NUTRIENT CRITERIA IMPLEMENTATION PLAN

STATE OF ALABAMA

Alabama Department of Environmental Management
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1.0 INTRODUCTION

Nutrients serve a very important role in our environment. They provide the essential building blocks necessary for growth and development of healthy aquatic ecosystems. However, if not properly managed, nutrients in excessive amounts can have detrimental effects on human health and the environment, creating such water quality problems as excessive growth of macrophytes and phytoplankton, harmful algal blooms, dissolved oxygen depletion, and an imbalance of flora and fauna. Based on water quality reports to Congress, nutrient over-enrichment has been identified as one of the leading causes of designated use impairments to surface waters throughout the Nation. According to the 2006 Water Quality Report to Congress, excess levels of nutrients were the third leading cause of impairments to rivers and streams of the United States and the second leading cause of impairment to lakes and reservoirs. In the same reporting period, nutrients contributed to impairment in 22% of Alabama's impaired rivers and streams and in 72% of Alabama's impaired reservoirs.

The Alabama Department of Environmental Management (ADEM) has prepared this plan to serve as a roadmap for development and implementation of nutrient criteria for surface waters of Alabama. Additionally, the purpose of this document is to provide ADEM, Environmental Protection Agency (EPA), interested stakeholders, and the public with an understanding of the methodologies, processes, and schedules that the Department intends to employ to effectively manage issues relating to nutrient enrichment of waters within Alabama. The plan will be updated as progress is made and as methodologies and schedules change.

2.0 OVERVIEW OF ALABAMA'S NUTRIENT CRITERIA STRATEGY

Water resources of Alabama are both abundant and diverse. Types of waterbodies include coastal and estuarine waters, extensive wetlands, abundant rivers and streams, a vast network of reservoirs and a few natural lakes. These waterbodies are contained within 14 major river basins and 25 different sub-ecoregions representing some of the most biologically diverse aquatic ecosystems in the United States.

Due to the complex nature of nutrients within each of these waterbody types, it is imperative to classify such waters in a manner that will allow for effective evaluation and management of issues associated with nutrient criteria development and implementation. ADEM's approach is to divide all waters of the State into four major waterbody types as follows.

1) Lakes and Reservoirs
2) Rivers and Streams
3) Estuarine and Coastal Marine Waters
4) Wetlands

The above waterbody-type classification system is based on the approach EPA uses in its National Nutrient Strategy[1]. The Department realizes that each of these four waterbody types will require different approaches and strategies in regards to nutrient criteria development and implementation; thus, this implementation plan has been structured to address each waterbody-type on an individual basis. It is also recognized that each of the four waterbody types may be further subdivided to better understand and evaluate the effects of nutrient enrichment.

[1] National Strategy for the Development of Regional Nutrient Criteria, USEPA-June 1998.

3.0 LAKES AND RESERVOIRS

3.1 Goals of Nutrient Program

ADEM's primary goals for developing and adopting nutrient criteria for Alabama's lakes and reservoirs are consistent with the Clean Water Act and EPA's National Nutrient Strategy. These goals are as follows:

1) Develop and adopt nutrient criteria that support the beneficial uses designated for each lake and reservoir and that protect these waters from potential adverse effects associated with nutrient over-enrichment.
2) Restore and maintain the chemical, physical, and biological integrity of each lake and reservoir.
3) Maintain the diversity and uniqueness of Alabama's lakes and reservoirs.

3.2 Conceptual Approach to Nutrient Criteria Development

In developing nutrient criteria, the Department's objective is to determine nutrient levels that are protective of the beneficial uses designated for each reservoir. Keeping in mind that these reservoirs serve a variety of uses, including swimming and recreation, sport-fishing, and public water supply, while also supporting a wide diversity of aquatic life, nutrient criteria are targeted that support the designated uses and are protective of aquatic communities. Thus, the Department's rationale is to establish nutrient criteria consistent with the "fishable/swimmable" goal of the Clean Water Act.

Located within 14 major river basins and 25 different sub-ecoregions, Alabama's surface waters represent some of the most biologically diverse aquatic ecosystems in the United States. Because of the large diversity in geographic and climatic conditions from one region to another, as well as the significant variability in dam operations between reservoirs, the Department used best professional judgment to develop nutrient criteria on a lake-specific basis rather than on a more aggregate basis such as an ecoregional approach. The lake-specific approach captures the large variability inherent in man-made reservoirs, where chlorophyll a concentrations are typically affected by such factors as reservoir depth, reservoir retention time, and scheduling of power generation.

During the criteria development process, historical data are studied to provide an overall perspective of the condition of each reservoir. This information is analyzed to determine trends in trophic conditions, the degree to which reservoir conditions remain stable over time, and whether any impairment has occurred due to nutrient over-enrichment. From this data, nutrient levels (expressed as seasonal means of chlorophyll a concentrations) are targeted that correlate with reservoir conditions that support the designated beneficial uses. The historical data depicts the diversity of reservoir conditions in Alabama, from lakes in the Tallapoosa River Basin that are naturally oligotrophic-mesotrophic, such as lakes Martin, Yates and Thurlow, to lakes that tend to be more eutrophic in nature, such as the mainstem reservoirs on the Tennessee and Coosa Rivers.

The Department recognizes that using reference condition analysis to establish nutrient criteria in reservoirs can be limited due to the fact that there is uncertainty regarding what constitutes "natural" conditions in a man-made waterbody. Therefore, in developing nutrient criteria, the Department has selected to analyze historical ambient data on an individual reservoir

basis to determine if each reservoir continues to support its designated uses. If so, the nutrient concentrations that have historically corresponded to that reservoir's use support are evaluated to determine a chlorophyll a target specific to that reservoir. This same approach is used regardless of the reservoir's trophic state (i.e. eutrophic, oligotrophic, or mesotrophic). Thus, the intent is that the selected chlorophyll a criteria values are specifically associated with a condition of full use support in each respective reservoir, taking into account the factors unique to various trophic conditions.

Nutrient criteria are developed to support the existing uses that define each reservoir system and protect the aquatic communities that inhabit them. Data are analyzed to determine the ranges of chlorophyll a and total phosphorus concentrations historically occurring in each reservoir. To maintain nutrient levels within the ranges associated with full use-support conditions, best professional judgment is used to derive criteria values that "cap" each reservoir system with a protective chlorophyll a concentration. In establishing chlorophyll a targets, the variability occurring within the growing season was taken into account. The cooler months are generally less productive and lower chlorophyll a values are usually recorded while the warmer months are generally more productive with higher values typically recorded.

To determine what constitutes healthy conditions in various types of reservoirs and how trophic gradients relate to use attainment, the Department utilizes research conducted by Dr. David Bayne at Auburn University. This research examines how the quality of fisheries correlates to varying trophic conditions in Alabama reservoirs. The study assesses the potential impacts of reverse eutrophication and nutrient reduction on reservoir fisheries and calculates target levels of primary production that provide both quality fishing and satisfactory water clarity for other recreational users, while protecting all aquatic communities. This research ("Compatibility between Water Clarity and Quality Black Bass and Crappie Fisheries in Alabama"; American Fisheries Society Symposium 16:296-305. 1996) provides substantial evidence that fish biomass and sport-fish harvesting are positively correlated to algal production in reservoirs.

The research by Dr. Bayne demonstrates that the size, growth rates and condition of certain species of sports fish are generally higher in eutrophic than in oligo-mesotrophic reservoirs. This study, along with case studies of reservoirs in other regions, raises the concern that the reversal of eutrophication and improvement in water clarity in some reservoirs can be deleterious to its warm-water sports fisheries by reducing fish production and biomass. The Department, therefore, believes that when establishing nutrient criteria it is vital to set water quality standards that adequately consider all the beneficial uses of the reservoir, fishing and swimming alike. Thus, caution is warranted when regulatory actions can potentially result in an undesirable shift in fish species. If, historically, a reservoir has supported all of its uses, including high-quality fisheries and other aquatic communities, nutrient criteria were targeted to preserve these reservoir conditions.

The typical hydraulic regime and flow characteristics of each reservoir are other key factors considered during criteria development. The relationship between water quality, biomass accumulation, and hydraulic residence time (or retention time), which is the average amount of time required to completely renew a reservoir's water volume, was taken into account when establishing the chlorophyll a criteria. For example, reservoirs associated with "run-of-the-river" dams typically have small hydraulic head, limited storage area and short retention times and are less likely to be susceptible to conditions that can lead to eutrophication or promote excessive algal growth. In contrast, reservoirs associated with larger dams, such as storage or hydroelectric

dams, are more likely to have longer retention times, providing a greater potential for incoming nutrients to stimulate increased algal production. Increased algal biomass can potentially deplete dissolved oxygen levels within the reservoir through bacterial decomposition and photosynthetic respiration.

A study by Dr. Bayne examined the relationship between reservoir-water retention times and phytoplankton algae production on Weiss Lake during the summer of 2001. Dr. Bayne, along with Auburn University professor Dr. Mike Maceina, assessed the potential water quality effects on Weiss Lake of the draft Coosa River water-sharing agreement between Alabama and Georgia. Their study showed that reservoirs with typically short retention times, such as reservoirs on the Coosa River, are more susceptible to hypereutrophic effects and higher chlorophyll a concentrations when retention times are increased even moderately. Historical data shows that higher chlorophyll a concentrations in Weiss Lake have consistently corresponded to longer retention times. Hydrologic models in their study indicated that longer retention times in the reservoir would likely increase phytoplankton algae production and algal biomass accumulation, assuming that other factors remain unchanged. This result is particularly evident during drought periods, such as occurred in 2000 and in 2006.

In addition, the nutrient criteria were developed to reflect downstream transport of nutrients and the processes by which nutrient uptake occurs in streams. Nutrient concentrations generally tend to decrease as they move downstream. This attenuation occurs as nutrients are absorbed by microorganisms and plants (biotic uptake) or as they adsorb onto sediment particles (abiotic uptake) and settle out of the water column. Thus, in developing nutrient criteria, the chlorophyll a targets were set so that along certain stretches of river, each successive reservoir has a lower criteria value as you move downstream. This approach takes into account natural processes that determine nutrient concentrations and is protective of downstream water quality.

3.3 Chlorophyll a

The Department has elected to use chlorophyll a as the primary indicator of cultural eutrophication. (The term “cultural eutrophication” is used to differentiate between over-enrichment caused by human activities and natural nutrient loading from soils and parent materials indigenous to each watershed.) Chlorophyll a criteria serve as the primary tool used by the Department to protect the designated uses of lakes and reservoirs from nutrient over-enrichment. These criteria are used to assess reservoir conditions (i.e. trophic state) and to determine use-support status (i.e. 303(d) listing and 305(b) reporting). The chlorophyll a criteria are also used as water quality targets necessary for Total Maximum Daily Load (TMDL) development. For example, when a reservoir is determined to be nutrient-impaired, ADEM will conduct analyses to determine the required pollutant load reductions (i.e. total phosphorus and/or total nitrogen loads) necessary to achieve the lake-specific chlorophyll a criteria, or targets. Loads are determined through various modeling techniques and incorporated in nonpoint source control plans and point source wastewater permits as appropriate. Chlorophyll a was selected as the candidate response variable because it is widely accepted among limnologists, scientists, and federal/state agencies as an effective surrogate for estimating the primary production response to nutrient loading. Chlorophyll a is also relatively easy and inexpensive to collect and analyze.

Establishment of chlorophyll a criteria occurs on a growing-season basis, which is defined as April through October for all reservoirs with the exception of the mainstem reservoirs in the Tennessee River basin. These reservoirs have a defined growing season of April through September. The chlorophyll a criteria are represented as the mean of samples (taken as photic-

zone composites) collected monthly during the growing season. Criteria for each reservoir were selected using historical data and best professional judgment, recognizing the seasonal variations that occur.

The numeric chlorophyll a criteria are selected to protect the designated uses in the majority of the reservoir but are typically established at specific locations within each reservoir. For example, a criterion established at a location in a dam forebay is expected to be protective of all the forebay area and a significant portion of the main reservoir body upstream of the dam. The criteria values are not intended to be applied as lake-wide averages or as chlorophyll a concentrations that shall be maintained at all locations within the lake at any given time. When the Department believes it to be appropriate, criteria are established at additional stations upstream of the dam forebay to recognize changing limnological conditions and to provide protection of existing uses in the majority of the reservoir. Because of the non-uniform, complex nature of embayments and the fact they are directly interrelated with tributaries, it is difficult to derive a single criterion value that is protective of an entire reservoir including its embayments. A "one size fits all" approach truly oversimplifies the complex nature of these reservoir systems and is not the preferred method of protecting designated uses. To address this complexity, the Department intends to continue embayment sampling as a part of the Reservoir Monitoring Program. Information obtained will be evaluated to determine the degree to which nutrients may be affecting designated use support and, where appropriate (i.e. where designated uses are threatened or impaired), criteria may be established to protect those designated uses. Until numeric criteria are developed for embayments, they remain addressed by the Department's narrative criteria.

At this point in time, the Department does not believe it is necessary to develop numeric criteria for other nutrient indicators such as total phosphorus (TP), total nitrogen (TN), or Secchi depth. However, these and many other parameters have and will continue to be routinely monitored as part of the Department's Reservoir Monitoring Program. The significance of these variables and their relation to nutrient loading will continually be evaluated as new data is collected. While chlorophyll a provides a reliable depiction of primary production levels and thus gives a fairly accurate assessment of nutrient conditions in a waterbody, it is uncertain how effective the other parameters are in assessing nutrient over-enrichment. For example, because there is such variability in how each waterbody responds to nutrient loading, it is difficult to determine what concentrations of TP and TN correlate to undesirable levels of primary production. Also, establishing meaningful relationships between causal and response variables is often problematic. Low concentrations of TP, for example, can correlate to both low and high phytoplankton biomass levels; the latter occurring when originally high TP (this would only occur with dissolved phosphorus) concentrations are significantly reduced as excessive nutrients are assimilated within the growing phytoplankton biomass. Algal Growth Potential Tests (AGPT) are conducted on each reservoir to determine if the limiting nutrient is phosphorus, nitrogen, or a combination of both. The Department continues to measure TP and the nitrogen series concentrations as a part of its routine reservoir monitoring program and has compiled the information in spreadsheets. Data collected through 2008 has not revealed significant relationships between growing season average chlorophyll a concentrations and mean TP or TN concentrations.

Establishing meaningful relationships between chlorophyll a and Secchi depth is also problematic. Poor water clarity can result from a number of causes other than nutrient over-enrichment. A low Secchi-depth measurement might be caused by abiogenic turbidity consisting of suspended non-algal particulate matter such as clay. The Department will continue to examine

linkages between chlorophyll a and other nutrient parameters as more data is collected. Also, because the relationships between nutrient impairment and chlorophyll a levels are not always well understood, it may be necessary to revise the criteria as additional water quality data and improved assessment tools (water quality models) become available.

3.4 Use Support Determination

The chlorophyll a criteria provide an effective decision-making tool for resource management and planning. Based on seasonal means of chlorophyll a concentrations, the Department will determine if reservoir conditions are supportive of designated uses or if the reservoir is impaired due to nutrient over-enrichment and should be added to Alabama's 303(d) list of impaired waters. The same criteria will be used to determine when remediation of an impaired water body has achieved water quality standards.

The Department will continue to monitor all of the state's major reservoirs on a routine basis through its Rivers and Reservoirs Water Quality Monitoring (RRMP) Program. While reservoir sampling will be most intense in the river basins that are the focus of the rotational monitoring, all reservoirs are expected to be sampled at least once per year at a minimum as part of the RRMP Program. These once per year samples will be used in the long-term trend analysis to distinguish increasing or decreasing trends.

Because chlorophyll a is a response variable influenced by a wide variety of factors, the Department may rely on examination of multiple growing seasons when assessing compliance with the established criteria. A reservoir or portion of a reservoir will be considered to have a nutrient impairment when a growing season mean criterion has been exceeded in two consecutive years or three times during the previous six years. In making this determination, chlorophyll a values in excess of the criterion, which are due to extreme hydrologic events (i.e., droughts and floods), may not be considered as an exceedance of the criterion. Extreme hydrologic events do not include significant changes to reservoir operation. For Alabama's large hydropower reservoirs, such changes would require a modification of the operating license issued by the Federal Energy Regulatory Commission and would be subject to review and water quality certification by this Department. One exceedance of the chlorophyll a criterion may be sufficient justification for inclusion of a water in Category 5 of the Integrated Water Quality Report when the exceedance is determined to be the result of increasing nutrient loading from anthropogenic sources. In any case, when a growing season mean chlorophyll a value exceeds the criterion, the reservoir will be identified for re-sampling the following year and enough samples will be collected to ensure that the minimum data requirements necessary to calculate a growing season mean are met. The assessment of chlorophyll a data for reservoirs will be consistent with the procedures described in Alabama's Water Quality Assessment and Listing Methodology, January 2008.

For reservoirs on the 303(d) list due to nutrient enrichment or with approved nutrient TMDLs, some reduction in chlorophyll a levels likely will be needed and achieved through necessary load reductions (e.g. phosphorus and/or nitrogen). Selection of protective criteria will consider the following factors.

- Physiographic setting of the reservoir and natural nutrient sources
    - Alabama's diverse landscape includes soils that contain naturally varying levels of nitrogen and phosphorus. Phosphorus-rich soils are found in the Black Belt region of west and central Alabama, as well as in the Appalachian and Interior

Plateaus of north Alabama. Soils with intermediate phosphorus levels are found in the Piedmont and Ridge and Valley provinces of north-central and east-central Alabama. Phosphorus-deficient soils are prevalent in the Coastal Plains of south Alabama.

- Reservoir characteristics
  - A reservoir's hydraulic retention time has a significant influence on how nutrients will affect algae growth and chlorophyll a concentrations. As a result, a reservoir's function as a storage reservoir or simply as a run-of-the river reservoir is an important consideration in the selection of an appropriate chlorophyll a criterion.
- Reservoir designated uses
  - While it is important to recognize the role that nutrients have in fish community productivity and diversity, other water body uses should also be considered as a chlorophyll a target is selected. For example, in reservoirs with the Public Water Supply classification, lower chlorophyll a levels may be necessary if algae are contributing to disinfection byproduct formation in drinking water distribution systems. Likewise, for reservoirs with the Swimming classification, water clarity may be an important consideration in selecting the chlorophyll a criterion.
- Connectivity with other reservoirs and subsequent attenuation
  - The chlorophyll a criterion determination process should also recognize the impact that the selected criterion will have on downstream reservoirs and their designated uses and the impact that an upstream reservoir will have on the reservoir in question. For example, reservoirs that are connected in series may operate as a single system and each reservoir is influenced by the operation of the reservoirs upstream. The Coosa River chain of lakes is a good example of this type of system. Selection of chlorophyll a criteria for each of these reservoirs should consider how nutrients are processed and expressed as water moves through this system.
- Downstream use protection
  - To the extent the data and information is available, the criteria determination process should take into consideration the water quality standards of downstream waters and ensure that those standards are attained and maintained.

Hydrodynamic water quality models are being developed as a part of the TMDL process for Alabama's nutrient-impaired reservoirs to better understand the link between nutrients, their sources, their effects on algal productivity, and which nutrient (nitrogen and/or phosphorus) will be the most effective to control in order to achieve the selected chlorophyll a targets and protection of downstream uses. These models will be used to evaluate necessary nutrient reductions to achieve chlorophyll a concentrations that fall within a range of values appropriate for the designated uses assigned to each reservoir and considering the factors listed above. It is expected that growing season mean chlorophyll a criteria established in the future for these nutrient-impaired reservoirs will be no higher than the value of 20 ug/l currently in place for Weiss Lake. This value is considered as the upper end of a range that is protective of a balanced sport fishery.

For the Coosa River reservoirs downstream of Weiss Lake, the TMDLs establish phosphorus load allocations necessary to achieve specific chlorophyll a targets at one or more locations within the mainstem of each reservoir and these phosphorus load reductions will be implemented, as appropriate, in nonpoint source control plans and wastewater discharge permits.

The growing season mean chlorophyll a levels for Neely Henry Lake are most significantly driven by nutrient loading from Weiss Lake with some influence from local nutrient sources in the Gadsden area and surrounding watersheds. Nutrient loading from Weiss Lake has been determined by the Weiss Lake nutrient TMDL established by EPA Region 4 on October 28, 2008. The nutrient TMDLs for Neely Henry Lake, Logan Martin Lake, Lay Lake, and Lake Mitchell were approved by EPA Region 4 on October 28, 2008, and require phosphorus reductions from local sources and surrounding watersheds in order to meet the selected chlorophyll a targets. Modeling of nutrient processing in the downstream reservoirs demonstrates that lower chlorophyll a targets are achievable in downstream reservoirs and that these levels remain within the range that is protective of existing designated uses on these reservoirs. The TMDL models are being used to determine where and how many target locations should be selected in the mainstem of each reservoir. These locations will be chosen with consideration of all designated uses within each reservoir and accounting for nutrient expression as peak chlorophyll a concentrations.

As with unimpaired reservoirs, nutrient criteria selection for impaired reservoirs will include, in addition to the detailed modeling analysis described above, a thorough analysis of available chlorophyll a, phosphorus, and nitrogen data to determine any significant trends or relationships in the variables. This analysis will include charts and tables giving annual mean concentrations for each sampling location as well as the measured monthly values. This analysis will complement the TMDL analysis by providing a historical view of nutrient and chlorophyll a levels and their spatial distribution over time.

3.5 Designated Uses of Alabama's Publicly Owned Lakes/Reservoirs

The use classifications (designated uses) utilized by the State for all surface waters of Alabama are as follows:

(1) Outstanding Alabama Water (OAW)
(2) Public Water Supply (PWS)
(3) Swimming and Other Whole Body Water-Contact Sports (S)
(4) Shellfish Harvesting (SH)
(5) Fish and Wildlife (F&W)
(6) Limited Warmwater Fishery (LWF)
(7) Agricultural and Industrial Water Supply (A&I)

As shown in Table 3-1, the designated use(s) of Alabama's publicly owned lakes and reservoirs primarily consist of one or more of the three following uses; Public Water Supply, Swimming and Other Whole Body Water-Contact Sports, and Fish and Wildlife. All three of these uses are considered "fishable/swimmable" as defined by Section 101(a) of the Clean Water Act. As stated earlier, the Department's major goal in developing nutrient criteria for lakes is to protect designated uses while maintaining the physical, chemical, and biological integrity that defines each of these systems. Currently, all lakes and reservoirs within Alabama are classified as Fish and Wildlife or higher. According to Alabama's 2008 303(d) list and the most recent list of approved Alabama TMDLs, all or part of 8 reservoirs are impaired for nutrients, totaling 72,570 acres of the 480,000 publicly owned lake acres within Alabama. This represents approximately 15% of total lake acres currently impaired due to nutrient over-enrichment.

Table 3-1: Designated Uses of Alabama's Publicly Owned Lakes and Reservoirs.

Reservoir Name	Major River Basin	Designated Use(s)	Size (acres)	Impaired for Nutrients?
Claiborne	Alabama	S, F&W	5,930	no
Dannelly	Alabama	S, F&W	17,200	no
Woodruff	Alabama	S, F&W	12,510	no
Purdy	Cahaba	PWS, F&W	1,050	no
Walter F. George[1]	Chattahoochee	S, F&W	45,181	no
Harding[2]	Chattahoochee	PWS, S, F&W	5,850	no
West Point[3]	Chattahoochee	S, F&W	25,864	no
Jordan	Coosa	PWS, S, F&W	6,800	no
Mitchell	Coosa	PWS, S, F&W	5,850	yes[4]
Lay	Coosa	PWS, S, F&W	12,000	yes[4]
Logan Martin	Coosa	PWS, S, F&W	15,263	yes[4]
Neely Henry	Coosa	PWS, S, F&W	11,235	yes[4]
Weiss	Coosa	PWS, S, F&W	30,200	yes[4]
Big Creek	Escatawpa	PWS, F&W	3,600	no
Coffeeville	Lower Tombigbee	PWS, S, F&W	8,500	no
Point A	Perdido/Escambia (Conecuh Sub-basin)	S, F&W	900	no
Gantt	Perdido/Escambia (Conecuh Sub-basin)	F&W	2,767	no
Frank Jackson	Perdido/Escambia (Conecuh Sub-basin)	F&W	1,000	no
Jackson	Perdido/Escambia (Yellow Sub-basin)	S, F&W	256	no
Thurlow	Tallapoosa	PWS, S, F&W	574	no
Yates	Tallapoosa	PWS, S, F&W	2,000	yes (204 acres)[4]
Martin	Tallapoosa	PWS, S, F&W	40,000	no
Harris	Tallapoosa	PWS, S, F&W	10,660	no
Pickwick[5]	Tennessee	PWS, S, F&W	43,100	no
Wilson	Tennessee	PWS, S, F&W	15,930	no
Wheeler[6]	Tennessee	PWS, S, F&W	67,100	yes (1569 acres)[7]
Guntersville[8]	Tennessee	PWS, S, F&W	69,700	no

[1] W.F. George Lake has a surface area of 45,181 acres at full pool, of which 18,672 acres are within Alabama.
[2] Lake Harding has a surface area of 5,850 acres at full pool, of which 2,180 acres are within Alabama.
[3] West Point Lake has a surface area of 25,864 acres at full pool, of which 2,765 acres are within Alabama.
[4] TMDL completed.
[5] Pickwick Lake has a surface area of 43,100 acres at full pool, of which 33,700 acres are within Alabama.
[6] Elk River embayment from Wheeler Lake to Anderson Creek has a surface area of 1569 acres.
[7] Elk River TMDL scheduled for 2010.
[8] Guntersville Lake has a surface area of 69,700 acres at full pool, of which 67,900 acres are within Alabama.

Table 3-1 cont'd: Designated Uses of Alabama's Publicly Owned Lakes and Reservoirs.

Reservoir Name	Major River Basin	Designated Use(s)	Size (acres)	Impaired for Nutrients?
Bear Creek	Tennessee	PWS, S, F&W	670	no
Upper Bear Creek	Tennessee	PWS, S, F&W	2,100	no
Cedar Creek	Tennessee	PWS, S, F&W	4,200	no
Little Bear Creek	Tennessee	PWS, S, F&W	1,600	yes
Gainesville	Upper Tombigbee	S, F&W	6,400	no
Aliceville	Upper Tombigbee	S, F&W	8,300	no
Demopolis	Upper Tombigbee	S, F&W	10,000	no
Warrior	Warrior	F&W	7,800	no
Oliver	Warrior	S, F&W	800	no
Holt	Warrior	S, F&W	3,200	no
Bankhead	Warrior	PWS, S, F&W	9,200	no
Tuscaloosa	Warrior	PWS, S, F&W	5,885	no
Lewis Smith	Warrior	PWS, S, F&W	21,200	no
Inland	Warrior	PWS, S	1,095	no

3.6 Water Quality Data

Water quality data used to establish numeric nutrient criteria will primarily come from ADEM as part of the Reservoir Water Quality Monitoring Program and from the Tennessee Valley Authority (TVA) as part of its Vital Signs Monitoring Program. Additional data resources include Auburn University, EPA Region 4, and Alabama Water Watch.

3.6.1 ADEM's River and Reservoir Monitoring Program (RRMP)

The Rivers and Reservoirs Monitoring Program assesses the water quality and trophic status of non-wadeable rivers and publicly owned lakes/reservoirs in the State, with monitoring in the Tennessee River system conducted through a collaborative monitoring effort between ADEM and the Tennessee Valley Authority (TVA). ADEM has defined publicly owned lakes/reservoirs as those that are of a multiple-use nature, publicly accessible, and exhibit physical/chemical characteristics typical of impounded waters. Lakes designated strictly for water supply, privately owned lakes, or lakes managed by the Alabama Department of Conservation and Natural Resources (ADCNR) strictly for fish production are not included in this definition. Currently, forty lakes/reservoirs meet this definition of being publicly owned. Initiated in 1990 as the Reservoir Water Quality Monitoring Program, the program was given the name Rivers and Reservoirs Monitoring Program (RRMP) in 2004 with the addition of free-flowing river reaches. Objectives of the program are to:

a. Develop and maintain a water quality database for rivers and publicly accessible lakes in the state sufficient to conduct comprehensive assessments of water quality, categorize waters for the Integrated Assessment Report, develop criteria, and determine criteria compliance;

b. Establish trends in river and lake trophic status that are only established through long-term, consistent monitoring efforts; and,

c. Conduct biennial assessments of water quality for publicly accessible lakes as required by Section 314 of the Clean Water Act.

Monitoring of rivers and lakes occurs at three levels of effort under the RRMP:

a. Intensive monitoring of river, main-stem reservoir, and tributary embayment stations is conducted monthly, April-October, on a five-year rotating basin schedule to provide a comprehensive determination of water quality throughout the algal growing season and provide data that can be used to develop nutrient criteria and total maximum daily loads;

b. Compliance monitoring of reservoirs with established nutrient criteria is conducted monthly, April-October, at least once every three years; and,

c. Critical period monitoring of rivers and mainstem reservoir stations is conducted at least once every two years in August to maintain a water quality database of this critical water quality period that extends from 1985 to the present, and to satisfy Section 314 requirements of biennial assessment of lake water quality.

Table 3-2: Water Quality Variables Collected as Part of ADEM's RRMP

Variable	Method	Reference	Detection Limit
Physical			
Vertical illumination	Photometer, Secchi disk	ADEM SOP #2046	---
Temperature	Thermistor	ADEM SOP #2041	---
Turbidity	Nephelometer	ADEM SOP #2044	---
Total dissolved solids	Filtration, drying	ADEM SOP #4007	1 mg/l
Total suspended solids	Filtration, drying	ADEM SOP #4008	1 mg/l
Specific conductance	Wheatstone bridge	ADEM SOP #2043	---
Hardness	Hardness (by Ca & Mg)	ADEM SOP #4057	1 mg/l
Alkalinity	Potentiometric titration	ADEM SOP #4039	1 mg/l
Chemical			
Dissolved oxygen	Luminescent Optical Probe	ADEM SOP #2045	---
pH	Glass electrode	ADEM SOP #2042	---
Ammonia	Semi-Automated Colorimetry	ADEM SOP #4045	0.015 mg/l
Nitrate + Nitrite	Cadmium reduction	ADEM SOP #4048	0.003 mg/l
Total Kjeldahl Nitrogen	Automated colorimetric	ADEM SOP #4046	0.15 mg/l
Dissolved reactive phosphorus	Automated single reagent	ADEM SOP #4049	0.004 mg/l
Total phosphorus	Persulfate digestion	ADEM SOP #4050	0.010 mg/l
Chloride	Ion Chromatography	ADEM SOP #4035	1 mg/l
5-Day biochemical oxygen demand	5-Day BOD Test	ADEM SOP #4053	1 mg/l
Biological			
Chlorophyll a	Spectrophotometric	ADEM SOP #4616	0.1 µg/l
Algal growth potential test	Printz Algal Assay Test	ADEM SOP #5700 (draft)	---
Fecal coliform	Membrane filter	ADEM SOP #5600	---

3.6.2 TVA Reservoir Vital Signs Monitoring Program

The TVA, through its Reservoir Vital Signs Monitoring Program (RVSP), conducts water quality monitoring of mainstem reservoir locations in the Tennessee River system. The objectives of the program are to provide basic information in the "health" or integrity of the aquatic ecosystem in each TVA reservoir and to provide screening-level information for describing how well each reservoir meets the "fishable/swimmable" goal of the Clean Water Act. Sampling activities involve examination of appropriate physical, chemical, and biological indicators in the forebay, mid-, and upper-regions of each reservoir. The TVA program provides results of monitoring to ADEM through program reports and data exchanges.

Over the last several years, collaborative efforts between the staff of the ADEM and TVA programs led to the incorporation of consistent monitoring techniques and the monitoring of reservoir tributary embayments by ADEM that are not routinely monitored in the TVA program. The tributary monitoring program is intended to identify embayment areas where watershed nutrient loads may be contributing to excessive enrichment and algal productivity leading to use impairment.

3.6.3 Other Lake Data Resources

- Auburn University-Department of Fisheries and Allied Aquacultures
- EPA Region 4-Environmental Services Division
- Alabama Power Company
- U.S. Army Corps of Engineers
- Alabama Water Watch
- United States Geological Survey
- Geological Survey of Alabama

3.7 Prioritization of Nutrient Criteria Development for Lakes/Reservoirs

In an effort to protect Alabama reservoirs from nutrient over-enrichment, the Department intends to develop numeric nutrient criteria for 41 separate reservoirs by the end of 2011. Chlorophyll a criteria were established for Weiss Lake, West Point Lake, R.L. Harris Lake, and Walter F. George Lake in 2001 and the following nine reservoirs in 2002: Guntersville, Wheeler, Wilson, Pickwick, Little Bear Creek, and Cedar Creek in the Tennessee River Basin and Yates, Thurlow, and Lake Martin in the Tallapoosa River Basin. In 2004, the Department established chlorophyll a criteria for eleven reservoirs, including Claiborne and Dannelly in the Alabama River Basin; Harding in the Chattahoochee River Basin; Point A and Gantt in the Perdido/Escambia River Basin; and Warrior, Oliver, Holt, Tuscaloosa, Bankhead and Smith in the Warrior River Basin. In 2005, the Department adopted chlorophyll a criteria for Gainesville and Demopolis in the Upper Tombigbee River Basin; Coffeeville in the Lower Tombigbee River Basin; Lake Jackson in the Perdido-Escambia River Basin; and Inland Lake in the Black Warrior River Basin. In 2010, the Department expects to develop chlorophyll a criteria for 10 of Alabama's remaining 12 reservoirs (see Table 3-3). Also in 2010, a nutrient criterion for Lake Purdy is projected to be developed after completion of a water quality model currently under development for Lake Purdy and its watershed. Nutrient criteria for the remaining 2 reservoirs are expected by 2011.

These 41 reservoirs represent the most significant of the publicly owned reservoirs in the state of Alabama. The Department defines publicly owned lakes/reservoirs as those that are of a multiple-use nature, publicly accessible, and exhibit physical and chemical characteristics typical of impounded waters. Figure 3-1 on the following page depicts the 41 lakes and the corresponding Level IV Ecoregion in which they are located.

Together, these 41 reservoirs comprise a total of approximately 480,000 acres in 11 of the 14 major river basins and represent a diverse range of trophic conditions as well as lake sizes. Figure 3-2 demonstrates the trophic diversity of Alabama's lakes. The largest of these lakes, Guntersville Reservoir, has a surface area of 69,700 acres at full pool of which 67,900 acres are in Alabama, and the smallest, Lake Jackson, has an area of 256 acres. These 41 reservoirs together represent approximately 80% of the reservoir surface waters in the state. The remaining lakes or reservoirs in Alabama are typically privately owned or are waterbodies maintained by the Alabama Department of Conservation and Natural Resources (ADCNR), many of which are maintained as fisheries and thus are fertilized periodically. The ADCNR manages 23 public lakes that range in size from 13 to 184 acres for a total of 1,912 surface acres in 20 counties. Some of the remaining reservoirs are smaller water supply reservoirs with limited public access. For these

remaining reservoirs, it is likely that narrative criteria will be applied to support the designated uses.

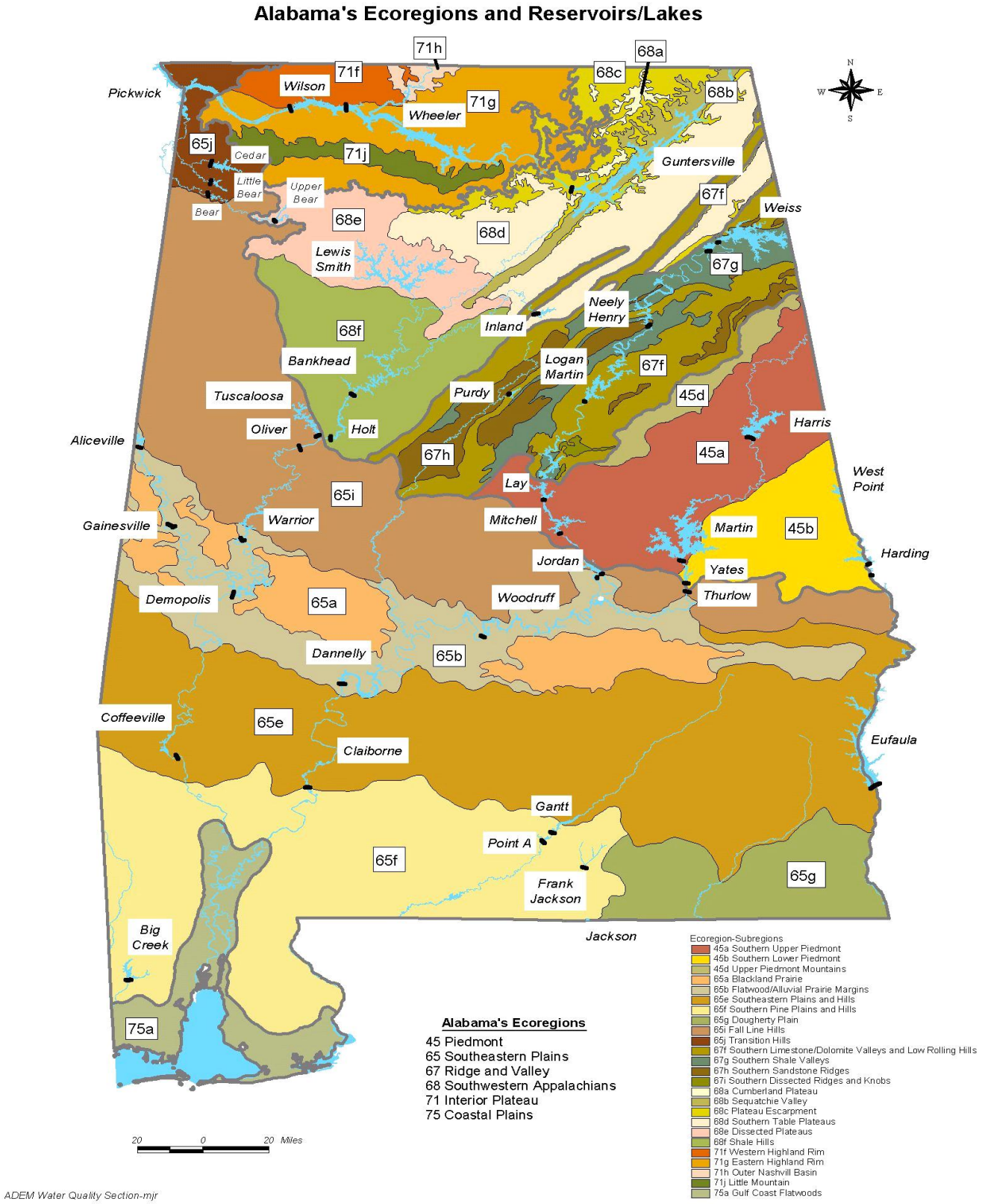
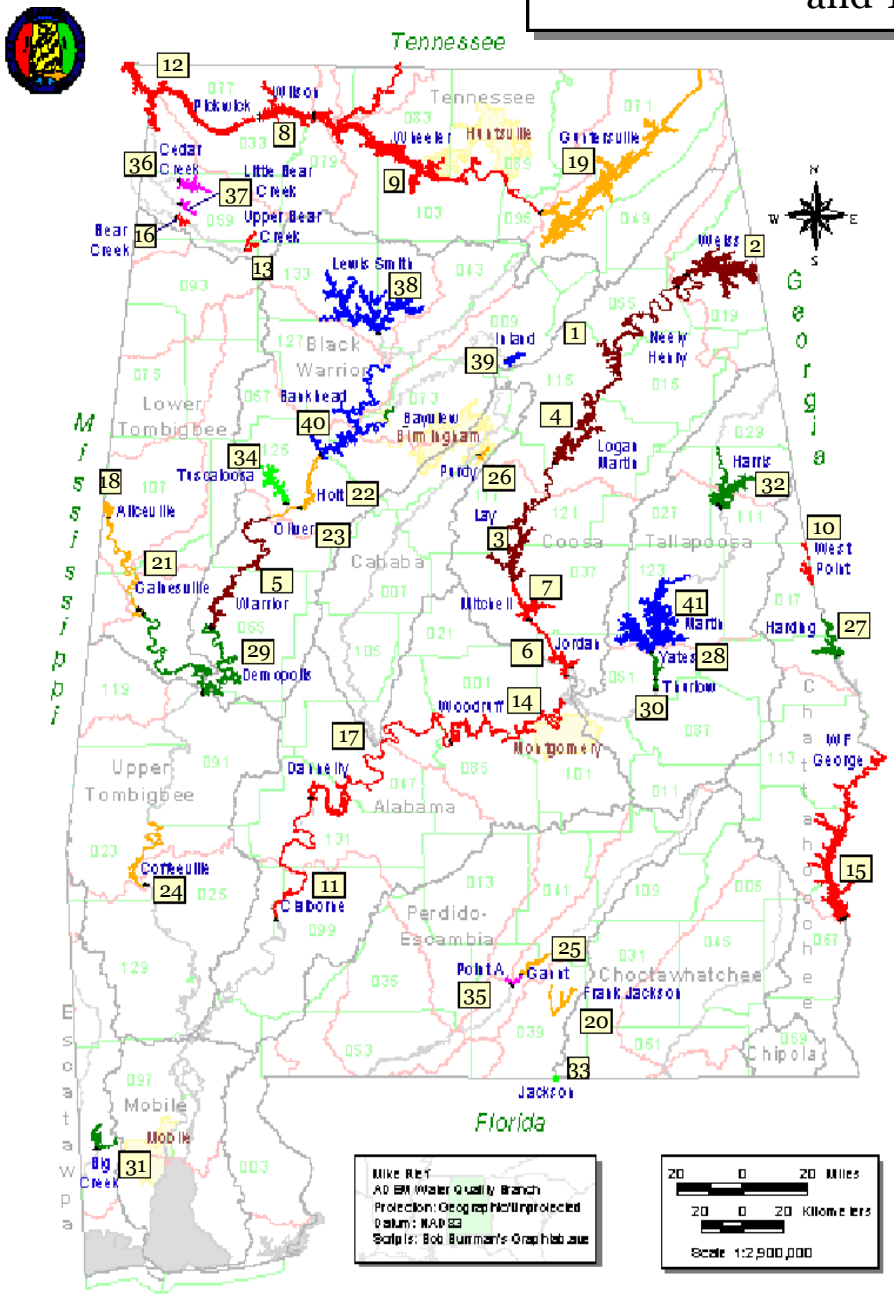


Figure 3-1: Alabama's Publicly Owned Lakes within Level IV Ecoregion

Lake and Reservoir
Trophic State Index Values (August Forebay)
and Trophic State



Trophic State	Index	Reservoir	River Basin	August TSI	Year
Eutrophic	1	Neely Henry	Coosa	66	2007
	2	Weiss	Coosa	65	2007
	3	Lay	Coosa	64	2007
	4	Logan Martin	Coosa	63	2007
	5	Warrior	Warrior	63	2007
	6	Jordan	Coosa	62	2007
	7	Mitchell	Coosa	62	2007
	8	Wilson	Tennessee	62	2007
	9	Wheeler	Tennessee	61	2007
	10	West Point	Chattahoochee	60	2007
	11	Claiborne	Alabama	58	2007
	12	Pickwick	Tennessee	58	2007
	13	Upper Bear	Tennessee	58	2007
	14	Woodruff	Alabama	58	2007
	15	W.F. George	Chattahoochee	58	2007
	16	Bear	Tennessee	57	2007
	17	Dannelly	Alabama	57	2007
	18	Aliceville	Tombigbee	56	2006
	19	Guntersville	Tennessee	56	2007
	20	Frank Jackson	Conecuh	54	2007
	21	Gainesville	Tombigbee	54	2006
	22	Holt	Warrior	54	2007
	23	Oliver	Warrior	54	2007
	24	Coffeeville	Tombigbee	52	2006
	25	Gantt	Perdido Escambia	52	2007
	26	Purdy	Cahaba	51	2007
Mesotrophic	27	Harding	Chattahoochee	49	2007
	28	Yates	Tallapoosa	49	2007
	29	Demopolis	Tombigbee	48	2006
	30	Thurlow	Tallapoosa	48	2007
	31	Big Creek	Escatawpa	47	2006
	32	Harris	Tallapoosa	47	2007
	33	Jackson	Perdido Escambia	46	2007
	34	Tuscaloosa	Warrior	45	2007
	35	Point A	Perdido Escambia	42	2007
	36	Cedar	Tennessee	41	2007
	37	Little Bear	Tennessee	41	2007
Oligotrophic	38	Smith	Warrior	35	2007
	39	Inland	Warrior	31	2007
	40	Bankhead	Warrior	24	2007
	41	Martin	Tallapoosa	24	2007

Most Recent August TSI Value
- Eutrophic 63-70
- Eutrophic 57-62
- Eutrophic 50-56
- Mesotrophic 47-49
- Mesotrophic 44-46
- Mesotrophic 40-43
- Oligotrophic 30-39
- River Basins
- USGS Cataloging Units
- Coastal/Mainstem Waters
- Mainstem Waters
- County
- Major Cities

FIPS Code	County
001	Autauga
003	Baldwin
005	Barbour
007	Bibb
009	Blount
011	Bullock
013	Butler
015	Calhoun
017	Chambers
019	Cherokee
021	Chilton
023	Choctaw
025	Clarke
027	Clay
029	Cleburne
031	Coffee
033	Colbert
035	Conecuh
037	Coosa
039	Covington
041	Crenshaw
043	Cullman
045	Dale
047	Dallas
049	De Kalb
051	Elmore
053	Escambia
055	Etowah
057	Fayette
059	Franklin
061	Geneva
063	Greene
065	Hale
067	Henry
069	Houston
071	Jackson
073	Jefferson
075	Lamar
077	Lauderdale
079	Lawrence
081	Lee
083	Limestone
085	Lowndes
087	Macon
089	Madison
091	Marengo
093	Marion
095	Marshall
097	Mobile
099	Monroe
101	Montgomery
103	Morgan
105	Perry
107	Pickens
109	Pike
111	Randolph
113	Russell
115	St. Clair
117	Shelby
119	Sumter
121	Talladega
123	Tallapoosa
125	Tuscaloosa
127	Walker
129	Washington
131	Wilcox
133	Winston

Figure 3-2: Trophic State Index of Alabama Lakes/Reservoirs

In developing numeric nutrient criteria, ADEM prioritized all lakes/reservoirs based on several factors such as public priority, available data, use-impairment status (i.e. 303(d) list), complexity of lake system, and modeling requirements. After careful consideration of these factors, the Department developed the schedule shown in Table 3-3. The schedule is primarily driven by the available water quality data for each lake and the timeframe it will take to gather additional data and complete development of water quality models where necessary. As of November 2009, Alabama has established nutrient criteria in the form of chlorophyll a criteria for 29 lakes and reservoirs.

Table 3-3: Nutrient Criteria Implementation Schedule for Lakes and Reservoir

Year	Number of Reservoirs	Major Basin(s)	Name of Reservoirs
2001	4	Chattahoochee, Coosa, Tallapoosa	West Point, W.F. George, Weiss, R.L. Harris
2002	9	Tallapoosa, Tennessee	Martin, Yates, Thurlow, Guntersville, Wheeler, Wilson, Pickwick, Little Bear, Cedar
2004	11	Alabama Black Warrior Chattahoochee Perdido-Escambia	Claiborne, Dannelly Bankhead, Holt, Lewis Smith, Oliver, Tuscaloosa, Warrior Harding Gantt, Point A
2005	5	Black Warrior Perdido-Escambia Lower Tombigbee Upper Tombigbee	Inland Jackson Coffeeville Demopolis, Gainesville
First half of 2010	8	Alabama Coosa Escatawpa Upper Tombigbee	Woodruff Jordan, Lay, Logan Martin, Mitchell, Neely Henry Big Creek Aliceville
Second half of 2010	2	Cahaba Perdido-Escambia	Purdy Frank Jackson
2011	2	Tennessee Tennessee	Bear Creek Upper Bear

3.8 Public Participation and Peer Review Process

In general, public participation for nutrient criteria development is conducted as part of ADEM's rule revision/adoption process. This involves publishing notices, holding public hearings, and receiving comments from the public regarding the proposed changes to Administrative Rules.

In addition, the Department has formed a Lakes and Reservoirs Workgroup for the purpose of gathering input and peer review from people who have certain expertise and knowledge in limnology and other fields relating to nutrient criteria development. These stakeholders are typically from academia, federal agencies, and other state agencies of Alabama.

ADEM has dedicated time and staff to actively participate as a state member of the EPA Region 4-Regional Technical Advisory Workgroup (RTAG).

3.9 Timeline for Adoption of Nutrient Criteria

In the first half of 2010, ADEM expects to propose nutrient criteria in the form of chlorophyll a criteria for 8 of the State's remaining 12 reservoirs. The Department expects to propose nutrient criteria for the remaining four reservoirs by 2011. Table 3-4 describes the significant milestones in this process.

Table 3-4: Timeline for Development of Nutrient Criteria in Reservoirs - 2008 and Beyond

Task / Description	Completion Date
Compile and analyze available reservoir data for Woodruff Reservoir, Lake Jordan, Lay Lake, Logan Martin Lake, Lake Mitchell, Lake Neely Henry, Big Creek Lake, and Aliceville Reservoir	December 2008
Initiate evaluation of reservoir embayment data and identify remaining data gaps	April 2009
Prioritize embayments for nutrient criteria development	2010
Complete watershed and reservoir models for Lake Purdy	2010
Complete ADEM internal review of potential criteria for the 8 reservoirs listed above	2010
Initiate public comment period for proposed nutrient criteria for the 8 reservoirs listed above	2010
Present proposed nutrient criteria for the 8 reservoirs listed above to the AEMC	2010

Table 3-4 cont'd: Timeline for Development of Nutrient Criteria in Reservoirs - 2008 and Beyond

Task / Description	Completion Date
Compile and analyze available reservoir data for Frank Jackson and Purdy Reservoirs	2010
Initiate watershed and reservoir modeling for Purdy Reservoir	2010
Complete watershed and reservoir models for Purdy Reservoir	2010
Complete ADEM internal review of potential criteria for Frank Jackson and Purdy Reservoirs	2010
Initiate public comment period for proposed nutrient criteria for Frank Jackson and Purdy Reservoirs	2010
Present proposed nutrient criteria for Frank Jackson and Purdy Reservoirs to the AEMC	2010
Compile and analyze available reservoir data for Bear Creek and Upper Bear Creek Reservoirs	2010
Initiate watershed and reservoir modeling for Bear Creek and Upper Bear Creek Reservoirs, if necessary	2010
Complete watershed and reservoir models for Bear Creek and Upper Bear Creek Reservoirs	2011
Complete ADEM internal review of potential criteria for Bear Creek and Upper Bear Creek Reservoirs	2011
Initiate public comment period for proposed nutrient criteria for Bear Creek and Upper Bear Creek Reservoirs	2011
Present proposed nutrient criteria for Bear Creek and Upper Bear Creek Reservoirs to the AEMC	2011

4.0 RIVERS AND STREAMS

4.1 Goals of Nutrient Program

ADEM's primary goals for developing and adopting nutrient criteria for Alabama's rivers and streams are consistent with the Clean Water Act and EPA's National Nutrient Strategy. These goals are as follows:

1) Develop and adopt nutrient criteria that support the beneficial uses designated for rivers and streams and that protect these waters from potential adverse effects associated with over-enrichment.
2) Restore and maintain the chemical, physical, and biological integrity of rivers and streams.
3) Maintain the diversity and uniqueness of Alabama's rivers and streams.

4.2 Conceptual Approach to Nutrient Criteria Development

Nutrient impairment of streams and rivers is an important water quality issue as evidenced by recent water quality assessments. EPA estimates that 40% of streams and rivers in the United States are contaminated by nutrient runoff. In Alabama, thirty of the total 181 stream segments (17%) appear on Alabama's 2008 CWA 303(d) list due to nutrient impairment. These segments together encompass approximately 275 stream miles.

The Department's primary goal in developing nutrient criteria for rivers and streams is to ensure that nutrient over-enrichment does not result in impairment of designated uses. A significant step in this process will be the development of relationships describing a waterbody's response to nutrients.

In practice, achieving this goal is difficult. This approach requires a significant amount of resources and an adequate quantity of collected data. From previous water quality studies conducted on waterbodies considered impaired from over-enrichment, the Department has found little, if any, correlation between nutrient loading and response variables—even when substantial data was available. Because fluctuations in primary production levels are the result of natural processes involving a complex interplay of numerous factors, it is very difficult to relate concentrations of chlorophyll a or periphyton coverage to a single parameter alone. Many factors other than nutrient loading can lead to fluctuations in algal biomass, including sunlight levels, water clarity, stream velocity, stream depth, and quantity of precipitation.

In developing nutrient criteria, the Department may also use a "reference condition approach" such as that described in the U.S. Environmental Protection Agency's publication, *Nutrient Criteria Technical Guidance Manual (Rivers and Streams)*, 2000. This approach uses data collected at a reference, or "least impacted," site that lies within the same ecoregion or bioregion as the targeted waterbody or that shares many of the same physical, chemical, and biological attributes. The Department is evaluating the use of Level IV Ecoregions as a method of *a priori* classification to facilitate program planning and development of reference conditions. This approach should help ensure that factors potentially affecting biotic communities are monitored. Analysis of this data may allow the Department to determine if biotic communities differ significantly between Level III and IV Ecoregions or if some of these Ecoregions can be lumped into bioregions.

In the reference condition approach, an upper percentile of the reference data is used to derive the numeric criteria. Although this method employs a statistical approach, it has a major shortcoming in that it does not establish a definitive link between nutrient concentrations and levels of impairment and is primarily applicable only to wadeable streams. Nor does this method provide information regarding the waterbody's capacity to assimilate nutrient loads. Without this type of information, it is difficult to determine if a derived numeric criterion will be under- or over-protective. Thus, there is a credible risk that a waterbody may be listed as impaired even though its designated uses are being attained.

While the Department believes an "effects-based" approach is best suited for nutrient criteria development, it realizes that time constraints and resource limits may require the use of a reference condition approach as a "fallback" method. In developing nutrient criteria for rivers and streams, effort will be given to establishing cause-and-effect relationships between nutrient concentrations and response variables, such as primary production. If a meaningful relationship cannot be determined for a waterbody, the reference approach recommended by EPA will be used to derive numeric criteria.

The Department anticipates that TMDL work relating to rivers and stream considered nutrient-impaired (i.e. occurrence of nuisance algae or low dissolved oxygen levels), in conjunction with data collected from reference sites, will provide helpful insight when developing nutrient criteria. As in nutrient criteria development, a major goal of TMDL studies is to find meaningful correlations in collected data that reveal how the waterbody responds to different levels of nutrient loading. If the nutrient concentration can be determined at which impacts from eutrophication begin to occur, this concentration can be considered a good approximate target and a numeric criterion below this value should protect the waterbody from any potential adverse effects of over-enrichment. However, if meaningful correlations between causal and response variables cannot be elucidated, then the fallback approach of a reference waterbody might be used. The Department may also consider other scientifically defensible methods and types of data analyses depending on the unique conditions of each waterbody being studied.

In developing nutrient criteria for streams and rivers, the Department expects to first target those stream segments currently identified as being impaired due to excess nutrient enrichment. This strategy is desirable for several reasons. First, it focuses efforts and resources on those segments that are currently impaired and should receive the highest priority in regards to determining assimilative capacities and establishing effective nutrient targets. Second, TMDL studies generate a significant amount of data, including computer modeling, which can potentially provide insight into how the waterbody and its aquatic ecosystems respond to different nutrient concentrations. The Department anticipates that this type of information, potentially combined with data collected at appropriate reference sites, will provide an adequate framework within which numeric nutrient criteria protective of the waterbody's designated uses can be established. Furthermore, data collected on a waterbody to determine the effectiveness of the remediation strategies outlined in the TMDL could provide additional insight into how nutrient loadings relate to water quality and use support. It is the Department's strategy to extrapolate much of the experience and knowledge gained from nutrient criteria development in impaired stream segments to surrounding unimpaired stream segments within the same ecoregions. As data is collected over time, it is hoped that correlations between causal parameters, such as nutrient loading, and response parameters, such as periphyton biomass or algal blooms, will become better elucidated and that appropriate trends are discovered in the data

that might allow a finer delineation of ecoregions and the development of criteria that reflect local conditions.

A complicating factor in developing nutrient criteria for rivers and streams is the limitation of assessment methods that can effectively monitor biological impairment from nutrients. Biological indicators capable of linking nutrient concentrations to aquatic community responses would facilitate efforts to develop nutrient criteria that are protective of stream communities and ecosystem processes. In the past, the Department has successfully used macroinvertebrate assessment to characterize aquatic life support in wadeable streams. If this tool can be made more sensitive to nutrient stress by adding periphyton assessment, it would likely provide a more effective means of measuring responses to nutrients and give additional insight into the relationship between nutrient concentrations and instream effects. The Department's Aquatic Assessment Unit has conducted studies to evaluate three different algal bioassessment techniques to determine which provides the most effective indication of nutrient enrichment. The three bioassessment methods being evaluated include periphyton biomass as chlorophyll a, diatom community assessment, and a field-based rapid periphyton survey. These methods were tested at 20 stream segments with known or suspected impairment from nutrient over-enrichment as well as at 14 ecoregional reference sites for comparison. To provide the most complete characterization of water quality conditions, habitat quality and macroinvertebrate and fish communities were also assessed at the reference and study reaches.

The preliminary results of the studies suggest that periphyton chlorophyll a, total chlorophyll a, and percent coverage of suitable substrate (CSS) can effectively indicate water quality problems associated with nutrient enrichment. Correlation between reference reaches was variable but may improve as additional data are collected and the method and delineation of ecoregions are further refined. It was determined that periphyton as chlorophyll a was significantly correlated ($p = 0.05$; $r = 0.88$) with average total phosphorus (TP) concentrations. The correlation between the CSS method and average TP was not as strong ($p = 0.02$; $r = 0.64$). In addition, several macroinvertebrate and fish bioassessment metrics were correlated with mean total phosphorus and nitrogen concentrations, suggesting that these metrics may be effective indicators of nutrient enrichment and changes in nutrient loading in streams. The Department anticipates that these correlations will become better defined as more appropriate reference conditions are developed. The Department continues to work closely with EPA Region 4 to refine periphyton assessment methods with the goal of establishing regional protocols. Periphyton monitoring efforts were conducted on selected waterbodies between 2004 and 2007 and have become a routine component of the Department's monitoring strategy. Water quality data collected through the Department's ambient monitoring program, 303(d) assessments, and randomized sampling will continue to be evaluated with the goal of determining natural variability and identifying data trends relative to distinct areas such as ecoregions or river basins. If such differentiation can be sufficiently clarified, it might allow single nutrient criterion values to be applied to other waters within the same geographical or ecoregional area. The potential benefits would be increased criteria coverage of waters and more efficient allocation of resources. The intended goal is to be able to develop criteria using regionalized strata, such as ecoregions or basins, or specific parameters, such as stream size and land use characteristics. Another aim is to determine the largest spatial and temporal gaps in the databases. This information will be helpful when planning future monitoring activities.

4.3 Designated Uses of Alabama's Rivers and Streams

The use classifications (designated uses) utilized by the State for all surface waters of Alabama are as follows:

(1) Outstanding Alabama Water (OAW)
(2) Public Water Supply (PWS)
(3) Swimming and Other Whole Body Water-Contact Sports (S)
(4) Shellfish Harvesting (SH)
(5) Fish and Wildlife (F&W)
(6) Limited Warmwater Fishery (LWF)
(7) Agricultural and Industrial Water Supply (A&I)

4.4 Prioritization of Nutrient Criteria Development for Rivers and Streams

Nutrient criteria development for rivers and streams is expected to begin in those waterbodies impaired by nutrients since, in most cases, adequate data will already be available and a nutrient target will be needed in the TMDL. Nutrient target development is already underway in several watersheds throughout the state. Nutrient criteria for unimpaired streams will proceed as data becomes available as described in Section 4.2. The following list shows the expected sequence of nutrient criteria development in rivers and streams in Alabama. However, it is likely that data collection, evaluation, and the nutrient criteria development process could proceed simultaneously in some of the following waterbodies.

1) Waterbodies with EPA-approved nutrient TMDLs
2) Waterbodies designated as Outstanding National Resource Water
3) Waterbodies with the OAW designated use and ecoregional reference waterbodies
4) Waterbodies contributing significant nutrient loads to reservoir embayments as indicated from embayment monitoring data
5) Other rivers and streams as data and resources allow

4.5 Data Collection and Assessment

ADEM revised its Rivers and Streams Monitoring Strategy in 2005 in part to provide stressor-response data that can be used to develop nutrient criteria. It is based on the two relationships depicted in Figure 4-1. The Strategy plans biological monitoring activities along a full disturbance gradient to produce a dataset representing both the full stressor gradient and the full biological condition gradient. The biological and chemical datasets that the ADEM is building will allow ADEM to use an iterative, weight of evidence approach to adopt the most appropriate numeric criteria for wadeable streams and rivers.

Two important aspects of the strategy were delineation of all wadeable, flowing watersheds or monitoring units (MUs) and the development of a watershed disturbance gradient to categorize waters by watershed conditions. ADEM defines MUs as the watershed upstream of the downstream-most, completely wadeable, and accessible stream reach. Where they meet these criteria, the watershed upstream of ADEM's targeted and fixed monitoring sites are delineated as MUs.

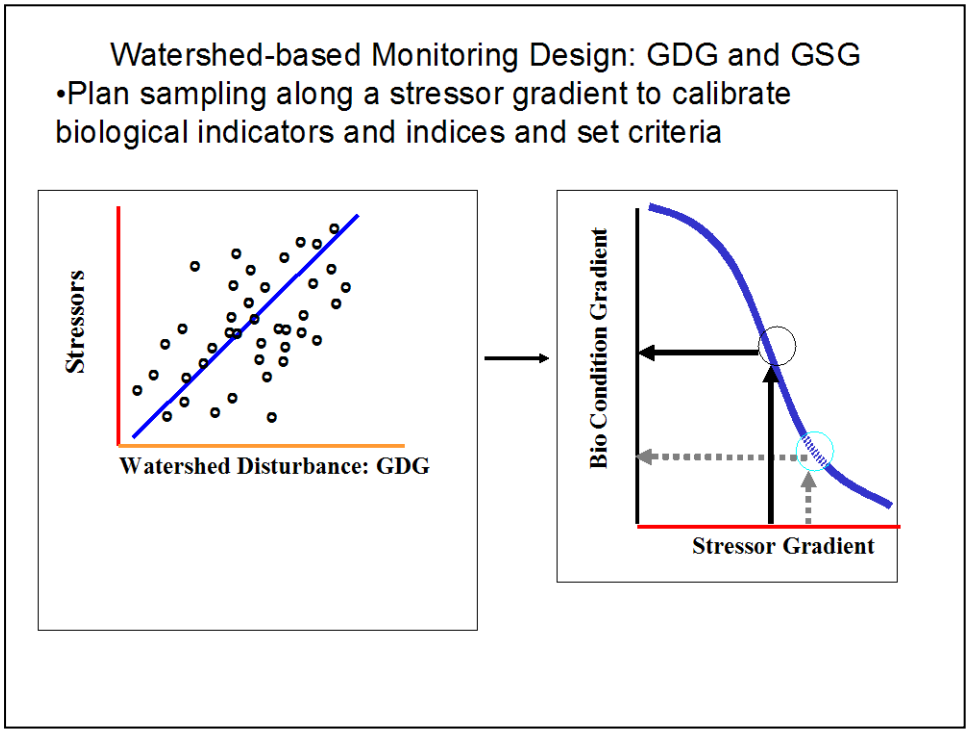


Figure 4-1: Watershed-Based Monitoring Design

Having an inventory of watershed conditions at ADEM's targeted and fixed monitoring sites as well as throughout the basin has enabled ADEM to plan its biological monitoring along the greatest disturbance gradient in each bioregion as efficiently as possible. ADEM's Rivers and Streams Monitoring Strategy incorporates biological monitoring and intensive water quality sampling at least-disturbed ecoregional reference, long-term ambient, targeted (relatively short-term intensive sampling conducted to support management listing/delisting, TMDL, etc. decisions), and probabilistic monitoring stations to provide the full gradient of stressor conditions needed to link nutrient concentrations with biological community response. Since 2005, intensive-level macroinvertebrate bioassessments have been conducted at 267 monitoring locations representing a gradient in watershed conditions. Periphyton assessments have been conducted at 200 of these locations. At each site, collection of a suite of nutrient parameters occurs at least three times annually, March through October. Table 4-1 summarizes ADEM's biological and nutrient dataset by ecoregion and disturbance gradient category. Intensive macroinvertebrate assessments, habitat assessments, and a minimum of three water quality sampling events were conducted at each location.

Table 4-1: Number of Monitoring Locations in Each Disturbance Category and Bioregion

Bioregion	Watershed Disturbance Category								
	1 (≤5th Percentile	2 (6-10th Percentile)	3 (11-25th Percentile)	4 (26-50th Percentile	5 (51st-75th Percentile)	6 (76-90th Percentile)	7 (90st-94th Percentile)	8 (≥95th Percentile)	Total
Piedmont (Level 3 Ecoregion 45)	5	2	11	12	9	4	2	2	47
Blackbelt (Level 4 Ecoregions 65a and 65b)	0	1	0	7	5	8	3	1	25
Level 4 Ecoregions 65d/i	1	10	14	22	20	10	1	4	82
Level 4 Ecoregion 65p	0	1	1	2	0	3	1	2	10
Level 4 Ecoregion 65q	5	1	2	4	1	0	0	0	13
Level 3 Ecoregion 67	2	0	3	4	10	6	3	2	30
Level 3 Ecoregion 68	5	1	3	3	8	2	0	2	24
Level 3 Ecoregion 75	0	0	0	1	2	0	0	0	3
Total	18	16	34	55	55	33	10	13	234

In general, the Rivers and Streams Monitoring Program follows a five-year rotating river basin schedule. Data gathered during each year of the cycle are stored in various databases and evaluation and assessment generally occur over a one- to three-year period following data collection. Table 4-2 shows ADEM's rotating river basin monitoring schedule.

In 2009, ADEM completed the migration of historic water quality and biological data from its current databases into the Alabama Water Quality Assessment and Monitoring Data Repository (ALA WADR). This new database facilitates thorough analysis of nutrient data for rivers and streams and significantly enhances the Department's ability to summarize information for nutrient criteria development.

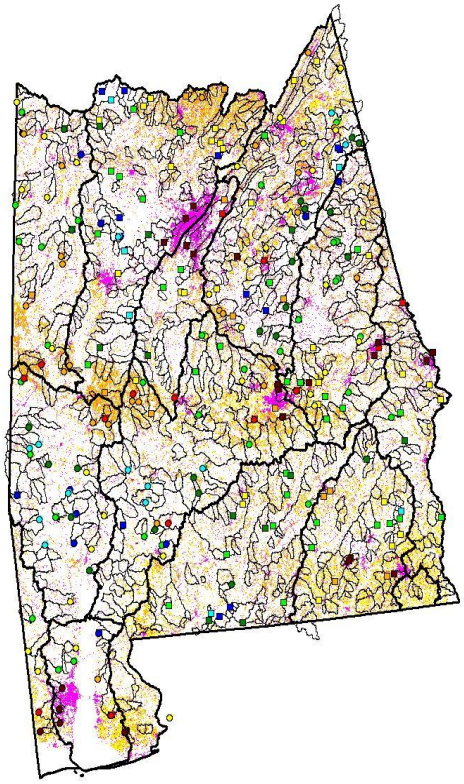


Figure 4-2: Monitoring Locations

Table 4-2: Alabama's Rotating River Basin Monitoring Cycle

River Basin Group	Year
Cahaba, Black Warrior	2007
Chattahoochee, Chipola, Choctawhatchee, Perdido-Escambia	2008
Tennessee	2009
Alabama, Coosa, Tallapoosa	2010
Escatawpa, Tombigbee, Mobile	2011

4.6 Public Participation and Peer Review

In general, public participation for nutrient criteria development will be conducted as part of ADEM's rule adoption process. This involves publishing notices, holding public hearings, and receiving comments from the public regarding the proposed changes to our water quality regulations.

A Rivers and Streams Workgroup has been established by the Department to provide input and peer review from individuals who have certain expertise and knowledge in nutrient relationships in rivers and streams. These stakeholders are typically from academia, federal agencies, and other state agencies of Alabama.

4.7 Timeline and Milestones

Because the following schedule is subject to the availability of resources, and further assessments may provide additional insight to the nutrient criteria development process as well as the identification of data gaps, the scheduled dates might be revised in the future.

Table 4-3: Timeline for Development of Nutrient Criteria in Rivers and Streams – 2009 and Beyond

Task / Description	Date
Update list of EPA-approved nutrient TMDLs and evaluate nutrient targets	2010
Complete ADEM internal review / peer review of potential criteria based on nutrient targets in approved TMDLs	2010
Compile and summarize available nutrient and biological data from ALA WADR for ecoregional reference sites	2010
Evaluate data availability / data gaps for OAW and ONRW waterbodies	2010

Complete ADEM internal review / peer review of potential criteria for OAW and ONRW waterbodies	2011
Prepare proposed changes to ADEM Rule 335-6-10 to assign nutrient criteria to waterbodies with approved nutrient TMDLs, OAW designated use, and the ONRW designation	2011
Issue Public Notice	2011
Present proposed criteria to AEMC	2011
Initiate evaluation of data for rivers and streams contributing to reservoir embayments	2012
Propose nutrient criteria for rivers and streams contributing to reservoir embayments where sufficient data has been collected	2012
Initiate evaluation of data for rivers and streams not previously addressed	2013
Propose nutrient criteria for remaining rivers and streams, where necessary	2013

5.0 ESTUARINE AND COASTAL MARINE WATERS

5.1 Goals of Nutrient Program

Consistent with the Clean Water Act and EPA's National Nutrient Strategy, ADEM's primary goals for developing and adopting nutrient criteria for Alabama's estuarine and coastal marine waters are as follows:

1) Develop and adopt nutrient criteria that support the beneficial uses designated for estuarine and coastal marine waters and that protect these waters from potential adverse effects associated with over-enrichment.
2) Restore and maintain the chemical, physical, and biological integrity of estuarine and coastal marine water.
3) Maintain the diversity and uniqueness of Alabama's estuarine and coastal marine water.

5.2 Conceptual Approach

In developing strategies relating to nutrient criteria in coastal and estuarine waters, the Department anticipates utilizing much of the information contained in EPA's *Nutrient Criteria Technical Guidance Manual for Estuarine and Coastal Marine Waters, 2001,* along with other approaches that may be developed through collaboration with other Gulf of Mexico states. Because coastal systems are often very complex in nature, a localized approach with the development of site-specific criteria may be more effective than a broad geographical approach.

Estuaries and near-shore coastal waters naturally vary in the type, abundance, and geographic coverage of biological communities at risk to nutrient over-enrichment, largely because of habitat differences. Because of these differences and the overall complexity of estuarine water systems, it is especially difficult developing a single national criterion or a regional criterion applicable to all estuaries. Therefore, it is necessary to focus on historical data to assess water quality in localized regions and to select appropriate reference conditions.

The Department participated in a nutrient pilot study coordinated by the Gulf of Mexico Program Office to study responses to excess nutrients in the Northern Gulf of Mexico. The goal of this study was to gather, qualify, and analyze relevant historical data and to determine meaningful characterizations and ecosystem assessments of nutrient load/responses for the near-coastal waters and associated estuaries of the northern Gulf of Mexico. The area of study extends from the Mississippi River-Gulf outlet through Mobile Bay and contains waterbodies in the states of Louisiana, Mississippi, and Alabama. The final objective of the pilot study was to provide information that states and federal managers could use in the development of nutrient criteria and management responses that protect the integrity of coastal ecosystems from the adverse effects of cultural eutrophication.

The Department is also an active participant in the Gulf of Mexico Alliance (GOMA). GOMA is a partnership, initiated in 2004, by the states of Alabama, Florida, Louisiana, Mississippi, and Texas, with the goal of significantly increasing regional collaboration to enhance the environmental and economic health of the Gulf of Mexico. The Alliance currently coordinates closely with the Gulf of Mexico States Accord to facilitate eventual collaboration with the six Mexican Gulf of Mexico states.

With the cooperation of the five Gulf States and support by federal and non-governmental partners, some of the goals accomplished from the 2006 *Governor's Action Plan* include:

- Coastal Ecosystem Learning Centers (CELCs) have been established in each of the five Gulf States and Veracruz, Mexico.
- A Regional Sediment Management Master Plan has been drafted that will provide a framework for better management of Gulf sediment resources facilitating a reduction in coastal erosion and storm damages, as well as the restoration of coastal habitats.
- Bi-national workshops designed to standardize harmful algal bloom identification and field sampling methods were conducted in Texas, Florida, and Mexico.
- An ecosystem data portal has been established that will be used by resource managers to evaluate habitat extent and changes over time.
- A regional Nutrient Criteria Research Framework was developed that has led to a better understanding of nutrient impacts to Gulf ecosystems, as well as a coordinated approach to managing them.

In March 2009, following the publication of the 2006 *Governor's Action Plan for Healthy and Resilient Coasts*, the Alliance published the *Governor's Action Plan II for Healthy and Resilient Coasts* which establishes specific goals to be accomplished by March 2014. The Gulf States identified six priority issues that are regionally significant and can be effectively addressed through increased collaboration at state, local, and federal levels. These priorities represent a focus for initial action through the Alliance:

- Water quality for healthy beaches and seafood
- Habitat conservation and restoration
- Ecosystems integration and assessment
- Reducing nutrient impacts to coastal ecosystems
- Coastal community resilience
- Environmental education

However, the actions identified in the *Governor's Action Plan II* address the following four major challenges to healthy and resilient communities in the Gulf region.

- Sustaining Gulf economy
- Improving ecosystem health
- Mitigating the impacts of and adapting to climate changes
- Mitigating harmful effects to coastal water quality

In August 2009, the five Gulf of Mexico states met in Mobile, Alabama during the 2009 Governors' Action Plan Implementation and Integration Workshop to develop work plans for the actions described within the *Governors' Action Plan II*. The action plan specifically addresses efforts to develop consistent approaches for establishing nutrient criteria in estuarine and coastal waters. Among the long-term goals of this partnership are:

- Design a regional process for comparing nutrient criteria across coastal and estuarine waters.
- Develop and implement strategies that reduce nutrient inputs and hypoxia.
- Establish a comprehensive ecosystem approach to manage nutrient inputs and reduce impacts to coastal ecosystems.

- Increase the capacity of Gulf coastal communities so that nutrient impacts are better managed and reduced.

The anticipated outcome of this process is a consistent framework that the five Gulf States can use to develop nutrient criteria for their coastal and estuarine waters. The Nutrient Reduction workgroup has grown to include experts from many different state, federal, educational, and research organizations. The collaboration among the states and their federal partners leverages resources to address the very challenging technical issue of nutrient criteria development.

5.3 Designated Uses of Alabama's Estuarine and Coastal Marine Waters

The use classifications (designated uses) utilized by the State for all surface waters of Alabama are as follows:

(1) Outstanding Alabama Water (OAW)
(2) Public Water Supply (PWS)
(3) Swimming and Other Whole Body Water-Contact Sports (S)
(4) Shellfish Harvesting (SH)
(5) Fish and Wildlife (F&W)
(6) Limited Warmwater Fishery (LWF)
(7) Agricultural and Industrial Water Supply (A&I)

5.4 Prioritization of Nutrient Criteria Development

Nutrient criteria development for coastal and estuarine waters is expected to begin in those waterbodies where adequate data exists to evaluate nutrient assimilative capacity. In addition, waters with identified use impairments caused by nutrients will be addressed early in the process, especially those waterbodies with EPA-approved nutrient TMDLs. The following list shows the expected sequence of nutrient criteria development in coastal and estuarine waters in Alabama. However, it is likely that data collection, evaluation, and the nutrient criteria development process could proceed simultaneously in some of the following waterbodies.

1) Waterbodies with EPA-approved nutrient TMDLs
2) Waterbodies with sufficient data to establish use-appropriate nutrient criteria
3) Nutrient-sensitive waters as characterized by the Gulf of Mexico Program Nutrient Pilot Study, Mobile Bay National Estuary Program, or other monitoring program

5.5 Data Collection & Assessment

The Department has participated in water quality studies sponsored and funded in part by the National Coastal Assessment program, the National Estuary Program, and the Gulf of Mexico Program. In addition, ADEM's data collection efforts involve a number of programs with specific data collection goals and requirements. These various programs are discussed in detail in *"State of Alabama Water Quality Monitoring Strategy*", 2005. The sampling programs that are expected to contribute significantly to nutrient criteria development in estuarine and coastal waters include the following:

1) Ambient Monitoring Program

2) §303(d) Monitoring Program / TMDL Development Program
3) Section 319 Nonpoint Source Intensive Survey Program
4) Coastal Sub-watershed Assessment Program
5) National Coastal Assessment Program

5.6 Public Participation and Peer Review

In general, public participation for nutrient criteria development will be conducted as part of ADEM's rule adoption process. This involves publishing notices, holding public hearings, and receiving comments from the public regarding the proposed changes to our water quality regulations.

5.7 Timeline and Milestones

Because the following schedule is subject to the availability of resources, and further assessments may provide additional insight to the nutrient criteria development process as well as the identification of data gaps, the scheduled dates might be revised in the future.

Table 5-1: Timeline for Development of Nutrient Criteria in Estuarine and Coastal Waters - 2007 and Beyond

Task / Description	Date
Participate in the Gulf of Mexico Alliance (GOMA) Nutrient Reduction Workgroup	2007 - 2014
Compile and evaluate data, including results from GMP Nutrient Pilot Study and Mobile Bay Water Quality Model	2010
Complete ADEM internal review / peer review of potential criteria for waters with EPA-approved TMDLs or other identified nutrient-sensitive coastal waters consistent with the goals / recommendations of the GOMA Nutrient Reduction Workgroup	2010
Propose nutrient criteria for selected coastal waters	2012
Initiate evaluation of data for estuarine and coastal waters not previously addressed	2012
Propose nutrient criteria for estuarine and coastal waters not previously addressed, where appropriate	2013

6.0 WETLANDS

6.1 Goals of Nutrient Program

Consistent with the Clean Water Act and EPA's National Nutrient Strategy, ADEM's primary goals for developing and adopting nutrient criteria for Alabama's wetlands are as follows:

1) Develop and adopt nutrient criteria that support the beneficial uses designated for wetlands and that protect these waters from potential adverse effects associated with over-enrichment.
2) Restore and maintain the chemical, physical, and biological integrity of wetlands.
3) Maintain the diversity and uniqueness of Alabama's wetlands.

6.2 Conceptual Approach

In developing strategies relating to nutrient criteria and wetlands, the Department anticipates utilizing the information contained in EPA's *Nutrient Criteria Technical Guidance Manual for Wetlands, 2007*. Because the overall science of wetland assessment and monitoring is still in the early stages, the Department will continue to follow closely any new developments.

6.3 Designated Uses of Alabama's Wetlands

The use classifications (designated uses) utilized by the State for all surface waters of Alabama are as follows:

(1) Outstanding Alabama Water (OAW)
(2) Public Water Supply (PWS)
(3) Swimming and Other Whole Body Water-Contact Sports (S)
(4) Shellfish Harvesting (SH)
(5) Fish and Wildlife (F&W)
(6) Limited Warmwater Fishery (LWF)
(7) Agricultural and Industrial Water Supply (A&I)

6.4 Prioritization of Nutrient Criteria Development

Because Alabama does not recognize wetlands as a distinct waterbody type within its water quality standards, ADEM has not targeted wetlands for monitoring within its monitoring programs. Therefore, very little data regarding water quality in wetlands is available in Alabama. As a result, much initial work will be required to gain an understanding of wetland functions relative to nutrient processes and responses to nutrient loading. The State will rely on EPA guidance as it develops a strategy for obtaining the information needed to proceed with nutrient criteria development in this waterbody type.

6.5 Data Collection & Assessment

ADEM will rely upon available EPA guidance and training for monitoring and assessing wetlands. Wetlands monitoring will be incorporated into the Department's overall monitoring strategy.

6.6 Public Participation and Peer Review

In general, public participation for nutrient criteria development will be conducted as part of ADEM's rule adoption process. This involves publishing notices, holding public hearings, and receiving comments from the public regarding the proposed changes to our water quality regulations.

6.7 Timeline and Milestones

Because wetland assessment and monitoring is in an early stage and the science is still evolving, this timeline is more extended with less definite dates.

Table 6-1: Timeline for Development of Nutrient Criteria in Wetlands - 2009 and Beyond

Task / Description	Date
Establish the Wetlands Monitoring and Assessment Workgroup	2010
Incorporate wetlands monitoring into the Department's monitoring strategy	2011
Gather and compile available wetlands water quality data	2012
Establish the Wetlands Nutrient Criteria Workgroup	2012
Initiate evaluation of data for wetlands and identification of nutrient-sensitive wetlands	2013
Complete ADEM internal review / peer review of potential criteria for selected nutrient-sensitive wetlands	2014
Propose nutrient criteria for selected nutrient-sensitive wetlands	2015

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
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APR 1 2010

Mr. James McIndoe
Chief
Water Division, Alabama Department of
Environmental Management
P.O. Box 301463
Montgomery, Alabama 36130-1463

Dear Mr. McIndoe:

This letter documents a mutual agreement between the Alabama Department of Environmental Management (ADEM) and the United States Environmental Protection Agency (EPA) with regards to the State's revised numeric nutrient criteria development plan, titled Nutrient Criteria Implementation Plan, State of Alabama (Plan), dated November 2009.

EPA recognizes that this Plan represents continued effort by the State to address the issue of nutrient over-enrichment. We appreciate the cooperation of your staff in working with EPA Region 4 to revise the Plan, and your continued support of their participation in EPA's Regional Technical Advisory Group (RTAG). The achievement of our mutual agreement on your revised Plan is an indication of the success of that process.

Based upon our review, we believe that this Plan details a reasonable process by which the State of Alabama can develop appropriate protective numeric nutrient criteria for adoption into Alabama's water quality standards and that completion of this process by the target dates indicated in the Plan should provide improved protection of state waters from the adverse effects of nutrient over-enrichment. EPA would like to reiterate that the establishment of chlorophyll-*a* criteria for Alabama's large reservoirs and lakes is a significant accomplishment. However, while nutrient criteria for response variables such as chlorophyll-*a* help to more accurately assess attainment, that approach alone may prove insufficient in the implementation of source controls which are intended to prevent impairments from occurring. It is EPA's national policy that nutrient criteria address causal and response variables and EPA recommends the development of nutrient criteria incorporating nitrogen, phosphorus, chlorophyll-*a* and water clarity criteria variables whenever possible. (2001 G. Grubbs Memorandum, 2007 B. Grumbles Memorandum to State Water Program Directors). EPA expects States to move forward with numeric criteria for causal and response variables wherever data are available. States can also opt to utilize a subset of parameters or other equivalent alternative criteria if sufficient science demonstrates that the approach is protective of designated uses. Additionally, each State is required to revise State standards when new scientific information and data are available. During our January 14th meeting, ADEM and EPA discussed the analysis of additional nutrient data being collected through various State monitoring programs.

As identified in our January meeting, ADEM should move forward on developing a process and schedule for addressing total nitrogen, total phosphorus and clarity. In addition, ADEM should develop a process and schedule for addressing protection of downstream waters, particularly lakes and estuaries. As you are aware, EPA is developing numeric nutrient criteria for Florida's lakes and flowing waters. When these criteria become effective, it will be necessary for Alabama to meet these criteria at the Alabama-Florida State line. We look forward to working with you on these efforts.

By this agreement, EPA is acknowledging that this Plan reflects a reasonable course of action by which the State can proceed to develop numeric nutrient criteria, but this agreement is not an approval of Alabama water quality standards. EPA's agreement at this time does not reflect an in-depth review or a judgment that the resulting criteria will or will not be protective or are consistent with the Clean Water Act (CWA).

According to the time-line projected in your revised Plan, we expect you to submit numeric water quality standards for nutrients for scheduled waterbody types to EPA for approval during the respective rulemakings. In the interim, we request that you provide updates to EPA as needed to document progress according to the Plan through the established 106 process conducted by EPA. If the Plan needs to be revised in the future, changes can be made with mutual agreement, and EPA will update this letter to document our agreement with the revisions.

EPA utilized the revised Plan to evaluate Alabama's progress and determined that the State will likely complete numeric nutrient criteria development and adoption for the response variable chlorophyll-*a* for lakes and reservoirs within the agreed upon time frame as outlined in the revised 2009 Plan. Additional waters in the Plan are expected to be completed as scheduled. If the State has not met the milestones as scheduled in the Plan, EPA will evaluate whether a federal promulgation is necessary. At that time, the Administrator may choose to exercise discretion under CWA § 303(c)(4)(B) to determine that new or revised standards are necessary to meet the requirements of the CWA, and accordingly may choose to promulgate water quality criteria for nutrients applicable to surface waters within Alabama in accordance with CWA §303. However, the revised Plan submitted by ADEM and agreed to here makes that possibility unlikely at this time.

EPA will continue to assist the State in developing nutrient criteria in a manner consistent with the Plan. The Region would like to continue to provide any technical assistance you might need to assist in your continued development of protective numeric nutrient criteria. We expect the continued cooperation and communication between ADEM and EPA staff will lead to scientifically defensible and protective nutrient criteria for State waters. We appreciate the time and resources you and your staff have devoted in nutrient criteria development thus far and anticipate continued accomplishments in future nutrient criteria development for State waters.

If you have any questions regarding this matter, please feel free to contact me at 404-562-9345 or have a member of your staff contact the Alabama Water Quality Standards Coordinator on my staff, Lydia Mayo, at 404-562-9247.

Sincerely,

Gail Mitchell, for

James D. Giattina
Director
Water Protection Division