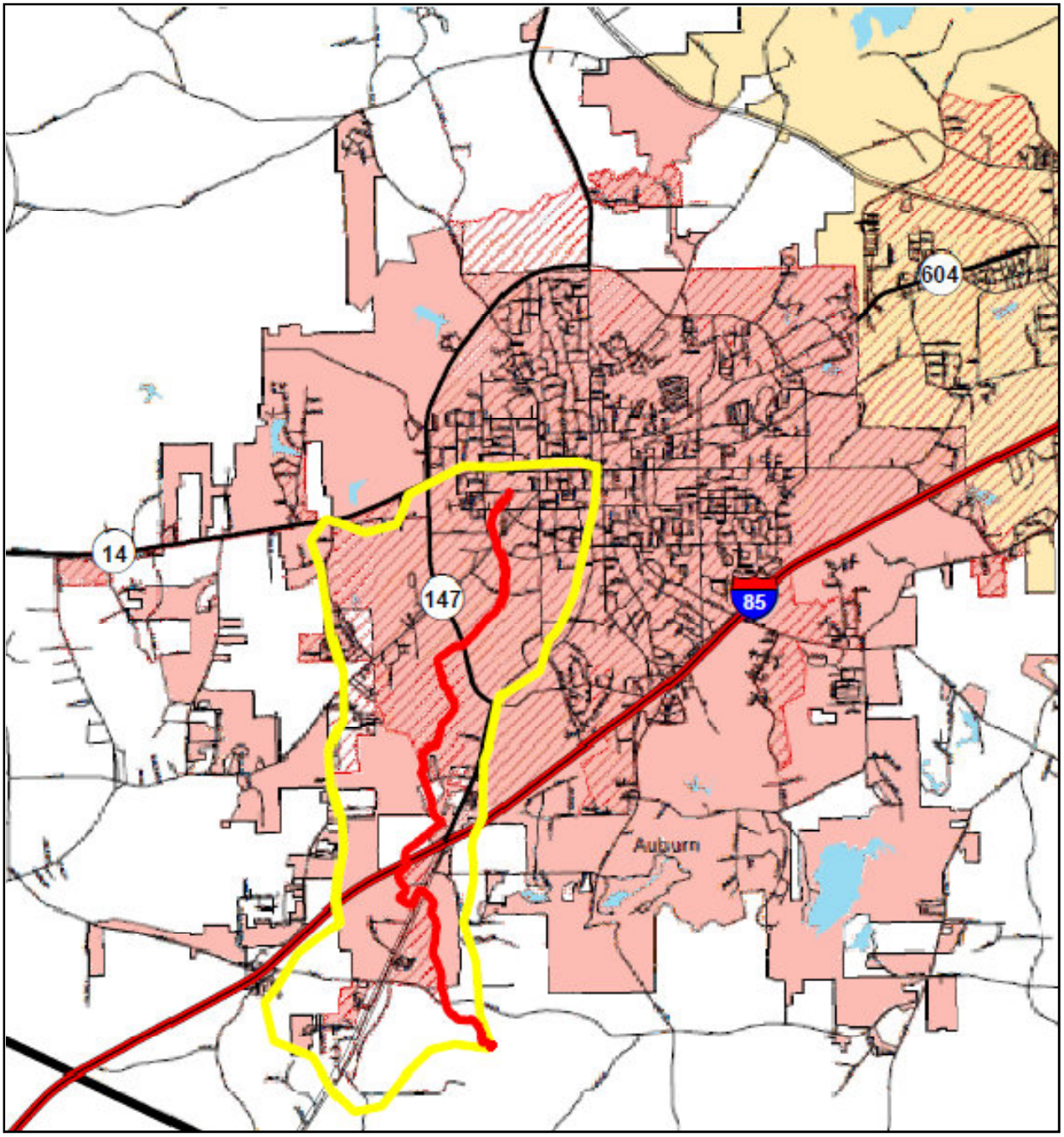
implement a stormwater management program (SWMP) to reduce the contamination of stormwater runoff and prohibit illicit discharges.

An MS4 is a conveyance or system of conveyances that is:

- Owned by a state, city, town, village, or other public entity that discharges to waters of the U.S.;
- Designed or used to collect or convey stormwater (including storm drains, pipes, ditches, etc.);
- Not a combined sewer; and
- Not part of a Publicly Owned Treatment Works (sewage treatment plant).

Please reference the map the following page which illustrates the Auburn urban area and MS4 zoning in relation to the Parkerson Mill impairment and contributing watershed. These are storm water entities as defined by the 2000 census. Two MS4 permits in the Auburn area have been issued: The City of Auburn, and Auburn University. The permit numbers are ALR040003 and ALR040030, respectively.

Figure 10: Map of Auburn Urbanized Area and MS4 zoning



3.2.2 Nonpoint Source Assessment

3.2.2.1 Wildlife

Wildlife can also contribute to pathogen impairments, especially where it is plentiful and widespread. The State of Alabama boasts a very diverse river and stream network that also provides plenty of habitats for all kinds of wildlife. For instance, the illustration below shows the density and reach of whitetail deer and feral swine in the state of Alabama and within the Parkerson Mill Creek watershed. Waste from animals such as these, birds, and other creatures can contribute to pathogen impairment. These are generally considered as natural background conditions and do not require a load reduction.

Figure 11: Whitetail Deer Distribution Map

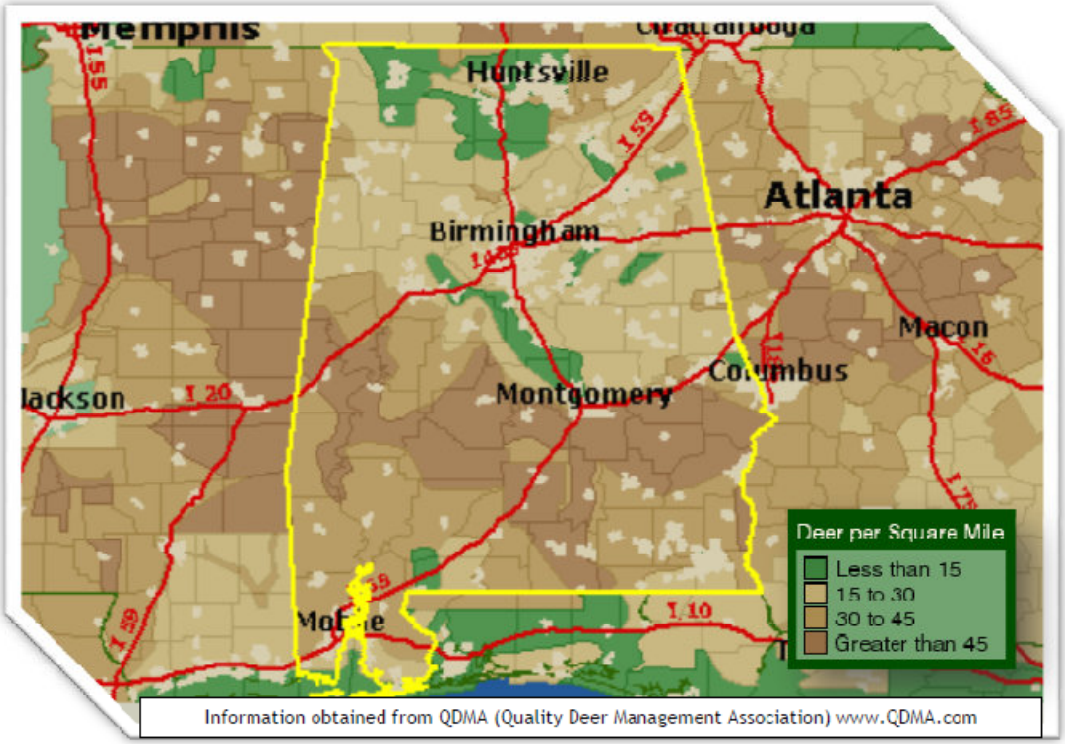


Figure 12: Whitetail Deer Distribution near Parkerson Mill Creek

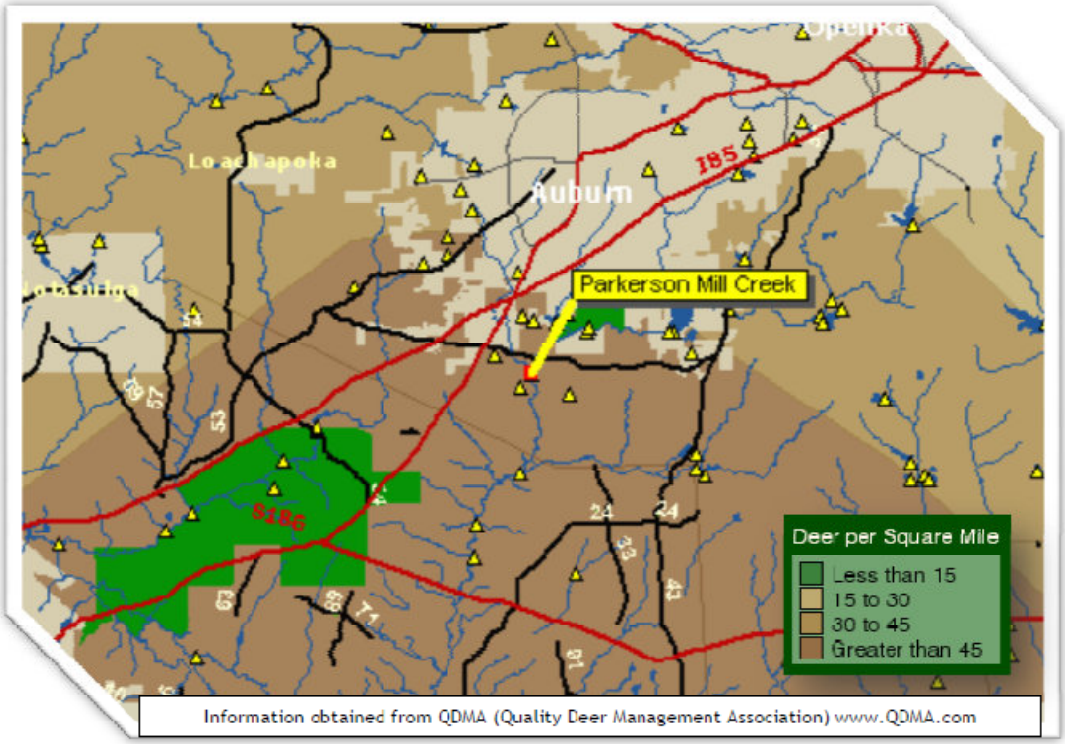


Figure 13: Feral Swine Proliferation Map

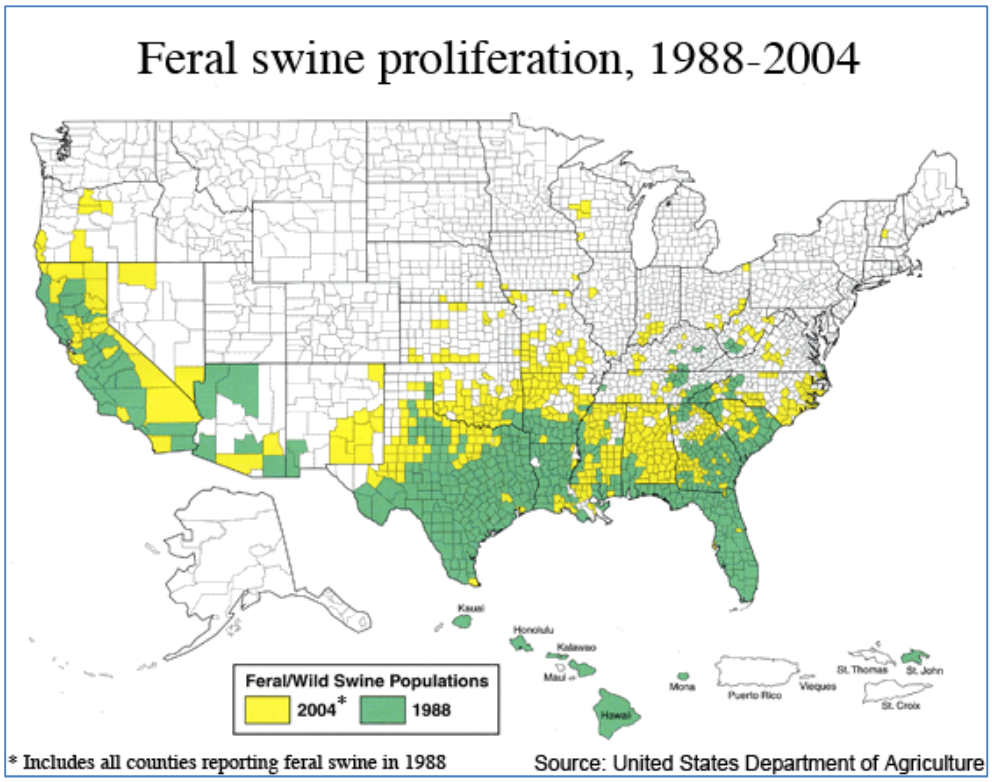
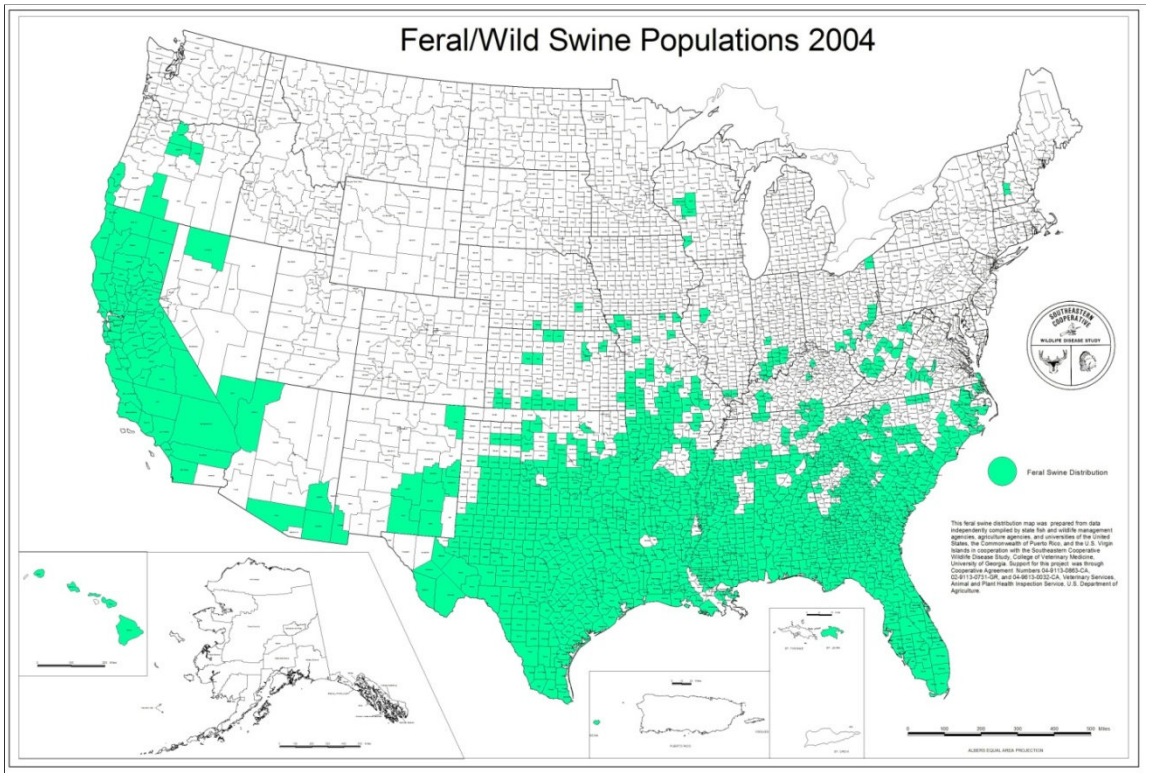


Figure 14: Feral Swine Population Map



3.2.2.2 Agricultural Activities & Domesticated Animals (AFOs, CAFOs, etc.)

Approximately 11% of the watershed's drainage area is categorized as agricultural lands. Though there are no confined animal feeding operations (CAFOs), there are active livestock operations within the Parkerson Mill Creek Watershed. The impact of these operations on water quality can be lessened by limiting the animal's access to the streams and other responsible best management practices (BMPs).

3.2.2.3 Failing Onsite Wastewater Disposal Systems

Onsite wastewater disposal systems can pose a serious threat to water quality if not maintained properly. According to the Lee County Department of Public Health, there is an estimated 1500 to 2000 active septic systems within the Parkerson Mill Creek Watershed. Conservative estimates would predict that approximately 250 of those systems are failing. During rain events, overflows and contaminants are transported to tributaries and eventually to the mainstem within the watershed. (*Parkerson Mill Creek Watershed Management Plan, 2011*)

3.2.2.4 Domestic Pets

Domestic pet animals, such as dogs, cats, and so forth, can also be a large contributor to pathogen impairment. If the waste of these animals is not properly disposed of, it eventually washes into the streams through storm sewers and overland flow. Since the areas near the headwaters and along the stream's path are developed and inhabited, it can be safely assumed that pet waste is a contributing factor to pathogen impairment. Moreover, there are several recreational facilities where pet activities are common.

3.2.3 Land Use Assessment

The following is a graphical illustration of the various types of land use in the Parkerson Mill Creek watershed. These statistics were obtained through GIS data from the National Land Cover Dataset (*NLCD, 2006*). These statistics offer an insight on how land use can impact water quality and potential sources of impairment. This narrows the scope of source assessment greatly. The ungrouped charts are followed by a grouped chart which generalizes the findings.

Table 6: Land Use Percentages

Class Description	Count (30m)	mi²	Acres	Percent
Emergent Herbaceuous Wetlands	37	0.01	8.23	0.13%
Open Water	163	0.06	36.25	0.59%
Woody Wetlands	340	0.12	75.61	1.22%
Herbaceuous	349	0.12	77.62	1.26%
Hay/Pasture	1013	0.35	225.29	3.64%
Developed, High Intensity	1360	0.47	302.46	4.89%
Evergreen Forest	1638	0.57	364.28	5.89%
Shrub/Scrub	1659	0.58	368.95	5.97%
Cultivated Crops	1892	0.66	420.77	6.81%
Mixed Forest	2074	0.72	461.25	7.46%
Deciduous Forest	3335	1.16	741.69	12.00%
Developed, Medium Intensity	3842	1.34	854.44	13.82%
Developed, Low Intensity	4086	1.42	908.71	14.70%
Developed, Open Space	6011	2.09	1336.82	21.62%
TOTALS →	27799	9.66	6182.35	100.00%

11 Open Water
12 Perennial Ice/Snow
21 Developed, Open Space
22 Developed, Low Intensity
23 Developed, Medium Intensity
24 Developed, High Intensity
31 Barren Land
41 Deciduous Forest
42 Evergreen Forest
43 Mixed Forest
51 Dwarf Scrub*
52 Shrub/ Scrub
71 Grassland/ Herbaceous
72 Sedge/ Herbaceous *
74 Moss *
81 Pasture Hay
82 Cultivated Crops
90 Woody Wetlands
95 Emergent Herbaceous Wetlands
* Alaska Only

Figure 15: Land Use by Percent Coverage

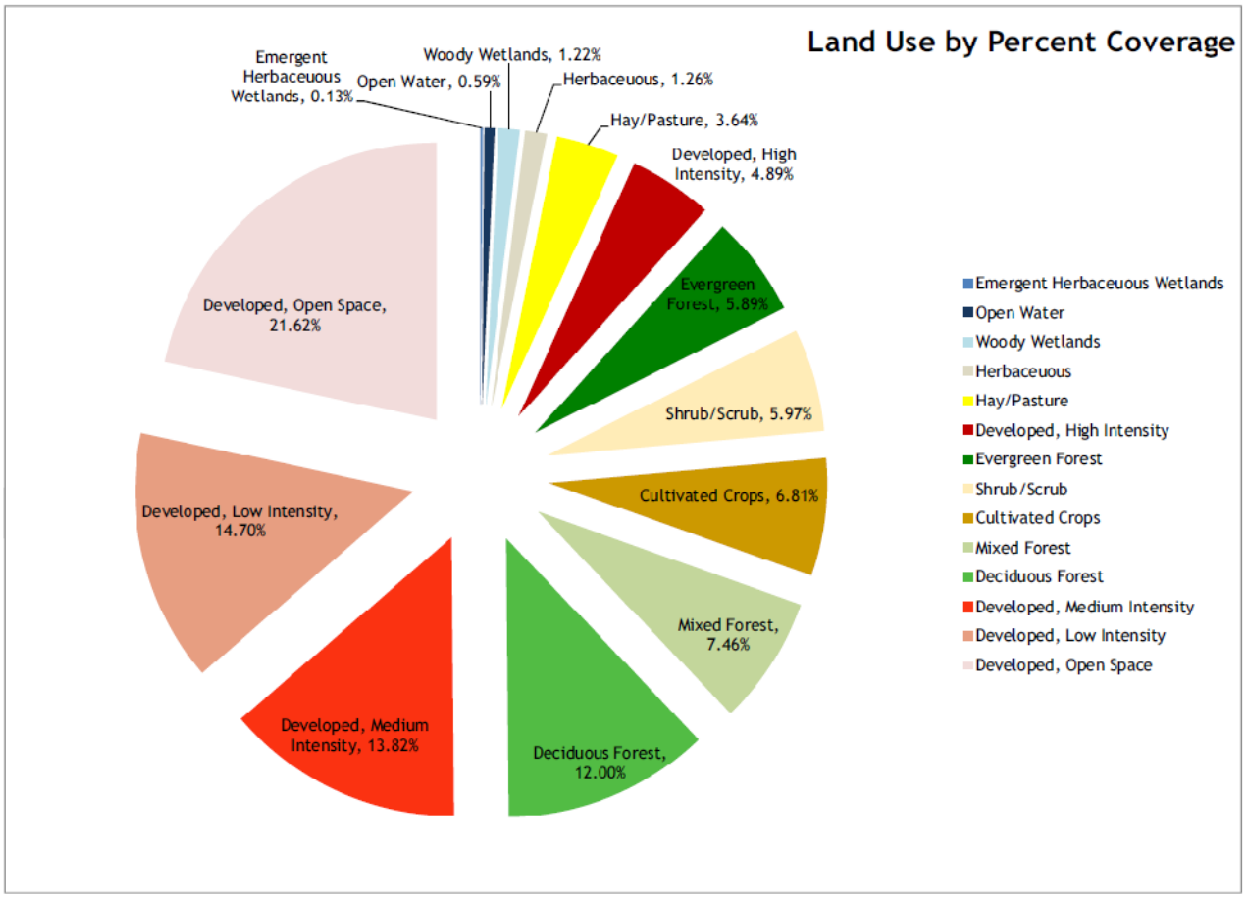


Table 7: Grouped Land Use Percentages

Class Description	Count (30m)	Mi²	Acres	Percent
Open Water	163	0.06	36.25	0.59%
Agricultural Lands	2905	1.01	646.06	10.45%
Forested / Natural	9432	3.28	2097.63	33.93%
Developed Land (Grouped)	15299	5.32	3402.42	55.03%
TOTALS →	27799	9.66	6182.35	100.00%

Figure 16: Grouped Land Use by Percent Coverage

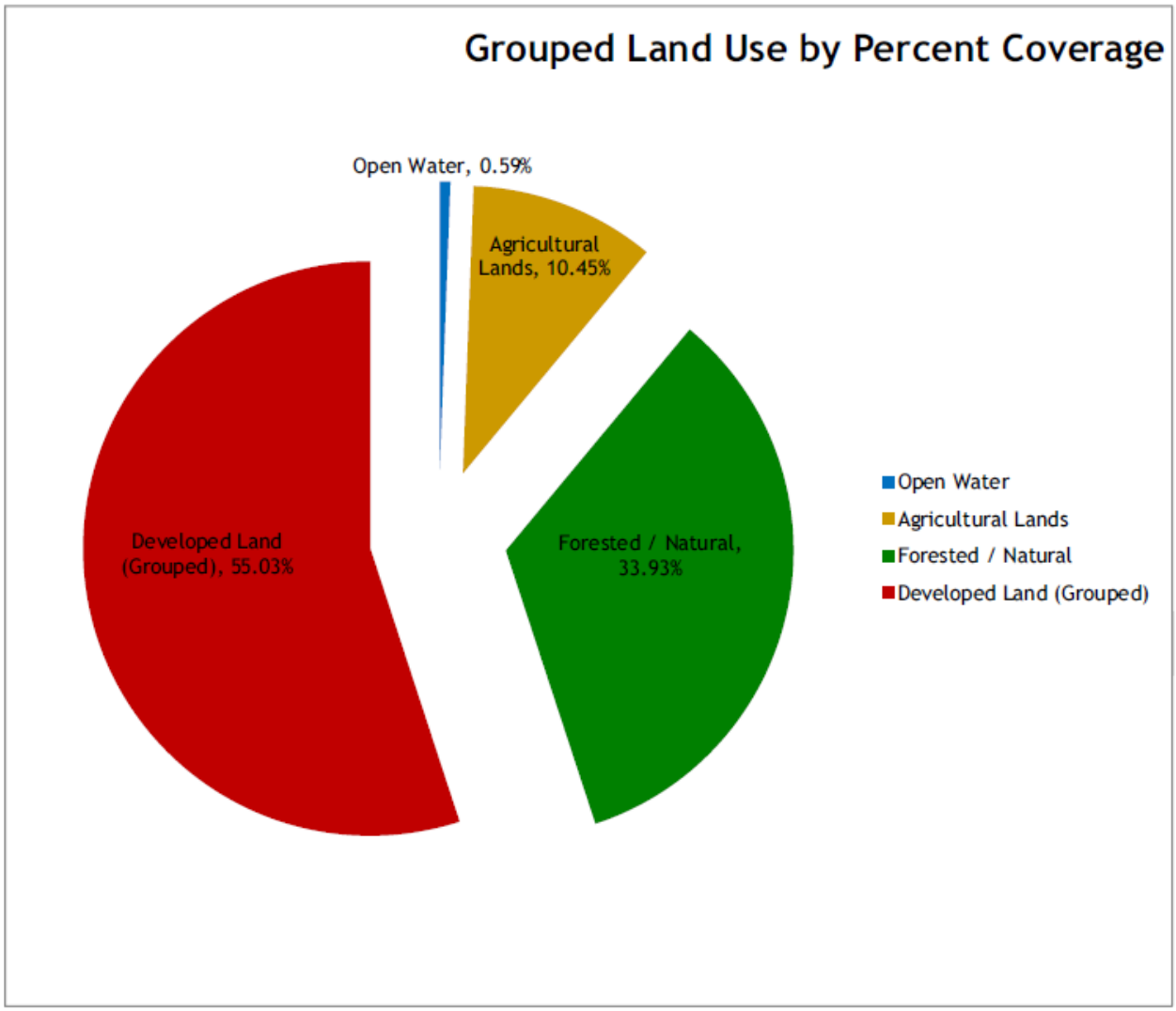
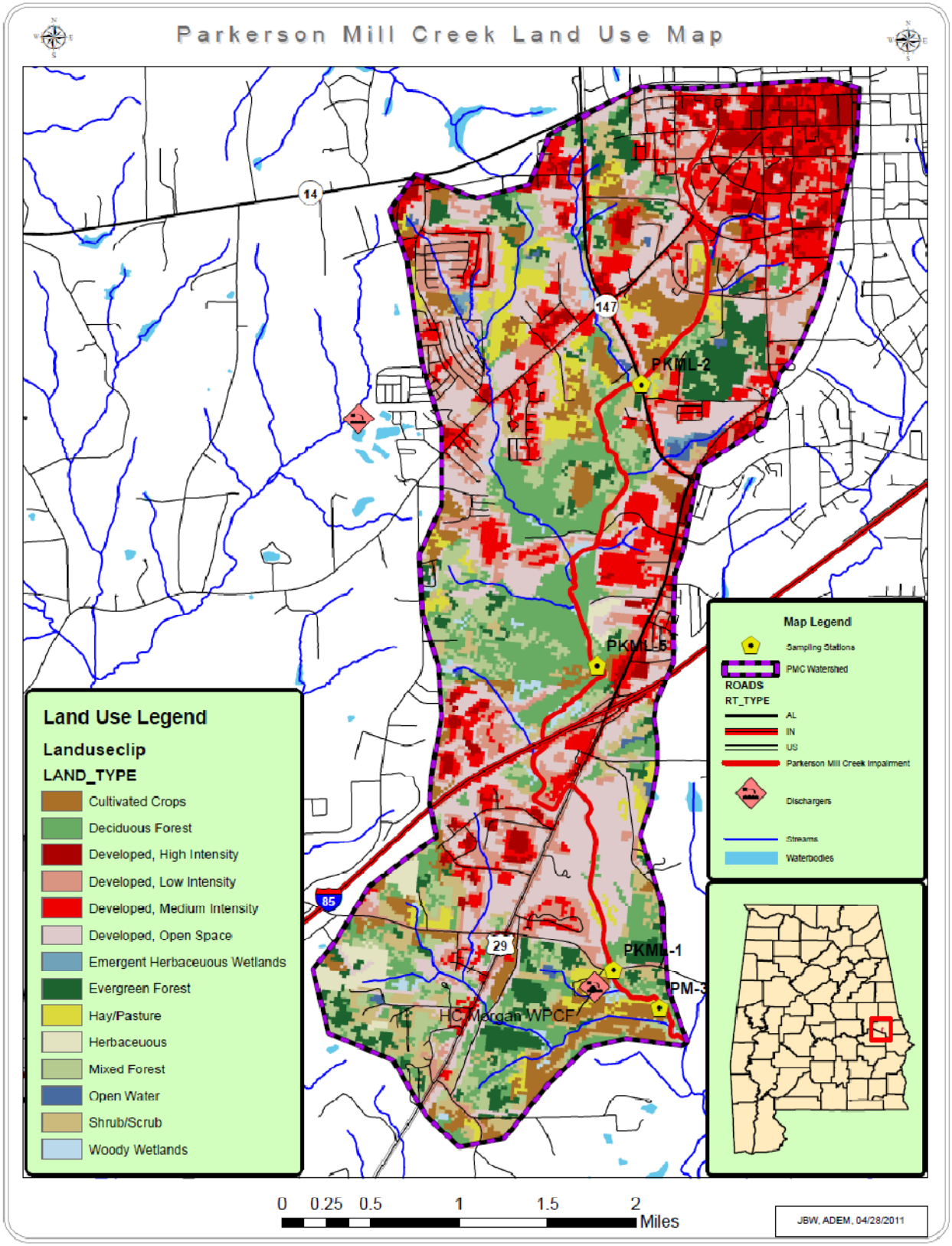


Figure 17: Parkerson Mill Creek Land Use Map

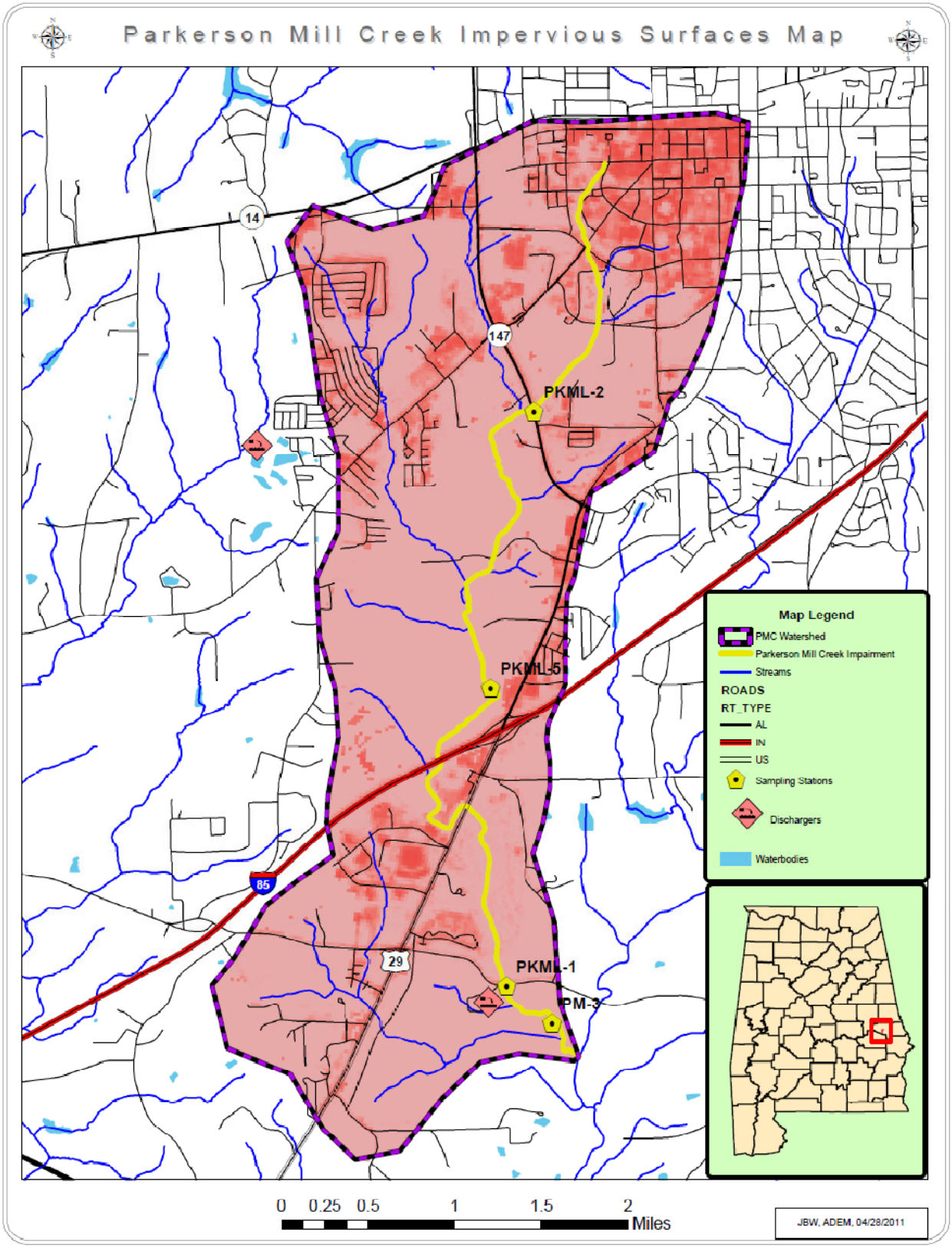


3.2.4 Impervious Surfaces Assessment

Impervious surfaces have become a key indicator of the impact of developed lands on water quality. These surfaces increase runoff velocity and restrict stormwater from permeating the natural soil. The runoff is typically gathered in to storm sewer systems which discharge into lakes and streams, carrying with it any pollutants that are present. From the land use assessment above, the Parkerson Mill Creek watershed is predominantly developed land (approximately 54%). Though not all of developed land is impervious, a large portion of it is.

The map on the following page depicts impervious surfaces (dark red) versus non-impervious surfaces (light pink). The darker the color red, the higher degree and density of impervious surfaces exists. Potential adverse water quality impacts can be reduced through engineering design of stormwater systems, best management practices, urban forestry and landscaping, and other initiatives.

Figure 18: Impervious Surfaces Map



3.3 Linkage Between Numeric Targets & Sources

3.3.1 Nonpoint Loading Information

The Parkerson Mill Creek watershed has three main land uses, namely urban developed areas, forests, and agricultural lands. Pollutant loadings from forested areas tend to be low due to their filtering capabilities and will be considered as background conditions. The most likely sources of pathogen loadings in the Parkerson Mill Creek watershed are from urban runoff, agricultural land uses, failing septic systems, and illicit discharges. It is not considered a logical approach to calculate individual components for nonpoint source loadings. Hence, there will not be individual loads or reductions calculated for the various nonpoint sources. The loadings and reductions will only be calculated as a single total nonpoint source load and reduction.

3.4 Data Availability & Analysis

3.4.1 Sampling Plan

Figure 19: ALAWADR Project Summary

Project# PRKMLTMDL: General Information

Project Name: CY2010 TMDL PARKERSON MILL CREEK (PATHOGENS)
Project Abbrev: PRKMLTMDL
Project Manager: WILKINS,JASON
Planned Duration: 2010
Start Date: 03/01/2010
Status: NEW PROJECT WITH DEFINED PROJECT PERIOD
Data Usability: DEPARTMENTAL-COLLECTED PROFESSIONAL DATA
Created By: JWILKINS
Purpose/Objective: To collect and verify data necessary to support information contained within the pathogen TMDL for Parkerson Mill Creek.

Program Information

Program Name
TOTAL MAXIMUM DAILY LOAD DEVELOPMENT

Personnel Information

Citation Information

Station Information

Station ID	Locale Name	COUNTY	Station Type	Ecoregion
PKML-1	Parkerson Mill Ck	LEE, AL	RIVER/STREAM	65I
PKML-2	Parkerson Mill Ck	LEE, AL	RIVER/STREAM	65I
PKML-5	Parkerson Mill Ck	LEE, AL	RIVER/STREAM	65I
PM-3	Parkerson Mill Ck	LEE, AL	RIVER/STREAM	65I

3.4.2 ALAWADR Station Information

Table 8: ALAWADR Stations Associated with Project

Station_ID	Locale_Nam	UT	Latitude	Longitude	Station_Ty	Location_D
CHWL-7	Chewacla Ck	N	32.53592	-85.4965	River/Stream	Chewacla Cr at Lee CR 010.
PKML-1	Parkerson Mill Ck	N	32.53744	-85.50601	River/Stream	Parkerson Mill Cr at Lee CR 010.
PKML-2	Parkerson Mill Ck	N	32.58551	-85.50249	River/Stream	Parkerson Mill Cr at Shug Jordan Park
PKML-3	Parkerson Mill Ck	N	32.5989	-85.49683	River/Stream	Parkerson Mill Cr at West Samford Av
PM-1	Parkerson Mill Ck	N	32.537111	-85.506222	River/Stream	
PM-1A	Parkerson Mill Ck	N	32.535583	-85.505167	River/Stream	
PM-3	Parkerson Mill Ck	N	32.534278	-85.501556	River/Stream	

*PKML-5 Lat: 32.562425, Long:-85.50716 Added (Parkerson Mill Creek @ Veteran's PKWY)

Figure 20: Sampling Parameters

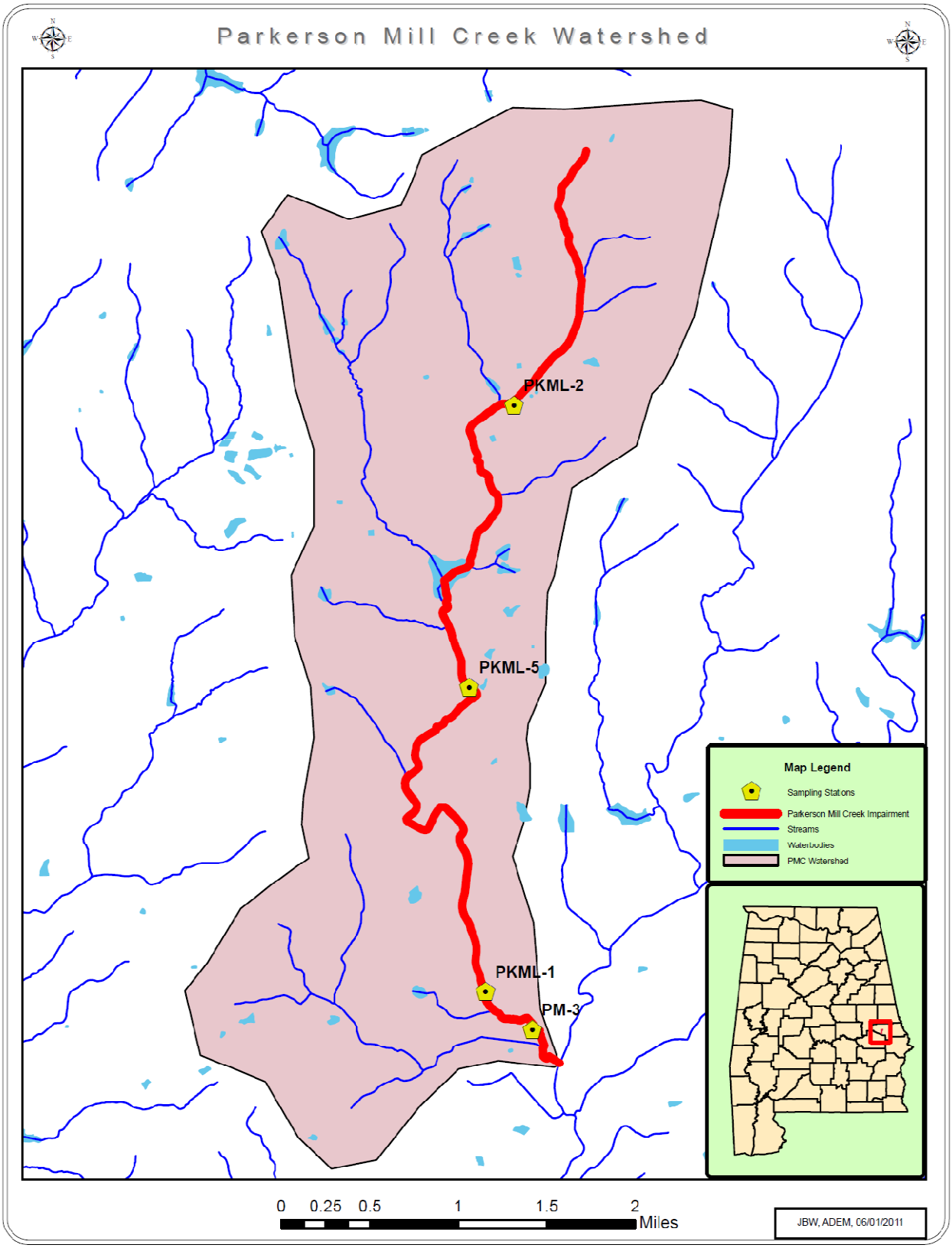
Station PKLM-2:
- Field Parameters
- Flow
- E-Coli
- Intensive E-Coli
- Habitat Assessment

Station PKLM-X:
- Field Parameters
- Flow
- E-Coli
- Intensive E-Coli
- Habitat Assessment

Station PKLM-1:
- Field Parameters
- Flow
- E-Coli
- Intensive E-Coli
- Habitat Assessment

Station PM-3:
- Field Parameters
- E-Coli
- Intensive E-Coli
- Habitat Assessment

Figure 21: Parkerson Mill Creek Sampling Station Map



3.4.3 Data Acquisition and Results

Following its listing in 2007, a §303(d) sampling study was performed by ADEM on the listed segment of Parkerson Mill Creek for additional water quality assessment. ADEM collected samples from several different surface water quality stations, including stations along the entire length of the impairment. It should be noted that this segment was originally listed while fecal coliform was the indicator bacteria used for Alabama's listing methodology. Since that time, *E. coli* has been adopted as the bacteriological indicator of choice. Consequently, the load reductions within this TMDL are entirely based on the *E. coli* criteria and data, though the fecal coliform data was also scrutinized in order to formulate the most practical and effective way to implement this TMDL. Further review of the general water quality and intensive *E. coli* study revealed that the listed segment of Parkerson Mill Creek was still not meeting the pathogen criterion applicable to its most stringent use classification (F&W). Each station was carefully examined and the data compiled to identify specific areas of impairment and possible sources. All stations with the exception of station PKML-1 (just upstream of H.C. Morgan WWTP) had both geomean and single sample exceedances. Therefore, a TMDL has been developed for the listed segment of Parkerson Mill Creek specific to the data collected and any other pertinent information available.

Station PKML-2, the closest station to the actual headwaters of Parkerson Mill Creek (Parkerson Mill Creek @ AL HWY 147), had 2 single sample exceedances and one geomean exceedance for the same date range listed for PKML-1.

Station PKML-5 (Parkerson Mill Creek @ Veteran's PKWY) showed one single sample exceedance and two geomean exceedances. This is approximately the midpoint of the impaired segment and marks a noticeable transition between a predominantly urban landscape, and a more agricultural and forest-dominated landscape.

Station PKML-1, located just upstream of H.C. Morgan WPCF, had no exceedances during the intensive *E. coli* study during August 2010. This includes 15 samples ranging from 04/07/2010 to 11/22/2010. Additional fecal coliform data was analyzed along the City of Auburn's side-by-side data, and both showed similar findings.

Finally, Station PM-3 lies just downstream of the H.C. Morgan WPCF prior to the confluence of Parkerson Mill Creek with Chewacla Creek. This station also showed a total of two geomean exceedances and one single sample exceedance.

Please see the "Appendices" section of this report for complete datasets containing the corresponding numeric information to the summary above.

3.5 Critical Conditions

3.5.1 Site-specific Flow Regime

This small upland stream is typical for the area. However, being that its headwaters are located in a densely populated and urbanized setting, flow patterns are heavily impacted by storm events which result in large amounts of urban runoff. It is generally a slow flowing (≤ 1.5 ft/s) stream with low turbidity and average water temperatures.

3.5.2 Climatic Conditions

The local climatic conditions during the intensive study were typical of the Southeast – hot, humid days with relatively little rainfall usually occurring late in the afternoon. There was a total rainfall of 2.76 inches over a total of 13 storm events. A large part of this accumulated rainfall can be attributed to an event on August 2nd, 2010 (~1.3”). See the weather summary below for more information:

Figure 22: Historical Weather Data (Aug 2010)

History for Auburn, AL
Month of August, 2010 — View Current Conditions
Month of August, 2010

« Previous Month | August 1 2010 View | Next Month »

Daily | Weekly | Monthly | Custom

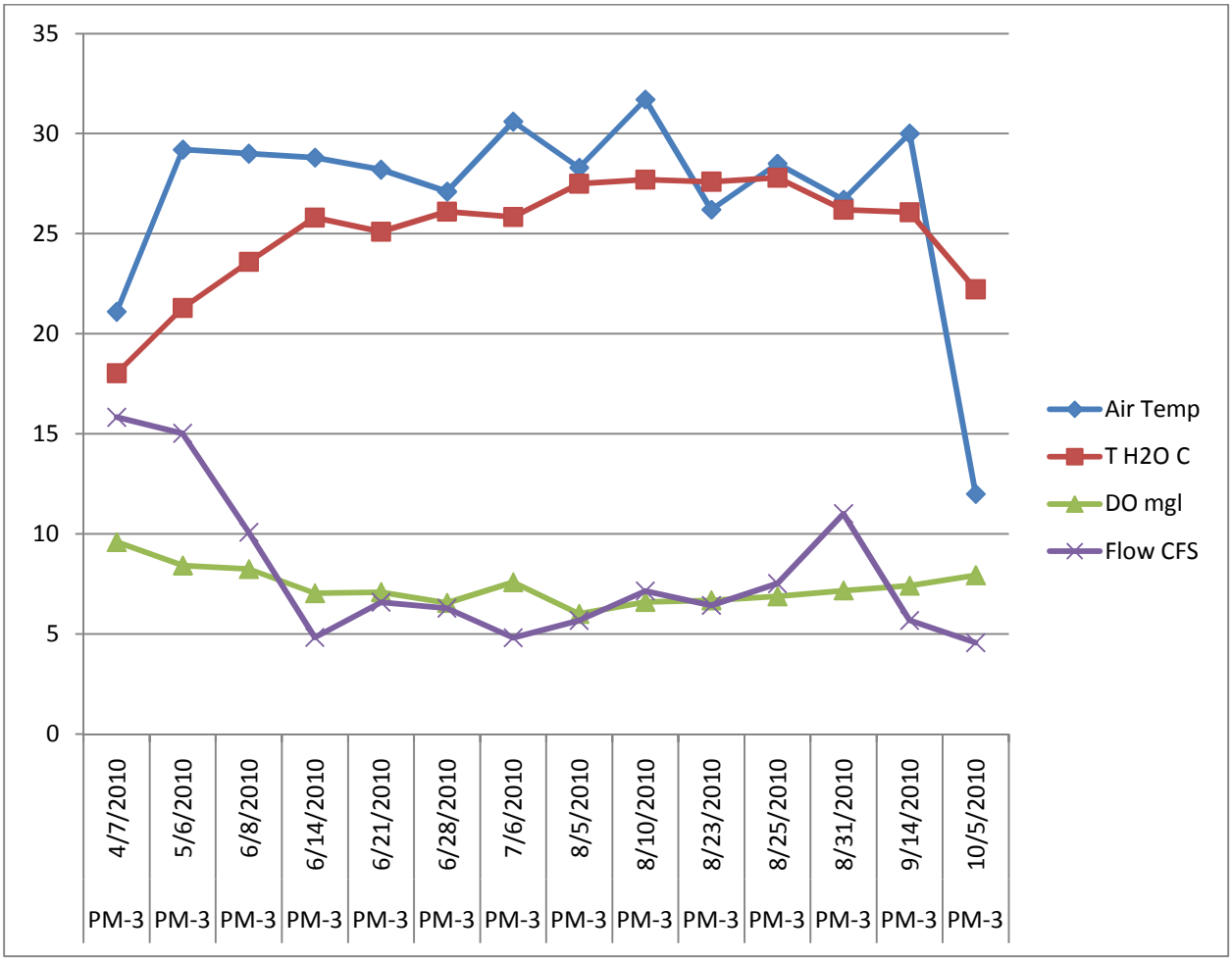
	Max	Avg	Min	Sum
Temperature				
Max Temperature	99 °F	92 °F	81 °F	
Mean Temperature	87 °F	83 °F	77 °F	
Min Temperature	77 °F	74 °F	70 °F	
Degree Days				
Heating Degree Days (base 65)	0	0	0	0
Cooling Degree Days (base 65)	22	18	12	565
Growing Degree Days (base 50)	36	33	26	1009
Dew Point				
Dew Point	79 °F	71 °F	59 °F	
Precipitation				
Precipitation	1.29 in	0.09 in	0.00 in	2.76 in

*Courtesy of http://www.wunderground.com

3.5.3 Critical Periods & Seasonal Variability

For the Southeast, including Alabama, the most critical time periods with respect to water quality and stream health occur during the hot, dry months. Typically, this is primarily the summer months of June through September. During these months, flow dissipates due to lack of precipitation and increase in temperature. This, in turn, results in a reduction in assimilative capacity of water bodies (less water = less medium for pollutants to dilute in). Moreover, water quality parameters such as dissolved oxygen are much more susceptible to reaching dangerous levels during these critical periods. As an illustration, the charts below display data from the station where the highest exceedance occurred (PM-3). It is clearly visible that the most critical periods (low flow, low DO, high temps, etc.) are during the summer.

Figure 23: Graph of Water Quality Data (April 2010 - October 2010)



3.5.4 Conditions During Data Collection

The previous sections gives a general description during the data collection period. No upset conditions or unusual circumstances were reported.

3.6 Margin of Safety

3.6.1 Implicit vs. Explicit MOS

There are two methods for incorporating a Margin of Safety (MOS) in the TMDL analysis: implicitly incorporate the MOS using conservative model assumptions to develop allocations, or 2) by explicitly specifying a portion of the TMDL as the MOS and using the remainder for allocations.

Both an explicit and implicit MOS were incorporated into this TMDL. The MOS accounts for the uncertainty associated with the limited availability of E. coli data used in this analysis. An explicit MOS was applied to the TMDL by reducing the E. coli target geometric mean criterion concentration by ten percent and calculating a mass loading target with measured flow data. The single sample maximum value of 126 colonies/100 mL was reduced by 10% to 113.4 colonies/100 mL. An implicit MOS was also incorporated in the TMDL by basing the existing condition on the highest measured E. coli concentration that was collected during critical conditions and using conservative assumptions in all calculations.

4.0 TMDL Development

4.1 TMDL Definition & Equations

A total maximum daily load (TMDL) is the sum of individual wasteload allocations for point sources (WLAs), load allocations (LAs) for nonpoint sources including natural background levels, and a margin of safety (MOS). The margin of safety can be included either explicitly or implicitly and accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. As discussed earlier, the MOS is explicit in this TMDL. A TMDL can be denoted by the equation:

$$\mathbf{TMDL = \Sigma\ WLAs + \Sigma\ LAs + MOS}$$

The TMDL is the total amount of pollutant that can be assimilated by the receiving waterbody while achieving water quality standards under critical conditions. For some pollutants, TMDLs are expressed on a mass loading basis (e.g. pounds per day). However, for pathogens, TMDL loads are typically expressed in terms of organism counts per day (colonies/day), in accordance with 40 CFR 130.2(i).

4.2 Load Calculations

A mass balance approach was used to calculate the *E. coli* pathogen TMDL for Parkerson Mill Creek. The mass balance approach utilizes the conservation of mass principle. Total mass loads can be calculated by multiplying the *E. coli* concentration and the estimated in-stream flow by one another. The existing load was calculated for the violation in August 2010 that gave the highest percent reduction. This violation was a geomean exceedance. In the same manner, the allowable load was calculated for the geomean criterion of 113.4 colonies/100 mL. Although there were multiple single-sample and geometric mean violations in 2010, the TMDL was based on the highest calculated *E. coli* load percent reduction to protect all applicable water quality standards.

4.2.1 Existing Load Conditions

The geomean mass loading was calculated by multiplying the *E. coli* geomean exceedance concentration of 294.42 colonies/100 mL by the average measured flow of 1.11 cfs. This concentration was calculated based on measurements at station PM-3 in August of 2010 (when the intensive *E. coli* samples were taken). The product of these two values multiplied by the standard conversion factor yields the total mass loading (colonies per day) of *E. coli* to Parkerson Mill Creek based on the highest geomean exceedance.

$$\frac{1.11\,\text{ft}^3}{\text{s}} \times \frac{294.42\ \text{colonies}}{100\,\text{mL}} \times \frac{24465755\quad 100\,\text{mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{8.00 \times 10^{09}\ \text{colonies}}{\text{day}}$$

4.2.2 Allowable Load Concentrations

The allowable load of pathogens to the watershed was calculated under the same physical conditions as discussed above for the geomean criterion. This is done by taking the product of the estimated flow and the allowable concentration and multiplying it by the conversion factor yielding the allowable load.

For the geomean criterion of 113.4 colonies/100 mL, the allowable *E. coli* loading is:

$$\frac{1.11\ \text{ft}^3}{\text{s}} \times \frac{113.4\ \text{colonies}}{100\,\text{mL}} \times \frac{24465755\quad 100\,\text{mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{3.08 \times 10^{9}\ \text{colonies}}{\text{day}}$$

The explicit margin of safety of 12.6 colonies/100 mL equals an allowable daily loading of:

$$\frac{1.11\,\text{ft}^3}{\text{s}} \times \frac{12.6\,\text{colonies}}{100\,\text{mL}} \times \frac{24465755 \quad 100\,\text{mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{3.42 \times 10^8\ \text{colonies}}{\text{day}}$$

The WLA portion of this TMDL was calculated by multiplying the design flow (currently 9.0 MGD – permit for 11.25 MGD on draft) of H.C. Morgan WPCF by the instream *E. coli* geomean criteria for the summer months (June-September) of 126 colonies/100 mL. This value was then multiplied by a conversion factor to come up with the appropriate loading. This calculation results in a loading of:

$$9.0 MGD \times \frac{1.55\,\text{ft}^3}{\text{s} * MGD} \times \frac{126\,\text{colonies}}{100\,\text{mL}} \times \frac{24465755 \quad 100\,\text{mL} * \text{s}}{\text{ft}^3 * \text{day}} = \frac{4.30 \times 10^8\ \text{colonies}}{\text{day}}$$

4.2.3 Required Load Reductions

The difference in the pathogen loading between the existing condition (violation event) and the allowable condition converted to a percent reduction represents the total load reduction needed to achieve the *E. coli* water quality criterion. The TMDL was calculated as the total daily *E. coli* load to Parkerson Mill Creek as evaluated at station PM-3. The following table shows the result of the *E. coli* TMDL and percent reduction based on the geomean criterion.

Table 9: *E. coli* Load Reduction Requirements

Source	Existing Load (colonies/day)	Allowable Load (colonies/day)	Required Reduction (colonies/day)	% Reduction
Nonpoint Source Load Geometric Mean	8.00E+09	3.08 E+09	4.92E+09	61%
Point Source Load[a]	4.44E+08	6.83E+09	0	0%

a. PS loads and load reductions based on current permit limits of Fecal coliform as well as a design flow of 9.0 MGD for HC Morgan WPCF. Therefore, units are actually fecal coliform colonies/day vs. Escherichia coli colonies/day as in the NPS load reductions. Based on these figures, one can conclude that no reductions are necessary to achieve appropriate pathogen loading for the permitted facility.

Note that the Allowable load was derived from the fecal coliform limits within the most recent NPDES permit (Daily Maximum 2000 colonies / 100 mL). Likewise, the "Existing Load Point Source Load" was calculated using the daily maximum reports on the August DMR (130 col/100 mL).

From the above table, compliance with the geomean criterion maximum of 126 colonies/100 mL requires a reduction in the *E. coli* load of 61%. The TMDL, WLA, LA and MOS values necessary to achieve the applicable *E. coli* criterion are provided in the table below.

Table 10*: E. coli* Pathogen TMDL Summary for Parkerson Mill Creek

TMDL[e]	Margin of Safety (MOS)	Waste Load Allocation (WLA)[a]			Load Allocation (LA)	
		WWTPs[b]	MS4s[c]	Leaking Collection Systems[d]		
(col/day)	(col/day)	(col/day)	(% reduction)	(col/day)	(col/day)	(% reduction)
3.42E+09	3.42E+08	4.30E+08	61%	0	2.65E+09	61%

a. There are no CAFOs in the Parkerson Mill Creek watershed. Future CAFOs will be assigned WLA of zero.
b. WLAs for WWTPs are expressed as a daily maximum. Future WWTPs must meet the applicable in-stream water quality criteria for *E. coli* at the point of discharge.
c. Future MS4 areas would be required to demonstrate consistency with the assumptions and requirements of this TMDL.
d. The objective for leaking collection systems is a WLA of zero. It is recognized, however, that a WLA of 0 colonies/day may not be practical. For these sources, the WLA is interpreted to mean a reduction in *E. coli* loading to the maximum extent practicable, consistent with the requirement that these sources not contribute to a violation of the water quality criteria *for E. coli*.
e. TMDL was established using the geomean criterion of 126 colonies/100ml.

Figure 24: Load Calculations Worksheet

Load Calculations Worksheet

Geomean Criteria Exceedance	294.42 col/100 ml						
Flow (instream PMC)	1.11 cfs						
Exisiting loads							
	1.11	294.42	24465755	100	8.00E+09		
		100					
Allowable Loading							
Geomean	1.11	113.4	24465755	100	3.08E+09		
		100					
MOS	1.11	12.6	24465755	100	3.42E+08		
		100				Reduction	4.92E+09
HC Morgan Geomean	9	1.55	126	24465755	4.30E+08		
E. coli			100			%-Change	61.48%
HC Morgan (Permitted)	9	1.55	2000	24465755	6.83E+09		
FECAL COLIFORM			100				
Actual (Daily Max, AUG 2010)	9	1.55	130	24465755	4.44E+08		
FECAL COLIFORM			100				
				WLA	4.30E+08		
				LA	2.65E+09	=TMDL - WLA - MOS	
				MOS	3.42E+08		
				TMDL (Check)	3.42E+09	=Σ WLA, LA, MOS	
TMDL (Calculated from Criteria)	1.11	126	24465755	100	3.42E+09		
		100					

4.3 TMDL Summary

Parkerson Mill Creek was originally placed on Alabama's §303(d) List of Impaired Waterbodies for pathogens in 2008. The listing was based exclusively on an intensive fecal coliform study performed in 2007 by ADEM. Potential sources of the impairment were listed as sanitary sewer overflows (SSOs) and urban runoff.

Subsequent intensive sampling in 2010 warranted a TMDL after Parkerson Mill Creek failed to meet water quality standards pursuant to the F&W use classification. The highest exceedance was used to result in the largest reduction in loading. In this case it was determined that the highest percent reduction was a geometric mean (geomean) violation of 294.42 colonies/100 mL calculated from values measured during an intensive pathogen study in August 2010 at station PM-3. This station is located just prior to the confluence of Parkerson Mill Creek and Chewacla Creek. As a result, this violation calls for a pathogen load reduction of 61%. There were also three

other geomean violations and four single sample violations, but these resulted in less stringent reductions and will have no bearing in this TMDL document. In the same manner as existing loads were calculated, an allowable load was calculated for the single sample E. coli criterion of 113.4 colonies/100 mL (126 colonies/100 mL – 10% Margin of Safety).

Compliance with the terms and conditions of existing and future NPDES sanitary and stormwater permits will effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL. Required load reductions in the LA portion of this TMDL can be implemented through voluntary measures and may be eligible for CWA §319 grants.

The Department recognizes that adaptive implementation of this TMDL will be needed to achieve applicable water quality criteria, and we are committed towards targeting the load reductions to improve water quality in the Parkerson Mill Creek watershed. As additional data and/or information become available, it may become necessary to revise and/or modify the TMDL accordingly.

5.0 Follow-up Monitoring

ADEM has adopted a basin approach to water quality management; an approach that divides Alabama's fourteen major river basins into five groups. Each year, ADEM's water quality resources are concentrated in one of the five basin groups. One goal is to continue to monitor §303(d) listed waters. Monitoring will help further characterize water quality conditions resulting from the implementation of best management practices in the watershed. This monitoring will occur in each basin according the schedule shown in the table below.

Table 11: Surface Water Quality Monitoring Schedule

River Basin Group	Year to be Monitored
Escatawpa / Mobile / Lower Tombigbee / Upper Tombigbee	2011
Black Warrior/Cahaba	2012
Chattahoochee / Chipola / Choctawhatchee / Perdido-Escambia	2013
Tennessee	2014
Alabama / Coosa / Tallapoosa	2015

6.0 Public Participation

As part of the public participation process, this TMDL will be placed on public notice and made available for review and comment. The public notice will be prepared and published in the four major daily newspapers in Montgomery, Huntsville, Birmingham, and Mobile, as well as submitted to persons who have requested to be on ADEM's postal and electronic mailing distributions. In addition, the public notice and subject TMDL will be made available on ADEM's Website: www.adem.state.al.us. The public can also request paper or electronic copies of the TMDL by contacting Mr. Chris Johnson at 334-271-7827 or cljohnson@adem.state.al.us. The public will be given an opportunity to review the TMDL and submit comments to the Department in writing. At the end of the public review period, all written comments received during the public notice period will become part of the administrative record. ADEM will consider all comments received by the public prior to final completion of this TMDL and subsequent submission to EPA Region 4 for final approval.

7.0 Appendices

7.1 References & Acknowledgements

- H.C. Morgan WPCF
- Alabama Water Watch
- Alabama Clean Water Partnership
- Auburn University
- City of Auburn
- Jess Roberts, ACES
- Tallapoosa Clean Water Partnership
- Parkerson Mill Creek Watershed Management Plan

ADEM Administrative Code, 2010. Water Division - Water Quality Program, Chapter 335-6-10, Water Quality Criteria.

ADEM Administrative Code, 2010. Water Division - Water Quality Program, Chapter 335-6-11, Use Classifications for Interstate and Intrastate Waters.

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Alabama Department of Environmental Management, 2008 §303(d) List and Fact Sheet. ADEM.

Alabama Department of Environmental Management (ADEM) Laboratory QA Manual, Chapter 5, Table 5-2: ADEM Laboratory Qualifier Codes and, June 13, 2005.

United States Environmental Protection Agency, 1991. Guidance for Water Quality-Based Decisions: The TMDL Process. Office of Water. EPA 440/4-91-001.

United States Environmental Protection Agency, 1986. Quality Criteria for Water. Office of Water. EPA 440/4-91-001.

7.2 Water Quality Dataset

7.2.1 ADEM E. Coli Data by Station

Table 12: *E. coli* Data (PKML-1)

Station ID	Activity Date	E Coli	GeoMean
PKML-1	4/7/2010	108.6	
PKML-1	5/6/2010	275.5	
PKML-1	6/8/2010	153.9	
PKML-1	6/14/2010	123.6	
PKML-1	6/21/2010	195.6	**107.9**
PKML-1	6/28/2010	150	
PKML-1	7/6/2010	26.2	
PKML-1	8/5/2010	67	
PKML-1	8/10/2010	21.3	
PKML-1	8/23/2010	12.2	**34.049**
PKML-1	8/25/2010	29.8	
PKML-1	8/31/2010	88.2	
PKML-1	9/14/2010	1	
PKML-1	10/5/2010	23.1	
PKML-1	11/22/2010	14.5	

= Exceedance

* No exceedances in given timeframe

Table 13: *E. coli* Data (PKML-2)

Station ID	Activity Date	E Coli	GeoMean
PKML-2	4/7/2010	686.7	
PKML-2	5/6/2010	172.2	
PKML-2	6/8/2010	517.2	
PKML-2	6/14/2010	290.9	
PKML-2	6/21/2010	488.4	**289.5**
PKML-2	6/28/2010	172.2	
PKML-2	7/6/2010	160.7	
PKML-2	8/5/2010	90.9	
PKML-2	8/10/2010	59.4	
PKML-2	8/25/2010	131.4	
PKML-2	8/31/2010	69.1	
PKML-2	9/14/2010	137.6	
PKML-2	10/5/2010	228.2	
PKML-2	11/22/2010	160.7	

= Exceedance

* 2 single sample & 1 geomean exceedances in given timeframe

Table 14: *E. coli* Data (PKML-5)

Station ID	Activity Date	E Coli	GeoMean
PKML-5	4/7/2010	118.7	
PKML-5	5/6/2010	165.8	
PKML-5	6/8/2010	214.3	
PKML-5	6/14/2010	178.9	
PKML-5	6/21/2010	325.5	197.54
PKML-5	6/28/2010	150	
PKML-5	7/6/2010	160.7	
PKML-5	8/5/2010	131.4	
PKML-5	8/10/2010	579.4	
PKML-5	8/23/2010	75.9	147.68
PKML-5	8/25/2010	65.7	
PKML-5	8/31/2010	185	
PKML-5	9/14/2010	34.5	
PKML-5	10/5/2010	93.3	
PKML-5	11/22/2010	58.3	

= Exceedance

* 1 single sample & 2 geomean exceedances in given timeframe

Table 15: *E. coli* Data (PM-3)

Station ID	Activity Date	E Coli	GeoMean
PM-3	4/7/2010	93.3	
PM-3	5/6/2010	166.4	
PM-3	6/8/2010	133.4	
PM-3	6/14/2010	131.7	
PM-3	6/21/2010	387.3	175.15
PM-3	6/28/2010	178.9	
PM-3	7/6/2010	135.4	
PM-3	8/5/2010	190.4	
PM-3	8/10/2010	290.9	
PM-3	8/23/2010	488.4	294.42
PM-3	8/25/2010	261.3	
PM-3	8/31/2010	313	
PM-3	9/14/2010	435.2	
PM-3	10/5/2010	290.9	
PM-3	11/22/2010	270	

= Exceedance

* 1 single sample & 2 geomean exceedances in given timeframe

7.2.2 City of Auburn E. coli Data

Table 16: City of Auburn *E. coli* Data

E-Coli						
Date	**PKML-2**	**PKML-5**	**PKML-1**	**PM3**	**HC**	
4/7/10	727.0	144.0	90.0	108.0		
5/6/10	180.0	180.0	216.0	162.0		
6/8/10	636.0	153.0	108.0	144.0		Geom. Mean Study #1
6/14/10	290.0	350.0	210.0	153.0		
6/21/10	320.0	455.0	131.0	455.0		
6/28/10	91.0	171.0	63.0	144.0		
7/6/10	180.0	135.0	72.0	270.0		
8/3/10	5000.0	2000.0	1182.0	1000.0		
8/5/10	273.0	117.0	45.0	545.0		Geom. Mean Study #2
8/10/10	36.0	380.0	9.0	250.0		
8/23/10	90.0	117.0	45.0	350.0	36.0	
8/25/10	315.0	162.0	1273.0	1182.0	72.0	
8/31/10	182.0	1000.0	300.0	364.0	90.0	
9/14/10	108.0	9.0	9.0	364.0	126.0	
10/5/10	364.0	240.0	9.0	144.0	18.0	

Table 17: City of Auburn Geomean Data (Study #1)

Geometric Mean Study #1				
	PKML-2	**PKML-5**	**PKML-1**	**PM3**
6/8/10	636	153	108	144
6/14/10	290	350	210	153
6/21/10	320	455	131	455
6/28/10	91	171	63	144
7/6/10	180	135	72	270
Geom. Mean	**249.50**	**223.88**	**106.15**	**208.05**
State WQ Criteria	126	126	126	126

Table 18: City of Auburn Geomean Data (Study #2)

Geometric Mean Study #2 (City)				
	PKML-2	**PKML-5**	**PKML-1**	**PM3**
8/5/10	273	117	45	545
8/10/10	36	380	9	250
8/23/10	90	117	45	350
8/25/10	315	162	1273	1182
8/31/10	182	1000	300	364
Geom. Mean	**138.36**	**242.74**	**93.01**	**459.65**
State WQ Criteria	126	126	126	126

7.2.3 Water Quality Parameters

Table 19: Water Quality Parameters

Station ID	Activity Date	T H2O C	Flow CFS	pH_SU	Turb NTU	DO mgl
PKML-1	4/7/2010	17.94	3.678	7.86	4.32	9.56
PKML-1	5/6/2010	21.34	4.5437	7.75	23	8.76
PKML-1	6/8/2010	23.83	2.086	7.88	5.84	8.62
PKML-1	6/14/2010	26.8	1.732	7.97	5.03	6.05
PKML-1	6/21/2010	25.3	3.547	7.9	14.2	7.2
PKML-1	6/28/2010	25.9	2.03	8.11	11.7	6.8
PKML-1	7/6/2010	25.31	1.04	7.85	2.61	8.03
PKML-1	8/5/2010	26.3	0.525	7.7	6.7	6.3
PKML-1	8/10/2010	26.5	0.157	7.5	3	6
PKML-1	8/23/2010	25.7	0.306	7.58	3.23	6.59
PKML-1	8/25/2010	25.3	0.1	7.44	2.23	5.50
PKML-1	8/31/2010	24.2	1.325	7.91	6.49	8.06
PKML-1	9/14/2010	22.41		7.13	2.22	7.87
PKML-1	10/5/2010	14.84		7.32	2.73	9.89
PKML-1	11/22/2010	14.88	1.2982	7.59	2.51	10.65
PKML-2	4/7/2010	17.52	1.131	7.85	2.7	9.87
PKML-2	5/6/2010		0.8962		2.7	
PKML-2	6/8/2010	22.04	0.741	7.07	1.04	0.04
PKML-2	6/14/2010	25.1	0.521	7.91	2.27	5.32
PKML-2	6/21/2010	24.7	0.725	7.78	16.6	5.66
PKML-2	6/28/2010	25.2	0.526	7.94	26.2	6.25
PKML-2	7/6/2010	24.39		7.71	2.41	0.34
PKML-2	8/5/2010	25.9	0.096	7.9	4	6.3
PKML-2	8/10/2010	25.9	0.113	7.9	2.8	6.2
PKML-2	8/25/2010	25	0.137	8.01	7.74	5.22
PKML-2	8/31/2010	23.8	0.668	7.85	4.6	6.52
PKML-2	9/14/2010	22.59		7.8	1.54	8.22
PKML-2	10/5/2010	14.09		7.64	3.64	9.78
PKML-2	11/22/2010	14.44		7.3	4.55	9.72

Table 20: Water Quality Parameters (Continued)

Station ID	Activity Date	T H2O C	Flow CFS	pH_SU	Turb NTU	DO mgl
PKML-5	4/7/2010	17.61	3.811	7.6	4.6	10.3
PKML-5	5/6/2010	20.92	3.5741	7.35	5.93	8.54
PKML-5	6/8/2010	23.17	2.538	7.57	5.55	8.48
PKML-5	6/14/2010	25.7	1.227	7.79	5.03	6.79
PKML-5	6/21/2010	25	4.027	7.55	12.6	6.61
PKML-5	6/28/2010	26.3	1.68	7.66	11.7	6.01
PKML-5	7/6/2010	24.64	1.05	7.57	1.99	7.62
PKML-5	8/5/2010	26	0.437	7.6	5	5.6
PKML-5	8/10/2010	26.1	0.274	7.7	3.6	5.2
PKML-5	8/23/2010	26	0.651	7.56	3.11	5.14
PKML-5	8/25/2010	25.5	0.241	7.6	3.51	5.01
PKML-5	8/31/2010	23.9	0.922	7.6	5.27	5.87
PKML-5	9/14/2010	23.21	0.1294	7.5	1.62	7.3
PKML-5	10/5/2010	14.75	0.758	7.2	2.42	9.27
PKML-5	11/22/2010	14.26	0.253	7.12	3.1	9.82
PM-3	4/7/2010	18.03	15.826	7.3	3.15	9.59
PM-3	5/6/2010	21.29	15.024	7.27	11.8	8.42
PM-3	6/8/2010	23.59	10.081	7.31	8.12	8.24
PM-3	6/14/2010	25.8	4.832	7.53	3.92	7.03
PM-3	6/21/2010	25.1	6.588	7.24	11.8	7.09
PM-3	6/28/2010	26.1	6.288	7.68	2.89	6.55
PM-3	7/6/2010	25.84	4.814	7.53	3.1	7.58
PM-3	8/5/2010	27.5	5.671	7.15	3	6
PM-3	8/10/2010	27.7	7.15	7.1	4	6.6
PM-3	8/23/2010	27.6	6.422	7.38	2.3	6.68
PM-3	8/25/2010	27.8	7.518	7.53	2.27	6.88
PM-3	8/31/2010	26.2	11.01	7.57	4.64	7.17
PM-3	9/14/2010	26.07	5.6762	7.39	2.39	7.41
PM-3	10/5/2010	22.2	4.564	7.18	2.16	7.93
PM-3	11/22/2010	19.96		7.32	2.01	8.86

7.3 Supporting Photographs

Table 21: Site Visit Picture Location Information

FID	Lat	Long	Location Desc.	Pic Num
0	32.55254	-85.50968	PMC @ 29 U/S	131
1	32.55254	-85.50968	PMC @ 29 D/S	132
2	32.536201	-85.505600	HC Morgan Outfall E.O.P.	133
3	32.536201	-85.505600	HC Morgan Outfall U/S	134
4	32.536201	-85.505600	HC Morgan Outfall D/S	135
5	32.53764	-85.50627	PMC @ CR10 U/S	136
6	32.53764	-85.50627	PMC @ CR10 D/S	137
7	32.532806	-85.500358	PMC Just U/S of Confluence with Chewacla Ck	139
8	32.532806	-85.500358	PMC Just D/S of Confluence with Chewacla Ck	140
9	32.553537	-85.511041	RV Park	141
10	32.553537	-85.511041	RV Park	142
11	32.56258	-85.50715	PKML-5 U/S (PMC @ Veteran's PKWY)	143
12	32.56258	-85.50715	PKML-5 D/S (PMC @ Veteran's PKWY)	144
13	32.57278	-85.50694	PMC @ Longleaf Dr. U/S	145
14	32.57278	-85.50694	PMC @ Longleaf Dr. D/S	146
15	32.582439	-85.501176	Swine Unit (AU)	147
16	32.58158	-85.50073	Pasture / Cows	148
17	32.58577	-85.5026	PMC @ Shug Jordan PWY U/S	149
18	32.58577	-85.5026	PMC @ Shug Jordan PWY U/S	150
19	32.589741	-85.504374	Agricultural Research Centers	151
20	32.598882	-85.49689	PMC @ Samford Ave. U/S	152
21	32.598882	-85.49689	PMC @ Samford Ave. D/S	153
22	32.60241	-85.49465	AU Campus C-zone	154
23	32.60561	-85.49157	AU Parking Areas	155
24	32.60645	-85.49393	Apartment Complexes	156
25	32.60561	-85.49071	AU Parking Areas	157
26	32.60577	-85.48959	AU Campus (Magolia @ Donahue)	158
27	32.60225	-85.49119	AU Campus (Nr. Coliseum)	159
28	32.60103	-85.49047	AU Campus (Nr Stadium)	160
29	32.59933	-85.49217	AU Campus (Nr. Coliseum)	161
30	32.59744	-85.49044	AU Campus (Donahue @ Samford)	162
31	32.59538	-85.49155	AU Poultry Science Unit	163

Picture 1: PMC near Confluence with Chewacla Creek

Picture 2: PMC near Confluence with Chewacla Creek

Picture 3: PMC @ AL HWY 29 U/S

Picture 4: PMC @ AL HWY 29 D/S

Picture 5: PMC @ Samford Avenue U/S

Picture 6: PMC @ Samford Avenue D/S

Picture 7: H.C. Morgan Outfall

Picture 8: Cattle in Pasture

Picture 9: Auburn University Campus

Picture 10: Auburn University Parking

7.4 Flow Estimates

Table 22: DMR & Stream Flow Estimates (Aug 2010)

HC Morgan WPCF DMR Data		
Date Range	**Effluent Flow (MGD)**	**Effluent Flow (cfs)**
Aug 2010 Monthly AVG	4.168	6.45
ADEM Flow Data		
Date Range	**Total Stream Flow (cfs)**	**Natural Stream Flow* (cfs)**
Aug 2010 Monthly AVG	7.55	1.11

*Natural Stream Flow was calculated by subtracting the gross effluent monthly average from H.C. Morgan's DMR data from the average of the ADEM-measured flows @ station PM-3. The date range used matches that of the geomean exceedance on which the percent reductions for the TMDL are based.

7.5 DMR Data

Daily Monitoring Report (DMR) data for H.C. Morgan WPCF was queried from ADEM's database for the date range in question. The data was found to be representative of typical values during that particular time of the year. H.C. Morgan was in compliance with their permitted effluent levels during the time of the study.

Figure 25: Aug 2010 DMR Report p.1

Alabama Department of Environmental Management Discharge Monitoring Report *(DMR)*

PERMITTEE NAME: City Of Auburn
MAILING ADDRESS: 1501 West Samford Ave. Auburn, AL 36832
FACILITY: Auburn City Of H C Morgan Wpcf
LOCATION: 616 Sandhill Road Auburn, AL 36830

PERMIT NUMBER: AL0050237
MONITORING POINT: 0012
MONITORING PERIOD:
YY | MM | DD — YY | MM | DD
From: 10 08 01 **To:** 10 8 31

MAJOR
COUNTY: Lee
PROGRAM: Municipal
*** NO DISCHARGE [ ] ***
NOTE: Read instructions before completing this form.

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
		Average	Maximum		Minimum	Average	Maximum				
STREAM FLOW, INSTANTANEOUS	Sample Measurement	*****	*****	*****	1.2	*****	*****	Z2 cfs	0	Week Days	Measured
Parameter Code: 00061 Stage Code: R R - SEE COMMENTS BELOW	Permit Requirement	*****	*****		3.1 minimum daily	*****	*****			Week Days	Measured
OXYGEN, DISSOLVED (DO)	Sample Measurement	*****	*****	*****	7.85	*****	*****	19 mg/l	0	5X Weekly	Grab
Parameter Code: 00300 Stage Code: 1 EFFLUENT GROSS VALUE	Permit Requirement	*****	*****		6.0 minimum daily	*****	*****			5X Weekly	Grab
PH	Sample Measurement	*****	*****	*****	6.87	*****	7.45	12 S.U.	0	5X Weekly	Grab
Parameter Code: 00400 Stage Code: 1 EFFLUENT GROSS VALUE	Permit Requirement	*****	*****		6.0 minimum daily	*****	8.5 maximum daily			5X Weekly	Grab
SOLIDS, TOTAL SUSPENDED	Sample Measurement	7751.4	9119.9	26 lbs/day	*****	202.0	225.4	19 mg/l	0	5X Weekly	24-Hr Composite
Parameter Code: 00530 Stage Code: G RAW SEW/INFLUENT	Permit Requirement	report monthly average	report weekly average		*****	report monthly average	report weekly average			5X Weekly	24-Hr Composite
SOLIDS, TOTAL SUSPENDED	Sample Measurement	46.8	57.0	26 lbs/day	*****	1.3	1.7	19 mg/l	0	5X Weekly	24-Hr Composite
Parameter Code: 00530 Stage Code: 1 EFFLUENT GROSS VALUE	Permit Requirement	2251 monthly average	3377 weekly average		*****	30.0 monthly average	45.0 weekly average			5X Weekly	24-Hr Composite
NITROGEN, AMMONIA TOTAL (AS N)	Sample Measurement	3.5	3.7	26 lbs/day	*****	0.1	0.1	19 mg/l	0	5X Weekly	24-Hr Composite
Parameter Code: 00610 Stage Code: 1 EFFLUENT GROSS VALUE	Permit Requirement	150 monthly average	225 weekly average		*****	2.0 monthly average	3.0 weekly average			5X Weekly	24-Hr Composite
NITROGEN, KJELDAHL TOTAL (AS N)	Sample Measurement	30.2	36.8	26 lbs/day	*****	0.9	1.1	19 mg/l	0	5X Weekly	24-Hr Composite
Parameter Code: 00625 Stage Code: 1 EFFLUENT GROSS VALUE	Permit Requirement	300 monthly average	450 weekly average		*****	4.0 monthly average	6.0 weekly average			5X Weekly	24-Hr Composite

Figure 26: Aug 2010 DMR Report p.2

Alabama Department of Environmental Management Discharge Monitoring Report *(DMR)*

PERMITTEE NAME: City Of Auburn
MAILING ADDRESS: 1501 West Samford Ave. Auburn, AL 36832
FACILITY: Auburn City Of H C Morgan Wpcf
LOCATION: 616 Sandhill Road Auburn, AL 36830

PERMIT NUMBER: AL0050237
MONITORING POINT: 0012
MONITORING PERIOD:
YY | MM | DD — YY | MM | DD
From: 10 08 01 **To:** 10 8 31

MAJOR
COUNTY: Lee
PROGRAM: Municipal
*** NO DISCHARGE [ ] ***
NOTE: Read instructions before completing this form.

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
		Average	Maximum		Minimum	Average	Maximum				
NITRITE PLUS NITRATE TOTAL 1 DET. (AS N)	Sample Measurement	291.3	291.3	26 lbs/day	*****	8.8	8.8	19 mg/l	0	Monthly	24-Hr Composite
Parameter Code: 00630 Stage Code: 1 EFFLUENT GROSS VALUE	Permit Requirement	report monthly average	report weekly average		*****	report monthly average	report weekly average			Monthly	24-Hr Composite
PHOSPHORUS, TOTAL (AS P)	Sample Measurement	5.9	5.9	26 lbs/day	*****	0.18	0.18	19 mg/l	0	Monthly	24-Hr Composite
Parameter Code: 00665 Stage Code: 1 EFFLUENT GROSS VALUE	Permit Requirement	report monthly average	report weekly average		*****	report monthly average	report weekly average			Monthly	24-Hr Composite
ZINC TOTAL RECOVERABLE	Sample Measurement	*****	*****	*****	*****	63.0	63.0	28 ug/l	0	Monthly	24-Hr Composite
Parameter Code: 01094 Stage Code: 1 EFFLUENT GROSS VALUE	Permit Requirement	*****	*****		*****	report monthly average	report weekly average			Monthly	24-Hr Composite
FLOW, IN CONDUIT OR THRU TREATMENT PLANT	Sample Measurement	4.168	4.647	03 MGD	*****	*****	*****	*****	0	Daily	Continuous
Parameter Code: 50050 Stage Code: 1 EFFLUENT GROSS VALUE	Permit Requirement	report monthly average	report maximum daily		*****	*****	*****			Daily	Continuous
CHLORINE, TOTAL RESIDUAL	Sample Measurement	*****	*****	*****	*****	*****	NODI=b	19 mg/l	0	5X Weekly	Grab
Parameter Code: 50060 Stage Code: 1 EFFLUENT GROSS VALUE	Permit Requirement	*****	*****		*****	*****	0.01 maximum daily			5X Weekly	Grab
COLIFORM, FECAL GENERAL	Sample Measurement	*****	*****	*****	*****	11	130	13 col/100 mL	0	5X Weekly	Grab
Parameter Code: 74055 Stage Code: 1 EFFLUENT GROSS VALUE	Permit Requirement	*****	*****		*****	200 max monthly	2000 maximum daily			5X Weekly	Grab
BOD, CARBONACEOUS 05 DAY, 20C	Sample Measurement	4265.5	5213.7	26 lbs/day	*****	111.1	128.4	19 mg/l	0	5X Weekly	24-Hr Composite
Parameter Code: 80082 Stage Code: G RAW SEW/INFLUENT	Permit Requirement	report monthly average	report weekly average		*****	report monthly average	report weekly average			5X Weekly	24-Hr Composite

Figure 27: Aug 2010 DMR Report p.3

Alabama Department of Environmental Management Discharge Monitoring Report *(DMR)*

PERMITTEE NAME: City Of Auburn
MAILING ADDRESS: 1501 West Samford Ave. Auburn, AL 36832
FACILITY: Auburn City Of H C Morgan Wpcf
LOCATION: 616 Sandhill Road Auburn, AL 36830

PERMIT NUMBER: AL0050237
MONITORING POINT: 0012
MONITORING PERIOD:
YY | MM | DD — From: 10 08 01 — To: YY | MM | DD: 10 8 31

MAJOR
COUNTY: Lee
PROGRAM: Municipal
*** **NO DISCHARGE** [ ] ***
NOTE: Read instructions before completing this form.

Parameter		Quantity or Loading Average	Quantity or Loading Maximum	Units	Quality or Concentration Minimum	Quality or Concentration Average	Quality or Concentration Maximum	Units	No. Ex.	Frequency of Analysis	Sample Type
BOD, CARBONACEOUS 05 DAY, 20C	Sample Measurement	69.8	74.3	26 lbs/day	*****	2.00	2.00	19 mg/l	0	5X Weekly	24-Hr Composite
Parameter Code: 80082 Stage Code: 1 EFFLUENT GROSS VALUE	Permit Requirement	900 monthly average	1351 weekly average		*****	12.0 monthly average	18.0 weekly average			5X Weekly	24-Hr Composite
BOD, CARB-5 DAY, 20 DEG C, PERCENT REMVL	Sample Measurement	*****	*****	*****	98.4	*****	*****	23 %	0	Monthly	Calculated
Parameter Code: 80091 Stage Code: K PERCENTREMOVAL	Permit Requirement	*****	*****		85.0 monthly average	*****	*****			Monthly	Calculated
SOLIDS, SUSPENDED PERCENT REMOVAL	Sample Measurement	*****	*****	*****	99.4	*****	*****	23 %	0	Monthly	Grab
Parameter Code: 81011 Stage Code: K PERCENTREMOVAL	Permit Requirement	*****	*****		85.0 monthly average	*****	*****			Monthly	Grab
	Sample Measurement										
	Permit Requirement										
	Sample Measurement										
	Permit Requirement										
	Sample Measurement										
	Permit Requirement										
	Sample Measurement										
	Permit Requirement										

7.6 Other Supporting Information

Figure 28: SSO Report Aug 2010

SSO Reports

Reports Between 08/01/2010 and 08/31/2010

County Name *Lee*

Facility Name: H C Morgan WPCF **Permit Number:** AL0050237 **FacilityType:** Major Mun **ADEM Area:** Torbert

Caller	Caller Phone #	Oral Report Date and Time	Overflow Date and Time	Written Report Date	Volume SSO	Length of SSO	Location SSO	Destination SSO	Cause SSO	Corrective Actions Taken	Others Notified
		8/19/2010 4:49 PM	8/19/2010 12:25 PM		400	1.25 hrs.	210 So. Donahue Drive	UT Parkerson Mill Creek	Blocked line	Remove blockage	
		8/23/2010 8:37 AM	8/21/2010 11:00 AM	8/26/2010	<1,000	30 mins.	Wooded lot by 423 Hare Ave.	UT Town Creek	Grease	Used high power pressure machine to clear line	