

An aerial photograph of Big Creek Lake and its surrounding watershed. The lake is a large, dark blue body of water with several smaller, irregularly shaped islands and peninsulas. The surrounding land is a mix of green, brown, and tan, indicating a mix of forest, agriculture, and developed areas. The text "Big Creek Lake" is overlaid in large, white, sans-serif font at the top left.

Big Creek Lake

Watershed Management Plan

April 2008

Big Creek Lake Watershed Management Plan

April 2008



MAWSS provides safe drinking water and sanitary sewer service for more than 265,000 people in the Mobile metropolitan area. The source of drinking water is the J.B. Converse Reservoir, better known as Big Creek Lake which is located in the western part of Mobile County. The 3,600 acre reservoir, completed in 1952, holds 17 billion gallons and is continually fed by groundwater, streams and rainfall. Built to supply Mobile with water for future generations, it provides an abundant and enviable supply of quality water for Mobile and surrounding communities. MAWSS has an alternative source of water in the Burton S. Butler River System which currently provides raw water for industrial use.



Founded in 1993, the Alabama Coastal Foundation has provided 15 years of innovative outreach programs with participation across the spectrum of socio-economic groups. ACF distinguishes itself among environmental protection advocates because of its goal to seek common ground among government, business/industry and citizens through the acknowledged need to maintain a balance between the conservation of our natural resources and the need for economic growth.

Executive Summary

Background and Purpose

This management plan was developed to serve as a planning and management tool for local decision-makers. The purpose of this document is to provide a summary of existing and potential environmental concerns in the Big Creek Lake Watershed and to provide a strategy to encourage, sustain and improve environmental quality and prevent additional degradation to the watershed associated with existing and rapidly changing land uses and other pressures.

To solicit input for the development of this plan, the Big Creek Lake Resource Alliance was formed as a communication link between MAWSS, local businesses and community stakeholders. The Big Creek Lake Resource Alliance held a series of community meetings to listen and present issues of concern and to solicit additional local input. The purpose of these meetings was to explain non-point source pollution, discuss the need for a watershed management plan, and discuss perceived problems and threats in the watershed.

The recommendations in this plan are based on comments and discussions presented during community meetings that were held throughout 2006. The scientific recommendations are based on water quality data, land use/cover information, and best judgment from professionals representing Mobile Area Water and Sewer System (MAWSS), the United States Geological Service (USGS), the Natural Resources Conservation Service (NRCS), the Alabama Department of Environmental Management (ADEM) and the Mobile Bay National Estuary Program (MBNEP).

The watershed project is a dynamic process. This document has gone through technical and citizen review but continually remains “in draft form” due to the ever constant alterations to our land. The watershed project will update this plan as often as feasible to ensure the plan does not become outdated.

Vision

The Big Creek Lake Watershed will be a clean and vibrant ecological community with citizens and other stakeholders dedicated to the preservation, protection, and restoration of its vital natural resources.

Mission

The purpose of the Big Creek Lake Watershed Management Project is to develop a feasible management plan for the Big Creek Lake Watershed that can be implemented to protect and improve the natural resources of the Big Creek Lake Watershed while educating MAWSS customers and watershed residents about the importance of the watershed.

The strategy for improving the watershed is based on the following objectives:

Non-Point Source Pollution Objectives

1. To reduce nonpoint source pollution from:
 - a. Agricultural activities, including nurseries.
 - b. Construction
 - c. Land clearing and development activities, including the conversion of agricultural and silvicultural lands to residential and urban uses.
 - d. Unpaved roads located within the boundaries of the watershed.
 - e. Roadside ditches and culverts without detention and silt collection
2. To Decrease/reduce water pollution and siltation from sewage and septic discharges from residential subdivisions and commercial areas.

Monitoring Objectives

1. To identify all research conducted within the watershed that will assist decision makers in policy decisions.
2. To better understand the effects of nutrient runoff from nurseries and other activities by developing a nutrient monitoring program.
3. To determine sources and levels of bacterial contamination.
4. To determine sources of Organic Carbon in the watershed.

Education and Outreach Objectives

1. To make landowners/homeowners aware of their impacts on the watershed, including their recreational impacts including: petroleum products, nutrients, pesticides and litter.
2. To make developers, contractors, business owners and others aware of their impacts on the watershed.
3. To develop and maintain good working relationships with contractors, developers, utility companies, farmers, businesses and homeowners through the Clean Water Partnership, or other avenues.

Land Use and Planning Objectives

1. Promote planning and zoning that will protect ecologically significant areas.
2. To work with Mobile County to develop a priority list of unpaved roads in the watershed that contribute to sedimentation problems

Preservation and Protection Objectives

1. To acquire environmentally significant land in the watershed, including areas to be designated as open space and riparian buffers.
2. Ensure protection of fish and wildlife habitats as well as sensitive habitats such as wetlands, marshes, bogs, grady ponds, long leaf pine flatwoods, and white cedar stands.
3. To preserve family farms and the agricultural/rural heritage of the watershed while protecting water quality.
4. To evaluate and pursue increased public and/or recreational access in the watershed.

Management and Implementation Objectives

1. To keep the efforts of the watershed project ongoing, establish a watershed project coordinator.
2. To establish an organizational committee with representatives from industries and activities in the area as well as MAWSS and local environmental groups
3. Establish an educational center for the community to learn about the watershed resources.
4. Cooperate and develop relationships with local municipalities, government officials, governmental agencies, large landowners and businesses.

TABLE OF CONTENTS

I. INTRODUCTION	
A. Purpose of Plan.....	7
B. Overview of the Report.....	7
II. Watershed Description	
A. Location/Boundary.....	8
B. Climate.....	9
C. Physical and Geographic Features.....	10
D. Soils.....	11
E. Land Use and Population Growth.....	12
F. Economic Development.....	13
G. Hydrology.....	15
III. Existing Pollution Sources	
Pollution Sources.....	15
1. Non-Point Source Pollution.....	15
2. Point Source Pollution.....	17
IV. Environmental Monitoring	
Current Environmental Monitoring.....	17
1. USGS Water Quality Simulated Effects of Urban Land Use.....	17
2. USGS Assessment of Water Conditions in Big Creek Lake.....	17
3. ADEM Fish Tissue Monitoring Program.....	17
4. ADEM Reservoir Water Quality Monitoring Program.....	17
5. Section 303 (d) of the Clean Water Act.....	18
V. Current Management Methods	
A. Non-Regulatory Programs.....	19
1. Incentive Programs.....	19
2. Alabama Non-Point Source Management Program.....	21
3. Private Stewardship.....	21
4. Tax Incentives.....	22
5. ADEM Source Water Protection Plan.....	22
B. Regulatory Programs.....	22
1. National Pollution Discharge Elimination System Program.....	23
2. U.S. Army Corps of Engineers Regulatory Programs.....	23
3. Mobile County Health Department.....	24

4. Mobile County Commission.....	25
5. Coastal Zone Regulations.....	26
6. Coastal Consistency.....	27
7. Clean Water Act §401 Water Quality Certification.....	27
8. Wetland Conservation Provisions (Swampbuster).....	28
9. Clean Water Act.....	28
10. Safe Drinking Water Act.....	28
C. Protective Mechanisms.....	29
1. Low Impact Developments.....	29
2. Zoning.....	29
3. Overlay Districts.....	30
4. Buffers.....	30
5. Open Space Design.....	30

VI. Action Strategies for Protection

Evaluative Criteria.....	31
1. Wastewater and Polluted Runoff.....	33
2. Recreation.....	35
3. Agriculture and Forestry.....	36
4. Construction.....	39
5. Human Health Issues.....	40
6. Wetlands.....	41
7. Management Plan Implementation.....	43

VI. Figures and Tables

A. Tables

1. Table 1 – Land Use.....	45
2. Table 2 – Population.....	45
3. Table 3 – Crop Statistics.....	46
4. Table 4 – 303 (d) Listed Streams.....	47
5. Table 5 – ADEM Water Use Classifications.....	48

B. Figures

1. Figure 1 - Watershed Project Locator.....	49
2. Figure 2 - Watershed Project Boundary.....	50
3. Figure 3 – Hydrologic Unit Codes (HUC).....	51
4. Figure 4 - Existing Land Use.....	52
5. Figure 5 – Growth East of Converse Lake Watershed.....	53
6. Figure 6 – Nurseries.....	54
7. Figure 7 – Monitoring Stations.....	55
8. Figure 8 – Building Developments.....	56
9. Figure 9 – Impervious Cover (Parking Only).....	58

10. Figure 10 – Boat Launch.....	59
11. Figure 11 – Paved Roads.....	60
12. Figure 12 – Unpaved Roads.....	61
13. Figure 13- Categorization of Unpaved Roads.....	62

VII. Appendices

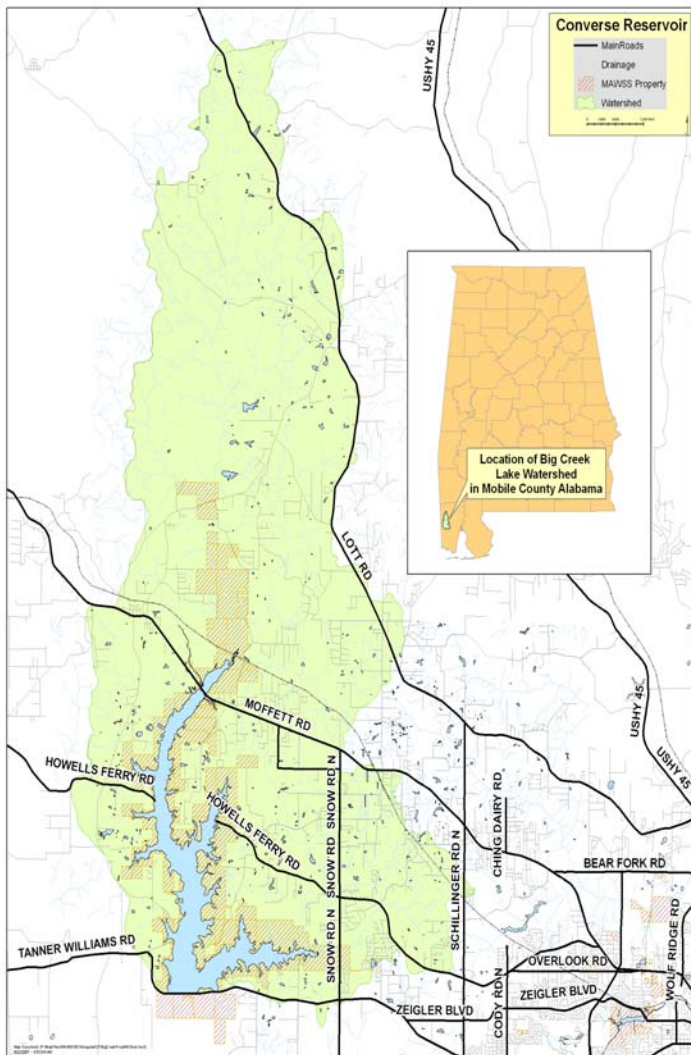
A. Abbreviations and Acronyms.....	64
B. Studies and Research in the Watershed.....	66

Introduction

Purpose of Plan

This management plan was developed to serve as a planning and management tool for local decision-makers and the Commissioners of the Mobile Area Water and Sewer System. The purpose of this document is to provide a summary of existing and potential environmental concerns in the Big Creek Lake Watershed and to provide a strategy to encourage, sustain and improve environmental quality and prevent additional degradation to the watershed associated with existing and rapidly changing land uses and other pressures.

To solicit input for the development of this plan, the Big Creek Lake Resource Alliance was formed as a communication link between MAWSS, local businesses and the community stakeholders. The Big Creek Lake Resource Alliance held a series of community meetings to listen and present issues of concern and to solicit additional local input. The purpose of the meetings was to explain non-point source pollution, discuss the need for a watershed management plan, and discuss perceived problems and threats in the watershed.



Overview of the Report

This management plan was developed to serve as a planning and management tool for local decision makers. The community has worked to provide the necessary information needed by local decision makers to make environmentally sound judgments for the watershed. Section II of the management plan provides a description of the watershed that includes its location, environmental importance, climate, physical and geologic features, soils, land use and population data, economic development and hydrology. Section III focuses on the issues that have been identified as environmental concerns by the watershed project. Issues include documented non-point source pollution problems as well as perceptions of local citizens. Section IV provides information on current monitoring in the watershed and Section V describes the current management methods (regulatory and non-regulatory) that are available to help protect water quality. Section VI contains the Action Strategies for Protection, i.e., the

specific action strategies that will need to be implemented to achieve the objectives of the Watershed Project. Sections VII& VIII provide the tables and figures that elected officials, agencies and watershed residents will utilize to address non-point source pollution and make sound decisions based on credible data.

Watershed Description

J.B. Converse Lake (Big Creek Lake) is a 3,600 acre tributary-storage reservoir in Mobile County located in southwest Alabama (Figure 1). It serves as the primary drinking water supply for the City of Mobile and is a local recreation spot for many reasons. Converse Lake is a popular site for fishing and boating, although swimming and water skiing are prohibited.

The warm Gulf climate attracts fishermen year round and supports a growing plant nursery industry in the watershed.

At present, the watershed is mostly rural and forested but as residential growth and development continues in the watershed, non-point source pollution must be addressed. Rapid and unmanaged human activities in the watershed can have long term adverse affects on water quality in the watershed. Since the reservoir serves as the primary drinking supply for the City of Mobile, it is necessary that people understand that what occurs on the land has a direct impact on their water quality.

MAWSS manages Big Creek Lake and the E. Morgan Stickney and Harry E. Myers Water Filtration Facilities. These facilities treat raw water withdrawn by a pump station and then deliver treated water to the City of Mobile. The area of land surrounding the reservoir is covered by a combination of longleaf pine and deciduous forests which are owned by MAWSS (Figure 1). The remainder of the land primarily consists of pastures and a dairy farm, forested woodlands, nurseries, pecan groves, and residential areas that primarily use septic tanks for sewage treatment and disposal. These land use activities may contribute to non-point source pollution which influences the water quality in the reservoir. Rainfall in the watershed causes runoff from the land, contributing to pollutants in the tributaries, which in turn end up in the reservoir.

A. Location/Boundary

The Big Creek Lake watershed includes approximately 103 square miles and is located in Alabama's Mobile County (Figure 2). Big Creek Lake, a central reservoir, is fed by several tributaries including Big Creek, Jackson Branch, Juniper Creek, Collins Creek, Long Branch, Boggy Branch, Crooked Creek and Hamilton Creek. There are no municipalities located within the

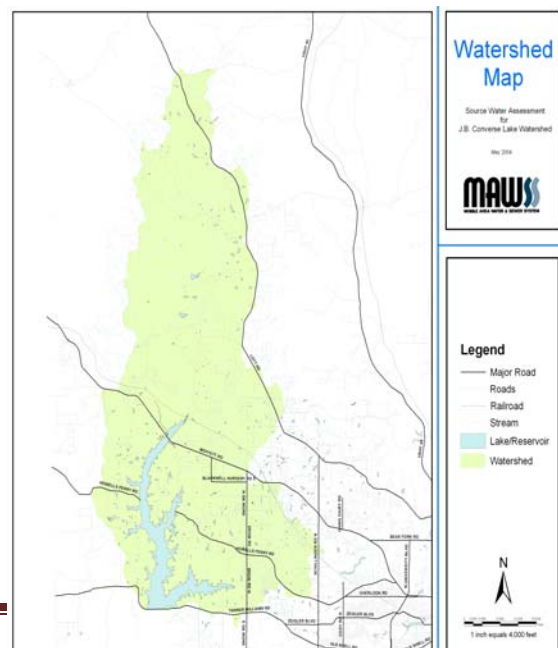


Figure 2: Watershed Boundary

watershed but there are several unincorporated communities including Wilmer and Semmes.

B. Climate

(paraphrased from Schroeder 1996) The Big Creek Lake watershed is located in close proximity to the Gulf Coast and thus, the climate is subtropical. Summers are characteristically warm and humid while winters are relatively mild with temperatures usually staying above freezing. In the contiguous United States, this region is second only to the Pacific Northwest in total annual rainfall (Baldwin 1973), receiving precipitation from a combination of winter storms, thunderstorms and tropical systems.

Summer Climate

High barometric pressure over the Atlantic Ocean is a dominant factor in the summer weather pattern. This semi-permanent weather system, called the subtropical anticyclone, provides a persistent southerly flow of humid air from the Gulf of Mexico. This air is normally unstable and thus, is easily lifted and condensed through convective heating or sea breeze convergences. As a result, thunderstorms are frequent and account for the major portion of summer rainfall. The frequency of thunderstorms over coastal Alabama is surpassed in the United States only by the Florida peninsula.

The influx of moisture from the Gulf of Mexico, in combination with numerous thunderstorms, produces a small daily temperature range during the summer. Average maximum air temperatures during the summer months vary from the upper 80°F to the low 90°F range in the vicinity of the Big Creek Lake watershed. Although temperatures may rise rapidly during the morning hours, the high frequency of thunderstorms usually limits the daily temperature peak at around 90 to 92°F (Williams 1973). Because of the high absolute humidity during this period, temperatures of 100°F or higher are occasionally observed.

Winter Climate

During the winter months, the Atlantic subtropical anticyclone retreats southward allowing the polar front to make numerous incursions into the Gulf States region from September to May. The arrival of polar air is frequently marked by heavy rain and a strong wind shift from southerly to northwesterly. When extremely low temperatures occur for at least two successive nights, freezing of the surface waters of the lake may take place near shore and up creeks.

Winter Storms

Although summer thunderstorms are numerous and greatly contribute to high annual rainfall totals, winter storms also produce heavy downpours. Those winter storms with the greatest impact upon the estuarine system originate in west Texas or along the Texas coast and are usually formed by upper atmosphere troughs that track across the southwestern U.S.. Surface cyclones developing beneath these troughs either move eastward from Texas across the Gulf States or along the coast. Storms of this type gain enormous energy from the

contrast between the warm Gulf waters and the cold polar air positioned over the Gulf States. The high frequency of winter storms accounts for a secondary rainfall maximum in March for many Gulf Coast regions. For areas around the Big Creek Lake, July normally slightly exceeds March as the wettest month with an average of more than 17.8 cm. (7 in.) of rain (Schroeder et al. 1990).

Tropical Storms

The central Gulf Coast had one of the highest frequencies of hurricane landfall in the United States for the period covering 1871 - 1990. The average occurrence of tropical storms from 1871 was 2.2 storms making landfall along every 18.5 km (10 nautical miles) stretch of the Gulf Coast (Neumann et al. 1981). Tropical storms are capable of producing enormous rainfalls in Mobile County and the surrounding areas. Rainfalls ranging from 13 to 25 cm (5 to 10 in.) are not unusual. However, hurricane rainfall totals vary considerably from storm to storm. When totals are high, the combination of flood runoff, erosion, and the destruction of trees along shorelines results in the transport of large amounts of sediment and debris into parts of Big Creek Lake watershed and into Big Creek Lake itself. This can have a profound post-storm impact on the ecosystem.

C. Physical and Geographic Features

The Big Creek Lake watershed lies within the Southern Pine Hills District of the East Gulf Coastal Plain section of the Coastal Plain Physiographic Province. The Southern Pine Hills District subdivision is a moderately dissected, southward sloping plain developed on sediments of Miocene and Citronelle Formation of Pleistocene Age (Boone 1974). In the coastal area the Southern Pine Hills range to 100 feet in elevation with numerous shallow saucer-like depressions. The depressions are scattered over nearly level interfluvies and hold water most of the year.

The Miocene Series undifferentiated, which is the older of the two units, is marine and estuarine in origin and consist of laminated to thinly bedded, laterally extensive clays, sands and sandy clays (Reed, 1971). The texture ranges from fine to coarse sands which are locally cross bedded (Mooty, 1988). The Miocene Series undifferentiated is about 3,000 feet thick near the coast (Davis, 1987).

The Citronelle Formation overlies the Miocene Series undifferentiated. The Citronelle Formation is relatively thin in the northern part of the watershed, but thickens toward the south (Davis, 1987). Sediments of this unit consist of gravelly sands and sandy clays. The base of the Citronelle Formation has a high clay and iron content and includes limonite-cemented gravelly sand.

The Pliocene-Miocene aquifer is the major system that contributes ground water to the streams and lakes of the Big Creek Lake watershed. This aquifer consists of the Citronelle Formation (of Pliocene age) and the Miocene Series undifferentiated (Mooty, 1988). The

combination of clayey sediments from the Miocene Series and the sand and gravel beds of the Citronelle Formation, which are hydraulically connected to the land surface, allow susceptibility for ground water contamination. The areas of the watershed that are most susceptible to contamination are those areas that are relatively flat with very permeable soils.

D. Soils

The major soil type found in the Big Creek Lake watershed is classified as ultisols. These zonal soils consist of soils having well-developed profile characteristics that reflect the influence of the active factors of soil formation. The active factors are climate, vegetation, and animal life. The zonal soils have an alluviated A horizon that is underlain by a finer textured alluviated B horizon. The C horizon varies in texture, but is generally coarser textured than the B horizon. These soils are well drained and acidic. Zonal soils are considered to be the more productive agriculture soils. Ultisols make up 100% of the total watershed and includes Troup-Heidel-Bama Association, Troup-Benndale-Smithton association and Shubuta-Troup-Benndale association.

The following are the soil associations and soil series found within the Big Creek Lake watershed.

Major Soil Associations

Troup-Heidel-Bama: Nearly level to undulating, well drained soils that have loamy subsoils; formed in loamy marine sediments on uplands.

Troup-Benndale-Smithton: Nearly level to hilly, well and poorly drained soils with loamy subsoils; formed in loamy marine and fluvial sediments on uplands.

Shubuta-Troup-Benndale: Gently undulating to rolling, well drained soils that have clayey and loamy subsoils; formed in clayey and loamy marine sediments on uplands.

Soil Series

Bama Series – This series consist of well drained, moderately permeable soils that form in loamy marine sediments. These soils are on Coastal Plain uplands. Bama soils are geographically associated with Benndale, Heidel, Lucedale, Malbis, Notcher and Troup soils.

Benndale Series - This series consist of well drained, moderately permeable soils that form in loamy marine sediments. These soils are on Coastal Plain uplands. Benndale soils are geographically associated with Bama, Harleston, Heidel, Malbis, Poarch, Shubuta, Suffolk, Smithton and Troup soils.

Heidel Series – This series consists of well drained, moderately permeable soils that form in loamy marine sediments. These soils are on Coastal Plain uplands. Heidel soils are geographically associated with Bama, Benndale, Lucedale, Shubuta and Troup soils.

Shubuta Series – This series consists of well drained, moderately slowly permeable soils that form in clayey marine sediments. These soils are on the Coastal Plain uplands. Shubuta soils are geographically associated with Benndale, Heidel, Smithton and Troup soils.

Smithton Series – This series consists of poorly drained, moderately slowly permeable soils that form in loamy marine sediments. These soils are on Coastal Plain uplands and stream terraces. They have a water table near the surface during winter and spring. The Smithton soils are geographically associated with Alaga, Benndale, Bibb, Escambia, Harleston, Johnston, Osier, Pactolus, Shubuta, Suffolk and Susquehanna soils.

Troup Series – This series consists of well drained, moderately permeable soils that form in sandy and loamy marine sediments. These soils are on Coastal Plain uplands. Troup soils are geographically associated with Bama, Benndale, Heidel, Pactolus, Shubuta and Susquehanna soils.

E. Land Use and Population Growth

The Big Creek Lake watershed encompasses about 103 square miles in Mobile County, Alabama. No municipalities exist within the watershed but several small towns including Wilmer and Semmes are location within the watershed boundaries. Table 1 represents land use data from Mobile Engineering's 2002 Source Water Assessment of the Big Creek Lake watershed.

Land Use	Acres	Square Miles (mi ²)	Percent (%)
Forest	381.78	62.5 mi ²	59.8%
Pasture	1050.2	17.2 mi ²	16.5%
Low Density Residential	64.74	10.6 mi ²	10.1%
Water	35.34	5.8 mi ²	5.5%
Row Crops	24.96	4.1 mi ²	3.9%
High Density Residential	14.58	2.4 mi ²	2.3%
Nursery	6.67	1.1 mi ²	1.1%
Disturbed Land	2.47	.4 mi ²	.4%
Commercial	1.73	.3 mi ²	.3%
Wetlands	.494	.1 mi ²	.1%
Industrial	.247	.1 mi ²	.02%

*Table
1: Land Use*

Land use in the Big Creek Lake watershed is dominated by forest and agriculture, especially nurseries and pastures, but residential land uses are also substantial (Figure 4). The tributary subwatersheds, including Hamilton and Crooked Creeks, make up the greatest percent of agriculture land (mostly nurseries) and residential homes.

MAWSS owns and maintains over 7981 acres (12.5 mi²) of land surrounding the reservoir (MAWSS, 2004). In order to protect the drinking water in the reservoir, MAWSS has limited the development in these areas, which has resulted in a protective buffer surrounding the reservoir (Figure 1).

Population

Census results for Mobile County in 2000 put population numbers for Mobile County at 399,843 people, an increase of 5.6% from the 1990 population rate. The estimated population for 2004 puts numbers for Mobile County at 400,526 people, an increase of .17% from the 2000 population rate. It is important to note that the US Census Bureau does not include migratory residents or tourists in its population figures. Listed below (Table 2) are population statistics from the US Census Bureau, 2000 and estimates (when available) for 2003 and 2006.

County/Town	2000	2003	2006 (estimates)
Mobile County	399,843	399,747	404,157
Semmes	15,389	Not Available	Not Available
Wilmer	8,591	Not Available	Not Available
Tanner-Williams Division (EPA Data)	59,443*	Not Available	Not Available

Table 2: Population

*Sub-county division census

F. Economic Development

Preserving environmental quality in the Big Creek Lake Watershed is essential to the economic health of the region in many ways. Traditional land uses such as agriculture and silviculture continue to thrive in this portion of Mobile County, but new economic development projects that will contribute to fast growth in the area in the coming years will undoubtedly increase developmental pressures in the area. Recently passed subdivision regulations prohibit the construction of new dirt road subdivision in the hope of limiting negative environmental impacts of siltation, but a lack of planning, zoning or any type of home rule make it difficult for decision-makers to control rapid growth and its associated problems.

The construction of an alternative route for Highway 98, connecting Mississippi and Alabama is currently under construction and passes through a large portion of the watershed. This contentious project has recently resulted in large-scale siltation of many of

the tributaries that feed the reservoir. The completion of this new corridor is also expected to lead to increased development in the area.

This management plan does not have any authority to abate development. However, it is the intention of this management plan that it be utilized by area decision-makers when looking at growth opportunities. As the watershed continues to be converted from agricultural land to residential and commercial development and we increase the extent of impervious surface, it is imperative our local governments utilize the principles and tools provided in this management plan to develop responsibly.

Agriculture is still Alabama's number one industry. Agriculture and associated industries account for more than \$43 billion or 22 percent of the state's direct output which is more than any other industry in Alabama. (Paraphrased from ALFA, AG Facts).

In Mobile County farming and agriculture contribute a large portion of the area's revenue. In 2004 cash receipts for crops produced \$68,602, livestock and poultry produced \$6,525, and forest products totaled \$17,466. All together, in 2004, cash receipts for farm and forestry totaled \$99,745. (ALFA, Mobile County AG Facts).

Listed below (Table 3) are the farming statistics for Mobile County. (ALFA)

Crops-2004	Acres Harvested	Yield	Production
Cotton	9,200	730 lbs	13,470 bales
Peanuts	4,600	3,240 bu	14,913,000 lbs
Hay	12,500	2.5 tons	31,000 tons

Crops - 2005	Acres Harvested	Yield	Production
Cotton	10,600	571 lbs	12,600 bales
Peanuts	5,000	3,335 bu	16,680,000 lbs
Hay	8,300	3.3 tons	27,500 tons

Crops-Jan. 2005	Number	Crops – Jan. 2006	Number
All Cattle & Calves	14,000 head	All Cattle & Calves	13,900 head
Beef Cows	6,800 head	Beef Cows	7,200 head
Milk Cows	700 head	Milk Cows	700 head

Table 3: Farming Statistics

G. Hydrology

Reservoirs are found primarily in areas with relatively few natural lakes, or where existing lakes are not suitable for a drinking water supply. Although lakes and reservoirs can serve several of the same purposes, reservoirs are usually created by humans to address one or more specific water needs. These needs include municipal and drinking water supplies, agricultural irrigation, industrial and cooling water supplies, power generation, flood control, sports or commercial fisheries, recreation and navigation.

Construction on Big Creek Lake Reservoir was completed in 1952 with the primary purpose of providing clean drinking water to the greater Mobile area. Over the years, MAWSS has purchased land to ensure that the water quality remains pristine for future generations. MAWSS owns and maintains over 7,981 acres of land surrounding the reservoir (MAWSS, 2004). In order to protect the drinking water in the reservoir, MAWSS has attempted to limit the development in these areas, which has resulted in a protective buffer surrounding the reservoir.

Understanding the hydrologic cycle of the Big Creek Lake watershed is necessary to identify the actual sources of contaminants that enter the lake and its tributaries. Contaminants from the land can permeate into the groundwater in the aquifer. Groundwater discharges to the lake and its tributaries. The tributaries provide flow to Big Creek Lake and can carry loads of nutrients, sediment, bacteria, and organic carbon directly to the lake. Therefore, groundwater can be the direct source of contamination to the lake and its tributaries.

III. Existing Pollution Sources

Pollution Sources

1. Non-Point Source Pollution

Non-point source pollution is considered by many to be the #1 problem in Alabama's coastal area. Also known as polluted runoff, this is caused when rainwater flows over the land, picking up pollutants, sediments and other contaminants. Defining methods to address non-point source pollution is a major objective of this management plan. Non-point source pollution sources are varied in nature, and as a result, solutions to non-point pollution problems can be very involved.

Pollutants of Concern:

Nutrients

Nutrients, including nitrogen and phosphorus, are vital for plant growth but can cause problems at

elevated concentrations in surface water where they can have direct toxic effects on living organisms or may stimulate undesirable alga growth. Pesticides and other contaminants are potentially dangerous not only to the aquatic ecosystem but also to water users as treatment processes may not be designed to remove these contaminants. Sources of nutrient contamination include animal waste, fertilizers, detergents and failing septic systems.

Pathogens

Pathogens include disease causing bacteria and viruses primarily associated with the presence of fecal matter. Sources include failing septic systems, wastewater treatment plant (WWTP) overflows, boat sewage and animal waste.

Sediment

Sediment is eroded soil or sand that is transported to waterbodies via stormwater. Sediment can smother aquatic habitat and in some extreme cases can lead to increased treatment costs for drinking water if the source is contaminated with large amounts of sediment. Anthropogenic sources include poorly managed agricultural practices, dirt roads and construction sites.

Litter or Debris

Litter or debris is another problem that may threaten aquatic life and is unsightly as well. Sources are directly connected to human activity and include illegal dumping, boat waste and litter.

Thermal Stress

Thermal stress is an elevation in water temperature that can harm native aquatic species and encourage nonnative species to spread. Sources include runoff from impervious surfaces such as roads, parking lots and roofs and the removal of streamside vegetation space that provided shading (NEMO, 2002).

Sources of Pollution

Agriculture

Agricultural operations can result in environmental degradation of water quality through increases in sediment, nutrients, debris and chemicals. The major concerns are sediment laden runoff from irrigation and rainfall events. The runoff can also contain elevated levels of nutrients from fertilizers, pesticides and herbicides.

Stormwater

Urban runoff may contain several pollutants including fertilizers, pesticides, herbicides, heavy metals, petroleum products from automotive fluids and parking lots, and sediment from localized erosion at construction sites.

Anthropogenic Sediment Sources

The erosion, release and transport of sediment are natural processes in all watersheds. However, human activities can alter the nature and extent of these processes creating serious environmental problems. The most serious threat posed by increased erosion and sedimentation is to water quality.

There are numerous anthropogenic activities or conditions that can increase erosion rates and sediment quantities. Some of the more significant sources of sediment include unpaved roads, construction sites and farmland.

2. Point Source Pollution

Point source pollution is an identifiable source that discharges pollutants into the environment. Examples include smokestacks and pipes. Point source discharges to area waterways are regulated by ADEM through the National Pollution Discharge Elimination System (NPDES) permitting process. Point source pollution problems are generally easier to identify and address than non-point sources as the sources are generally very visible. Potential point sources in the Big Creek Lake Watershed include:

- Industrial Manufacturing
- Domestic wastewater treatment
- Detention/Retention basins associated with construction activities
- Livestock Operations

IV. Environmental Monitoring

Current Environmental Monitoring

1. USGS and MAWSS began a cooperative study in 1990 to describe the assessment of water conditions in the Big Creek Lake watershed and the impact of land use practices on the water conditions of the lake.
2. The ADEM Fish Tissue Monitoring Program was initiated in 1991 as a cooperative agreement with ADPH, ADCNR and the Tennessee Valley Authority (TVA) to monitor fish tissue throughout the State for bioaccumulative contaminants that can present a risk to human health, e.g. mercury.
3. USGS and MAWSS began a new cooperative study in 1998 to address concerns over the effects of urban land use change on lake water quality in order to better understand the effects of watershed loading on the water quality of Big Creek Lake. The results of this research identified advanced understanding of two high priority issues that have been identified by USGS; drinking water quality and the effects of urbanization on water resources (USGS, 1999).
4. The ADEM Reservoir Water Quality Monitoring Program assesses the water quality and trophic status of all large publicly accessible lakes and reservoirs in the State. Monitoring takes place during the algal-growing season at least once every two years with many

lakes/reservoirs being monitored every year. This routine reservoir monitoring is supplemented with information gained from more intensive studies conducted on selected reservoirs as funding becomes available.

5. Section 303 (d) of the Clean Water Act (CWA) requires states to develop a list of impaired waters that are not meeting, or not expected to meet, water quality standards. Federal regulations require states to submit a new list of at least every four years. In 2004, Boggy Branch, Collins Creek and Juniper Creek were 303 (d) listed in the watershed. The 2006 draft list only includes Boggy Branch and Collins Creek (Table 4).

Table 4: 303 (d) Listed Streams

2006 DRAFT 303(d) LIST

Assessment Unit ID	Water Body Name	Support Status	Type	Rank	River Basin	Uses	Causes	Sources	Date of Data	Size	Downstream/Upstream Locations	Draft TMDL Date
AL03170008-0402-400	Boggy Branch	Partial	R	M	Escatawpa	F&W	Metals (Fe)	Natural	1996-99	3.6 mi.	Big Creek Lake / Its source	2008
AL03170008-0401-200	Collins Creek	Non	R	H	Escatawpa	F&W	Pathogens	Pasture grazing, On-site wastewater systems	1996-99	4.9 mi.	Big Creek Lake / Its source	2008
AL03170008-0402-700	Collins Creek	Partial	R	L	Escatawpa	F&W	Metals (As)	Unknown	2001,02	5.15 mi.	Big Creek Lake / Its source	2013

Data from the Alabama Department of Environmental Management DRAFT 303(d) List

2008 Alabama §303(d) List (Draft)

Assessment Unit ID	Waterbody Name	Type	Rank	River Basin	County	Uses	Causes	Sources	Date of Data	Size	Downstream / Upstream Locations	Draft TMDL Date
AL03170009-0402-100	Big Creek (Big Creek Reservoir)	R	L	Escatawpa	Mobile	Public Water Supply, Fish & Wildlife	Metals (Mercury)	Atmospheric Deposition	2006	3109.31 acres	Big Creek Reservoir / Collins Creek	2015
AL03170008-0402-400	Boggy Branch	R	M	Escatawpa	Mobile	Fish & Wildlife	Metals (Iron)	Natural	1996-99	4.58 miles	Big Creek Lake / Its source	2008
AL03170008-0402-700	Collins Creek	R	H	Escatawpa	Mobile	Fish & Wildlife	Pathogens	Pasture grazing, On-site wastewater systems	1996-99	5.15 miles	Big Creek / Its source	2008
AL03170008-0402-700	Collins Creek	R	L	Escatawpa	Mobile	Fish & Wildlife	Metals (Arsenic)	Unknown	2001, 2002	5.15 miles	Big Creek / Its source	2013

V. Current Management Methods

The Big Creek Lake Watershed Management Plan is a guide for the citizens of the watershed to assist them in identifying the methods and entities that will help provide for the future protection environmental health in the watershed. The success of this project rests solely on the participation of local governments and area residents.

The two most successful management tools are citizen involvement and private stewardship. No regulation can substitute a landowner's willingness to employ Best Management Practices (BMPs) on his land. Incentive programs, which provide money on a cost share or grant basis, will also help

accomplish good stewardship. It is also important to understand existing regulatory programs which affect development in the watershed.

A. Non-Regulatory Programs

1. Incentive Programs

Many landowners do not have funds or interest to initiate a restoration or preservation project without the support of incentive programs. These programs provide cash or tax incentives as a match to those who agree to participate in environmental protection or enhancement programs.

a. Conservation Reserve Program (CRP)

This program, administered by the Consolidated Farm Service Agency, was established as a conservation provision of the Farm Bill to encourage and assist farm producers willing to set aside highly erodible, riparian, and other environmentally sensitive land from crop production for a 10 or 15 year period. Producers may enroll in the program according to USDA rules. The program is a 50-50 cost share.

b. Wetlands Reserve Program (WRP)

This voluntary program is administered by NRCS with technical support from U.S. Fish and Wildlife Service (FWS). Participating landowners can establish conservation easements of either permanent or 30-year duration, or can enter into restoration cost-share agreements where no easement is involved. NRCS and FWS assist private landowners with site selection and development of restoration plans for the site. If a permanent conservation easement is established, up to 100% of the cost of restoring the wetland may be provided by the United States Department of Agriculture (USDA).

c. Grassland Reserve Program (GRP)

GRP is a voluntary program offered by NRCS. This program offers landowners the opportunity to protect, restore and enhance grasslands on their property.

d. Environmental Quality Incentives Program (EQIP)

EQIP is a voluntary program administered by NRCS. EQIP works in locally identified conservation priority areas where there are significant problems with natural resources. High priority is given to areas where state or local governments offer financial, technical, or educational assistance, and to areas where agricultural improvements will help meet water quality objectives. Landowners apply to the program for assistance in solving problems related to animal waste management, erosion, and other environmental problems. EQIP will provide up to 60% cost-share for restoration.

e. Forest Land Enhancement Program (FLEP)

The Forest Land Enhancement Program (FLEP) is part of Title VIII of the 2002 Farm Bill. FLEP replaces the Stewardship Incentives Program (SIP) and the Forestry Incentives Program (FIP). FLEP is optional in each State and is a voluntary program for non-industrial private forest (NIPF) landowners. It provides for technical, educational, and cost-share assistance to promote sustainability of the NIPF forests.

State Forestry Agencies in coordination with their State Forest Stewardship Coordinating Committees will develop a State Priority Plan for FLEP. This Plan will provide the details for how the FLEP funds will be utilized, including minimum acres, maximum acres, aggregate payment, use for technical, educational and cost-share assistance, and all other factors for the program. Landowners will have to have a forest management plan to be eligible for cost-share. The practices to be cost-shared and the cost-share rate will be described in the State Priority Plan.

f. Wildlife Habitat Incentives Program (WHIP)

Administered by NRCS, WHIP is a voluntary program for landowners who want to develop and improve wildlife habitat on private lands. Participants work with NRCS to prepare a wildlife habitat development plan. USDA provides technical assistance and cost-share payments up to 50 % of the cost of installing the wildlife habitat practices.

g. Partners for Fish and Wildlife

Administered by FWS, this program restores, improves and protects fish and wildlife habitat on private lands. Funds can not exceed \$25,000 per project and the landowners must secure a minimum 10-year habitat development agreement. Landowners can receive up to 100% funding for project expenses, however, the overall goals of partners is a 50-50 cost share.

h. Farm and Ranch Land Protection Program (FRPP)

The Farm and Ranch Lands Protection Program (FRPP) is a voluntary program that helps farmers and ranchers keep their land in agriculture. The program provides matching funds to State, Tribal, or local governments and non-governmental organizations with existing farm and ranch land protection programs to purchase conservation easements. FRPP was reauthorized in the Farm Security and Rural Investment Act of 2002. USDA and NRCS manage the program.

USDA works through State, Tribal, and local governments and non-governmental organizations to conduct FRPP. These entities acquire conservation easements from landowners. Participating landowners agree not to convert their land to non-agricultural uses and to develop and

implement a conservation plan for any highly erodible land. All lands enrolled must have a conservation plan developed based on the standards in the NRCS Field Office Technical Guide and approved by the local conservation district. Landowners retain all rights to use the property for agriculture.

2. Alabama Non-Point Source Management Program

In 1987, Congress passed Section 319 of the Clean Water Act which established a national program to address the problems of nonpoint source pollution. Although each state administers the program differently, the program was developed to highlight watershed approaches to nonpoint source pollution impacts. ADEM administers this program in Alabama.

In 1990, the Coastal Zone Act and Reauthorization Amendments (CZARA) were promulgated to establish the Alabama Coastal Nonpoint Source Pollution Program. This program is also administered by ADEM.

3. Private Stewardship

Landowners in the Big Creek Lake Watershed, particularly nursery owners, are interested in incorporating conservation practices into management of their property. NRCS educates the landowners of the incentive programs and works with them to incorporate nonpoint source pollution control methods. Education and public participation are also an important part of private stewardship.

The Private Stewardship Program, through NRCS, provides grants and other assistance on a competitive basis to individuals and groups engaged in local, private, and voluntary conservation efforts that benefit federally listed, proposed, or candidate species, or other at-risk species. Diverse panels of representatives from state and federal government, conservation organizations, agriculture and development interests, and the science communities assess applications and make recommendations to the Secretary of the Interior, who awards the grants. The Private Stewardship Program was initiated during Fiscal Year 2002, with grants first awarded during Fiscal Year 2003.

For Fiscal Year 2004, NRCS awarded more than \$7 million in federal funding under the Private Stewardship Program. A ten percent (10%) match of cash or through in-kind contributions is required. The program is available to private landowners and their partners.

4. Tax Incentives

a. Conservation Easements

A conservation easement is a legal agreement between a landowner and a land trust (or government agency) that protects open space by limiting the amount and type of development that can take place, but leaves the land in private ownership. Each easement restriction is tailored to the individual landowner's need. When a landowner donates or sells a conservation easement to a land trust or other qualified organizations, he can continue to live on or work the land in accordance with the easement's provisions and can sell the land or pass it on to heirs. Donating the easement can result in reduced income and estate taxes.

b. Gift of Remainder Interest

A gift of a remainder interest in a personal residence or farm provides the donor with an income tax charitable deduction for the present value of the remainder interest and permits the donor to escape any potential capital gain tax on the built-in appreciation. The donor can continue to occupy the residence or operate the farm without disruption. Such a gift provides a deduction that converts tax dollars into spendable income without causing any disruption in lifestyle. Taxes, insurance, and normal maintenance remain the responsibility of the donor.

5. ADEM Source Water Protection Plan

The Source Water Assessment and Protection Program were mandated by Congress in the 1996 Amendments to the Safe Drinking Water Act. The Source Water Assessment Program is a mandatory program in Alabama and requires that all public water supply utilities complete a 3-part assessment for all of their supply wells. The assessment must delineate the boundaries of the area that contribute groundwater and potential contaminants to the community water systems. The assessment must include a contamination source inventory and a susceptibility determination to identify how susceptible the public water supply is to contamination. Lastly, the assessment must include a public awareness program that informs the public about information gathered by the assessment.

Once the assessment is completed, local authorities are encouraged to use the assessment information to protect their water supplies and to develop a Source Water Protection Plan. Source water protection efforts may involve corrective activities to remove contamination threats or preventative actions through land use planning and education.

B. Regulatory Programs

1. National Pollutant Discharge Elimination System (NPDES) Program

Under the Clean Water Act, most point source discharges of pollution require a permit. The NPDES program is administered by ADEM. Point sources are direct discharges from factories, sewage treatment plants, mining and concentrated animal feedlot operations. Permittees are required to submit discharge monitoring reports (DMR) to ADEM. The DMR contains data for all pollutant releases and the monitoring frequency required by the NPDES permit.

On Jan. 23, 2003 ADEM approved Administrative Code Chapter 335-6-12 which regulates stormwater discharges from construction and mining activities. All construction sites greater than 1 acre and all mining activities greater than 5 acres are required to register under the current regulations. The regulations require the implementation and maintenance of effective Best Management Practices (BMPs) to control pollutants in stormwater discharges. ADEM enforces the regulations through site inspections and water sampling at the discharge points.

Note: The Act specifically excludes “return flows from irrigated agriculture or agricultural storm water runoff.” This exempts many, but not all, agricultural activities from the NPDES program.

2. U.S. Army Corps of Engineers (USACE) Regulatory Programs

The Corps of Engineers has been involved in regulating activities by others in navigable waterways through the granting of permits since the passage of the Rivers and Harbors Act of 1899. Initially, this program was meant to prevent obstructions to navigation, although an early 20th century change to the law gave the Corps regulatory authority over the dumping of trash and sewage. Passage of the Federal Water Pollution Control Act in 1972 and the Clean Water Act Amendments of 1977 greatly broadened this role by giving the Corps authority over dredging and filling in the “waters of the United States,” including many wetlands.

A major aspect of the regulatory program is determining which areas qualify for protection as wetlands. In determining what constitutes a wetland, the Corps uses the procedures set forth in the 1987 Wetland Delineation Manual as amended. In making decisions on whether to grant, deny, or set conditions on permit applications, District Engineers are required to consider “all factors in the public interest,” including economic development and environmental protection.

Numerous relatively minor activities in wetlands are covered by regional or nationwide general permits, allowing the regulatory staff to concentrate on more complex cases. Of the approximately 1,100 people who carry out this mission, about 70% have academic backgrounds in biology and environmental sciences.

The navigation program includes all of the nation's deep draft harbors which are a vital link to seaborne commerce and handle much of the nation's international trade each year, as well as hundreds of smaller harbors that serve a variety of recreational and commercial purposes. The Corps has also built an intracoastal and inland network of commercial navigation channels, as well as river workers of locks and dams as aids to navigation.

a. Section 404 of the Clean Water Act

The USACE administers Section 404 of the Clean Water Act. Section 404 requires permits for dredging or filling a "water of the United States." This permit requires public input on the questions of need, alternatives and impacts. In theory, the law requires the permit applicant to prove the destruction of wetlands is necessary. If the proposed activity does not have to be conducted near the water, the permitting agency is to assume practical alternatives exist.

b. Section 10 of the Rivers and Harbors Act

The USACE also administers Section 10 of the 1899 Rivers and Harbors Act. This Act was enacted to protect and promote water navigation for commercial activity. This Act prohibits the unauthorized obstruction or alteration of any "navigable water of the United States" except by a Corps of Engineers permit. Regulated activities include dredging, placement of dredged or fill material, and construction in or over navigable waters.

3. Mobile County Health Department

The Mobile County Health Department (MCHD) plays an important role in the maintenance of environmental health in the Big Creek Lake Watershed. The two primary areas of influence are through the design and oversight of water quality standards for the public drinking water supply in Big Creek Lake and the permitting and control over wastewater treatment systems.

The MCHD operates as an adjunct of the Alabama Department of Public Health (ADPH) and regulates within the area designated as ADPH Public Health Area 11. The ADPH acts, either directly or indirectly through agreements with the Alabama Department of Environmental Management (ADEM), to control and manage the installation and maintenance of all public wastewater treatment systems including individual on-site systems, cluster systems, and municipal systems. MCHD regulates any system treating less than 10,000 gallons per day. For all systems treating over 10,000 gallons per day, authority is conferred to ADEM.

The ADPH Division of Community Environmental Protection carries out programs to minimize the adverse effects of disposal of sewage on human health and the environment by establishing and enforcing requirements for the design, permitting, installation,

approval and use of onsite sewage treatment and disposal systems. One of the Division's main objectives is the coordination of the on-site sewer departments in the county health departments. The Onsite Sewage Division of the MCHD, through its association with the ADPH Soils and Onsite Sewage Branch, is charged to reduce non-point pollution sources that threaten human health and endanger community environmental protection. Their efforts include the review and approval of subdivision and individual lots for the use of an onsite sewage disposal system, the permitting and inspection of onsite disposal systems and associated plumbing to guarantee environmental compliance, and the investigation of complaints regarding unsanitary conditions.

All authority for the permitting and control of onsite sewage disposal systems (OSDS) is granted to the MCHD through the ADPH Code entitled Rules of State Board of Health Bureau of Environmental Services, Division Of Community Environmental Protection, Chapter 420-3-1 ; Onsite Sewage Treatment and Disposal, as adopted by the State Board of Health, effective March 19, 2006, amended effective November 23, 2006.

The most common conventional OSDS utilized in rural areas to treat household and business waste is the septic tank. The decision to permit an OSDS is dependent upon a soil percolation test performed by a licensed engineer, surveyor, or soil classifier or an evaluation by a certified site evaluator from the health department. A percolation test or site evaluation determines the soil's permeability and checks for any limiting factors such as a seasonal high water table. The percolation test procedures are designed to simulate operating conditions of the OSDS and the site evaluation assesses the soil texture and type to determine site suitability.

The number of applications for septic tank systems within the Big Creek Lake Watershed has been decreasing over the last three years based primarily on the utilization of small cluster (neighborhood) systems to service new subdivisions. It is estimated by the Onsite Sewage Division of the MCHD that there are currently 5,000 operating septic systems within the Big Creek Lake Watershed and over 49,000 systems county wide. Although the exact location and total number of operating septic systems in the Big Creek Lake Watershed is unknown, a system to GPS locate all new installations and repairs on septic systems was implemented by the MCHD in 2004.

4. Mobile County Commission (MCC)

There is no zoning or planning commission in Mobile County outside of the City of Mobile and their 5 mile planning jurisdiction. Zoning is a tool used by communities to guide growth and development to protect public health, safety and general welfare by encouraging the use of lands and natural resources in accordance with their character and adaptability. Zoning regulations also establish standards for the size and placement of buildings on the land. This lack of planning and control in the unincorporated portions of the County make it difficult to control sprawl and the unintended consequences of rapid growth without an overarching vision.

Subdivision Regulations

In December of 2004, the Mobile County Commission passed a set of Subdivision Regulations in response to growing concerns of the affect of unmitigated growth on the water supply for Mobile residents. These regulations prohibit the creation of new dirt road subdivisions. Developers were building unrestricted private dirt roads faster than the County could pave existing public dirt roads. Now, any time a parcel of land is subdivided, the access to the parcels must be paved according to Mobile County's road building standards.

Building Permits

Mobile County building permit holders are required to use "Best Management Practices" (BMPs) to comply with the County Building Permit, however, many sites are not inspected to ensure compliance with this stipulation unless the siltation or other problems are affecting the roadway.

Structural changes to an existing residence that will use an existing septic tank, require contractors to obtain an **On-Site Sewage System Certificate of Approval from the Mobile County Health Department**.

A new residence being built, at a new location, using a septic tank must have a licensed Engineer or Surveyor perform a percolation test and determine a septic tank system for the new residence. Then an **On-Site Sewage System Certificate of Approval for the new system from the Mobile County Health Department** must be obtained.

The Health Department will check to make sure the on-site sewage system proposed is adequate to handle the new residence or that the existing system is adequate for the renovation planned.

5. Coastal Zone Regulations

In 1972, Congress passed the Coastal Zone Management Act (CZMA) in order to improve the management of our nation's coastal resources. The Act created the Coastal Zone Management Program (CZMP), which on a federal level, is administered by NOAA. The CZMP provides coastal states the opportunity and financial support to develop coastal zone management programs to protect coastal resources. Alabama drafted its first CZMP in 1979.

Alabama's designated Coastal Area (generally defined as the 10' continuous contour elevation of Mobile and Baldwin Counties seaward to the outer limit of the United States territorial sea). ADEM has certain regulatory, permitting, and enforcement functions that are established under the Alabama Coastal Area Management Program (ACAMP). The specific regulatory requirements and procedures can be found in ADEM Administrative Code Reg. 335-8-XX. In general terms, ADEM

regulates certain activities in the coastal area, including beach and dune construction, commercial and residential developments greater than 1 acre, groundwater extraction of a certain capacity, siting, construction and operation of energy facilities, marina development, and wetland impacts, to name a few. Since many of these activities are also federally regulated, ADEM has developed procedures for joint review in order to avoid overlap.

6. Coastal Consistency

One power granted to states with federally approved coastal zone management programs is the authority to require individuals, local agencies, and federal agencies to carry out their activities within the coastal zone in ways that are consistent with the state's coastal program's policies and regulations. As such, applicants applying for permits to conduct activities within the coastal area must certify that the proposed activity is consistent with the policies and regulations of the ACAMP. In review of coastal consistency, ADEM may deny or conditionally approve a project that is determined to be inconsistent with ADEM Division 8 Coastal Program Regulations. An applicant may also seek a variance from any unduly restrictive coastal regulation. Federal activities subject to coastal consistency determination include: US Army Corps of Engineers Section 10 (Navigation and Navigable waters) and Section 404 (wetland dredge and fill) permits; Federal Energy Regulatory Commission permits, and Environmental Protection Agency permits for air quality, water quality and solid waste disposal.

7. Section 401 Water Quality Certification

Under Section 401 of the Clean Water Act, the state water quality agency (ADEM) must certify that adequate measures for water quality protection are to be implemented before a federal agency can issue a permit that allows pollutant discharges into state waters. Like the coastal consistency review, the water quality certification process allows ADEM to condition federal permits in order to comply with state regulations and enforceable policies. Alabama water quality certifications issued by ADEM under Section 401 are typically conditioned to require the implementation of management measures, the avoidance of specific activities, and strict standards for certain types of discharges. Certification for wetland and riparian impact typically includes conditions for avoidance, minimization, and mitigation of impacts. Certification for dams and other impoundments typically includes conditions for maintaining minimum instream base flows and minimizing impacts downstream.

Certification for dredge impacts typically includes conditions for minimizing dredge quantity, protecting instream water quality and maximizing beneficial use of dredge disposal. Certification for structural shoreline stabilization calls for demonstration that nonstructural methods are not feasible and dissuades use of vertical bulkheads.

8. Wetland Conservation Provisions (Swampbuster)

Swampbuster has reduced the loss of wetlands due to agricultural activities to the lowest levels on record. Swampbuster helps preserve the environmental functions and values of wetlands, including flood control, sediment control, groundwater recharge, water quality, wildlife habitat, recreation, and aesthetics.

The 1996 Farm Bill changed Swampbuster to give USDA participants greater flexibility to comply with wetland conservation requirements and to make wetlands more valuable and functional. The new Farm Bill changed the following Swampbuster provisions: upon request, NRCS will determine if a producer's land has areas subject to Swampbuster. The NRCS maintains a list of the plants and combinations of soils and plants found in wetlands and uses these technical tools, along with the hydrology of the area, to conduct determinations. These determinations stay in effect as long as the land is used for agricultural purposes (unless a violation occurs) or until the producer requests a review due to natural events. NRCS certifies previous wetland determinations upon request.

9. Clean Water Act

Growing public awareness and concern for controlling water pollution led to enactment of the Federal Water Pollution Control Act of 1972. As amended in 1977, this law became commonly known as the Clean Water Act. The Act established the basic structure for regulating discharges of pollutants into the waters of the United States. It gave EPA the authority to implement pollution control programs such as setting wastewater standards for industry. The Clean Water Act also continued requirements to set water quality standards for all contaminants in surface waters. The Act made it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions. It also funded the construction of sewage treatment plants under the construction grants program and recognized the need for planning to address the critical problems posed by nonpoint source pollution.

Amendments in 1981 streamlined the municipal construction grants process, improving the capabilities of treatment plants built under the program. Changes in 1987 phased out the construction grants program, replacing it with the State Water Pollution Control Revolving Fund, more commonly known as the Clean Water State Revolving Fund.

10. Safe Drinking Water Act (SDWA)

Millions of Americans receive high quality drinking water every day from their public water systems, (which may be publicly or privately owned). Nonetheless,

drinking water safety cannot be taken for granted. There are a number of threats to drinking water, including: improperly disposed of chemicals, animal wastes, pesticides, human wastes, wastes injected deep underground, and abnormal concentrations of naturally-occurring substances. Likewise, drinking water that is not properly treated or disinfected, or which travels through an improperly maintained distribution system, may also pose a health risk.

The SDWA was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. The law was amended in 1986 and 1996 and requires many actions to protect drinking water and its sources; rivers, lakes, reservoirs, springs, and ground water wells. (SDWA does not regulate private wells which serve fewer than 25 individuals.) SDWA authorizes the EPA to set national health-based standards for drinking water to protect against both naturally-occurring and man-made contaminants that may be found in drinking water. EPA, states and water systems then work together to make sure that these standards are met.

The 1996 amendments greatly enhanced the existing law by recognizing source water protection, operator training, funding for water system improvements, and public information as important components of safe drinking water. This approach ensures the quality of drinking water by protecting it from source to tap.

C. Protective Mechanisms

1. Low Impact Developments (LID)

LIDs are an innovative stormwater management approach whose basic principle is to manage rainfall at the source using uniformly distributed decentralized micro-scale controls. LIDs goal is to mimic a site's predevelopment hydrology by using design techniques that infiltrate, filter, store, evaporate, and detain runoff close to its source. Techniques are based on the premise that stormwater management should not be seen as stormwater disposal. Instead of conveying and managing/treating stormwater in detention structures located at the bottom of drainage areas, LID addresses stormwater through small, cost-effective landscape features located at the lot level. These landscape features, known as Integrated Management Practices (IMPs), are the building blocks of LID. Almost all components of the urban environment have the potential to serve as an IMP. This includes not only open space, but also rooftops, streetscapes, parking lots, sidewalks, and medians. LID is a versatile approach that can be applied equally well to new development, urban retrofits, and redevelopment/ revitalization projects.

2. Zoning

Zoning is a method utilized by governments to control the physical development of land and stipulate the category of use for which each individual property may be

utilized. Zoning laws typically specify the areas in which residential, industrial, recreational or commercial activities may take place. There is no zoning in the unincorporated areas of Mobile County, including the Big Creek Lake Watershed

3. Overlay Districts

Overlay districts are typically developed in conjunction with the preparation of a comprehensive land-use plan. An overlay district is an additional zoning requirement that is placed on a geographic area but does not change the underlying zoning. They can provide significant improvements to overall water quality. Careful consideration of economic impacts, natural impacts, and private rights should be exercised when using overlay districts. Overlay districts have been used to impose developmental restrictions in specific locations in a watershed in addition to standard zoning requirements.

4. Buffers

Buffers, or protective areas, are important tools that help protect and improve the condition of our waterways. An aquatic or riparian buffer is an area along a waterway or waterbody where development is prohibited or limited. Though often not effective alone, they can be an important part of an overall stormwater management plan. Buffers reduce the potential for pollutants such as sediments and nutrients from reaching the waterway and also helps stabilize banks along a waterway.

5. Open Space Design

Open-space design involves concentrating development in a compact area of a site, leaving the remainder of the site as open space or natural areas. This type of design is also referred to as cluster or conservation development. Open-space design integrates stormwater management into the core of the site design.

The benefits to stormwater management provided by this type of development over conventional subdivision design include:

- a. Impervious cover is minimized, reducing runoff and pollutants.
- b. Existing vegetation that absorbs and minimizes runoff is maintained. Pollutants contained in the runoff are also absorbed.
- c. Turf areas are minimized, reducing the area where nutrient-rich fertilizer and pesticides are applied.
- d. Overall land disturbing activities are minimized, resulting in less construction site erosion if proper management techniques are used.
- e. Existing natural areas are preserved.

- f. Efficient use of infrastructure.

VI. Action Strategies for Protection

The goal of the Big Creek Lake Watershed Management Plan is to provide a summary of existing and potential environmental concerns in the Big Creek Lake Watershed; to provide a strategy to encourage, sustain and improve environmental quality; and to prevent additional degradation to the watershed associated with existing and rapidly changing land uses and other pressures. Objectives have been developed to help the management plan achieve this goal.

Evaluation Method	Strategy Evaluated	Evaluation Mechanism
1.	Workshops, Conferences, Handouts Informal presentations	Pre and post tests # of attendees
2.	Surveys	Evaluations Act or vote on recommendations
3.	Adoption or Implementation	# of attendees
4.	Maps, Documents and Final Reports	# documents returned vs. # of documents distributed
5.	Property acquired	# of municipalities vs. # of policies adopted # of acres
6.	Pollution reduction	# of permits applied # of permits issued

Evaluative Criteria

It is important to track the progress of the management plan and its effect on the improvement of water quality. Stakeholders and decision-makers need to know what makes this management plan successful. Each one of these action strategies has an evaluation mechanism to accurately assess each strategy. Continual evaluation of the plan is critical to the long-term success of the plan as conditions and funding sources change over time. Listed below are the evaluative criteria that will be utilized for the action strategies. In cases where these criteria are not applicable, the evaluation criteria will be

listed within that action strategy. Each section that follows includes specific action strategies, a discussion of each strategy, responsible parties and partners and potential funding sources. Responsible parties are those agencies with regulatory or legal authority or a vested interest in the strategy. Partners are those who could assist the responsible parties through shared resources and/or technical support. Potential funding sources are grant programs where funds may be pursued; however, the list is not comprehensive and does not guarantee that funds have been committed by those agencies. The action strategies, responsible parties, partners and funding sources are only recommendations and are dependent on available funding resources and local support. The overall purpose of the following management objectives and action strategies is to coordinate and better utilize existing federal, state and local resources to improve and maintain water quality in the watershed. Following is a summary of the Management Plan Objectives:

Non-Point Source Pollution Objectives (NPS)

- 1 To reduce nonpoint source pollution from:
 - a. Agricultural activities, including nurseries
 - b. Construction
 - c. Land clearing and development activities, including the conversion of agricultural and silvicultural lands to residential and urban uses.
 - d. Unpaved roads located within the boundaries of the watershed.
 - e. Roadside ditches and culverts without detention and silt collection
- 2 To Decrease/reduce water pollution and siltation from stormwater, sewage and septic discharges from residential subdivisions and commercial areas.

Monitoring Objectives (M)

- 1 To identify all research conducted within the watershed that will assist decision makers in policy decisions.
- 2 To better understand the effects of nutrient runoff from nurseries and other activities by developing a nutrient monitoring program.
- 3 To determine sources and levels of bacterial contamination.
- 4 To determine sources of Organic Carbon in the watershed.

Education and Outreach Objectives (EO)

- 1 To make landowners/homeowners aware of their impacts on the watershed, including their recreational impacts including: petroleum products, nutrients, pesticides and litter.

- 2 To make developers, contractors, business owners and others aware of their impacts on the watershed.
- 3 To develop and maintain good working relationships with contractors, developers, utility companies, farmers, businesses and homeowners through the Clean Water Partnership, or other avenues.

Land Use and Planning Objectives (LUP)

- 1 Promote planning and zoning that will protect ecologically significant areas.
- 2 To work with Mobile County to develop a priority list of unpaved roads in the watershed that contribute to sedimentation problems

Preservation and Protection (PP)

- 1 To acquire environmentally significant land in the watershed, including areas to be designated as open space and riparian buffers.
- 2 Ensure protection of fish and wildlife habitats as well as sensitive habitats such as wetlands, marshes, bogs, grady ponds, long leaf pine flatwoods, and white cedar stands.
- 3 To preserve family farms and the agricultural/rural heritage of the watershed while protecting water quality.
- 4 To evaluate and pursue increased public and/or recreational access in the watershed.

Management and Implementation Objectives (MI)

- 1 To keep the efforts of the watershed project ongoing, establish a watershed project coordinator.
- 2 To establish an organizational committee with representatives from industries and activities in the area as well as MAWSS and local environmental groups
- 3 Establish an educational center for the community to learn about the watershed resources.
- 4 Cooperate and develop relationships with local municipalities, government officials, governmental agencies, large landowners and businesses.

1. Wastewater and Polluted Runoff

Wastewater is used water that may contain substances such as human waste, food scraps, oils, soaps and chemicals. In homes, this includes water from sinks, showers, bathtubs, toilets, washing machines and dishwashers. Businesses and industries also contribute their share of waste water that is discharged into waterways. Storm runoff from heavy rains may also contain substances that may be harmful to area waters. Although some people assume that the rain that runs down the

street during a storm is fairly clean, it may not be. Harmful substances that wash off roads, parking lots, and rooftops can harm our rivers and lakes.

Source: USGS, Water Science for Schools

Issue: The public does not understand the basics of septic tank and sewer system care and maintenance or the potential impacts of improperly maintained septic systems.

Action Strategy 1: Develop or adopt educational programs to educate landowners about septic tank and sewer system care. This program will highlight the need for tank inspection and periodic pump out. The program will also work to explain the reasons sewage systems fail.

Objective Met: NPS2

Responsible Parties: MCHD, MCC, ADEM OEO

Partners: MCHD, MEE, ACES

Funding Sources: Sewer Utilities, 319 Grants, Septic Tank Companies, (NOAA 306, 6217)

Evaluation method 2

Action Strategy 2: Target all homeowner associations in the area and provide them with educational presentations about septic systems.

Objective Met: EO1

Responsible Parties: MCHD, government officials

Partners: Homeowners/Homeowners Associations, Realtors, governmental Mortgage Companies, MEE, ACF, government agencies, large landowners

Funding Sources: no funding needs anticipated

Evaluation method 1

Action Strategy 3: Develop a survey to determine how many houses within the watershed utilize septic tanks. Work with Mobile County Health Department to have all existing septic tanks located and mapped.

Objective Met: M3

Responsible Parties: MCHD, ADCNR

Partners:

Funding Sources: NOAA (309/6217/306)

Evaluation method 2

Issue: Homeowners do not always follow Best Management Practices and need to be better educated on nonpoint source pollution.

Issue: Homeowners are concerned about how to properly address nutrient and sediment runoff.

Action Strategy 1: Develop a workshop for homeowners within the watershed on stormwater runoff and BMPs.

Responsible Parties: MAWSS, ADEM

Objective Met: EO1

Partners: Homeowners Associations, ACES , land developers

Funding Sources: Land developers, NOAA (309/6217/306)

Evaluation method 1

Action Strategy 2: Provide educational programs for the general public and K-12 on the environmental benefits of the Big Creek Lake Watershed. **Discussion:** Programs must be in place to educate the residents of the watershed on the importance of environmental issues such as groundwater, conservation and habitat protection. Community meetings revealed that programs should start with the younger generation. Efforts are in place to bring educational programs to the schools in the watershed. In addition, the CACWP is in the process of arranging an annual groundwater festival for fourth graders. There are also other programs already in place; ACF provides a K-3 Bay Buddy Program, a fourth grade ground water festival, a fifth grade Coastal Kids Quiz, and are in the process of developing a sixth grade habitat program—Project Osprey.

Objective Met: EO1

Responsible Parties: Mobile County School System, ACF

Partners: CACWP, ACF, ADEM, volunteer

Potential Funding: ADEM, MBNEP, MCC

Evaluation method 1

Issue: Additional treatment of stormwater runoff is necessary to protect area waterways.

Action Strategy 1: Encourage the County and municipalities to develop and implement stormwater management policies to control both the quantity and quality of stormwater runoff.

Action Strategy 2: Determine impervious cover limits and its effect on water quality.

Action Strategy 3: Work with Auburn University Marine Extension and Research Center to implement a storm drain stenciling program throughout the watershed.

Objective Met: EO1, EO2, NPS2

Responsible Parties: MCC

Partners: ADEM, ADCNR, AUMERC, Neighborhood Associations

Funding Sources: OEO, NOAA 6217

Evaluation method 3 & number of storm drains stenciled

Issue: Stormwater runoff is not adequately monitored so the quality or quantity is not known.

Action Strategy 1: Monitor stormwater in strategic locations to determine types and quantities of contaminants and quantity of runoff.

Objective Met: M2, M3

Responsible Parties: Mobile County

Partners: ACF, ADEM, ADCNR, AUMERC, AWW, Neighborhood Associations,

Funding Sources: OEO, NOAA 6217

Evaluation method 6

2. Recreation

There are currently few public access points for recreation in the watershed. Residents have expressed an interest in utilizing the area for more boating, fishing, hiking and horse back riding. Much of the area surrounding Big Creek Lake is held by MAWSS to act as a protective buffer.

Issue: There is a need for public recreational and education facilities within the watershed.

Action Strategy 1: Prioritize parcels of land around the reservoir to utilize as recreational areas for citizens of the watershed. **Discussion:** Throughout the process of compiling the management plan, the one concern that continued to surface was the use of Big Creek Lake and the land surrounding the reservoir. Since the reservoir is utilized for public drinking water, MAWSS must take great lengths in protecting the water quality. However, this drinking water is not provided to Mobile County and this issue presents some animosity against MAWSS. The perception is that MAWSS has prohibited local communities from using the Lake and surrounding areas. Residents that live in the watershed would like to see portions of the land around the lake made available for recreational use. Surveys were taken during community meetings and the following ideas were suggested: hiking trails with educational kiosks, biking trails, horseback trails and more public water access.

Objective Met: PP6

Responsible Parties: MAWSS, local stakeholders

Partners: MAWSS

Funding Sources: MCC

Action Strategy 2: Identify areas for possible acquisitions to be used for a variety of uses including habitat protection and restoration.

Objective Met: PP3, PP4

Responsible Parties: MAWSS, MCC

Partners: TNC, Private Landowners, ADCNR, ACF, NEP, FWS, ADCNR

Funding Sources: ADCNR, Brown Foundation, National Coastal Wetland Conservation Grants Program, CELCP, Forest Legacy, FWS

Evaluation method 5

3. Agriculture and Forestry

Issue: There is a lack of stakeholder understanding regarding effects of agriculture operations in the watershed.

Action Strategy 1: Determine the number and types of farms, proximity to waterways and effects on land and water.

Objective Met: NPS1

Responsible Parties: NRCS

Partners: Farmers, ADEM, ACF

Funding Sources: NRCS

Evaluation method 4

Action Strategy 2: Develop a bacteria, nutrient and pesticide monitoring program to determine effects from agricultural and forestry sources and plant nurseries.

Objective Met: M2, M3

Responsible Parties: ACF, AWW, ADEM

Partners: Nursery Owners, Nurserymen's Association, GCRCD, CACWP

Funding Sources: GCRCD, NEP, ADEM, CACWP

Evaluation method 4 & 6

Action Strategy 3: Develop or adopt an education campaign about nutrient effects with nursery management specialists.

Objective Met: EO2

Responsible Parties: ACF, ACES

Partners: AUMERC, Auburn University

Funding Sources: CACWP, GCRCD

Evaluation method 1

Action Strategy 4: Develop a Green Nursery Initiative or Clean Water Guardian Program for water quality protection, e.g. an award program highlighting BMPs based on % pollutant reduction.

Objective Met: EO3, NPS1

Responsible Parties: ADEM

Partners: CACWP, ACF, AUMERC, South Alabama Nurserymen's Association

Funding Sources: AUMERC

Evaluation method 6

Action Strategy 5: Identify and encourage BMP demonstration projects on local farms within the watershed. Throughout community meetings, NRCS and ACES encouraged the dispersal of BMP manuals to local feed stores, hardware stores, etc. Past experience has shown that it is more effective to go to the landowner's organizations, rather than inviting them to attend community meetings. Contacting the landowners in person shows a non-regulatory stance and ensures that we are simply looking after the protection of the watershed.

Responsible Parties: NRCS, Alabama Cooperative Extension System (ACES)

Partners: ALFA, South Alabama Nurserymen's Association

Potential Funding: Mobile Bay National Estuary Program (MBNEP), NRCS

Evaluation method 6

Issue: There is limited information on monitoring runoff from agricultural activities.

Action Strategy 1: Develop sediment and water column monitoring program.

Objective Met: M2, 3, 4

Responsible Parties: ACF, AWW

Partners: ADEM, GCRCD, NEP, NRCS

Funding Sources: GCRCD, ADEM, NEP

Evaluation method 6

Action Strategy 2: Develop an aerial photography nonpoint source pollution monitoring program.

Objective Met: M3

Responsible Parties: ACF

Partners: CACWP

Funding Sources: NOAA, MAWSS, EPA, ADEM

Evaluation method 2 & 4

Issue: There is a need to reduce non-point source pollution from agricultural activities and land clearing activities.

Action Strategy: Identify and prioritize the sub-watersheds that are most affected by agricultural non-point source pollution through the use of existing water quality data and aerial photography to find the proximity of existing pasture and farmlands to waterways.

Objective Met: EO1

Responsible Parties: ADEM, NRCS

Partners: ACF, CACWP, MAWSS, landowners

Funding Sources: MAWSS, NRCS, ADEM

Issue: Conversion of agricultural and silvicultural land to residential land

Action Strategy 1: Develop or adopt a workshop for estate attorneys, landowners, municipalities, etc. on incentives to preserve land.

Objective Met: PP

Responsible Parties: ACF

Partners: Hand Arendall, NRCS, farmers, attorneys, CPAs

Funding Sources: In Kind

Evaluation method 1

Action Strategy 2: Work to develop an incentive-based program to conserve land, i.e. riparian buffers, conservation easements, land trusts, etc.

Objective Met: PP

Responsible Parties: Forestry Commission

Partners: ACF, Hand Arendall, NRCS, farmers, Forever Wild, Coastal Land Trust

Funding Sources: In Kind

Evaluation method 1

Action Strategy 3: Provide education and outreach to the general public on estate taxes, property tax assessments and conservation easements and its connection to land use.

Objective Met: EO

Responsible Parties: ACF,

Partners: Hand Arendall, NRCS, farmers,

Funding Sources: In Kind

Evaluation method 1

Action Strategy 4: Work with the local community to develop and provide incentives to preserve family farms.

Objective Met: PP5

Responsible Parties: ACF

Partners: NRCS, farmers,

Funding Sources: In Kind

Evaluation method 1

4. Construction

Unpaved roads can be significant contributors of water quality degradation if not properly designed and maintained. Discharges of sediment laden waters into our waterways and wetland habitats diminishes channel capacity causing more frequent and severe flooding; destroys aquatic and riparian habitat; and has other adverse effects on water quality and water-related activities. Erosion of unpaved roads occurs when soil particles are loosened and carried away from the roadway base, ditch, or road bank by water, wind, or traffic. After being dislodged, eroded soil particles are carried into the roadway drainage system. Road construction projects should be designed to allow eroded particles to settle out before discharging into our waterways. Sediment control is usually accomplished through gradients of slope and vegetative buffers. Over time, the particles that settle out build up and reduce the carrying capacity of the drainage system and can cause increased flooding, erosion, and discharges of sediment. Proper maintenance reduces both environmental impacts and maintenance costs.

Several miles of unpaved County-maintained roads are located within the watershed. The County maintains these roads by grading after rainfalls, and keeping ditches clean and free of debris.

Another source of sediment is the large number of privately owned and maintained dirt roads. Although Mobile County previously had a dirt road program whereby they accepted a mile of previously private road for every mile of County maintained dirt road that was paved, that program has not been active for several years. Were the County to re-establish the program, they are prohibited by law from accepting for maintenance roads that are not built in accordance with current acceptable roadway design and construction practices.

Issue: Nonpoint source runoff from dirt roads, farms and commercial and residential development.

Action Strategy 1: Develop workshops to explain impacts of non-point source pollution and the benefit of better site design for homeowners, design engineers, architects, municipalities and developers.

Objective Met: EO2

Responsible Parties: ADEM

Partners: ADEM, ACF, AGCA, HBBA, homeowner, engineers, architects, MCC

Funding Sources: No funding anticipated

Evaluation method 1

Action Strategy 2: Work with roadbuilders and Mobile County on implementation of BMPs.

Objective Met: NPS1

Responsible Parties: Mobile County

Partners: ADEM, ACF, Mobile County Roadbuilders Association

Funding Sources: No funding anticipated

Evaluation method 6

Action Strategy 3: Work with Mobile County Commission to prioritize paving of County dirt roads within the watershed and develop a program to assess feasibility of accepting private dirt roads in the watershed for County maintenance. Acquire list of dirt roads as well as cost to maintain these roads.

Objective Met: LUP2

Responsible Parties: MCC

Partners: MAWSS, ACF

Funding Sources: No funding anticipated

Evaluation method 4 & 6

Action Strategy 4: Recognize contractors that are taking steps to protect the watershed by developing a responsible builder rating system.

Objective Met: EO

Responsible Parties: ACF **Partners:** MAWSS, AGCA, HBBA

Funding Sources: In Kind

Evaluation method: number of builders who meet requirements for system

Action Strategy 6: Support efforts to ensure that permits are obtained for one acre or larger disturbances and BMPs are installed correctly.

Objective Met: MI

Responsible Parties: ADEM, area neighborhood watch groups

Partners: AGCA, HBBA

Funding Sources: No funding anticipated

Evaluation method 3

5. Human Health Issues

With the continued increase in population in the area, watershed residents are concerned about a variety of human health issues including the presence of pathogenic bacteria in area waterways, the rate of groundwater withdrawal, sediment contamination, and hazardous waste.

Issue: Limited information regarding groundwater withdrawal and recharge.

Action Strategy 1: Assess groundwater withdrawal zones and rates within the watershed.

Objective Met: MO

Responsible Parties:

Partners: GSA, USGS, OWR, ADEM

Funding Sources: No funding anticipated

Evaluation method 4

Action Strategy 2: Encourage Mobile County to develop a source water protection zone.

Objective Met: MI

Responsible Parties: MCC

Partners: ACF, ADEM

Funding Sources: Unknown

Evaluation method 4

Action Strategy 3: Provide citizen education on prevention of groundwater pollution

Objective Met: EO1

Responsible Parties: ADEM, ACES

Partners: ACF, MBNEP

Funding Sources: NEP

Evaluation method 1

Issue: Inadequate disposal facilities for hazardous waste

Action Strategy 1: Work to acquire funds for a permanent HHW collection facility.

Objective Met: NPS

Responsible Parties: Mobile County Public Works Department, Keep Mobile Beautiful

Partners: ACF, ADCNR, Coastal; ADAI

Funding Sources: ADCNR, NOAA (CIAP), BCC

Evaluation method: pounds of waste collected and number of people participating

Issue: Bacteria levels may be unsafe after rain events.

Action Strategy 1: Develop a bacteria source tracking program.

Responsible Parties: local citizens

Objective Met: M3

Partners: ACF, ADEM

Funding Sources: MAWSS, EPA

6. Wetlands

Wetlands are a semi-aquatic lands that are either inundated or saturated by water for varying periods of time. The three defining characteristics of wetlands include hydrology, hydrophytic vegetation and hydric soils. Wetlands serve as a transitional zone between upland and aquatic systems and are typically very productive nursery areas. Wetlands serve additional functions including: pollution control, sediment filtering, groundwater recharge, flood protection, and shoreline buffering.

The federal regulations implementing Section 404 of the Clean Water Act define wetlands as: "Those areas that are inundated or saturated by surface or ground water (hydrology) at a frequency and duration

sufficient to support, and that under normal circumstances do support, a prevalence of vegetation (hydrophytes) typically adapted for life in saturated soil conditions (hydric soils). Wetlands generally include swamps, marshes, bogs, and similar areas (40 CFR 232.2(r)).”

Issue: Current wetland regulations do not adequately protect wetlands.

Action Strategy 1: Develop and implement a non-regulatory protection program similar to the ADID process.

Action Strategy 2: Identify impaired wetlands and have them mapped.

Action Strategy 3: Restore impaired wetlands.

Objective Met: PP, LUP

Responsible Parties: Mobile County

Partners: USACE, ADEM, ADCNR Coastal, ACF

Funding Sources: MCC

Evaluation method 4

Issue: There is a need for the general public to understand the benefits of wetlands.

Action Strategy 1: Provide educational programs for the general public on the economic, social and environmental benefits of wetlands.

Action Strategy 2: Provide information to the general public on tax incentives and other benefits that can be achieved through the use of conservation easements for land protection.

Action Strategy 3: Develop an Adopt a Wetlands Program

Objective Met: EO1

Responsible Parties: USACE, ADEM, ADCNR Coastal

Partners: USACE, ADEM, ADCNR Coastal, Hand Arendall, FWS

Funding Sources: MCC

Evaluation method 1

Action Strategy 5: Utilize existing and pursue new programs to provide landowners with economically viable solutions for wetland habitat protection and restoration activities.

Objective Met: PP4

Responsible Parties: USACE, ADEM, DCNR

Partners: MCC, ACF

Funding Sources: Mobile County

Evaluation method 4

Issue: Need for coordinated plan to protect sensitive habitats including habitat acquisition and protection.

Action Strategy 1: Identify and map sensitive habitats and work with existing ranking systems to prioritize the acquisitions or other forms of protection.

Objective Met: PP

Responsible Parties: ACF, TNC **Partners:** FWS, NEP, ADCNR, USACE, Land Trusts, MCC, Wetland

Resources, ACF, Forever Wild, CLT, Forest Legacy

Funding Sources: CELCP, ADCNR, FWS, Forest Legacy, Forever Wild

Evaluation method 4

Action Strategy 2: Encourage statewide legislation for overlay districts of riparian buffer zones for planning and zoning documents, countywide master plans, and subdivision regulations.

Objective Met: LUP

Responsible Parties: Mobile County, local legislators

Partners: ACF, ADEM

Funding Sources: No funding anticipated

Evaluation method 3

7. Management Plan Implementation

Issue: There is a need to develop relationships with local municipalities, governmental officials and agencies, utility companies, large landowners and businesses.

Action Strategy 1: Identify and rank information needs.

Action Strategy 2: Support MAWSS, MCC and USGS monitoring.

Action Strategy 3: Provide special workshops and community events to keep residents involved.

Action Strategy 4: Encourage participation from government officials.

Action Strategy 5: Encourage businesses to participate in voluntary programs.

Objective Met: MI

Responsible Parties: Mobile County, local legislators

Partners: ACF, ADEM, MAWSS

Funding Sources: No funding anticipated

Evaluation method 3

TABLES AND FIGURES

TABLE 1 – LAND USE

Land Use	Acres	Square Miles (mi²)	Percent (%)
Forest	381.78	62.5 mi ²	59.8%
Pasture	105.02	17.2 mi ²	16.5%
Low Density Residential	64.74	10.6 mi ²	10.1%
Water	35.34	5.8 mi ²	5.5%
Row Crops	24.96	4.1 mi ²	3.9%
High Density Residential	14.58	2.4 mi ²	2.3%
Nursery	6.67	1.1 mi ²	1.1%
Disturbed Land	2.47	.4 mi ²	.4%
Commercial	1.73	.3 mi ²	.3%
Wetlands	.494	.1 mi ²	.1%
Industrial	.247	.1 mi ²	.02%

TABLE 2 – POPULATION

County/Town	2000	2003	2006 (estimates)
Mobile County	399,843	399,747	404,157
Semmes	15,389	Not Available	Not Available
Wilmer	8,591	Not Available	Not Available
Tanner-Williams Division (EPA Data)	59,443*		

(US Census Bureau)

*Sub-county division census

TABLE 3 – CROP STATISTICS

Crops-Jan. 2004	Acres Harvested	Yield	Production
Cotton	9,200	730 lbs	13,470 bales
Peanuts	4,600	3,240 bu	14,913,000 lbs
Hay	12,500	2.5 tons	31,000 tons

Crops – 2005	Acres Harvested	Yield	Production
Cotton	10,600	571 lbs	12,600 bales
Peanuts	5,000	3,335 bu	16,680,000 lbs
Hay	8,300	3.3 tons	27,500 tons

Crops-Jan. 05	Number
All Cattle & Calves	14,000 head
Beef Cows	6,800 head
Milk Cows	700 head

Crops – Jan. 06	Number
All Cattle & Calves	13,900 head
Beef Cows	7,200 head
Milk Cows	700 head

TABLE 4 – 303 (D) LISTED STREAMS

2004 FINAL 303(d) LIST

Assessment Unit ID	Water Body Name	Support Status	Type	Rank	River Basin	Uses	Causes	Sources	Date of Data	Size	Downstream/Upstream Locations	1996 303(d)?	Draft TMDL Date
AL03170008-0402-400	Boggy Branch	Partial	R	M	Escatawpa	F&W	Metals (Fe)	Natural	1996-99	3.6 mi.	Big Creek Lake / Its source	NO	2008
AL03170008-0401-200	Juniper Creek	Non	R	H	Escatawpa	F&W	Pathogens	Pasture Grazing	1996-99	6.6 mi.	Big Creek Lake / Its source	NO	2002
AL03170008-0402-700	Collins Creek	Partial	R	H	Escatawpa	F&W	Pathogens	Pasture grazing, On-site wastewater systems	1996-99	4.9 mi.	Big Creek Lake / Its source	NO	2008

Data from the Alabama Department of Environmental Management 2004 Final 303(d) List, March 29, 2006

2006 DRAFT 303(d) LIST

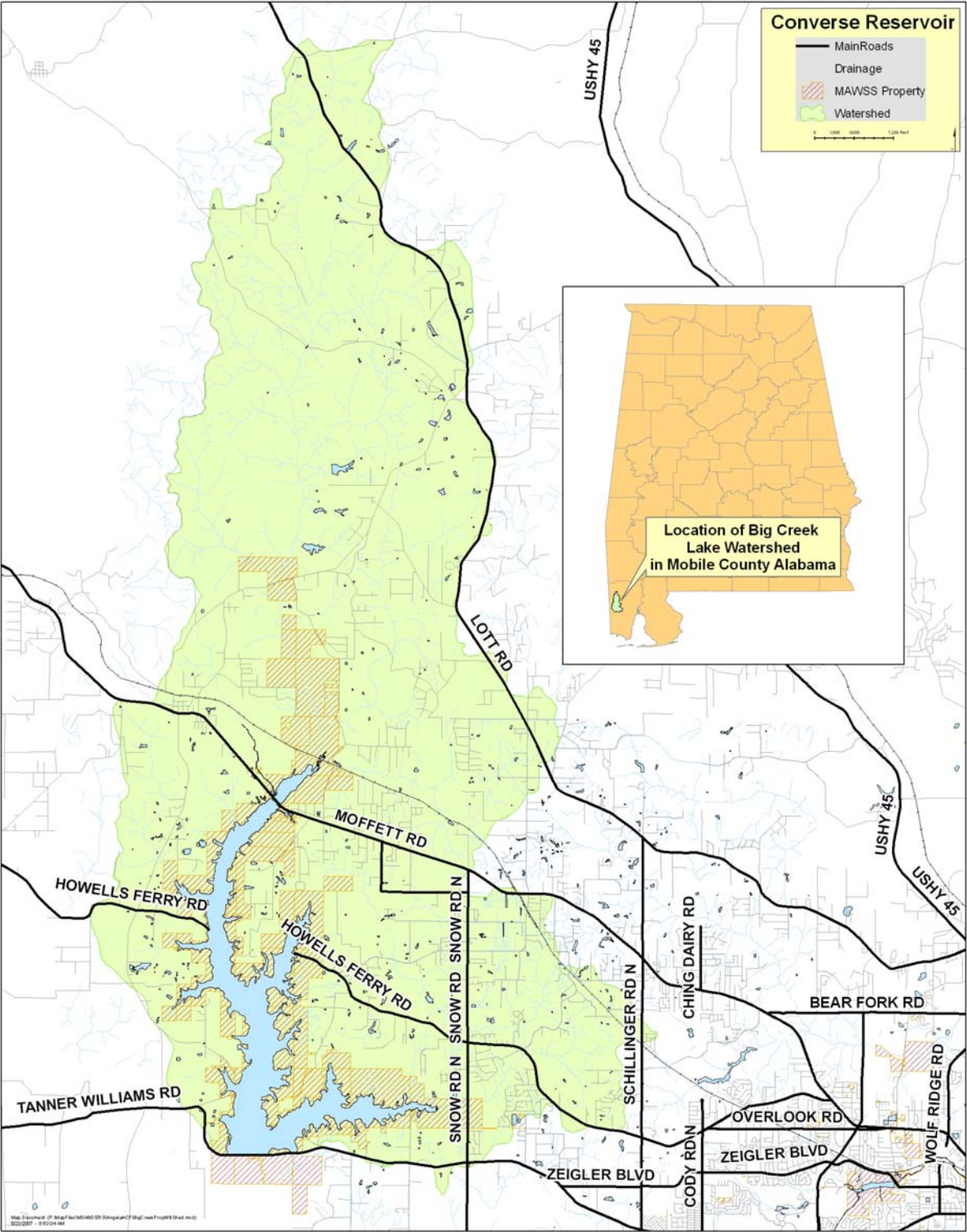
Assessment Unit ID	Water Body Name	Support Status	Type	Rank	River Basin	Uses	Causes	Sources	Date of Data	Size	Downstream/Upstream Locations	Draft TMDL Date
AL03170008-0402-400	Boggy Branch	Partial	R	M	Escatawpa	F&W	Metals (Fe)	Natural	1996-99	3.6 mi.	Big Creek Lake / Its source	2008
AL03170008-0401-200	Collins Creek	Non	R	H	Escatawpa	F&W	Pathogens	Pasture grazing, On-site wastewater systems	1996-99	4.9 mi.	Big Creek Lake / Its source	2008
AL03170008-0402-700	Collins Creek	Partial	R	L	Escatawpa	F&W	Metals (As)	Unknown	2001,02	5.15 mi.	Big Creek Lake / Its source	2013

Data from the Alabama Department of Environmental Management DRAFT 303(d) List

TABLE 5 – ADEM WATER USE CLASSIFICATION

Rank	Classification	Sewage, Industrial Waste or Other Waste	pH (s.u.)	Temperature (F)	Dissolved Oxygen (mg/L)	Bacteria (colonies/100-mL)	Turbidity (NTU)	Toxicity, Taste, Odor and Color
^{*i}	Outstanding National Resource Water (ONRW)	No new or expanded point source discharges shall be allowed.	6.0-8.5	The water quality criteria are contingent upon the use classification of the specific Waterbody that has been assigned the ONRW designation. For example, Little River has been designated as an ONRW waterbody, however it has been classified by ADEM as a PWS, S, & F&W, therefore the applicable water quality criteria associated with the PWS, S, & F&W classification apply.				
1	Outstanding Alabama Water (OAW)	No new or expanded point source discharges shall be allowed, unless no other feasible alternative can be demonstrated to the satisfaction of ADEM		Shall not exceed 90 F; (86 F) ^{*ii} Maximum instream rise above ambient conditions shall not exceed 5 F; (4.0/1.5 F) ^{*iii}	Shall not be less than 5.5	Fecal coliform group shall not exceed a geometric mean of 100 (coastal waters) and 200 (all other waters)	Shall not exceed 50 NTUs above background	Must meet all toxicity requirements, not affect propagation or palatability of fish/shellfish, or affect aesthetic values
2	Public Water Supply (PWS)	Must be treated or controlled in accordance with ADEM Rule 335-6-10-.08		Shall not exceed 90 F; (86 F) Maximum instream rise above ambient conditions shall not exceed 5 F; (4.0/1.5 F)	Shall not be less than 5.0	1000 geometric mean 2000 max. single sample (year-round) [100(coastal waters) and 200 (all other waters) June-Sep] ^{*iv}	Shall not exceed 50 NTUs above background	Shall not render waters unsafe or unsuitable for drinking supply or food processing; must meet all toxicity requirements, & not affect fish palatability
3	Swimming and Other Whole Body Water Contact Sports (S)	Must be treated or controlled in accordance with ADEM Rule 335-6-10-.08		Shall not exceed 90 F; (86 F) Maximum instream rise above ambient conditions shall not exceed 5 F; (4.0/1.5 F)	Shall not be less than 5.0	Fecal coliform group shall not exceed a geometric mean of 100 (coastal waters) and 200 (all other waters)	Shall not exceed 50 NTUs above background	Shall not render the water unsafe for water-contact; not exhibit acute or chronic toxicity; not impair fish palatability, or affect the aesthetic value
4	Shellfish Harvesting (SH)	Must be treated or controlled in accordance with ADEM Rule 335-6-10-.08		Shall not exceed 90 F; (86 F) Maximum instream rise above ambient conditions shall not exceed 5 F; (4.0/1.5 F)	Shall not be less than 5.0	Fecal coliform group shall not exceed a geometric mean of 100 (coastal waters) and 200 (all other waters) Not to exceed FDA limits ^{*v}	Shall not exceed 50 NTUs above background	Shall not exhibit acute or chronic toxicity; not affect marketability or palatability of fish and shellfish, or affect the aesthetic value

FIGURE 1 – WATERSHED PROJECT LOCATOR



Big Creek Lake Watershed Management Plan



FIGURE 3 – HYDROLOGIC UNIT CODES (HUC)

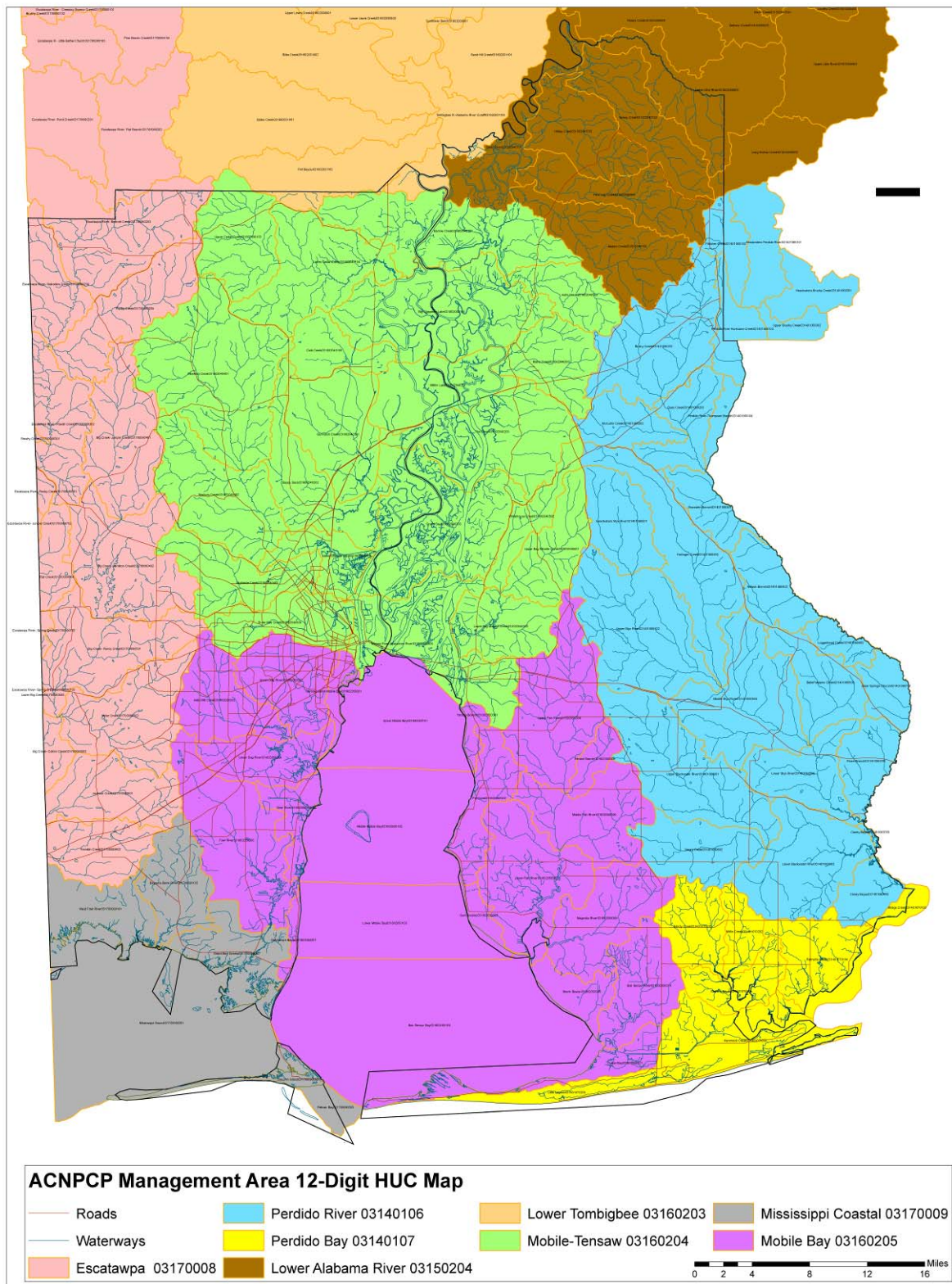


FIGURE 4 – EXISTING LAND USE

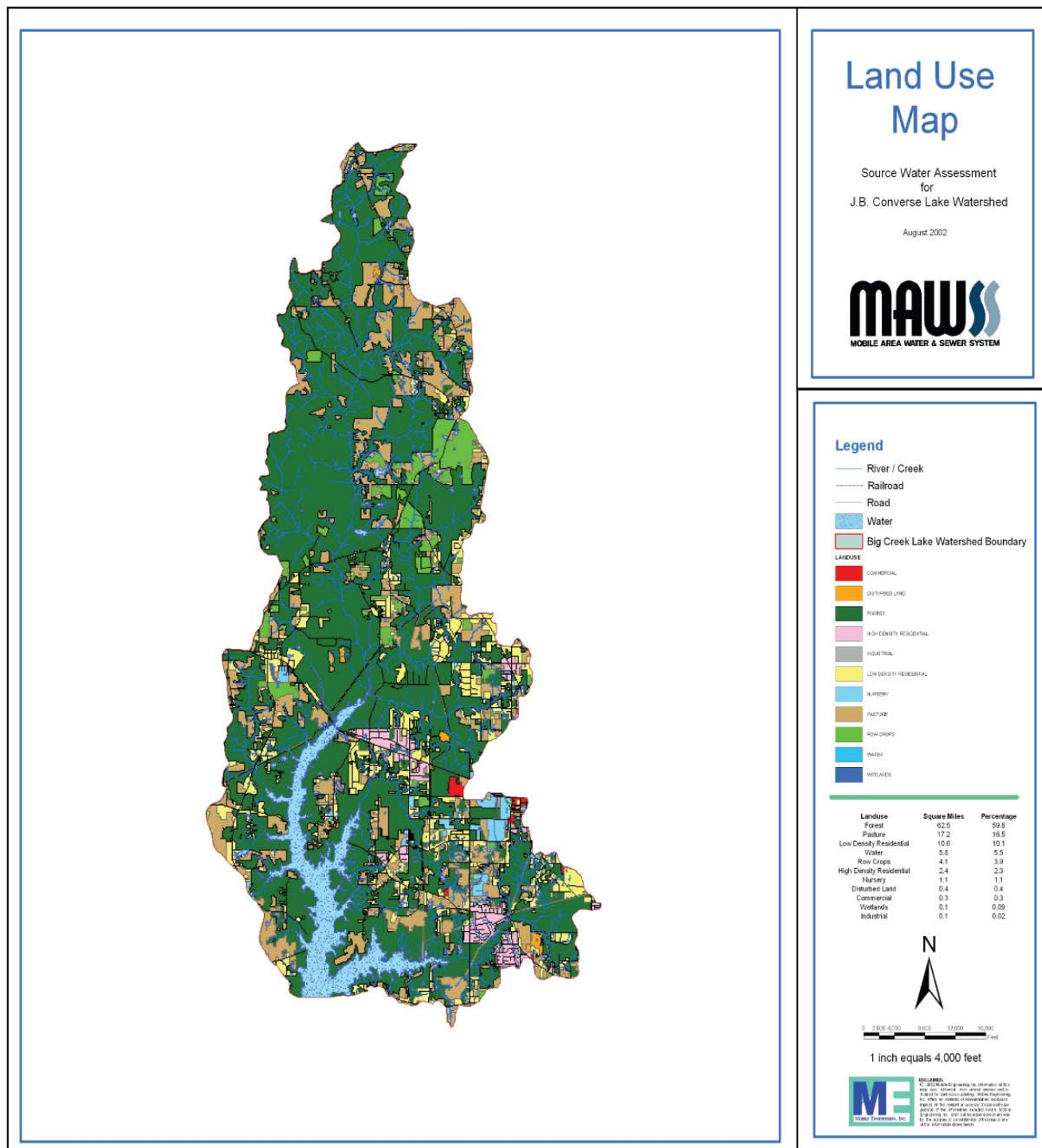


FIGURE 5 – GROWTH EAST OF CONVERSE LAKE WATERSHED



FIGURE 6 – NURSERIES

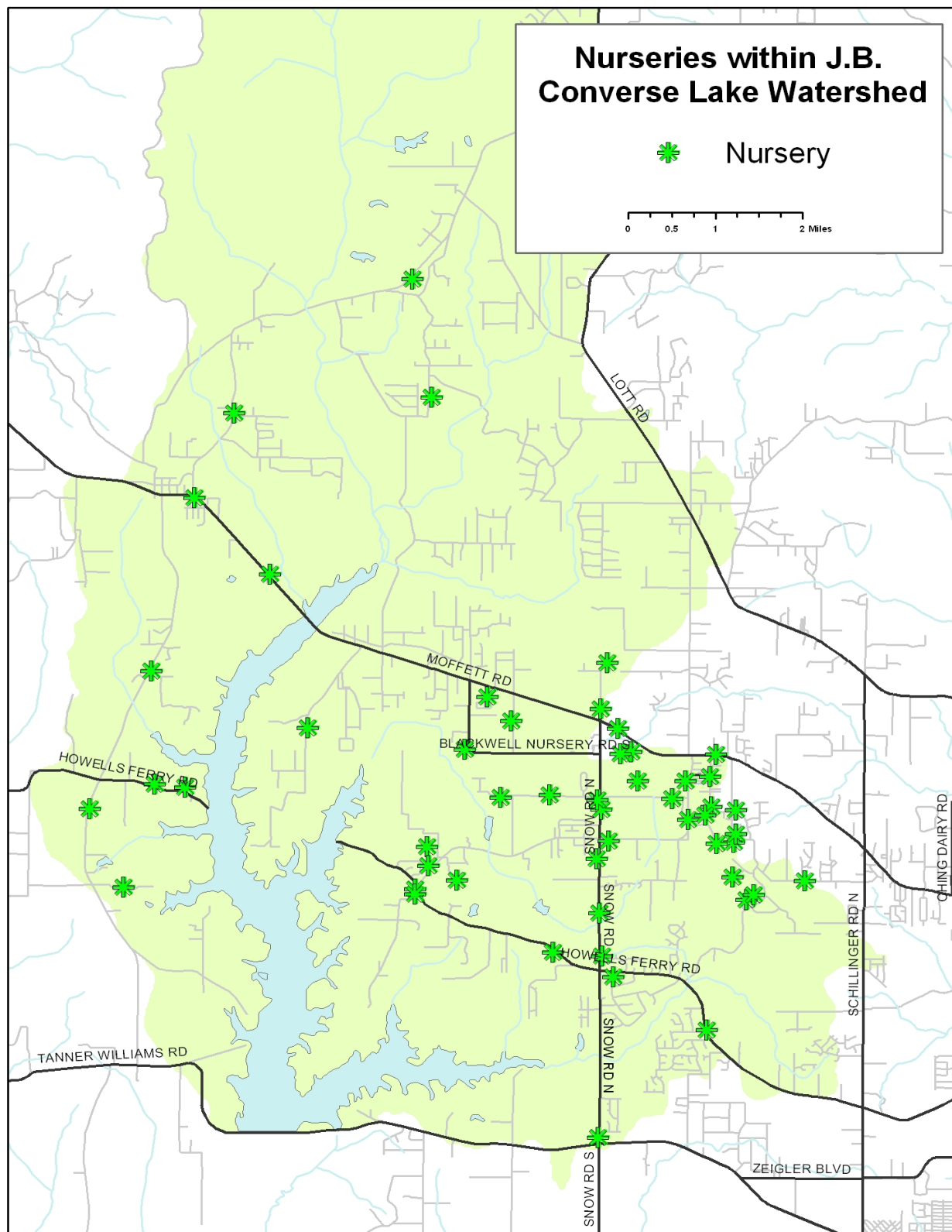


FIGURE 7 – MONITORING STATIONS

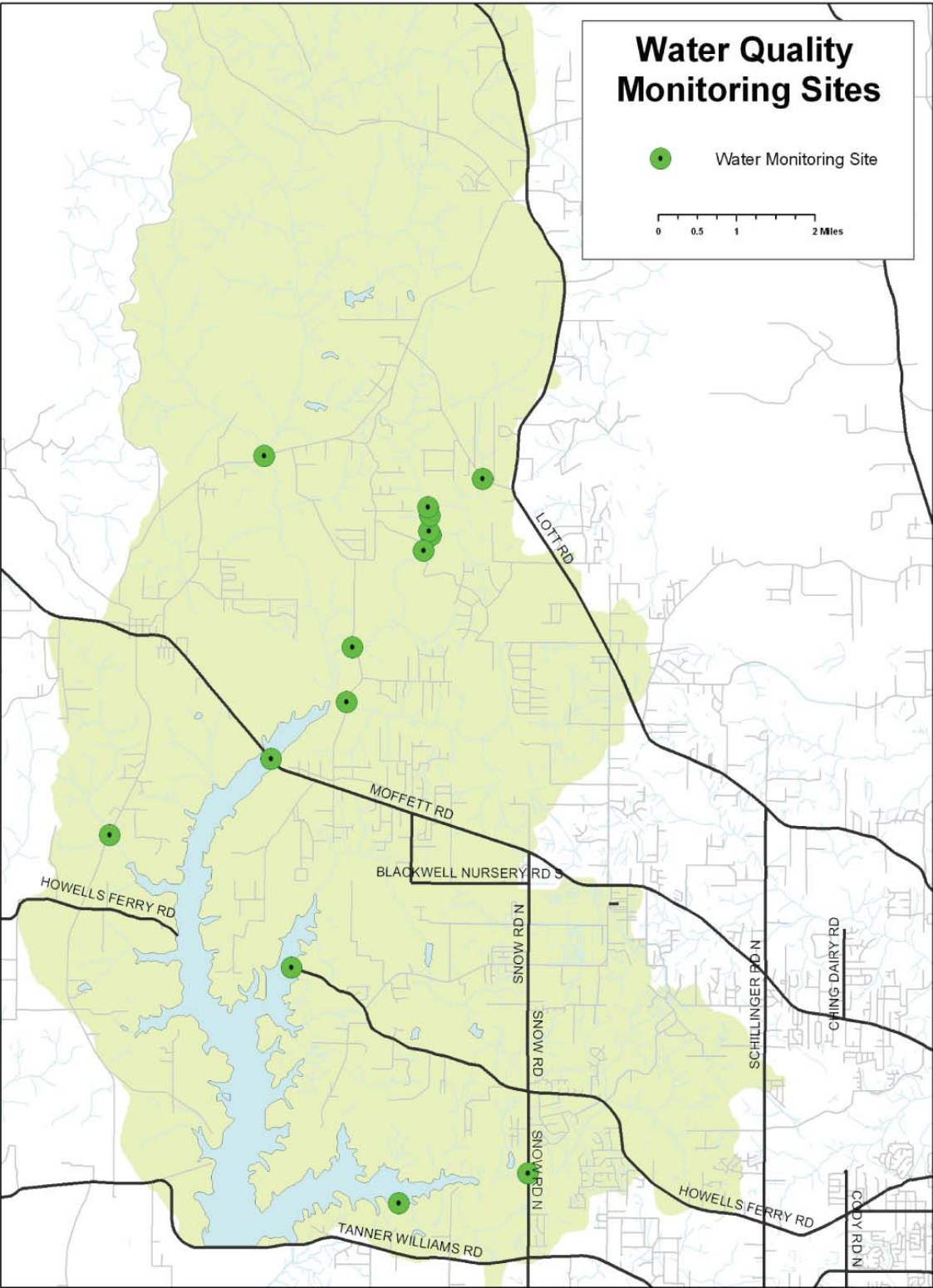


FIGURE 8 – BUILDING DEVELOPMENT 1997

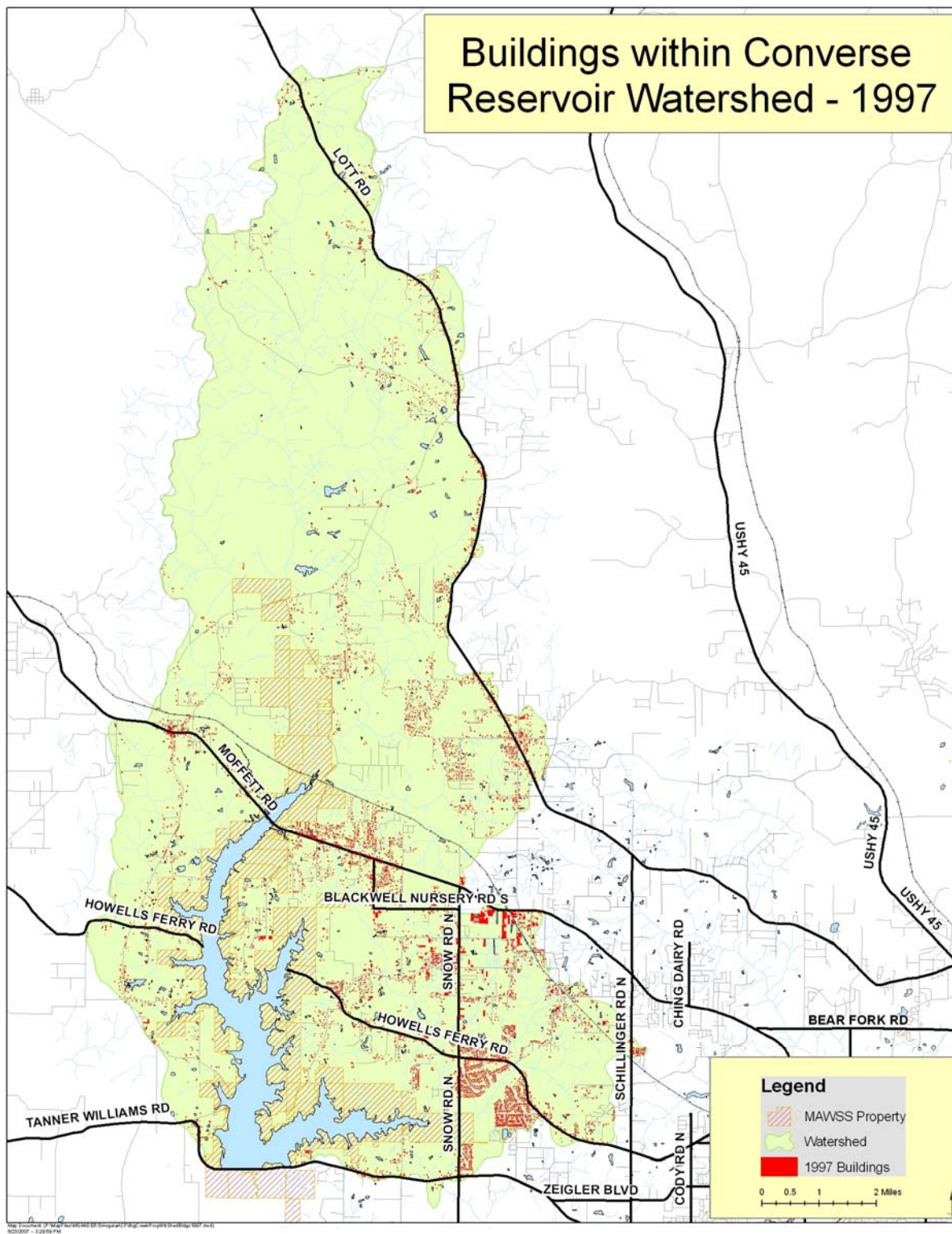


FIGURE 8 – BUILDING DEVELOPMENT 2006

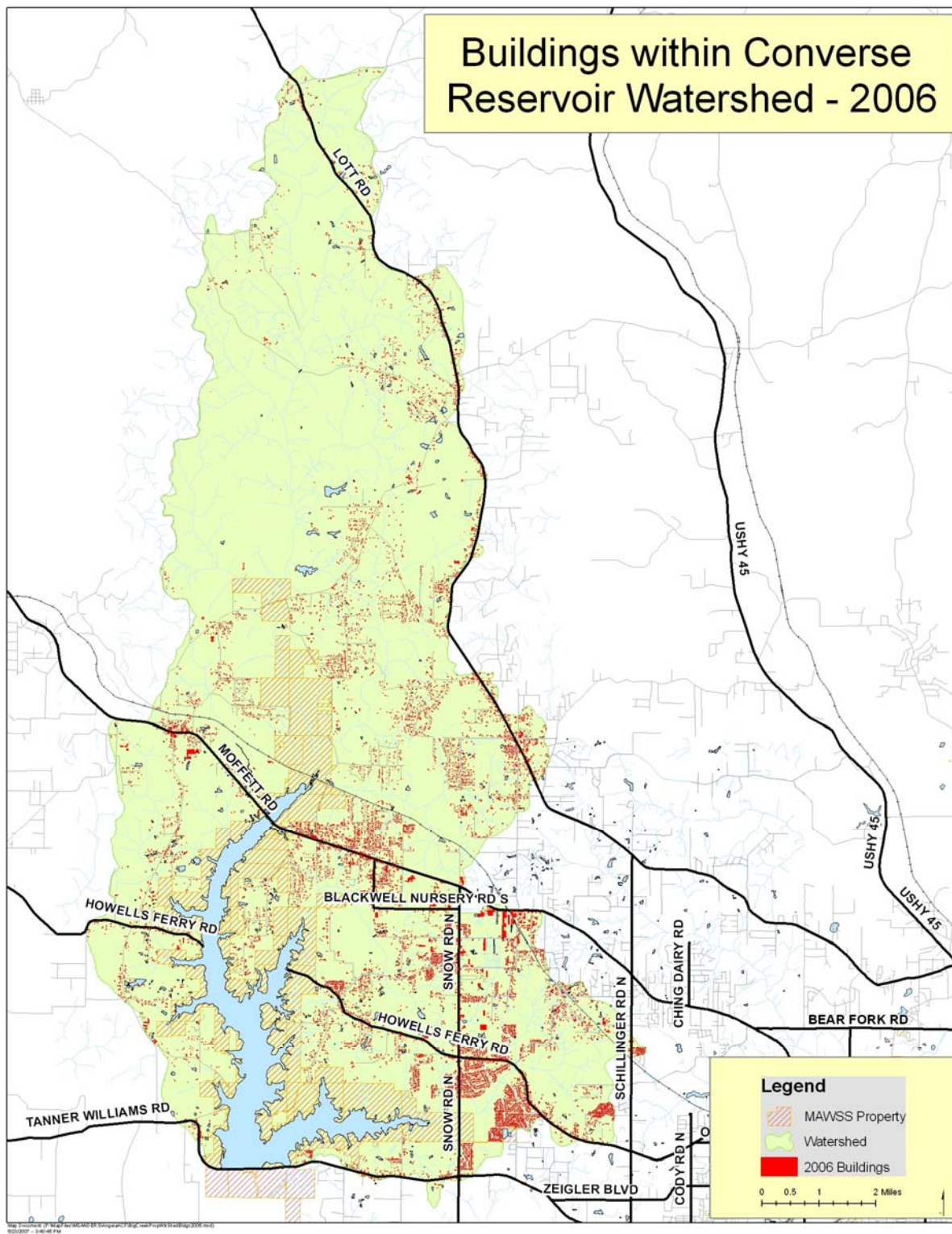
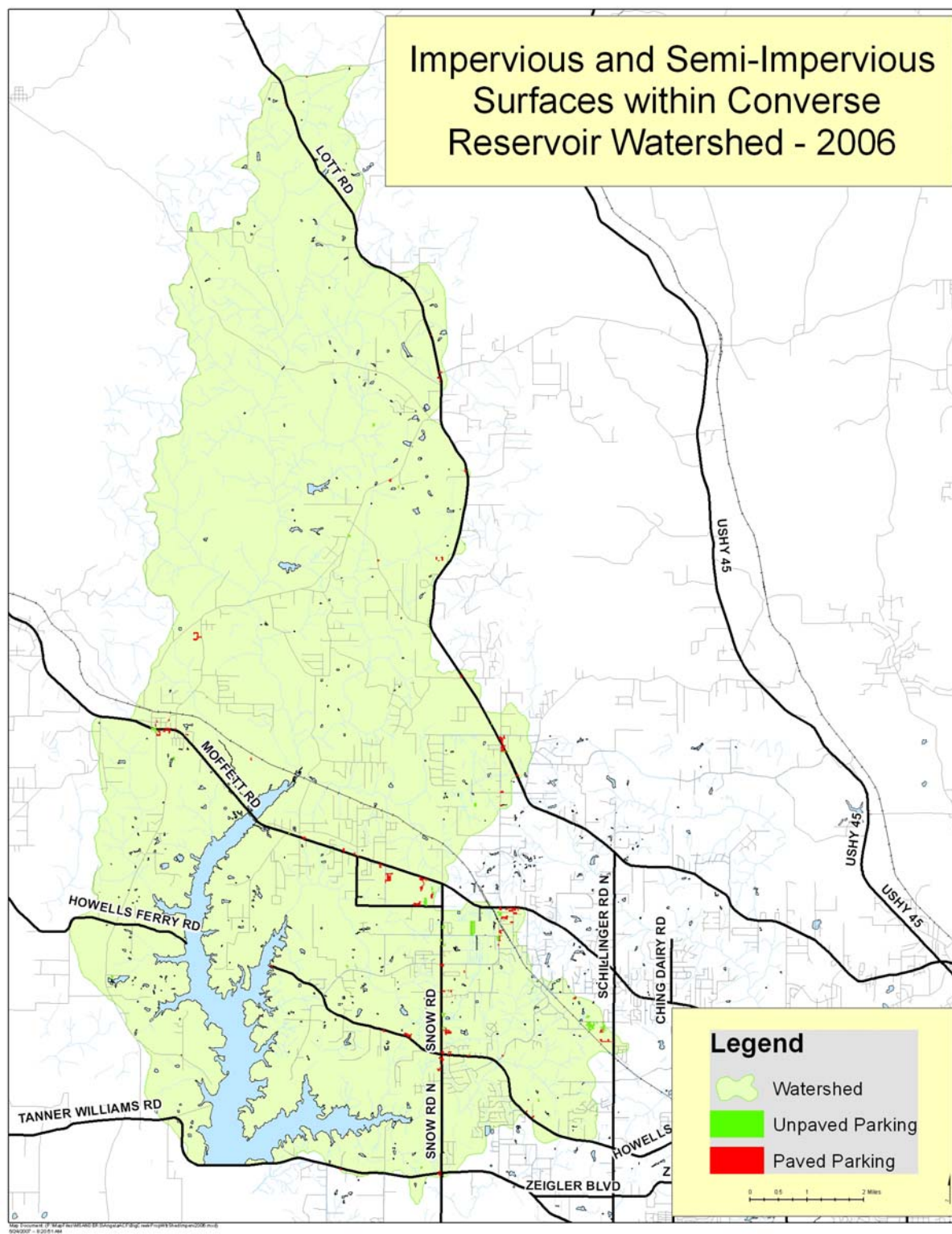


FIGURE 9 – IMPERVIOUS COVER (PARKING ONLY)



Big Creek Lake Watershed Management Plan



FIGURE 11 – PAVED ROADS

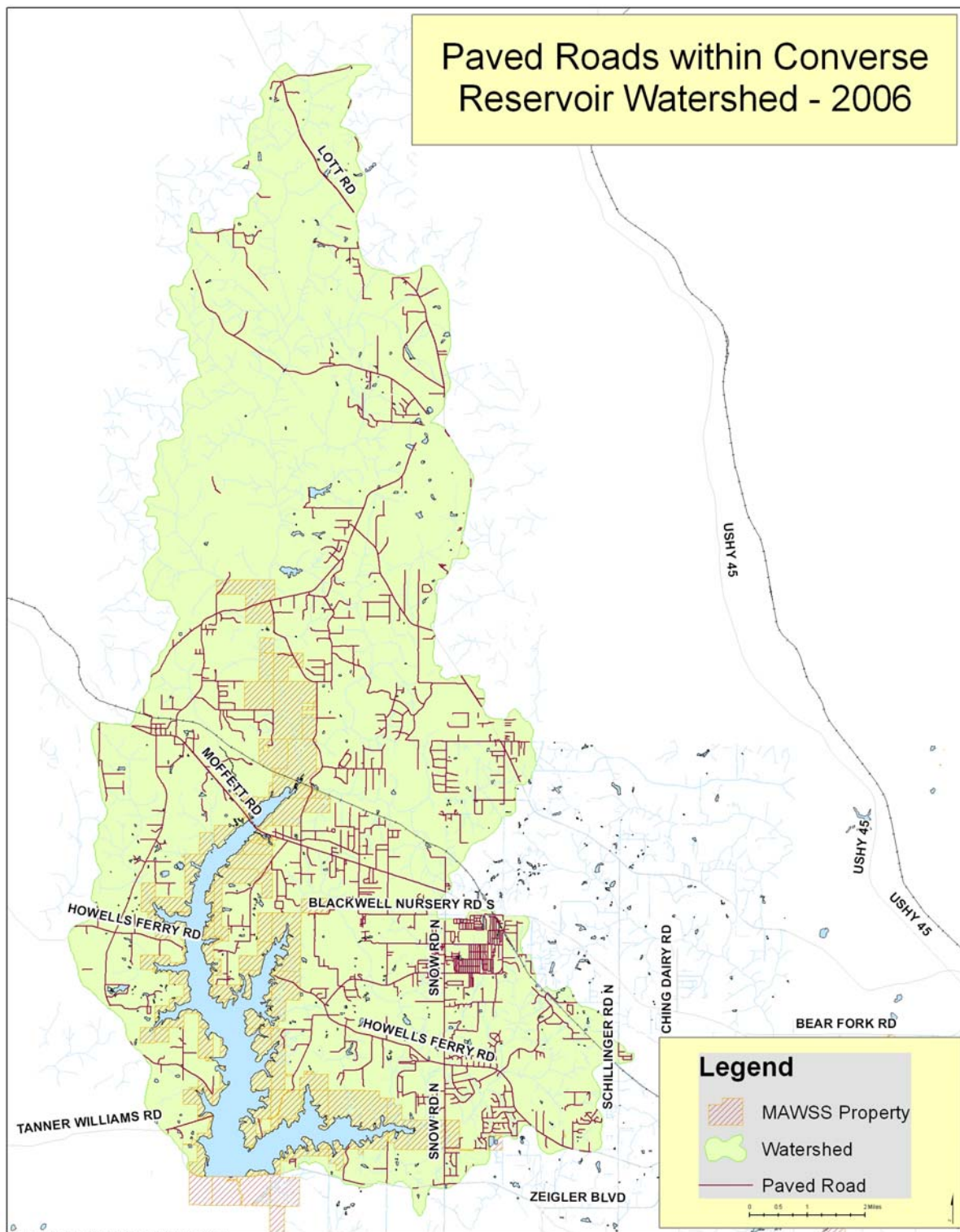


FIGURE 12 – UNPAVED ROADS

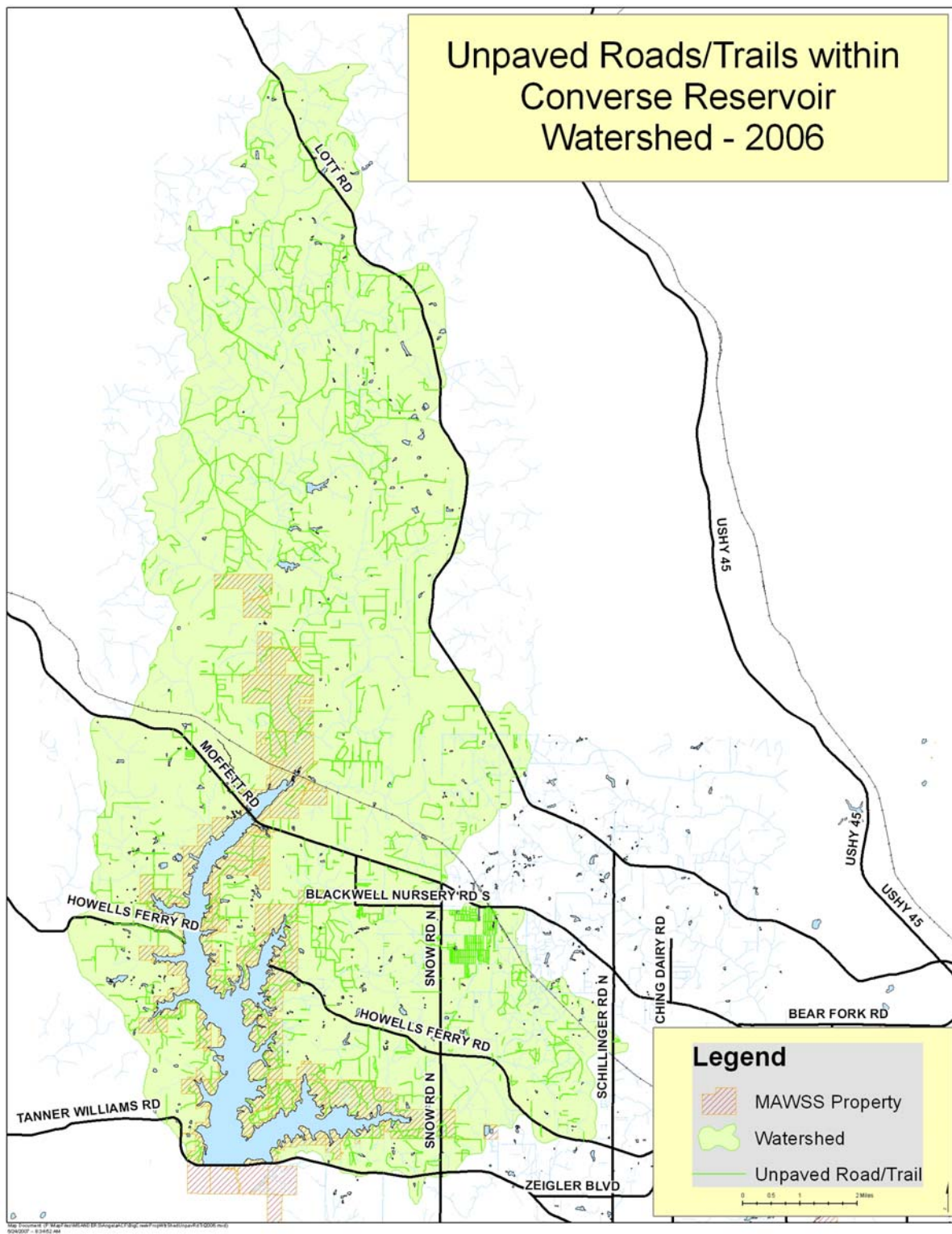
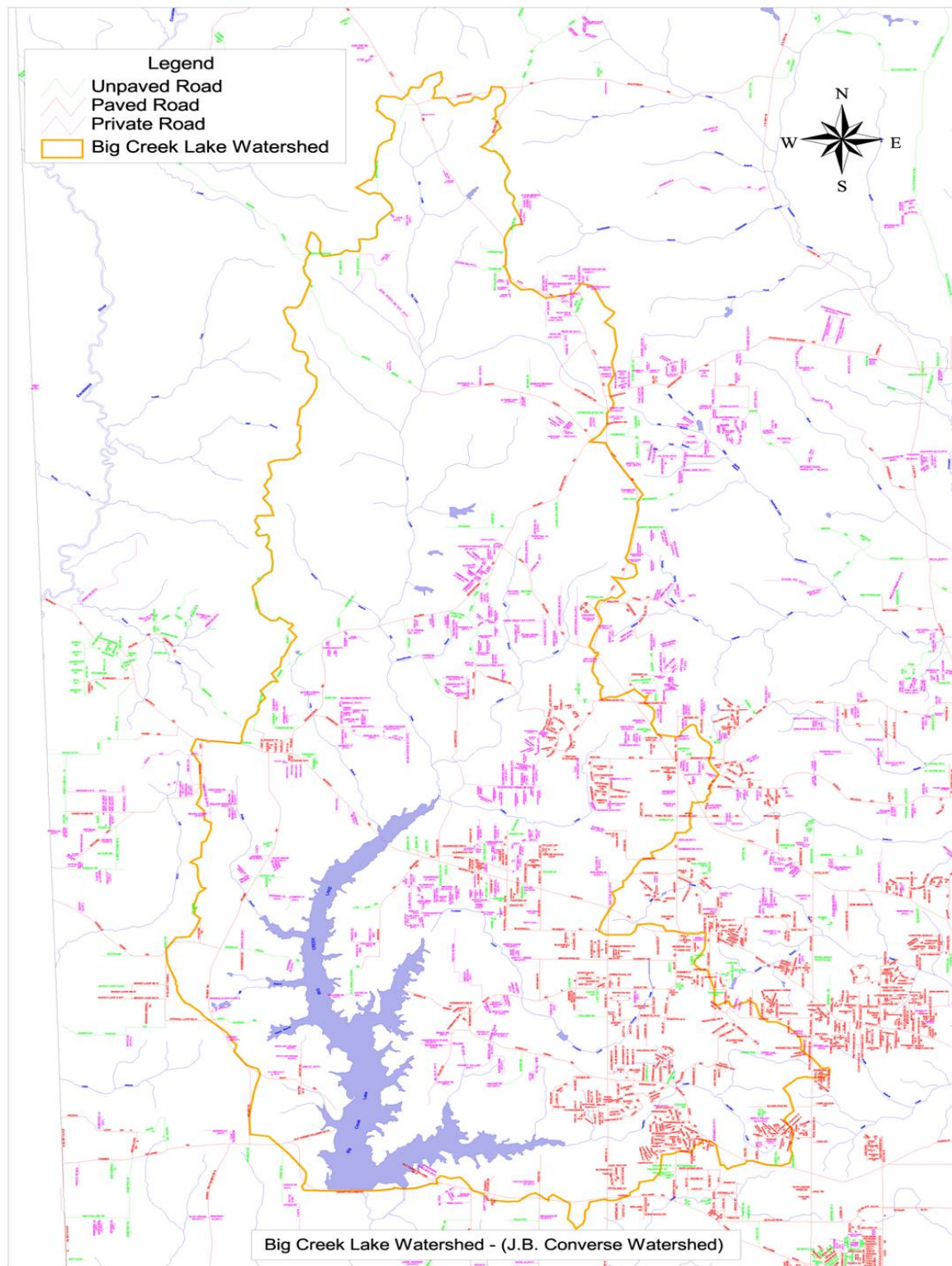


Figure 13- Categorization of Unpaved Roads in Watershed



APPENDICES

APPENDIX 1

ABBREVIATIONS AND ACRONYMS

A&I - Agriculture and Industry (water use classification)
ABTT - Alabama Bureau of Tourism and Travel
ACES - Alabama Cooperative Extension System
ACF - Alabama Coastal Foundation
ADAI - Alabama Department of Agriculture and Industries
ADCNR - Alabama Department of Conservation and Natural Resources
ADECA - Alabama Department of Economic and Community Affairs
ADEM - Alabama Department of Environmental Management
ADID - Baldwin County Wetland Advance Identification
ADPH - Alabama Department of Public Health
AFC - Alabama Forestry Commission
AGCA - Associated General Contractors of Alabama
AMP - Alabama Marine Police
ARA - Alabama Rivers Alliance
AUMERC - Auburn University Marine Extension and Research Center
AWW - Alabama Water Watch
BCC - Baldwin County Commission
BMP - Best Management Practice
CACWP - Coastal Alabama Clean Water Partnership
CELCP - Coastal and Estuarine Land Conservation Program
CIAP - Coastal Impact Assistance Program
CLT - Coastal Land Trust
CRP - Conservation Reserve Program
CVA - Clean Vessel Act
CZMA - Coastal Zone Management Act
CZARA - Coastal Zone Act Reauthorization Amendments
DISL - Dauphin Island Sea Lab
DMR - Discharge Monitoring Reports
DO - Dissolved Oxygen
EPA - U.S. Environmental Protection Agency
EQIP - Environmental Quality Incentives Program
F&W - Fish and Wildlife (water use classification)
FDA - U.S. Food and Drug Administration
FLEP - Forestland Enhancement Program
FRPP - Farmland and Ranchland Protection Program
FWS - U.S. Fish and Wildlife Service
GCRCDD - Gulf Coast Resource, Conservation and Development
GIS - Geographic Information System

GPS - Global Positioning System

GRP - Grassland Reserve Program
GSA - Geological Survey of Alabama
HBAA - Homebuilders Association of Alabama
HHW - Household Hazardous Waste
MASGC - Mississippi Alabama Sea Grant Consortium
MBW - Mobile Bay Watch
MCC – Mobile County Commission
MEE - Master Environmental Educators
MOA - Memorandum of Agreement
MRD - Marine Resources Division
MS4 - Municipal Separate Storm Sewer Systems
NEMO - Nonpoint Education for Municipal Officials
NEP - Mobile Bay National Estuary Program
NOAA - National Oceanic and Atmospheric Administration
NPDES - National Pollutant Discharge Elimination System
NPS - Nonpoint Source
NRCS - Natural Resources Conservation Service
OAW - Outstanding Alabama Water (water use classification)
OE - Organic Enrichment
OEO - Office of Education and Outreach (ADEM)
ONRW - Outstanding National Resource Water (water use classification)
OSDS - Onsite Sewage Disposal System
OWR - Office of Water Resources
POTW - Public/Private Owned Treatment Works
PWS - Public Water Supply (water use classification)
QA/QC - Quality Assurance / Quality Control
S - Swimming and Other Whole Body Contact (water use classification)
SARPC - South Alabama Regional Planning Commission
SH - Shellfish Harvesting (water use classification)
SWCD - Soil and Water Conservation District
TMDL - Total Maximum Daily Loads
TNC - The Nature Conservancy
TVA - Tennessee Valley Authority
USA - University of South Alabama
USACE - U.S. Army Corps of Engineers
USDA - U.S. Department of Agriculture
USGS - U.S. Geological Survey
WHIP - Wildlife Habitat Incentives Program
WRP - Wetlands Reserve Program
WWTP - Wastewater Treatment Plant

APPENDIX 2

STUDIES AND RESEARCH IN THE WATERSHED

1. Gill, Amy C., McPherson Ann K., and Moreland, Richard S. 2005, *Water Quality and Simulated Effects of Urban Land-Use Change in J.B. Converse Lake Watershed, Mobile County, Alabama, 1990-2003*; U.S. Geological Survey Scientific Investigations Report 2005-5171.
2. Journey, C.A., and Gill, A.C. 2001, *Assessment of Water Quality Conditions in the J.B. Converse Lake Watershed, Mobile County, Alabama, 1990-98*; U.S. Geological Survey Water Resources Investigations Report 01-4225.
3. McPherson, Ann K., Gill, Amy C., and Moreland, Richard S. 2005, *Assessment of Water Quality, Benthic Invertebrates, and Periphyton in the Threemile Creek Basin, Mobile, Alabama, 1999-2003*; U.S. Geological Survey Scientific Investigations Report 2004-5302
4. Plinakis, W.L, Lambeth D.S, Stricklin V.E, and Treece M.W. 2004, *Water Resource Data Alabama Water Year 2004*; U.S. Geological Survey Water-Data Report AL-04-1, p. 440-453.
5. Robinson, James L. 2003, *Comparison Between Agricultural and Urban Ground-Water Quality in the Mobile River Basin, 1999-2001*; U.S. Geological Survey Water Resources Investigations Report 03-4182.
6. Subject: Fish Testing at Converse Reservoir
File #: 328 M
Comments: Project is Big Creek Lake Fish study.--This is the results of a test for Mercury in Bass, Crappie, and Catfish. (1998)
7. Subject: Land Use/Land Cover Changes in the Big Creek Lake Watershed Derived From LANDSAT TM Data: 1984-1995
File # 328AB
(We have a full copy of this document)
8. Subject: Risk Assessment for Zebra Mussel Infestation of Big Creek Reservoir
File # 328AA
Comments: Background of how the mussels were discovered.--Discusses their effect on water quality.--Their negative costs to plants, equipments, industry, ect. (April 30, 1997)
9. Subject: Converse Lake Special Study
File # 322
Comments: 7 sites sampled.--Results included: PH, temperature, coliform presentand fecal coliform present. (1995) 4 pages

10. Subject: Mineral Analysis of Big Creek Lake

File # 328A

(Sample ID-Big Creek, Lab ID- K34-98, Analysis- Water, Includes- Mineral Analysis, (1998)).

Comments: The results of the soil testing lab analysis of the split water samples collected July 10, 1998.--Also attached to this file is an analysis of raw water supply (11/13/1990) by MAWS.

11. Subject: Limnological Study of Big Creek Lake

Comments: Discusses plankton density.--Identifies dominant aquatic plants and estimated area coverage. --Examines temporal and spatial variation in organism matter content of lake waters as it relates to trihalomethane precursor formation. --Determines water quality conditions of Big Creek Reservoir. (June 1998)

12. Reservoir Management for Water Quality and THM Precursor Control

Prepared by: Cooke and Carlson

Published by: AWWA Research Foundation and American Water Works Association

Copyright 1989 AWWA

13. Effective Watershed Management for Surface Water Supplies

Prepared by: Robbins, Glicker, Bloom, and Niss

Published by: AWWA Research Foundation and American Water Works Association

Copyright 1991

* 12 and 13 do not concern Big Creek Lake, but rather water quality in general

