FINAL

Total Maximum Daily Load (TMDL)
for
Siltation in Bayview Lake of the
Village Creek Watershed

Bayview Lake **AL/03160111-140_03**

Alabama Department of Environmental Management
Water Quality Branch
Water Division
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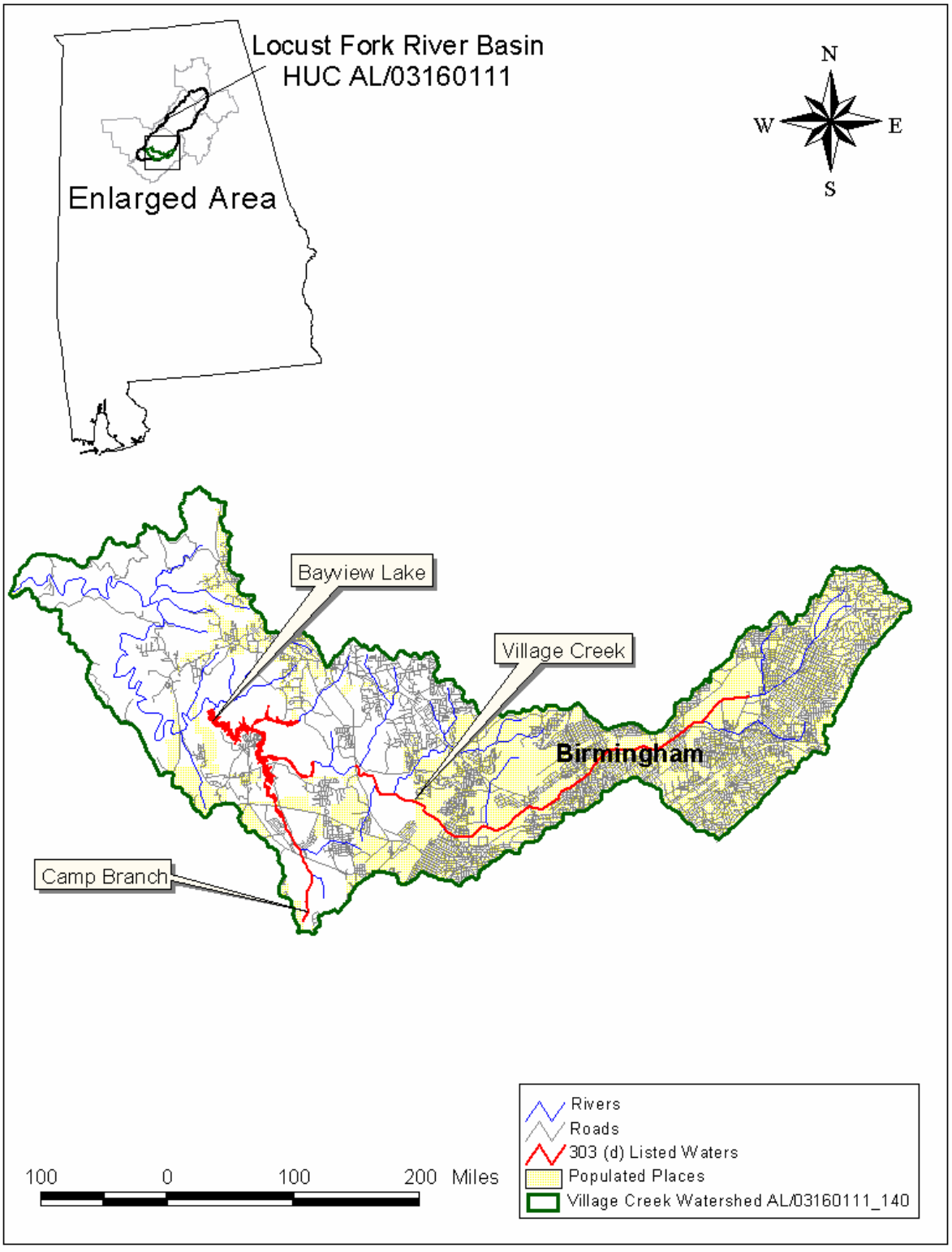

Figure I Village Creek Watershed in the Black Warrior River Basin HUC AL/03160111-140

List of Abbreviations

ADEM	Alabama Department of Environmental Management
AWW	Alabama Water Watch
BMP	Best Management Practices
CAFO	Confined Animal Feeding Operation
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
CWA	Clean Water Act
CWP	Clean Water Partnership
DEM	Digital Elevation Model
EPA	Environmental Protection Agency
FSA	Farm Services Agency
GIS	Geographic Information System
HUC	Hydrologic Unit Code
LA	Load Allocation
MOS	Margin of Safety
MRLC	Multi-Resolution Land Characteristic
MS4	Municipal Separate Stormwater System
NED	National Elevation Database
NHD	National Hydrography Dataset
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source Pollution
NRCS	Natural Resources Conservation Service
OEO	Office of Education and Outreach
RF3	Reach File 3
STORET	STOrage RETrieval Database
SWMA	Storm Water Management Authority
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USDA	United States Department of Agriculture
USF&WS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USLE	Universal Soil Loss Equation
WCS	Watershed Characterization System
WLA	Waste Load Allocation
WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant

1.0 Executive Summary

Bayview Lake is a 440-acre impoundment on the mainstem of Village Creek just downstream of the City of Birmingham. The Village Creek watershed is located in the Black Warrior River basin in Jefferson County, Alabama. The watershed drains 94.5 square miles at its confluence with the Locust Fork (HUC AL/03160111). Urban activities dominate the upper most portion of the watershed. Total Maximum Daily Loads (TMDLs) were put out for public notice in 2002 for three segments identified on the State of Alabama's §303(d) list of impaired waters: an upper segment of Village Creek (HUC AL/03160111-140_02), Camp Branch (HUC AL/03160111-140_01), and Bayview Lake (HUC AL/03160111-140_03). Both Camp Branch and Village Creek discharge into Bayview Lake. Bayview Lake is designated for Limited Warmwater Fishery (LWF) use.

Bayview Lake (HUC AL/03160111-140_03) has been included on the State of Alabama's §303(d) list of impaired waters since 1996. More recent data has removed the lake from the list of impaired waters for ammonia and organic enrichment/dissolved oxygen (OE/DO). This report presents the results of a siltation Total Maximum Daily Load (TMDL) developed for Bayview Lake (HUC AL/03160111-140_03). Based on the assessment of all available physical, chemical, and biological data, ADEM has determined that tributary loads of siltation cause impairment to Bayview Lake; therefore, compliance of this TMDL will be met through siltation reductions to the upstream contributing tributaries, Village Creek and Camp Branch. Thus, no action is required for the Bayview Lake siltation TMDL at this time. Table 1-1, below, illustrates the existing and allowable siltation loads for Bayview Lake.

Table 1-1 Siltation TMDL in for Bayview Lake HUC AL/03160111-140_03

Impaired Segment	Drainage Area (acres)	Existing Loads			Allowable Loads			Reductions [4]			TMDL
		WLA[1] (Continuous Sources)	WLA[2] (Stormwater Sources)	L A[3]	WLA[1] (Continuous Sources)	WLA[2] (Stormwater Sources)	L A[3]	WLA[1] (Continuous Sources)	WLA[2] (Stormwater Sources)	L A[3]	
Camp Branch AL/03160111-140_01	3,562	NA	964 lb/acre/yr	964 lb/acre/yr	NA	279 lb/acre/yr	279 lb/acre/yr	NA	71%	71%	499 tons/yr
Village Creek AL/03160111-140_02	21,440	16571 lb/day	12.9 lb/acre/hr	12.9 lb/acre/hr	15571 lb/day	8.3 lb/acre/hr	8.3 lb/acre/hr	0%	35%	35%	178,000 lbs/hr
Bayview Lake Direct Discharge AL/03160111-140_03	7,385	NA	964 lb/acre/yr	964 lb/acre/yr	NA	279 lb/acre/yr	279 lb/acre/yr	--	--	--	1030 tons/yr [4]

(1) No continuous WLAs discharge to Bayview Lake.
(2) Stormwater WLAs are based on the MS4 (ALS000001).
(3) LA is equal to the WLA based on the MS4 (ALS000001).
(4) The actual contribution of sediment discharged directly to Bayview Lake, not including Village Creek and Camp Branch, is less than 1% of the total load from upstream sources; therefore no action is required to meet this TMDL.

2.0 Basis for the §303(d) Listing

2.1 Introduction

Section §303(d) of the Clean Water Act (CWA) as amended by the Water Quality Act of 1987 and EPA's Water Quality Planning and Management Regulations [Title 40 of the Code of Federal Regulations (CFR), Part 130] require states to identify waterbodies, which are not meeting water quality criteria applicable to their designated use classifications. The identified waters are prioritized based on severity of pollution with respect to designated use classifications. TMDLs for all pollutants resulting in violations of applicable water quality criteria are established for each identified waterbody. Such loads are established at levels necessary to implement the applicable water quality criteria with seasonal variations and margins of safety. The TMDL process establishes allowable loading of pollutants (or other quantifiable parameters for a waterbody) based on the relationship between pollution sources and instream water quality conditions, so that states can establish water quality based controls to reduce pollution from both point and nonpoint sources and to restore and maintain the quality of their water resources (EPA, 1991).

Bayview Lake was added to the §303(d) list based on data collected for the 1988 §305(b) Report to Congress. Site visits and data collected by ADEM identified impairments to this waterbody in the Locust Fork-Black Warrior River basin. Table 2-1 describes the designated use and cause of impairment of Bayview Lake as they appear on the 2002 §303(d) list.

Table 2-1 2002 §303(d) Siltation Impairment to Bayview Lake AL/03160111-140_03

Waterbody Name (ID)	Use Classification	Causes of Impairment	Sources of Impairment	Size (Miles)	Downstream/ Upstream Locations
Bayview Lake (03160111-140_03)	Limited Warmwater Fishery	Siltation	Municipal Urban Runoff/Storm sewers Industrial Surface Mining-abandoned	440 acres	Bayview Lake Dam/ Village Creek

2.2 Problem Definition

Bayview Lake (HUC AL/03160111-140_03) has been impacted by upstream activities from two impaired tributaries, Camp Branch and Village Creek. The 440-acre lake was built in 1911 by the Tennessee Coal and Iron Company to provide water supply for a mining village and mill operation. Historical sources of pollution and loadings from upstream tributaries contribute to the lake's impairment.

Bayview Lake been listed as impaired due to siltation from urban runoff, instream erosion from Village Creek, and other, unknown sources.

Waterbody Impaired:	Bayview Lake
Pollutant of Concern:	Siltation
Water Use Classification:	Limited Warmwater Fishery

Bayview Lake is classified as a Limited Warmwater Fishery. Usages of waters in this classification are described in ADEM Admin. Code. The seasonal usages are described below:

Admin. Code R. 335-6-10-.09(5)(a), (b), (c), and (d) ***December through April***

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

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

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

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

Admin. Code R. 335-6-10-.09(6)(a), (b), (c), and (d) ***May through November***

(a) The provisions of the Fish and Wildlife water use classification at Rule 335-6-10-.09(5) shall apply to the Limited Warmwater Fishery water use classification, except as noted below. Unless alternative criteria for a given parameter are provided in paragraph (e) below, the applicable Fish and Wildlife criteria at paragraph 10-.09(5)(e) shall apply year-round. At the time the Department proposes to assign the Limited Warmwater Fishery classification to a specific waterbody, the Department may apply criteria from other classifications within this chapter if necessary to protect a documented, legitimate existing use.

(b) Best usage of waters (May through November): agricultural irrigation, livestock watering, industrial cooling and process water supplies, and any other usage, except fishing, bathing, recreational activities, including water-contact sports, or as a source of water supply for drinking or food-processing purposes.

(c) Conditions related to best usage (May through November):

1. The waters will be suitable for agricultural irrigation, livestock watering, and industrial cooling waters. The waters will be usable after special treatment, as may be needed under each particular circumstance, for industrial process water supplies. The waters will also be suitable for other uses for which waters of lower quality will be satisfactory.

2. This category includes watercourses in which natural flow is intermittent, or under certain conditions non-existent, and which may receive treated wastes from existing municipalities and industries. In such instances, recognition is given to the lack of

opportunity for mixture of the treated wastes with the receiving stream for purposes of compliance. It is also understood in considering waters for this classification that urban runoff or natural conditions may impact any waters so classified.

(d) Other usage of waters: none recognized.

The State has established a narrative criterion to maintain the biological integrity of waters of the State of Alabama where numerical criteria have not been established (ADEM 335-6-10-.06 (a) & (c)). Alabama's Water Quality Program does not include numerical water quality criteria for aquatic life protection due to sediment. However, ADEM uses narrative criteria as shown in ADEM Rule 335-6-10-.06 to address impairments of this nature. ADEM and EPA guidance documents are used to establish numerical targets for the purposes of developing TMDLs.

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

Biological assessment data is used in combination with other physical and chemical data or information to arrive at an overall use support determination for siltation. Use support determinations for the State of Alabama's §303(d) list are made with the following guidelines for interpretation of biological data:

- Fully Supporting - Macroinvertebrates determined to be Excellent (Unimpaired), Good (Slightly Impaired), and Fair (Moderately Impaired) rating if Chemical/Physical/Field Data indicates compliance.
- Partial Supporting - Macroinvertebrates determined to be Fair (Moderately Impaired) and Chemical/Physical/Field Data indicates impairment.
- Not Supporting - Macroinvertebrates determined to be Poor (Severely Impaired) and Chemical/Physical/Field Data indicates impairment.

Alabama's water quality standards do not include numerical water quality criteria for aquatic life protection due to sediment. Narrative criteria are considered to maintain the biological integrity of the waters of the State of Alabama. Therefore, it is necessary to develop numerical targets based upon these narrative criteria for Bayview Lake. The siltation impairment of Bayview Lake is primarily a function of loads being delivered from Camp Branch and Village Creek. It is believed that reductions in these segments will alleviate the primary sediment loads to Bayview Lake.

For Camp Branch, a numerical target for siltation was established through the use of an Ecoregion reference watershed within the Tennessee River basin that reflects similar conditions within the listed segment, and that has been determined through biological assessment to be unimpaired. As the impairment of biological integrity is generally a long-term process of sediment build up, the use of the Sediment Tool to determine annual average loading conditions through the Universal Soil Loss Equation (USLE) is appropriate for developing numerical targets in reference watersheds, as well as determining existing loads and reductions in nonpoint source loads to the system. Baseline annual average loading conditions, numerical targets, are then defined using reference watersheds.

The goal of the approach to address the siltation TMDL for Village Creek is to restore and protect the habitat and biological community present in the stream. A sediment model, such as the sediment tool, is not appropriate in this case because the large contributor of degradation to the habitat in the stream is due to peak flows and the carrying (shaping) capacity of the stream. A technique is used that calculates and compares the specific stream power to that of a stable system. A stable system is defined as a cross-section that its width and thalweg depth remain relatively constant over a long period (i.e., 15-20 years). If the cross-section is remaining constant through time, the net sedimentation/deposition and erosion/scouring is zero. This idea was used to develop a target of stream power that could be used to assess if the impaired stream is stable or unstable and help determine the evolution of the stream channel. Specific stream power has been used in prior studies to predict channel stability, with most streams attaining relative stability less than 30 W/m^2 (Bledsoe *et al.*, 2002).

3.2 Data Availability and Analysis

A wide range of data and information were used to characterize the watershed and instream conditions. The categories of data used include physiographic data that describe the physical conditions of the watershed, environmental monitoring data that identify potential pollutant sources and their contribution, and instream water quality monitoring data.

Instream water quality data are necessary to evaluate impairment and characterize watershed loads. Figures 3-1 and 3-2 illustrate the location of water quality stations, USGS flow stations, and the weather station utilized in the development of TMDLs for Village Creek and Camp Branch. The data used in the development of these TMDLs is detailed in the Final Village Creek and Camp Branch TMDLs, ADEM, 2005. A brief description of the data sources and station locations is provided in the following section. Various data types and sources are listed in Table 3-1.

Table 3-1 Data Utilized in TMDL Development

Data Category	Description	Source(s)
Watershed Physiographic Data	Landuse – 1992 MRLC	USGS
	National Elevation Data-30 x 30 meter grid	USEPA
	National Hydrography Database Reach Network	USGS
	Level IV Ecoregion Coverage	ADEM, USEPA and NRCS
Meteorological Data	Rainfall, Air Temperature, Solar Radiation, Wind Speed and Direction, Relative Humidity, and Cloud Cover at Birmingham International Airport	National Climatic Data Center
Environmental Monitoring Data	NPDES Permits	ADEM
	Discharge Monitoring Reports	ADEM
	303(d) Listed Waters	ADEM
	Water Quality Monitoring Data	ADEM, USEPA, USGS, B'ham SWMA, AWW, and STORET

There are several continuous flow gages in operation on the impaired segment of Village Creek. The USGS gaging stations and their corresponding period of record are listed in Table 3-2. Figure 3-1 shows the location of the USGS gaging stations in the impaired segment of Village Creek, upstream of Bayview Lake.

Table 3-2 USGS Gaging Stations on Village Creek

USGS Station ID	Location	Drainage Area (sq.miles)	Period of Record
02458600	Village Creek near Docena-Minor Pkwy.	52.2	6/21/1996 - Present
02458502	Village Creek near Pratt City	36.7	10/1/1997 – Present
02458450	Village Creek at Ave W	33.5	7/01/1975 – Present
02458300	Village Creek at 24th Street	26	6/01/1988 - Present
02458200	Village Creek at Apalachee St	15.6	10/01/1998 - Present
02458148	Village Creek at 86th Street	4.1	10/01/1998 - Present

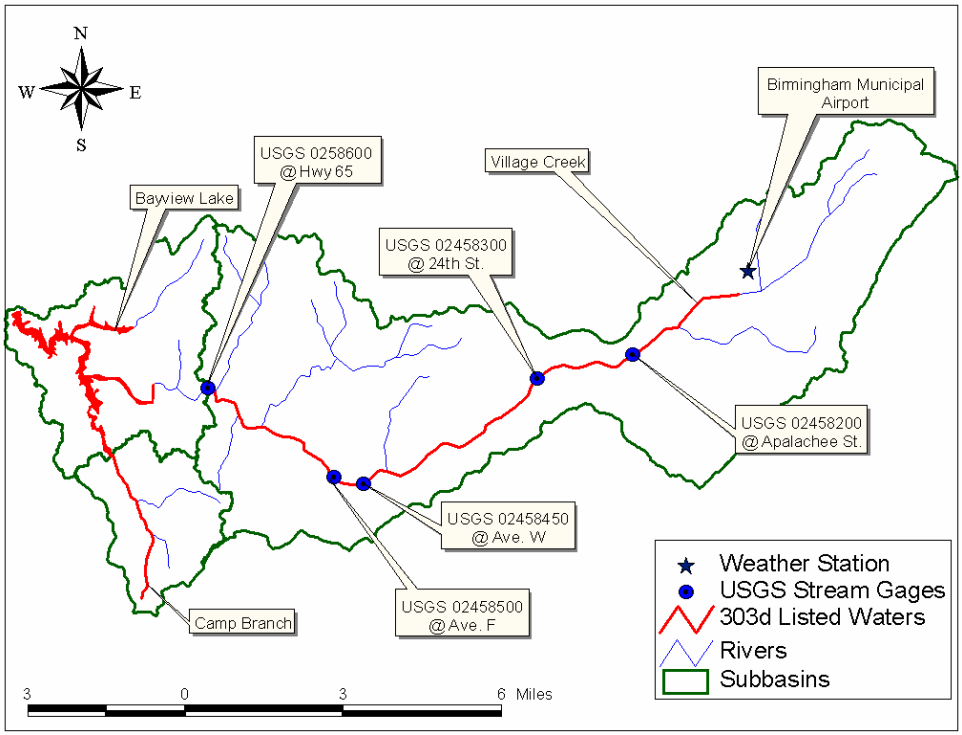

Figure 3-1 USGS Stations in the Impaired Segments of the Watershed

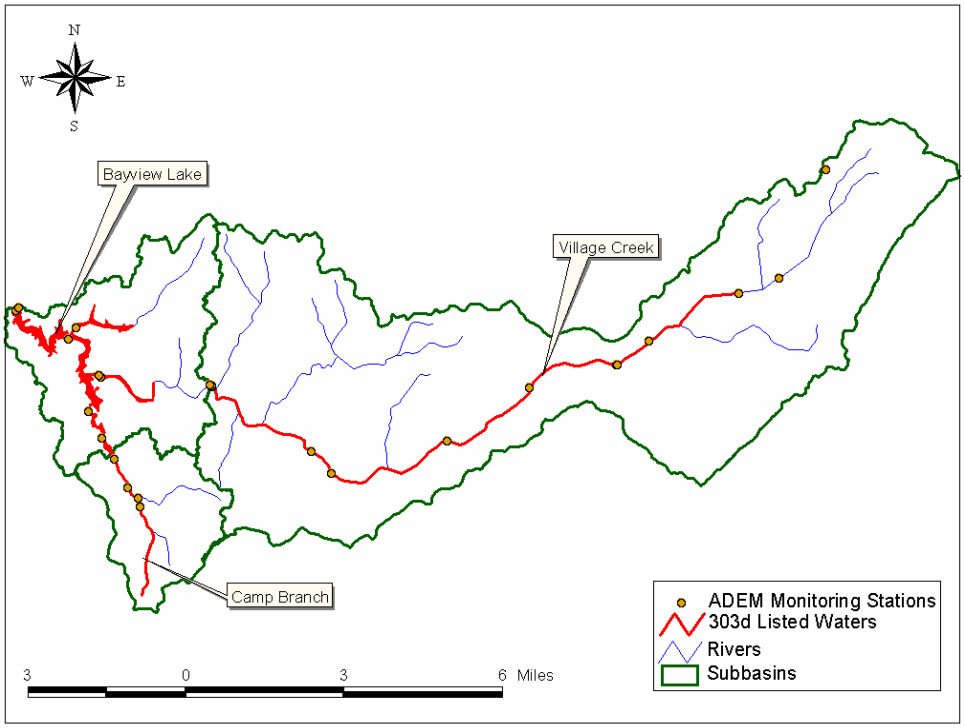

Figure 3-2 ADEM Water Quality Stations in the Impaired Segments of the Watershed

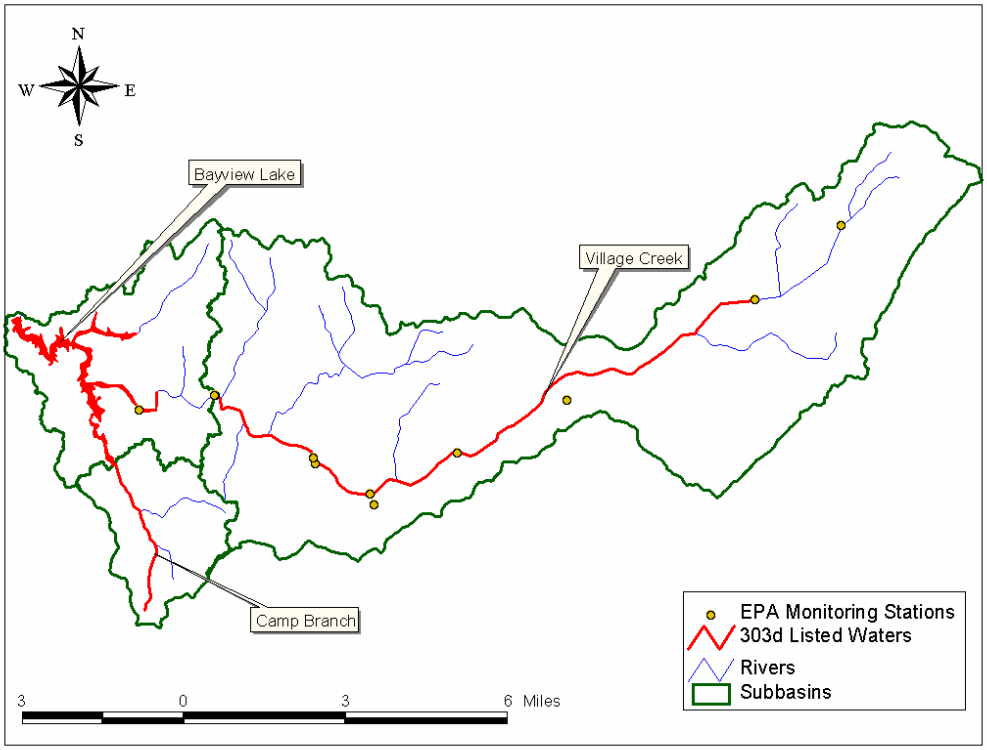

Figure 3-3 EPA Water Quality Stations in the Impaired Segments of the Watershed

Limited water quality sampling has been conducted in Bayview Lake. Table A-1 of the appendix describes the location of stations and the years when data were collected. ADEM conducted two studies in 1988 and 1991 to access lake water quality (ADEM, 1989; ADEM, 1991). As part of §303(d) Monitoring Program, ADEM collected data on Bayview Lake in 2002. The 2002 data were compared with data collected in 1988 and 1991 to determine current violations of the use classification for Bayview Lake.

Several studies cite Village Creek as contributing siltation to Bayview Lake (EPA, 1999; EPA, 1989; USGS, 2002; ADEM, 2001). Examination of aerial photographs show sediment deposition in the embayments of Village Creek and Camp Branch (GlobXplorer, 2002). The Village Creek and Camp Branch TMDLs, finalized and approved by EPA in 2005, will reduce the sediment loadings into Bayview Lake. The adjacent land use and the contribution from Corbett Branch are not significant contributors of sediment to the lake.

3.3 Source Assessment

TMDL evaluations examine the known potential sources of pollutants in the watershed including point sources, nonpoint sources and background levels. For the purpose of these TMDLs, facilities permitted under the National Pollutant Discharge Elimination System (NPDES) Program are considered point sources. The source assessment was used as the basis of the TMDL allocations.

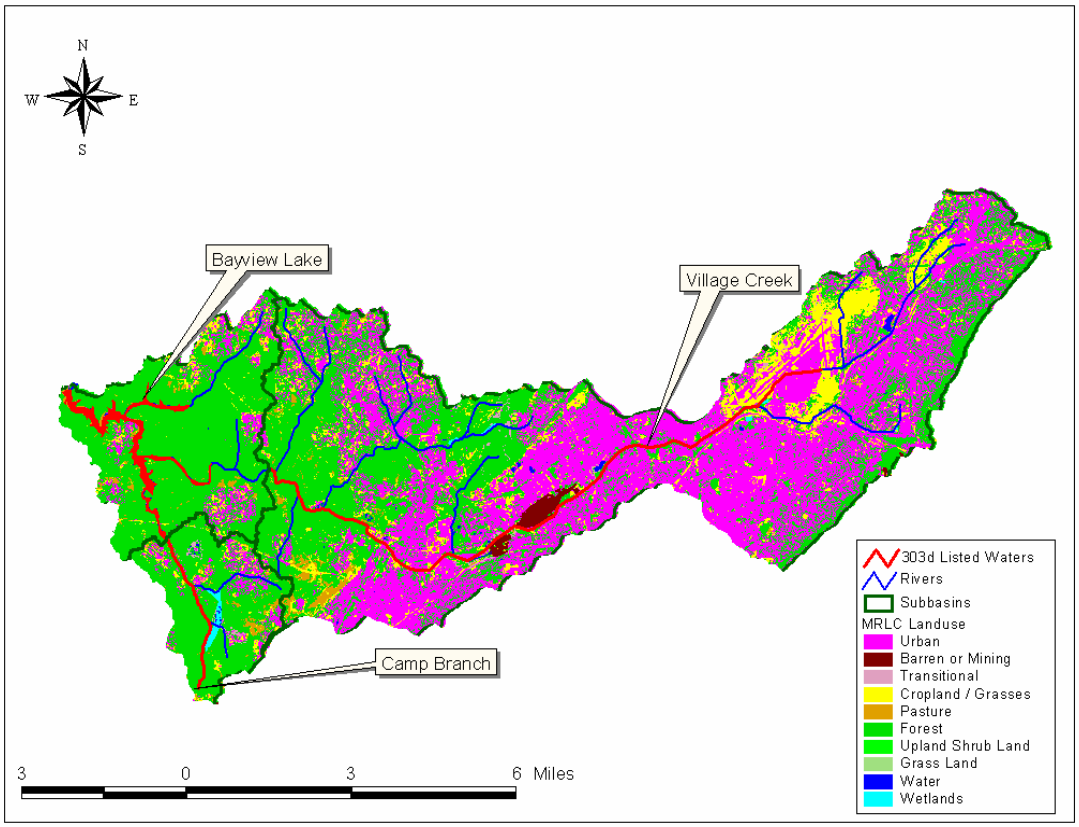

Figure 3-4 Landuse Map of the Village Creek Watershed

Table 3-3 Landuse Characteristics within the Village Creek Watershed

Landuse Classification	Percent of Watershed
Open Water	0.6%
Low Intensity Residential	20.2%
High Intensity Residential	6.9%
High Intensity Commercial/Industrial/Transportation	12%
Quarries/Strip Mines/Gravel Pits	0.6%
Transitional	0.4%
Forest	48.6%
Pasture/Crops/Other Grasses (Urban/recreational; e.g. parks, lawns)	10.4%
Wetlands	0.3%

3.3.1 Nonpoint Sources

A landuse map of the Village Creek watershed, areas contributing to Bayview Lake, is presented in Figure 3-4. The predominant landuses within the watershed are forest and urban with respective percentages of the total watershed equal to 49 percent and 50 percent respectively. Much of the urban area is commercial and industrial, including the Birmingham International Airport. Table 3-3 lists landuse percentages determined from the 1992 Multi-Resolution Land Characteristics (MRLC) map. Each landuse type has the potential to contribute sediment to the receiving waters. Urban stormwater runoff can be a significant source of sediment load in the watershed.

The major sources of habitat impairment in the watershed are due to nonpoint sources from urban runoff. The large percentage of impervious area and limited stream buffer create dynamic flow events that destroy riparian habitat and impair water quality as noted in several studies (EPA, 1999; EPA, 1989; USGS, 2002; ADEM, 2001). Water reaches the stream very quickly in urban areas at high velocities. Figure 3-5 illustrates the hydrograph response of an area upstream of Bayview Lake in Village Creek to a 2-year, 24-hour storm; within hours Village Creek flows increase 6,000 cfs. The dramatic change to velocity increases instream scour. Instream scour in Village Creek generates a large amount of sediment that settles in the backwater area of Bayview Lake causing impairment to both segments.

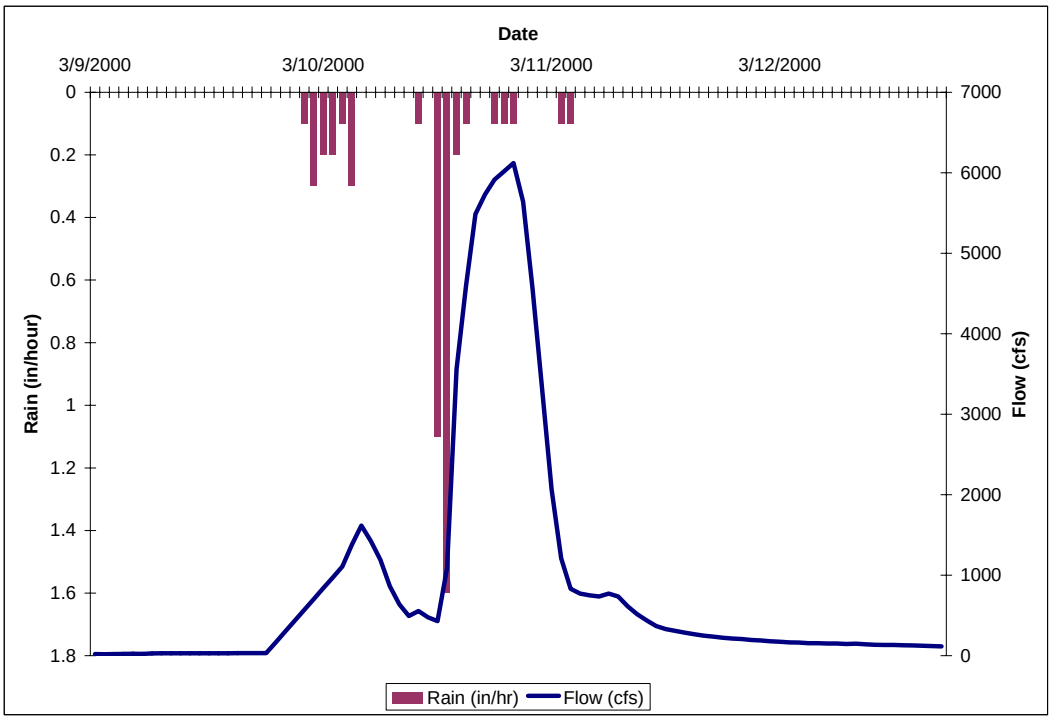

Figure 3-5 Village Creek Hydrograph Response to the 2- year – 24-Hour Storm Event or 4 inches in 24 Hours, at Ave W.

The Village Creek watershed lies within the Southern Limestone/Dolomite Valleys and Low Rolling Hills (67f) and Shale Hills (68f) Level IV Ecoregions (Omernik, 1995). Figure 3-6 illustrates the watershed coverage for each Ecoregion described below.

- (67f.) The Southern Limestone/Dolomite Valleys and Low Rolling Hills form a heterogeneous region composed predominantly of limestone and cherty dolomite. Landforms are mostly undulating valleys and rounded ridges and hills, with many caves and springs. Soils vary in their productivity, and land cover includes oak-hickory and oak-pine forests, pasture, intensive agriculture, and urban and industrial. Along the Coosa River floodplain, biota more typical of coastal plain regions can be found due to the valley and riverine connection to Ecoregion 65.

- (68f.) The Shale Hills Ecoregion, sometimes called the Warrior Coal Field, has more shale and less sandstone than 68e. The soils generally have silt loam surfaces rather than sandy loams and have a silty clay or clayey subsoil. Although it has the lowest elevations in Ecoregion 68, the surface features are characterized by extensive hills and mostly strongly sloping topography. The shale, siltstone, and sandstone are relatively impermeable, and streams do not have the base flow found in more permeable adjacent areas, such as 65i or 67f. The region is mostly forested, but coal mining is a major industry, and the extensive open-pit mines have altered the landscape, soils, and streams.

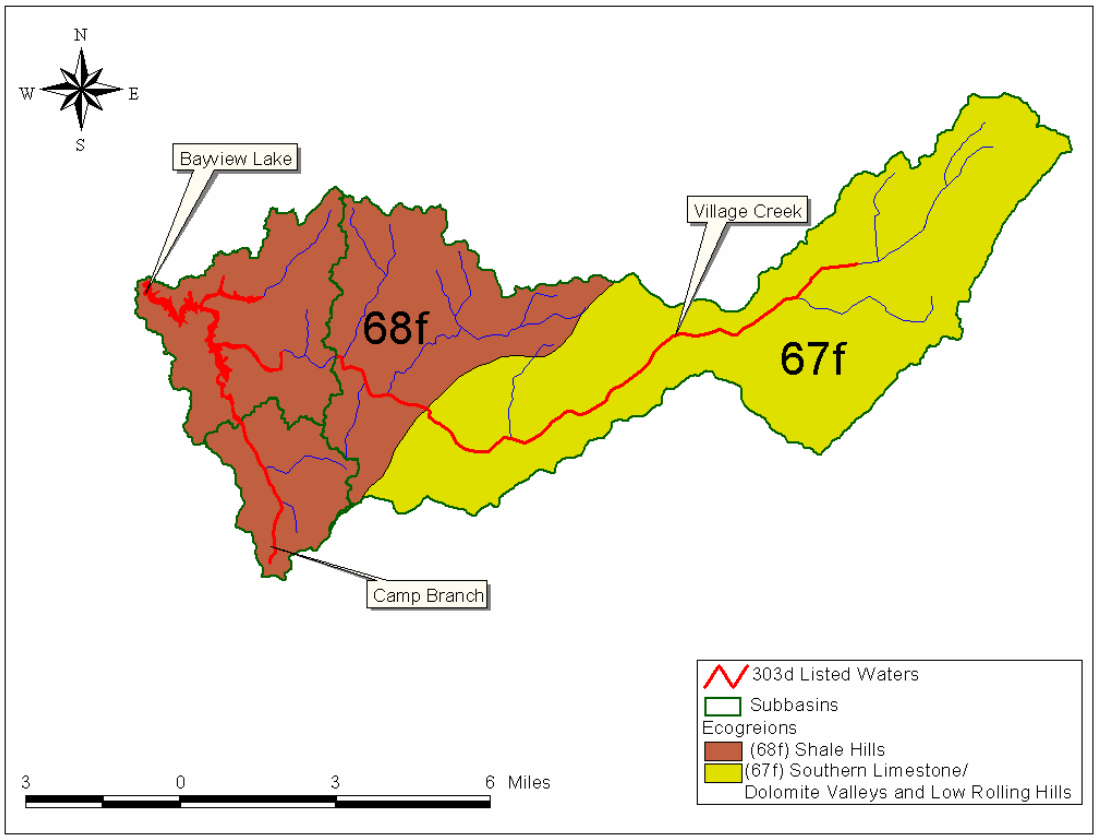

Figure 3-6 Level IV Ecoregions in the Village Creek Watershed

3.3.2 Point Sources

ADEM maintains a database of current NPDES permits and GIS files that locate each permitted outfall. This database includes municipal, semi-public/private, industrial, mining, industrial storm water and concentrated animal feeding operations (CAFO) permits. There are several point sources in the watershed, but none discharging directly to Bayview Lake.

4.0 Model Development

Establishing the relationship between instream water quality and source loading is an important component of TMDL development. It allows the determination of the relative contribution of sources to total pollutant loading and the evaluation of potential changes to water quality resulting from implementation of various management options. This relationship can be developed using a variety of techniques ranging from qualitative assumptions based on scientific principles to numerical computer modeling. In this section, the techniques developed to simulate loadings are presented.

Siltation TMDLs proposed in 2002 used a system of models to quantify contributions of sediment from landuse activities and instream scour. The system of models includes the following:

- Sediment Tool – to quantify the sediment load from landuse activities in the watershed.
- Stream Power – to quantify the instream sediment transport potential.

These models were discussed in the Final TMDLs for Camp Branch and Village Creek in 2005. Details of the models will therefore not be discussed in this report.

5.0 Development of Total Maximum Daily Load

A TMDL is the total amount of a pollutant that can be assimilated by the receiving water while still achieving water quality standards. In the case of Bayview Lake, it is the water quality criteria necessary to protect aquatic life for a Limited Warmwater Fishery use. TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or other appropriate measures. TMDLs are comprised of the sum of individual wasteload allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this definition is denoted by the equation:

$$TMDL = \sum WLAs + \sum LAs + MOS$$

This section presents the siltation TMDL developed for Bayview Lake (HUC AL/03160111-140_03).

5.1 Numeric Targets for the TMDL

Alabama's water quality criteria do not include numerical water quality criterion for aquatic life protection due to sediment. Instead, the State of Alabama's water quality criteria document (ADEM Admin. Code R. 335-6-10-06-(a) & (c)) provides a narrative criteria that establishes the biological integrity within the stream segment that must be maintained.

In Village Creek, the siltation TMDL target was determined using a specific stream power as discussed in the 2005 EPA approved TMDL. The peak hydrograph with an average recurrence interval of 1.5 years, $Q_{1.5}$, was calculated based on measured peak flows and reduced to meet a stability requirement of 25 W/m^2, including a margin of safety. The proposed peak hydrograph would allow the stream to reach an equilibrium so that instream sedimentation would be reduced and ultimately provide a sustainable habitat.

In order to develop a numeric criterion that protects the designated use in Camp Branch, a target annual average loading of sediment to the listed reach was determined. The target represents loading conditions within a reference watershed where physical conditions are similar and biological assessments have identified the reference waterbody as fully supporting its designated use(s). It has been determined that biological impairment of waterbodies due to excessive siltation is a long-term process and therefore the use of annual average loading conditions, as

calculated through the Universal Soil Loss Equation (USLE), are appropriate as the TMDL target loading conditions.

The siltation impairment to Bayview Lake is the result of instream loads from Village Creek and overland loads similar to those calculated for Camp Branch. Compliance with the siltation targets established for Bayview Lake will be met when reductions are made to these upstream segments.

5.2 Existing Conditions

The habitat in Village Creek is currently degraded due to excessive sedimentation, originating instream due to urban runoff (Table 5-1). The TMDL target is representative of a recurring phenomenon of flashy hydrology that typically has a higher energy than the stream can handle. By targeting a low return interval (1.5 years), it is more protective of frequent storms; therefore, providing the greatest mechanism against instream erosion. The TMDL condition for Village Creek is to increase the timing of the peak of the hydrograph by catching and retaining the runoff during storm events. The volume of runoff would not change, but the peak flow magnitude and timing would be modified to stabilize the stream and reduce the siltation load to Bayview Lake.

Table 5-1 Village Creek Existing Sediment Conditions

Watershed	Flow (cfs)	Suspended Sediment Load (tons/hr)	Area (sq. miles)	Suspended Sediment Load (tons/sq. mile/hr)	Suspended Sediment Load (lbs/sq. mile/hr)	Suspended Sediment Load (lbs/acre/hr)
Village Creek	3120	138.4	33.5	4.13	8,262	12.9

The sediment tool was used to establish sediment loads from various landuse activities in the watershed. The summation of the sediment loads coming from the various landuses equates to an overall existing annual load of 0.4818 tons/acre/year (Table 5-2). This load was extended over the area of the entire Bayview Lake watershed for consideration of the overland contribution of siltation to Bayview Lake.

Table 5-2 Camp Branch Existing Sediment Conditions from Landuse Activities

Watershed	Area		Road Erosion	Source Erosion	Composite Erosion	Road Sediment	Source Sediment	Composite Sediment	Unit Sediment	
	sq. miles	acres	(tons/yr)	(tons/year)	(tons/yr)	(tons/yr)	(tons/yr)	(tons/yr)	tons/acre/yr	lb/acre/yr
Camp Branch	5.57	3,562	2,947	713	3,661	1390	326	1,716	0.48	964

5.3 Critical Conditions

The critical condition for the siltation TMDL on Bayview is the 1.5-year recurrence interval peak flow. This flow is the effective discharge that performs most of the channel shaping activities in the urban portions of Village Creek. The critical condition was determined to be 3,120 cfs by analyzing available USGS flow and peak hourly flow records.

5.4 Margin of Safety (MOS)

There are two methods for incorporating a MOS in the analysis: a) by implicitly incorporating the MOS using conservative model assumptions to develop allocations; or b) by explicitly specifying a portion of the TMDLs as the MOS and using the remainder for allocations.

An explicit MOS was incorporated in the instream contributions of the siltation TMDL, calculated using the Village Creek siltation TMDL. The stability target of the stream was based on the specific stream power approach. The literature values indicate that 30 W/m^2 is an appropriate target and that any stream power less than that would indicate a stable stream. The explicit MOS was determined to be 17 percent by expressing the target as 25 W/m^2, rather than 30 W/m^2, to provide for a conservative approach.

An implicit MOS was incorporated in the overland siltation TMDL through the use of conservative modeling assumptions. These include setting sediment target values using reference streams within Alabama that represent "least-impaired" conditions. This was accomplished by using annual average sediment loads from the reference watershed as target values for the calculation of needed load reductions, and the use of the sediment delivery process that results in the most sediment transport to surface waters.

5.5 Seasonal Variation

Sediment loading is expected to fluctuate according to the amount and distribution of rainfall. In Bayview Lake seasonal variation was handled in the development of TMDLs for the contributing tributaries, Village Creek and Camp Branch.

5.6 Wasteload Allocations

There are no permitted direct discharges to Bayview Lake. The Village Creek watershed draining Bayview Lake is within a Phase I Municipal Separate Stormwater System (MS4). Given the MS4 designation, the TMDL is considered a WLA for Bayview Lake. Compliance with the Village Creek TMDL for siltation will allow the TMDL developed herein to meet the allowable loads. Therefore, no reductions are provided to the WLA for Bayview Lake. For further explanation of the reductions and WLA to Village Creek above Bayview Lake please see the Final Village Creek TMDL, approved by EPA in 2005.

5.7 Load Allocations

The nonpoint source loads to Bayview Lake were based on overland contributions of siltation. The overland contribution represents less than one percent of the total siltation load. The LA was developed based on sediment yields calculated for the Camp Branch TMDL. Compliance with the Camp Branch TMDL for siltation will allow the TMDL developed herein to meet the allowable loads. Therefore, no reductions are provided to the LA for Bayview Lake. For further explanation of the reductions and LA to Camp Branch, a tributary to Bayview Lake, please see the Final Camp Branch TMDL, approved by EPA in 2005.

5.8 TMDL Results

The siltation TMDL (Table 5-3) for Bayveiw Lake is based on instream and overland sources of siltation in the watershed. The instream allowable load was calculated based on stream stabilization in the urban areas of the watershed, namely Village Creek (HUC AL/03160111-140_01). The long-term goal for Village Creek is to achieve a stable stream that allows extended periods of time for a healthy substrate and benthic community to develop that does not become washed out during each major rain event or, on the other hand, has excessive sediment deposition from upstream scouring sources.

Table 5-3 Siltation TMDL in for Bayview Lake HUC AL/03160111-140_03

Impaired Segment	Drainage Area (acres)	Existing Loads			Allowable Loads			Reductions [4]			TMDL
		WLA[1] (Continuous Sources)	WLA[2] (Stormwater Sources)	L A[3]	WLA[1] (Continuous Sources)	WLA[2] (Stormwater Sources)	L A[3]	WLA[1] (Continuous Sources)	WLA[2] (Stormwater Sources)	L A[3]	
Camp Branch AL/03160111-140_01	3,562	NA	964 lb/acre/yr	964 lb/acre/yr	NA	279 lb/acre/yr	279 lb/acre/yr	NA	71%	71%	499 tons/yr
Village Creek AL/03160111-140_02	21,440	16571 lb/day	12.9 lb/acre/hr	12.9 lb/acre/hr	15571 lb/day	8.3 lb/acre/hr	8.3 lb/acre/hr	0%	35%	35%	178,000 lbs/hr
Bayview Lake Direct Discharge AL/03160111-140_03	7,385	NA	964 lb/acre/yr	964 lb/acre/yr	NA	279 lb/acre/yr	279 lb/acre/yr	--	--	--	1030 tons/yr [4]

(1) No continuous WLAs discharge to Bayview Lake.
(2) Stormwater WLAs are based on the MS4 (ALS000001).
(3) LA is equal to the WLA based on the MS4 (ALS000001).
(4) The actual contribution of sediment discharged directly to Bayview Lake, not including Village Creek and Camp Branch, is less than 1% of the total load from upstream sources; therefore no action is required to meet this TMDL.

The WCS Sediment Tool was used to calculate the existing average annual overland sediment load for Camp Branch. The estimated existing average annual sediment load for Camp Branch was compared to the estimated existing average annual sediment load for the appropriate biologically healthy subwatershed to determine the percent reduction of sediment loading required to fully attain the fish and aquatic life designated use. The estimated allowable loads were extended over the entirety of the Bayview Lake watershed. This contribution represents less than one percent of the annual allowable siltation load.

6.0 Follow-up Monitoring

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

Table 6-1 Basin Monitoring Schedule

River Basin Group	Schedule
Choctawhatchee, Chipola, Perdido-Escambia and Chattahoochee	2004
Tallapoosa, Alabama and Coosa	2005
Escatawpa, Lower Tombigbee, Upper Tombigbee, Mobile	2006
Cahaba, Black Warrior	2007
Tennessee	2008

Monitoring will help further characterize water quality conditions resulting from the implementation of best management practices in the watershed.

7.0 Public Participation

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

8.0 References

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Appendix A

Table A-1 Sampling Stations in Bayview Lake

Year	STUDY	Station	AGENCY	Stream Section	Road Crossing	Latitude	Longitude
1980	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867
1981	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867
1982	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867
1983	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867
1984	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867
1985	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867
1986	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867
1987	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867
1988	BAYVIEW LAKE STUDY	BAYVIEWLAKE01+21AWIC	ADEM	Bayview Lake Forbay		33.5736	-86.9878
1988	BAYVIEW LAKE STUDY	BAYVIEWLAKE02+21AWIC	ADEM	Bayview Lake near Bayview Community		33.5647	-86.9714
1988	BAYVIEW LAKE STUDY	BAYVIEWLAKE03+21AWIC	ADEM	Bayview Lake in Corbert Branch near Power Line Crossing		33.5672	-86.9686
1988	BAYVIEW LAKE STUDY	BAYVIEWLAKE04+21AWIC	ADEM	Bayview Lake in Village Crk 300ft above Camp Branch		33.5533	-86.9619
1988	BAYVIEW LAKE STUDY	BAYVIEWLAKE05+21AWIC	ADEM	Bayview Lake in Camp Branch		33.5444	-86.9672
1988	BAYVIEW LAKE STUDY	BAYVIEWLAKE06+21AWIC	ADEM	Village Creek DS of Bayview Lake at FAS-12 W. of Mulga		33.5538	-86.9626
1988	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867
1989		010359E+1114PEST	EPA	24.8 Miles Up Village Creek		33.5528	-86.9333
1989	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867

Year	STUDY	Station	AGENCY	Stream Section	Road Crossing	Latitude	Longitude
1990	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867
1991	BAYVIEW LAKE STUDY	BAYVIEWLAKE01+21AWIC	ADEM	Bayview Lake Forbay		33.5736	-86.9878
1991	BAYVIEW LAKE STUDY	BAYVIEWLAKE02+21AWIC	ADEM	Bayview Lake near Bayview Community		33.5647	-86.9714
1991	BAYVIEW LAKE STUDY	BAYVIEWLAKE02a+21AWIC	ADEM	Downstream of Confluence of Camp Branch and Village Creek			
1991	BAYVIEW LAKE STUDY	BAYVIEWLAKE03+21AWIC	ADEM	Bayview Lake in Corbert Branch near Power Line Crossing		33.5672	-86.9686
1991	BAYVIEW LAKE STUDY	BAYVIEWLAKE04+21AWIC	ADEM	Bayview Lake in Village Crk 300ft above Camp Branch		33.5533	-86.9619
1991	BAYVIEW LAKE STUDY	BAYVIEWLAKE05+21AWIC	ADEM	Bayview Lake in Camp Branch		33.5444	-86.9672
1991	BAYVIEW LAKE STUDY	BAYVIEWLAKE06+21AWIC	ADEM	Village Creek DS of Bayview Lake at FAS-12 W. of Mulga		33.5538	-86.9626
1991	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867
1992	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867
1993	USX Study	CAMP6+USX	USX	Camp Branch	AL HWY 269	33.5367	-86.9634
1993	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867
1994	USX Study	CAMP6+USX	USX	Camp Branch	AL HWY 269	33.5367	-86.9634
1994	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867
1995	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867
1996	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Dam		33.5742	-86.9867
1997	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867
1998	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867
1999	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867
1999	1999 WATER QUALITY ON	VIC6+EPA	EPA	Village Creek	Mulga Rd.	33.5462	-86.9508

Year	STUDY	Station	AGENCY	Stream Section	Road Crossing	Latitude	Longitude
	VILLAGE CREEK, EPA						
2000	TREND STATION	VI1+21AWIC	ADEM	Village Ck at Bayview Res Dam		33.5742	-86.9867
2002	303(d) Monitoring Program	BVLJ-1	ADEM	Bayview lake above dam		33.5736	-86.9878
2002	303(d) Monitoring Program	BVLJ-2	ADEM	Bayview lake Near the Bayview Lake Community		33.5647	-86.9714
2002	303(d) Monitoring Program	BVLJ-3	ADEM	Bayview lake-Corbet Branch near Power line crossing		33.5672	-86.9686
2002	303(d) Monitoring Program	BVLJ-4	ADEM	Bayview lake-Village Cr ~ 200yds U/S of mouth in		33.5533	-86.9619
2002	303(d) Monitoring Program	BVLJ-5	ADEM	Bayview lake-Camp Branch "behinds the Knowles Island Area"		33.5444	-86.9672