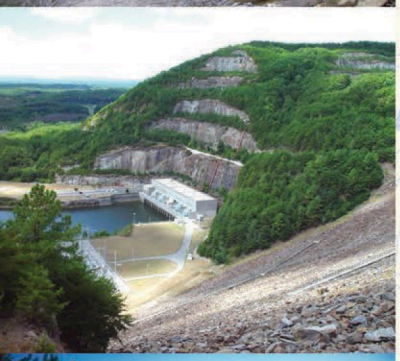
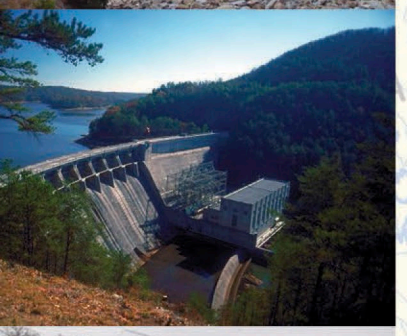
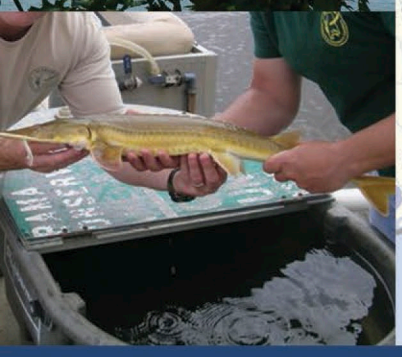






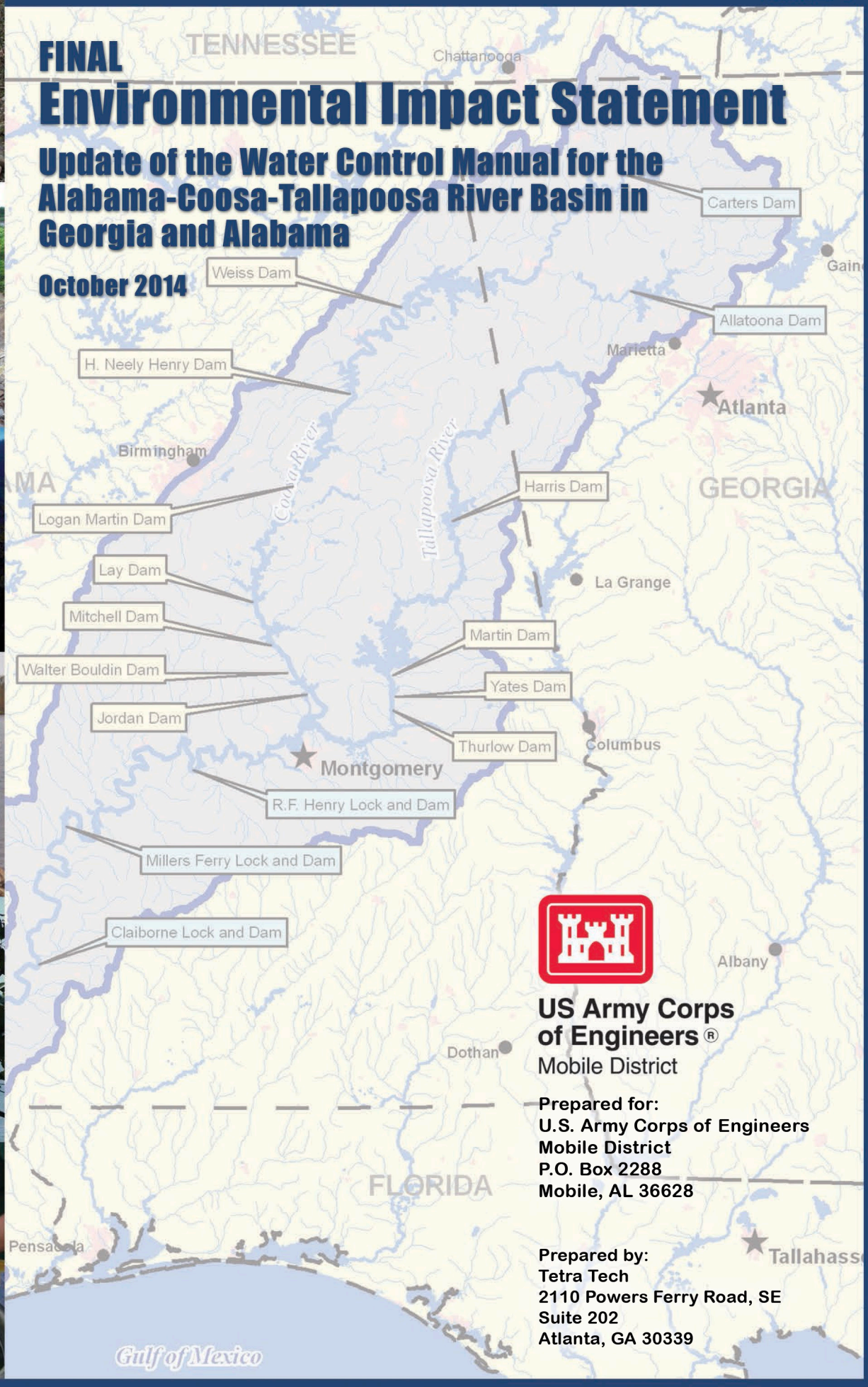






FINAL
Environmental Impact Statement
Update of the Water Control Manual for the Alabama-Coosa-Tallapoosa River Basin in Georgia and Alabama

October 2014



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Mobile District

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Abbreviations and Acronyms

aad-mgd	average annual day-million gallons per day
ac	acre(s)
ac-ft	acre-feet
ac-ft/yr	acre-feet per year
ACF	Apalachicola-Chattahoochee-Flint
ACT	Alabama-Coosa-Tallapoosa
ADAPT	Alabama Drought Assessment and Planning Team
ADCNR	Alabama Department of Conservation and Natural Resources
ADCNR-MRD	Alabama Department of Conservation and Natural Resources-Marine Resources Division
ADEM	Alabama Department of Environmental Management
ALCWP	Alabama Clean Water Partnership
ALOWR	Alabama Office of Water Resources
ANSI	American National Standards Institute
APC	Alabama Power Company
APCDOP	APC draft Alabama Drought Operations Plan
AQCR	Air Quality Control Region
AWAWG	Alabama Water Agencies Working Group
AWW	Alabama Water Watch
BA	Biological Assessment
BG	billion gallons
BOD	biochemical oxygen demand
C	Celsius
CAA	Clean Air Act
CAGR	compound area growth rate
CC	combined cycle (generating plant)
CCMWA	Cobb County-Marietta Water Authority
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
cfs	cubic feet per second
CH_4	methane
CNG	Coosa–North Georgia
CO	carbon monoxide
CO_2	carbon dioxide
Corps	U.S. Army Corps of Engineers
CT	combustion turbine (generating plant)

CWA	Clean Water Act
dB	decibels
dBA	a-weighted decibels
DDT	dichlorodiphenyltrichloroethane
DIG	Drought Impact Group
DIL	Drought Intensity Level
DNL	day-night sound level
DO	dissolved oxygen
DOE	U.S. Department of Energy
dsf	day second feet
EA	Environmental Assessment
EFDC	Environmental Fluid Dynamic Code
EFH	essential fish habitat
EIA	Energy Information Administration
EIS	Environmental Impact Statement
EM	Engineering Manual
EMM	Electricity Market Module
EO	Executive Order
EOP	Environmental Operating Principles
ER	Engineering Regulation
ESA	Endangered Species Act
F	Fahrenheit
FAV	floating aquatic vegetation
FERC	Federal Energy Regulatory Commission
FMP	Fishery Management Plan
ft	foot/feet
ft/mi	feet per mile
FWCAR	Fish and Wildlife Coordination Act Report
FY	fiscal year
GADNR	Georgia Department of Natural Resources
GAEPD	Georgia Environmental Protection Division (or EPD)
GEFA	Georgia Environmental Finance Authority
GHG	greenhouse gases
GIS	geographic information system
GIWW	Gulf Intracoastal Waterway
GMFMC	Gulf of Mexico Fishery Management Council
gpcd	gallons per capita per day
gpd	gallons per day
GSA	Geological Survey of Alabama
HAC	Hydropower Analysis Center

HEC	Hydrologic Engineering Center
HEC-ResSim	Hydrologic Engineering Center – Reservoir Simulation (model)
HFCs	hydrofluorocarbons
HUC	Hydrologic Unit Code
IIL	Initial Impact Level
in/yr	inch(es) per year
JBT	Jordan-Bouldin-Thurlow (Dams)
kwh	kilowatt hour
L_{eq}	Equivalent Sound Level
LA/UE	Lake Allatoona/Upper Etowah River
LSPC	Load Simulation Program C++
M&I	municipal and industrial
MAG	Monitoring Advisory Committee
mg/L	milligrams per liter
mgd	million gallons per day
mi	mile(s)
MNGWPD	Metropolitan North Georgia Water Planning District
MOU	Memorandum of Understanding
MS4	municipal separate storm sewer systems
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MW	megawatt
MWh	megawatt hours
NAAQS	National Ambient Air Quality Standards
NASS	National Agricultural Statistics Service
NEMS	National Energy Modeling System
NEPA	National Environmental Policy Act
NGVD	National Geodetic Vertical Datum
NHL	National Historic Landmark
NLCD	National Land Cover Database
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrous oxide
NOA	Notice of Availability
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWS	National Weather Service
O_3	ozone
PAL	Planning Aid Letter
PCB	Polychlorinated Biphenyls

PFCs	perfluorocarbons
P.L.	Public Law
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
PMCL	Planning and Management Consultants, Ltd.
PO4-P	organic phosphorus and ortho-phosphorus
RCHARC	Riverine Community Habitat Assessment and Restoration Concept
RDC	regional developmental centers
ResSim	Reservoir Simulation
RHA	River and Harbor Act
RIL	Recreation Impact Level
RM	river mile
ROD	Record of Decision
ROI	region of influence
SADR	South Atlantic Division Regulation
SAV	submerged aquatic vegetation
SERC	Southeastern Electrical Reliability Corporation
SERCC	Southeast Regional Climate Center
SEPA	Southeastern Power Administration
SF_6	sulfur hexafluoride
SO_2	sulfur dioxide
SOP	Standard Operating Procedure
sq mi	square mile(s)
SWP	Statewide Water Management Plan
TMDL	total maximum daily load
TVA	Tennessee Valley Authority
µg/L	microgram per liter
USACE	U.S. Army Corps of Engineers (also Corps)
U.S.C.	U.S. Code
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WAL	Water Access Limited Level
WASP	Water Quality Analysis Simulation Program
WCIP	water conservation implementation plan
WCM	Water Control Manual
WDCP	Water Development and Conservation Plan
WRDA	Water Resources Development Act
WSA	Wadeable Streams Assessment

WSA 1958	Water Supply Act of 1958
WWTP	Wastewater Treatment Plant

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Executive Summary

This environmental impact statement (EIS) evaluates proposals by the U.S. Army Corps of Engineers (hereafter referred to as USACE or Corps) to adopt an updated *Master Water Control Manual* (WCM or Master Manual) for the Alabama-Coosa-Tallapoosa (ACT) River Basin. The EIS has been prepared to comply with the requirements of the National Environmental Policy Act of 1969 (NEPA), as amended (Title 42 of the *United States Code* [U.S.C.], Sections 4321−4347); the Council on Environmental Quality's (CEQ's) *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (Title 40 of the *Code of Federal Regulations* [CFR] Parts 1500–1508); and Engineering Regulation (ER) 200-2-2, *Environmental Quality—Procedures for Implementing NEPA* (33 CFR Part 230).

The ACT Basin comprises approximately 22,739 square miles (sq mi) in Georgia and Alabama. USACE operates five reservoir projects in the ACT Basin: Allatoona Dam and Lake, Georgia; Carters Dam and Lake, Georgia (includes both Carters Dam and Carters Reregulation Dam [which function as a single system]); Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake, Alabama; Millers Ferry Lock and Dam and William "Bill" Dannelly Lake, Alabama; and Claiborne Lock and Dam and Lake, Alabama. USACE must operate and manage those projects as a system to meet their authorized purposes, which include: flood risk management, hydropower, navigation, fish and wildlife conservation, recreation, water quality, and water supply. The term "flood risk management" has been used herein lieu of the more traditional terms of "flood control" or "flood damage reduction." In addition, USACE has a flood risk management responsibility and authority at four Alabama Power Company projects in the ACT Basin: Weiss, H. Neely Henry, and Logan Martin lakes on the Coosa River and Harris Lake on the Tallapoosa River.

Purpose and Need

Section 7 of the Flood Control Act of 1944 provides that, "On and after December 22, 1944, it shall be the duty of the Secretary of the Army to prescribe regulations for the use of storage allocated for flood control or navigation at all reservoirs constructed wholly or in part with federal funds provided on the basis of such purposes, and the operation of any such project shall be in accordance with such regulations:..." (33 U.S.C. 709).

The purpose of the proposed action is to update the WCM for the ACT Basin as directed by Secretary of the Army Pete Geren on October 18, 2007. Specifically, the purpose and need for the federal action is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law, and to implement those operations through updated water control plans and manuals. Conditions in the basin (population, socio-economic, land use, infrastructure, demand for water resources, etc.) have changed substantially since the federal reservoirs were authorized and constructed, and a variety of applicable federal and state environmental laws have been passed and implemented. Operation of the federal reservoir projects in the basin both affect, and are affected by, current conditions in the basin and must comply with current laws and regulations. This action will result in updated plans and manuals that comply with existing USACE regulations and reflect operations under existing congressional authorizations, taking into account changes in basin hydrology and demands from years of growth and development, new/rehabilitated structural features, legal developments, and environmental issues.

USACE regulations also provide specific policy and guidance for inclusion of drought contingency plans as part of USACE overall water control management activities. To be effective, the drought plan for the ACT Basin must incorporate a comprehensive, basin-wide approach that considers the interrelationship of USACE projects and Alabama Power Company (APC) projects in the basin (see pages ES-5 and ES-6). This WCM update includes a proposed drought plan for the basin developed in collaboration with APC.

Any proposed changes to the ACT Basin water control operations that would significantly affect other project purposes or require substantial structural modifications would require feasibility-level studies and congressional authorization. Such studies are not consistent with the purpose and need of updating the WCM. Accordingly, the alternatives considered in this EIS do not address any proposed changes to water management practices that exceed existing congressional authority.

Scope of the EIS

The purpose of scoping is to determine the range of issues to be addressed in this EIS and to identify the significant issues to be analyzed in depth with respect to the proposed action. The scope of the federal action examined in this EIS is to update the water control plans and manuals to reflect operations as they have evolved because of changing conditions in the basin and to fully comply with agency regulations, federal laws, and the court's order. The scope is also limited to the geographic areas directly or indirectly affected by the proposed action for the federal project in the ACT Basin.

This EIS identifies, documents, and evaluates the environmental effects of operating USACE projects in the ACT Basin under alternative management regimes that could reasonably be expected to accomplish the purpose and need of the proposed federal action. The purpose of the EIS is to inform decision makers and the public of the likely environmental consequences of the proposed action and alternatives. The range of actions, alternatives, and effects considered in this EIS are driven by the requirements set forth by Congress and USACE policies for project operation. This EIS considers only operational changes within existing congressional authorities and does not consider operational changes that would require additional authority.

Public Involvement

Under regulations issued by the CEQ, *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (40 CFR Parts 1500–1508), the evaluation of potential environmental effects of federal actions is open to the public. Public participation in the NEPA process promotes both open communications between the public and USACE and is intended to result in better decision making. All persons and organizations that have a potential interest in the proposed action, including minority, low-income, disadvantaged, and Native American groups, are urged to participate in the NEPA environmental analysis process.

Public participation opportunities with respect to the proposed action are guided by CEQ regulations and USACE regulations (USACE 1988). Those regulations provide for five major opportunities for public participation in conjunction with preparing this EIS: (1) issuance of a Notice of Intent (NOI) to prepare an EIS, (2) scoping, (3) public review of the draft EIS, (4) public meeting(s) on the draft EIS, and (5) public review of the final EIS. Each of those steps in the process provides for public involvement and is briefly discussed below. Throughout the process, the public can obtain information on the status and progress of the proposed action and the EIS through the USACE, Mobile District Public Affairs Office by calling 251-690-2505. In addition, interested persons can visit the USACE, Mobile District's Web site for the ACT WCM Update at www.sam.usace.army.mil. Additionally, Section 310(b) of WRDA 1990 requires public participation in changes to reservoir operation criteria. For this update, this public participation has been accomplished through the NEPA process.

Notice of Intent

The NOI informing the public that an EIS is being prepared is the first formal step in the NEPA public involvement process. USACE published an NOI on November 9, 2007, in the *Federal Register* declaring its intent to prepare an EIS for the proposed action. A supplement to the NOI was published in the *Federal Register* on August 22, 2008, announcing that four public scoping meetings would be held during September as part of the USACE review and update of the WCM for the ACT Basin.

Scoping Process

In fall 2008 the USACE, Mobile District conducted public scoping for preparation of this EIS. The USACE scoping objectives were to identify public and agency concerns; clearly define the environmental issues and alternatives to be examined in the EIS, including the elimination of insignificant issues; identify related issues that originate from separate legislation, regulations, or Executive Orders (EOs) (e.g., federally listed threatened and endangered species or environmental justice concerns); identify state and local agency requirements that must be addressed; and identify available sources of data, studies, or tools that could provide information valuable in preparing the EIS.

USACE conducted public scoping in fall 2008 to initiate preparation of the EIS regarding implementation of an updated WCM for the ACT Rivers Basin in Alabama and Georgia. On September 11, 2008, USACE hosted a web conference, and 10 representatives from six federal agencies participated: U.S. Fish and Wildlife Service (USFWS), Southeastern Power Administration (SEPA), U.S. Environmental Protection Agency (USEPA) Region 4, Natural Resources Conservation Service (NRCS), Federal Energy Regulatory Commission (FERC), and National Oceanic and Atmospheric Administration (NOAA)– National Marine Fisheries Service. Additionally, government-to-government tribal consultation letters were sent electronically on October 1, 2008, and on October 15, 2008, the letters were sent by U.S. mail to 26 federally recognized American Indian tribes.

The public scoping effort for updates to the WCM resulted in comments from 117 individuals, organizations, and agencies. The agencies consisted of federal, state, and local governments. All the comments from scoping were reviewed, analyzed, and organized into the categories shown in Table ES-1. The table also shows the percentage of comments in each category.

Table ES-1.
Comments categorized by segment

Category	Percent of comments
Water Resources	29%
Economic Resources	17%
Ecological Resources	11%
Other	11%
Recreation	10%
NEPA	10%
Baseline Conditions	4%
Public Communications/newsletters	3%
Scoping Meetings	3%
Cultural Resources	1%
Agriculture	1%
Total	100%

Analysis of Public Comments

As described in more detail below (Water Management Alternatives Formulation), stakeholder comments assisted in identifying water resources/water management problems and in identifying measures (or alternatives) the public desired to be considered in updating the WCM. Considering the purpose and need for this EIS, USACE developed screening criteria to guide information gathering, to help identify solutions and to formulate alternative plans. Further, the screening criteria helped define the scope of proposed updates to the Master Manual EIS. Those screening criteria, shown below, guided the consideration of input received from the public and from federal and state agencies as well as suggestions from within USACE. The following nine screening criteria were applied to each proposed water management measure.

A measure (or alternative) should meet the purpose and need of the proposed federal action. Any proposed changes that would require feasibility-level studies and congressional authorization, such as changes that would significantly affect other project purposes or require substantial structural modifications, are not consistent with the purpose and need of updating the WCM.

A measure (or alternative) should address one or more of the congressionally authorized project purposes. In accordance with USACE governing regulations, water control plans are prepared giving appropriate consideration to all applicable congressional acts relating to the operation of federal facilities.

A measure (or alternative) should not require a reallocation of storage for water supply. USACE has the discretionary authority to consider such requests; however, this is a separate and distinct discretionary authority that USACE is not pursuing as part of this WCM update. Further, such a measure would not meet the purpose and need which is to determine how USACE projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law, and to implement those operations through an updated WCM of the ACT Basin.

A measure (or alternative) should maintain at least the current level of flood risk management. Any proposed action must not significantly alter the level of flood risk management intended by Congress in its authorizing language or increase the current levels, frequency, and duration of flood damage.

A measure (or alternative) should be consistent with the contemporary water resource needs of the basin to the extent practicable. Engineering Manual (EM) 1110-2-3600(2)(1)(b) and (3)(1)(b) state than an overarching goal of water control plans is to account for changing local conditions and needs in the basin.

A measure (or alternative) should support operations of the projects in the ACT Basin as a system. In accordance with EM-1110-2-3600 the operation of a multiple project system such as the ACT Basin requires integrated WCM and plans whereby projects are regulated jointly to achieve the overall river basin management objectives.

A measure (or alternative) should not increase the risk to public safety in the facility or downstream of the project. USACE operates the projects and systems in full compliance with USACE safety regulations. Therefore, measures (or alternatives) that would increase the risk to the facility, the facility personnel or the general public were not considered.

A measure (or alternative) that exceeds the physical limitations of or increases the risks to the structural integrity of the projects should not be considered. The federal action is an updated WCM, which inherently must reflect existing infrastructure and authorized project purposes. Structural changes to constructed projects are subject to specific study and approval processes and beyond the scope of the proposed action.

Any measure (or alternative) that violates USACE responsibilities under the Endangered Species Act will not be considered. As part of its WCM update, USACE planned to enter into consultation with the USFWS regarding potential effects on threatened and endangered species in the ACT Basin. Consultation with the USFWS was conducted and subsequently completed in March 2014.

In addition to their application in considering public and agency input to defining the general scope of the WCM update and identifying relevant issues and concerns to be considered, those criteria were also used to conduct initial screening of potential water management measures for more detailed evaluation and possible inclusion in one or more of the WCM update alternatives. This initial screening process is described in more detail below.

Public Review of the Draft EIS

The Draft EIS for the update of the ACT Basin Water Control Manual was filed with EPA on February 22, 2013 and formally released for public review on March 1, 2013 when the Notice of Availability (NOA) of the EIS was published in the Federal Register. Agencies (federal, state, and local), tribes, and interested organizations and individuals were invited to review and comment on the document. The public comment period was initially scheduled to end on May 1, 2013 but was extended by USACE until May 31, 2013 in response to multiple requests for an extension. During the comment period, public workshops on the draft EIS and WCM were held in four cities within the ACT Basin during the week of March 25, 2013: Kennesaw, Georgia on March 25; Rome, Georgia on March 26; Gadsden, Alabama on March 27; and Montgomery, Alabama on March 28. A cumulative total of 129 persons attended these workshops, either representing various agencies and organizations or as interested individual citizens. Seventy (70) comments on the draft EIS were submitted by agencies (federal, state, and local), private organizations, and individuals. A list of those submitting comments is presented in Appendix B (Pertinent Correspondence) of the final EIS.

Final EIS

As provided for in CEQ regulations for implementing NEPA, USACE considered all comments provided by the public and agencies on the draft EIS. Copies of all comments received as well as USACE responses to the comments are included in the comment-response section of the final EIS (Appendix B – Pertinent Correspondence). Additionally, USACE incorporated pertinent revisions and updates to the EIS WCM based on input received during the public review process. Key revisions and updates to the final EIS and WCM documents are summarized in Section 1.4.6 of the final EIS. USACE will make the final EIS available to agencies (federal, state, and local), American Indian tribes, private organizations, and interested individuals for review and will place copies in local libraries in the basin. The final EIS will be available for review for 30 days following publication of the NOA of the final EIS in the Federal Register.

Record of Decision

No sooner than 30 days after filing the final EIS with USEPA and publication of the NOA for the final EIS in the *Federal Register*, USACE will prepare a record of decision (ROD) that will state the decision in regard to the update of the ACT Basin Master Manual and the individual project WCMs, summarize alternatives that were considered and relevant factors that were balanced in making the decision, and identify means that have been adopted to mitigate for adverse effects.

Impact Analysis Performed

An interdisciplinary team of environmental scientists, biologists, planners, economists, engineers, archaeologists, and historians has analyzed the proposed action and alternatives in light of existing conditions and has identified relevant beneficial and adverse effects associated with the action. The environmental resources addressed in this EIS include water resources, water quality, geology and soils, climate change, land use, biological resources, socioeconomics, environmental justice, and cultural resources.

The ACT Basin has 17 large dams. USACE owns and operates 6 dams (Carters Dam and Carters Reregulation Dam operate as a single system); the remaining 11 are owned and operated by the APC. In addition to the federal dams operated by USACE, four APC projects (Weiss, H. Neely Henry, and Logan Martin lakes on the Coosa River and R.L. Harris Lake on the Tallapoosa River) have federally authorized responsibilities to operate for flood risk management and navigation. Those operations are carried out by APC in consultation with USACE and in accordance with provisions of USACE WCM and individual project WCMs. Section 2 of the River and Harbor Act of 1945 (Public Law [P.L.] 79-14) authorized the initial and ultimate development of the ACT Basin for navigation, flood risk management, power development, and other purposes. In June 1954, Congress enacted P.L. 83-436, which suspended the authorization under the River and Harbor Act of March 2, 1945, insofar as it concerned federal development of the Coosa River for the generation of electric power. This legislation enabled development of the Coosa River by the APC under a license(s) to be issued by the Federal Power Commission (now FERC). That legislation enabled development of Weiss, H. Neely Henry, and Logan Martin lakes. P.L. 83-436 stipulated that the license(s) require provisions for flood risk management storage and for future navigation, with operation for those purposes performed in accordance with reasonable rules and regulations of the Secretary of the Army. Similarly, section 12 of P.L. 89-789 (80 Stat. 1405), November 1966, suspended the authorization for federal development of the Crooked Creek reservoir project on the Tallapoosa River under the River and Harbor Act of 1945 to permit development by non-USACE interests (APC). That legislation led to development of R.L. Harris Lake.

Table ES-2 provides an overview of all the dams (USACE and non-USACE) in the ACT Basin.

Table ES-2.
Major projects on the mainstem rivers in the ACT Basin

Basin/river/ project name	Owner/state/ year initially completed	Drainage area (sq mi)[a]	Reservoir size at normal pool (acre [ac]) size (ac)[b]	Total storage at normal pool (ac-ft)[b]	Conservation storage (ac-ft)[b]	Power capacity (megawatt [MW])	Normal (summer) lake elev (ft)[b]	Authorized purposes for USACE-owned projects[c]
Coosawattee River		*862*						
Carters Lake	USACE/GA/1974	374	3,275	383,565	141,402	600[d]	1,074	FRM, HP, REC, NAV, WS, WQ, FW
Carters Reregulation Dam	USACE/GA/1974	520	870	17,500	16,000	None	698	
Etowah River		*1,861*						
Allatoona Lake	USACE/GA/1949	1,122	11,862	367,471	284,580	82.2[d]	840	FRM, HP, NAV, REC, WQ, WS, FW
Coosa River		*10,156*						
Weiss Lake	APC/AL/1961	5,270	30,207	306,655	263,417	87.75[e]	564	
H. Neely Henry Lake	APC/AL/1966	6,596	11,235	120,853	118,210	72.9[e]	508	
Logan Martin Lake	APC/AL/1964	7,743	15,269	273,467	144,383	128.25[e]	465	
Lay Lake	APC/AL/1914	9,053	11,795	262,887	92,352	177[e]	396	
Mitchell Lake	APC/AL/1923	9,778	5,855	170,783	51,577	170[e]	312	
Jordan Dam and Lake[f]	APC/AL/1929	10,102	5,890	236,130[f]	19,057[f]	100[e]	252	
Bouldin Dam[f]	APC/AL/1967	10,102	734	----[f]	----[f]	225[e]	252	
Tallapoosa River		*4,687*						
R.L. Harris Lake	APC/AL/1982	1,454	10,660	425,721	207,317	135[b]	793	
Lake Martin	APC/AL/1927	2,984	39,210	1,628,303	1,202,340	182.5[b]	491[g]	
Yates Lake	APC/AL/1928	3,293	2,004	53,908	6,928	44.25[b]	345[g]	
Thurlow Lake	APC/AL/1930	3,308	570	17,976	NA	81.35[b]	289[g]	
Alabama River		*22,739*						
R F. Henry Lock and Dam/ R.E. "Bob" Woodruff Lake	USACE/AL/1972	16,233	13,500	247,210	36,450	82[d]	126[h]	NAV, REC, HP, WQ, FW
Millers Ferry Lock and Dam/ William "Bill" Dannelly Lake	USACE/AL/1969	20,637	18,528	346,254	46,704	90[d]	80.8[h]	NAV, REC, HP, WQ, FW
Claiborne Lock and Dam and Lake	USACE/AL/1969	21,473	6,290	102,408	None	None	36[h]	NAV, REC, WQ, FW

a. Source: USGS HUC Units and stream gage data (Subregion 0315)

b. Source: USACE projects – verified by USACE (June 2014); APC projects – values verified by USACE coordination with APC via email (June 2014)

c. As used in this table, the term *authorized purposes* includes purposes expressly identified in the project authorizing documents, incidental benefits recognized in project authorizations, and objectives that result from other general authorities contained in congressional legislation for which USACE operates each listed project: FRM = flood risk management; HP = hydropower; NAV = navigation; REC = recreation; WQ = water quality; WS = water supply; FW = fish and wildlife conservation.

d. Declared Power Capacity is defined as the plant's operational capacity declared on a weekly basis to the power marketing agency. The value may vary slightly from week to week depending on factors such as head and cooling capabilities; values shown are the nominal values reported

e. Source: FERC 2009

f. Jordan and Bouldin Dams both impound the same reservoir and share the same reservoir storage.

g. Subtract one (1) ft to convert from ft NGVD29 to Martin datum

h. Represents the upper limit elevation of the normal operating range

Applicable USACE Guidance

The following USACE regulations and manuals apply to operation of the ACT Basin projects and management by use of WCMs. The directives are at http://www.publications.usace.army.mil/.

- ER 1110-2-240, Water Control Management (October 8, 1982).
- ER 1110-2-241, Use of Storage Allocated for Flood Control and Navigation at Non-Corps Projects (May 24, 1990).
- ER 1110-2-1150, Engineering and Design for Civil Works Projects (August 31, 1999).
- ER 1110-2-1941, Drought Contingency Plans (September 15, 1981).
- ER 1110-2-8154, Water Quality and Environmental Management for Corps Civil Works Projects (May 31, 1995).
- ER 1110-2-8156, Preparation of Water Control Manuals (August 31, 1995).
- Engineering Manual (EM) 1110-2-3600, *Management of Water Control Systems* (November 30, 1987).

In addition to the above guidance, USACE established Environmental Operating Principles (EOP) in 2002 to guide and ensure that USACE mission activities include totally integrated sustainable environmental practices. These seven principles were reviewed, updated, and reissued in August 2012. The EOP are applicable to the ACT WCM update and were fully considered in the update process, as described in the EIS.

Authorized Project Purposes

USACE operates projects in the ACT Basin for various purposes. Federal legislation authorizing project purposes in the ACT Basin has occurred over time. Section 2 of the River and Harbor Act of 1945 (P.L. 79-14) approved the plan for developing flood risk management, hydropower, and navigation on the ACT rivers. Those purposes are often referred to as expressly authorized project purposes. Other operational objectives derive from authorities that generally apply to all USACE reservoirs, such as fish and wildlife conservation (Fish and Wildlife Coordination Act of 1958 [P.L. 85-624] and Endangered Species Act of 1973 [P.L. 93-205]), recreation (Flood Control Act of 1944 [P.L. 78-534]), water quality (Water Pollution Control Act Amendments of 1972 [P.L. 92-500]), and water supply (Water Supply Act of 1958 [P.L. 85-500]). The purposes for which the various projects are operated are the following:

- Flood risk management
- Hydropower
- Navigation
- Fish and wildlife conservation
- Recreation
- Water quality
- Water supply

While USACE projects in the ACT Basin, operating in a system-wide context, serve the authorized purposes identified above, each individual project might not operate for all seven purposes. For example, Robert F. Henry Lock and Dam, Millers Ferry Lock and Dam, and Claiborne Lock and Dam do not operate for flood risk management, and Claiborne Lock and Dam does not include hydropower facilities. Project purposes for each of USACE projects in the ACT Basin are summarized in Table ES-2 and are discussed in more detail in the EIS.

Water Control Manuals

WCMs are guidance documents that assist federal water managers in operating individual and multiple interdependent USACE reservoirs on the same river system. They provide technical, historical, hydrological, geographic, demographic, policy, coordination, and other information that guides the proper management of reservoirs during times of high water, low water, and normal conditions. The manuals contain water control plans for each of the USACE reservoirs in the basin system and specify how the various reservoir projects will be operated as a balanced system. The manuals also contain drought plans and storage zones to assist federal water managers to know when to reduce or increase reservoir releases and conserve storage in the USACE reservoirs. The manuals further ensure water control regulation and coordination for the safety of dams during extreme conditions such as floods.

Negotiations and Litigation

In 1989 proposals by USACE to reallocate storage to municipal and industrial (M&I) water supply at Carters Lake and Allatoona Lake in the ACT Basin and Lake Lanier in the Apalachicola, Chattahoochee, Flint (ACF) Rivers Basin, and by Georgia to develop a regional reservoir in the Tallapoosa River Basin near the Alabama state line (West Georgia Regional Reservoir) caused controversy among water user groups, Alabama and Florida, and various federal agencies. A *draft Reallocation and Post-Authorization Report and draft Environmental Assessment* (EA) were prepared for the Lake Lanier proposal. A draft *Apalachicola-Chattahoochee-Flint Basin Water Control Plan,* dated October 1989, was included as an appendix to the post-authorization change report. A *final Water Supply Reallocation Report and final Environmental Assessment* were also prepared for the Carters Lake and Allatoona Lake proposals and submitted to the South Atlantic Division for approval in May 1990. Alabama filed a lawsuit against USACE in June 1990 to halt those proposed actions. As a result of the litigation, the proposed revisions to the ACF Basin WCM were deferred while the parties negotiated.

After a period of negotiation, the governors of Alabama, Florida, and Georgia and the Assistant Secretary of the Army for Civil Works (ASA(CW)) addressed the issues of concern by signing a Memorandum of Agreement (MOA) on January 3, 1992. The MOA specified that a comprehensive study of the water resources of the basins would be conducted, in partnership among the states and USACE, to develop the needed water resources data and to investigate the feasibility of implementing an interstate coordination mechanism (compacts) for resolving water resources issues in the ACT and ACF Basins. The MOA contained a *live and let live* provision for water use in the basins while the ACT/ACF Comprehensive Study and negotiations were conducted. That approach permitted existing water users to reasonably increase water withdrawal amounts for the period necessary to negotiate a solution to the water issues. The MOA also specified that USACE would operate the federal reservoirs in the ACT and ACF Basins, within its statutory and contractual obligations, to maximize water resource benefits to the basins as a whole while taking into account the needs of existing water users and the need to maintain the historic flow regime in the rivers within the basins. Further, the MOA specified that USACE would withdraw the 1990 *Water Supply Reallocation Report and final Environmental Assessment for Carters Lake and Lake Allatoona*, but that USACE could proceed with appropriate evaluations and documentation related to the use of storage space in Allatoona Lake to meet the identified water supply needs of the City of Cartersville through 1995 and Carters Lake to meet the identified water supply needs of the City of Chatsworth through 1995. This report was completed and submitted to the South Atlantic Division for approval in August 1991.

Subsequent supplemental MOAs extended the term of those agreements and continue to include the live and let live provisions. The comprehensive study partners recommended river basin compacts among the states as the mechanism for negotiating water allocation formulas and managing the basins. The live and

let live provisions were incorporated into the Interstate River Basin Compacts for each basin, signed into law by the President in November 1997; the MOAs were allowed to expire in September 1998.

It was envisioned that the comprehensive study would recommend, among other things, a conceptual plan for managing water resources in the ACT and ACF Basins, including managing the USACE and non-USACE reservoirs in the basins; assessing existing and future water resource needs; the extent of water resources available in the basins to serve such needs; and an appropriate mechanism to implement management of the basins. Although much useful data on water resource needs and availability was generated and assessment and modeling tools were developed to assist in resource assessment and management of the basins, the comprehensive study was never completed.

Compact negotiations began in early 1998, with a December 31, 1998, deadline for reaching agreement on the water allocation formulas. By mutual agreement and in accordance with the provisions of the compacts, the states extended the deadline numerous times. Nevertheless, the state commissioners (governors of each state) were unable to reach an agreement on an equitable apportionment of the waters in either basin, and the compacts were allowed to expire in August 2003 (ACF Basin) and in July 2004 (ACT Basin). Upon expiration of the ACT and ACF compacts, Alabama and Florida reactivated their previous litigation and filed new litigation, resulting in a stay of any action by USACE related to implementation of any new water supply contracts or changes in reservoir storage or water control operations. The states asserted in the litigation that water control operations in the ACF Basin are not being conducted in accordance with approved water control plans, USACE regulations, and federal law.

Court-ordered mediation among the parties was initiated in March 2006 for both the ACT and ACF litigation. The order expired in March 2007 for the ACF Basin. In March 2007 the ACF claims were consolidated as Multiple District Litigation to be heard by one judge, with proceedings to be held in the U.S. District Court for the Middle District of Florida.

ACT claims remained with the U.S. District Court for the Northern District of Alabama. The court-ordered mediation order for the ACT Basin expired in September 2007. In October 2007[1], the Secretary of the Army directed USACE to proceed with updating the water control plans for the ACT Basin. On November 9, 2007, the USACE, Mobile District published in the *Federal Register* the NOI to prepare an EIS for the ACT WCM update.

The ACT Complaints included a claim that NEPA evaluation performed by the USACE, Savannah District, for the permitting of the Hickory Log Creek Reservoir was inadequate. Hickory Log Creek Reservoir was permitted by the Savannah District in 2004 as a water supply reservoir for the Cobb County Marietta Water Authority (CCMWA) and city of Canton. The reservoir is located on a tributary to the Etowah River upstream of Allatoona Lake. Alabama was concerned that Hickory Log Creek Reservoir would serve as a vehicle to allow CCMWA to withdraw more water from Allatoona Lake than is currently allowed in its water supply storage agreement.

The ACF litigation was divided into two phases to address separate distinct legal issues. Phase I addressed the USACE authority to operate Lake Lanier for water supply and reallocate storage under the Water Supply Act of 1958 (WSA 1958), as well as claims raised under NEPA and other statutes. The Phase I summary judgment hearing was held on May 11, 2009. On July, 17, 2009, Judge Magnuson issued a ruling that found that USACE operations in support of water supply had "seriously affected the

[1] On November 1, 2007, the governors of Alabama, Florida, and Georgia met with Executive branch leaders (Secretary of the Department of the Interior, Chairman of the CEQ, Chief of Engineers) to discuss strategies for developing solutions to the decades-long dispute among the three states and associated litigation. The resulting discussions focused primarily on the ACF system and the need for the states to agree on a drought water-management plan. The mutually agreed-upon deadline was March 1, 2008. The parties did not reach an agreement, and negotiations ended on the deadline.

project purposes for which the Buford project was originally authorized" and that "the Corps is therefore in violation of the WSA."

The United States appealed the Phase I ruling. The Eleventh Circuit Court issued a ruling that reversed the findings of the District Court on June 28, 2011. The court found that water supply was an authorized project purpose of Buford Dam under the River and Harbors Act of 1946 and the WSA 1958. As to the merits, the court held that the majority of Plaintiffs' claims in the ACF Basin were not final agency actions and therefore not subject to judicial review.

Phase II of the ACF litigation concerned USACE compliance with the Endangered Species Act (ESA), as well as claims raised under NEPA. The Phase II summary judgment hearing was held on June 8, 2010. Judge Magnuson issued a ruling on Phase II in the summer of 2010. In his ruling, he determined that USACE and the USFWS had complied with the ESA, but that USACE had not properly complied with its NEPA requirements. The appropriate remedy would be for USACE to conduct new NEPA on the WCM; however, because USACE had already agreed to develop an EIS as part of the WCM update Judge Magnuson determined Florida's claims were moot. Florida appealed the Phase II ruling to the Eleventh Circuit. After the appeal was filed, new information on the endangered species caused the USFWS to request that USACE reinitiate consultation. All parties agreed to stay the appeal while USACE and the USFWS conducted additional studies. On January 24, 2013, the district court vacated its phase two ruling on the grounds that the USACE and the USFWS reinitiated consultation while the appeal was pending, thus rendering the appeal moot and making it proper to vacate the underlying order. Accordingly, there is no active litigation regarding the USACE operation of the ACF Basin.

After the Eleventh Circuit's opinion holding that the majority of Plaintiffs' claims in the ACF Basin were not final agency actions and therefore not subject to judicial review, the Northern District of Alabama requested all parties file briefs on whether the ACT claims are final agency actions based on the rationale contained in the Eleventh Circuit's decision in the ACF litigation. The Court scheduled hearing on the motions to dismiss took place on June 29, 2012. On July 3, 2012, Judge Bowdre dismissed nine of the ten claims because no final agency action had been taken. On October 19, 2012, the Plaintiffs agreed to dismiss the last remaining claim, the permitting of Hickory Log Creek Reservoir, with prejudice.

Other Relevant Statutes and Executive Orders

A decision on whether to proceed with the proposed action rests on numerous factors such as mission requirements, schedule, availability of funding, and environmental considerations. In addressing environmental considerations, the Army is guided by relevant statutes (and their implementing regulations) and EOs that established standards and provide guidance on environmental and natural resources management and planning. Those authorities are addressed in various sections throughout this EIS when relevant to environmental resources and conditions. The full text of the laws, regulations, and EOs is available on the DoD Environment, Safety and Occupational Health Network and Information Exchange (DENIX) web site at www.denix.osd.mil.

Water Management Alternative Formulation

The WCM update has been prepared in compliance with ER 1110-2-240 and all other applicable USACE regulations and policies. In updating the Master Manual within the context of the purpose and need statement, USACE used a structured, six-step planning process described in the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources* (U.S. Water Resources Council 1983) and in ER 1105-2-100, which is well-suited for this Master Manual update and is consistent with the CEQ's regulations for Implementing NEPA (40 CFR 1500-1508). The six steps are

- Step 1. Identify problems (challenges) and define objectives (includes scoping as required by 40 CFR 1501.7)
- Step 2. Inventory and forecast critical resources (physical, environmental, economic, and demographic) and develop the No Action Alternative
- Step 3. Formulate alternative plans
- Step 4. Evaluate alternative plans
- Step 5. Compare alternative plans
- Step 6. Select a plan

The six steps, although presented and discussed in a sequential manner for ease of understanding, usually occur iteratively and sometimes concurrently. Iterations of steps were conducted as necessary to formulate efficient, effective, complete, and acceptable plans. On the basis of operational experience gained between 1951 and now, challenges were identified. From those challenges, several objectives for the WCM update were developed.

- More accurately define flow requirements for APC projects to support navigation on the Alabama River
- Develop a drought management plan as required by USACE regulations
- Improve conditions downstream of Carters Reregulation Dam for fish and wildlife conservation, including threatened and endangered species
- Improve system performance to more efficiently and effectively achieve congressionally authorized project purposes
- Incorporate appropriate changes in APC project operations into the updated WCM

On the basis of the identified operational challenges and extensive stakeholder input during scoping, USACE identified numerous management measures for possible consideration in the updated WCM. The measures considered in updating the WCM included variations for revising reservoir guide curves and conservation storage action zones; revising hydropower generation plans for water control regulation; revising drought procedures and environmental flows; and developing navigation-specific operations. USACE used an iterative process to identify the various measures that would be further developed, analyzed, and refined toward the goal of developing an updated WCM.

Management Measures Eliminated from Consideration

Management measures eliminated from consideration were those that did not pass the screening criteria (see pages ES-3 and ES-4). Further, in the scoping comments received, a number of specific management measures (or alternatives) were identified that were found to be outside the scope of this EIS. The following is a brief description of some examples of management measures (or alternatives) eliminated from further consideration:

USACE does not prioritize project purposes, except for flood risk management during a flood event. Therefore, any measure proposed during public scoping that recommended prioritization of project purposes was not carried forward for further consideration.

Navigation is one of the congressionally authorized purposes in the ACT Basin; however, recommendations to add channel buoys in the vicinity of Gadsden, construct additional training works in the Alabama River, or maintain tributaries to the Alabama River exceed the scope and authority for water

control management of existing reservoir projects and the development/update of water control plans for water control regulation. Consequently, these measures were not considered further.

Management measures that suggest use of flood storage for purposes other than flood storage were not considered. Accordingly, management measures to raise Allatoona Lake 2 feet (ft) to a conservation pool elevation of 842 ft or to raise the winter pool level above 823 ft were eliminated from consideration.

A number of scoping comments suggested various means of addressing water supply needs in the ACT Basin. USACE did not carry forward for further consideration management measures, such as additional reallocation of storage in Allatoona Lake, rainfall recycling, eliminating interbasin transfer, increasing the yield of Allatoona Lake by dredging or other means, and desalination, which would address the future water supply needs for the Atlanta region. Additionally, measures suggesting that USACE establish broad-based water conservation measures, impose surcharges on water supply storage used to supply needs outside the ACT Basin, or limit growth in the Atlanta area are outside the USACE authority to implement and were not carried forward. While USACE recognizes the water needs of entities downstream of its reservoirs, the authorized purposes of the federal ACT system do not include making specific releases to satisfy those needs.

USACE also did not carry forward for further consideration management measures that change minimum releases or minimum flows to ensure other entities meet their federal clean water compliance requirements in the future. USACE recognizes existing minimum flow requirements but is not authorized to operate projects to ensure compliance by others; the use of Allatoona Lake releases to ensure discharges by municipalities and industries comply with the Clean Water Act are also not within USACE authority.

Some scoping comments suggested significant revisions to hydropower operations such as reducing peak flows for hydropower and provide windows of no peak flows during spawning season; considering dam operations at Allatoona Lake that would more closely mimic the natural flow regime; or minimizing the amount of water being released from Allatoona Lake during droughts. Hydropower is one of the congressionally authorized purposes in the ACT Basin. Hydropower facilities at USACE projects in the ACT Basin are operated to meet daily peak electric power demands during periods of high use. The number of hours of peaking operations on any given day at any specific project may vary as necessary to balance with meeting other authorized project purposes. Recommended measures for off-peak hydropower operations to achieve other objectives or benefits were determined to be inconsistent with the authorized hydropower purpose. Consequently, recommended measures that would dictate non-peak hydropower operations or would otherwise have a significant adverse effect on the hydropower function were not carried forward for detailed consideration.

Management measures that suggest mitigating for project construction, operations or restoring degraded habitat were not considered. The update of the ACT WCMs and plans is not the appropriate authority to evaluate alternatives for mitigation of the construction of the Carters Lake project, for considering construction of structural measures to improve the water quality of releases, or for recommending restoration of habitat for federally listed species. Accordingly, such measures were not carried forward for detailed consideration. Separate authorities that may be pursued to improve or restore degraded environmental conditions from past project-related activities include: Section 216 of the River and Harbor and Flood Control Act of 1970 (Review of Completed Projects); Section 1135 of WRDA 1986, as amended (Project Modifications for Improvement of the Environment); and Section 206 of WRDA 1996, as amended (Small Aquatic Ecosystem Restoration Projects). The latter two authorities have specific limits on federal funds that can be expended on each project ($10,000,000).

Several scoping comments suggested taking actions regarding APC projects on the Coosa and Tallapoosa Rivers, such as operating the winter pool level for Lake Martin at or above elevation 479 ft, making other

operational changes to APC projects, or addressing erosion problems on APC projects. Such measures are beyond the authority of USACE to address.

Management Measures Considered for Further Evaluation

The management measures considered in updating the WCM are described in the subsections to follow. The measures considered in formulating alternatives were those that passed the screening criteria. The following provides a general description of the measures considered. Each measure was considered individually and refined iteratively.

Navigation

Allatoona Lake and Carters Lake, while authorized for navigation, are not regulated specifically for navigation, which occurs only on the Alabama River downstream of Montgomery, Alabama, the *head of navigation*. Those projects contribute flows which aids APC's support of navigation on the Alabama River as explained below.

USACE considered several factors in developing options to support navigation on the ACT Basin. First, it reviewed historic channel availability, flow depth patterns, and the relationship between basin inflows and storage usage to determine flow levels necessary to support navigation on the system. To accomplish that, USACE also considered dredging impacts (timing and extent) during low- and high-flow periods. Because dredging typically occurs in the summer and fall months, less flow would be required during those periods to provide the necessary channel depths.

Management measures for navigation included consideration of a 9.0-ft or 7.5-ft, channel and assumed dredging would occur each year from May through August. Under the management measure to support navigation, USACE and APC would make releases to support commercial navigation use of the Alabama River when basin inflows meet or exceed seasonal targets for either the fully authorized 9.0-ft or a lesser 7.5-ft channel template. Triggers were also identified to change operations between the 9.0-ft and 7.5-ft channel. When basin inflows are not sufficient to accommodate releases from the APC projects to support a minimum 7.5-ft channel, commercial navigation on the Alabama River could be impeded and APC would provide combined minimum releases of 4,640 cubic feet per second [cfs] [weekly average] from Jordan and Bouldin dams on the Coosa River and Thurlow Dam on the Tallapoosa River near Montgomery, Alabama, unless conditions dictate initiation of drought operations as presented in the following paragraphs. Flow augmentation to support commercial navigation would remain suspended until basin inflows, and associated releases from APC projects, recover to a level that would support at least a reliable 7.5-ft channel, as defined in the drought management plan.

Drought Management Plan

Both Alabama and Georgia have general statewide drought plans. Management measures to establish a drought management plan for the ACT Basin were considered to meet the objectives to develop a drought management plan as required by USACE regulations and to incorporate changes made at APC projects into operations of the ACT Basin in the updated WCM. About 78 percent of the water stored in the ACT Basin is managed by APC.

During the drought of 2006–2008, USACE did not have a drought plan applicable across the entire ACT Basin. USACE generally responded to drought conditions by reducing hydropower generation at Allatoona Lake and Carters Lake as the reservoir pools dropped throughout the summer and fall. In response to the 2006–2008 drought, APC worked closely with Alabama to develop the APC draft Alabama Drought Operations Plan that specified operations at APC projects on the Coosa and Tallapoosa

Rivers. That plan is referred to as the APC Drought Operations Plan, or APCDOP. The plan included the use of composite system storage, state line flows, and basin inflow as triggers to drive drought response actions. Similarly, in response to the 2006–2008 drought, USACE recognized that a basin-wide drought plan must incorporate variable hydropower generation requirements from its headwater projects in Georgia (Allatoona Lake and Carters Lake), a reduction in the level of navigation service provided on the Alabama River as storage across the basin declines, and that environmental flow requirements must still be met to the maximum extent practicable. Building on the APCDOP and APC experience applying it to project operations, USACE sought, in cooperation with APC, to develop a basin-wide drought plan composed of three components—headwater operations at Allatoona Lake and Carters Lake in Georgia; operations at APC projects on the Coosa and Tallapoosa rivers; and downstream operations at USACE projects downstream of Montgomery. The concept is graphically depicted in Figure ES-1 below.

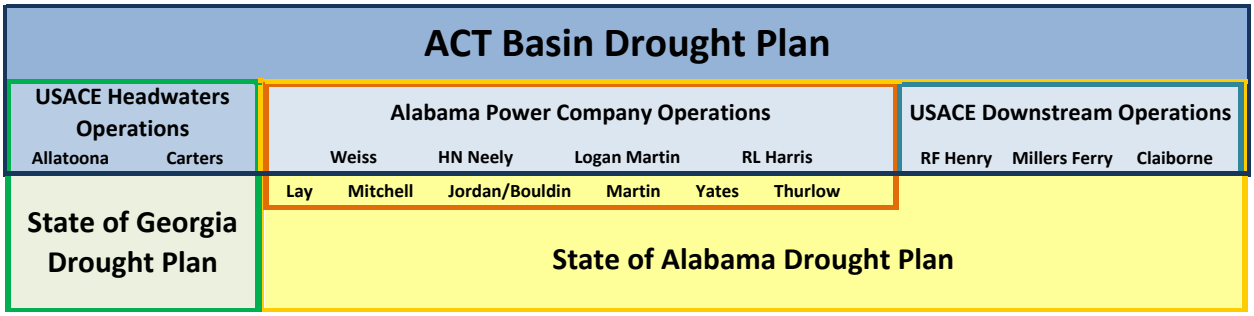


Figure ES-1. Schematic of the ACT Basin drought plan.

Headwater Operations for Drought at Allatoona Lake and Carters Lake. Drought operations at Carters Lake and Allatoona Lake would consist of progressively reduced hydropower generation as pool levels decline. As Carters Lake pool level drops into a newly created Zone 2, minimum target flows would be reduced from seasonal varying values to 240 cfs.

Operations at APC Projects on the Coosa, Tallapoosa, and Alabama Rivers. Under current operations, APC provides minimum releases of 4,640 cfs (7-day average) from Jordan and Bouldin Dams on the Coosa River and Thurlow Dam on the Tallapoosa River near Montgomery, Alabama (hereafter referred to as Jordan-Bouldin-Thurlow or JBT). As dry conditions continued in 2007, water managers understood that, if the basin inflows from rainfall were insufficient, the minimum flow target would not likely be achievable. With that understanding, USACE considered updating drought operations in coordination with the APC.

The APCDOP, described in the following paragraphs, served as the initial template for developing proposed drought operations for the ACT Basin. APCDOP operational guidelines for the Coosa, Tallapoosa, and Alabama Rivers have been defined on the basis of a Drought Intensity Level (DIL). The DIL is a drought indicator, ranging from zero to three. The DIL is determined using three different basin drought criteria (or triggers). A DIL=0 indicates normal operations, while a DIL from 1 to 3 indicates some level of drought conditions. The DIL would increase as more of the drought indicator thresholds (or triggers) are exceeded. The APCDOP defines monthly minimum flow requirements for the Coosa, Tallapoosa and Alabama Rivers, as function of DIL and time of year. Those flow requirements are modeled as daily averages. The combined occurrences of the drought triggers determine the DIL. Three intensity levels for drought operations are applicable to APC projects.

- DIL0 – (normal operation) no triggers exceeded
- DIL1 – (moderate drought) 1 of 3 triggers exceeded
- DIL2 – (severe drought) 2 of 3 triggers exceeded
- DIL3 – (exceptional drought) all 3 triggers exceeded

The indicators used in the APCDOP to determined drought intensity include the following:

- Low Basin Inflow Trigger. The total basin inflow needed for navigation is the sum of the total filling volume plus minimum releases from JBT near Montgomery of 4,640 cfs (weekly average). The basin inflow value is computed daily and checked on the 1st and 3rd Tuesday of each month. If computed basin inflow is less than the value required, the low basin inflow indicator is triggered.
- State Line Flow Trigger. A low state-line flow trigger occurs when the Mayo's Bar USGS gage measures a flow below the monthly historical 7Q10 flow. The 7Q10 flow is defined as the lowest flow over a 7-day period that would occur once in 10 years. The term state line flow is used in developing the drought management plan because of the proximity of the Mayo's Bar gage to the Alabama-Georgia state line and because it relates to flow data upstream of the Alabama-based APC reservoirs.
- Low Composite Conservation Storage in APC projects. Low composite conservation storage occurs when the APC projects' composite conservation storage is less than or equal to the storage available within the drought contingency curves for the APC reservoirs. Composite conservation storage is the sum of the amounts of storage available at the current elevation for each reservoir down to the drought contingency curve at each APC major storage project. The reservoirs considered for this trigger are R.L. Harris Lake, H. Neely Henry Lake, Logan Martin Lake, Lake Martin, and Weiss Lake projects. If the actual active composite conservation storage is less than or equal to the active composite drought zone storage, the low composite conservation storage indicator is triggered. That computation is performed on the 1st and 3rd Tuesday of each month and is considered in addition to the low state line flow trigger and basin inflow trigger.

Operations for USACE Projects Downstream of Montgomery. Drought operations of the USACE Alabama River projects (R.E. "Bob" Woodruff Lake [Robert F. Henry Lock and Dam] and William "Bill" Dannelly Lake [Millers Ferry Lock and Dam]) will respond to drought operation of the APC projects. When combined releases from the APC projects (JBT) are reduced to 4,640 cfs, the USACE Alabama River projects will operate to maintain a minimum flow of 6,600 cfs downstream of Claiborne Lock and Dam.

Revised Guide Curves and Action Zones

USACE considered redefining guide curves and action zones at USACE projects in the ACT Basin to meet the objective of improved system performance to achieve congressionally authorized project purposes. Specific management measures included the following:

- Maintaining existing guide curves at Allatoona Lake and Carters Lake
- Maintaining existing action zones at Allatoona Lake and Carters Lake
- Modified guide curves at Allatoona Lake
- Modified action zones at Allatoona Lake and Carters Lake

Additionally, the following guide curve options at APC projects with federally authorized flood risk management functions were carried forward for detailed consideration:

- H. Neely Henry Lake original guide curve
- H. Neely Henry Lake revised guide curve

Maintaining existing guide curves and action zones would maintain current operating conditions at the projects. Modifying the guide curve at Allatoona Lake and the action zones at Allatoona Lake and Carters

Lake were considered to enhance operations at each federal project. Action zone modifications at Carters Lake were considered to establish variable seasonal releases from the reregulation dam.

Carters Lake. No changes to guide curve were considered at Carters Lake. The top of conservation pool is at elevation 1,074 ft from May through September transitioning to 1,072 ft from mid-October through mid-April. Under current conditions, water management operations at Carters Lake occur without action zones. Establishing conservation storage action zones at Carters Lake was carried forward for further consideration.

Allatoona Lake. Modifications to the guide curve and action zones were considered at Allatoona Lake based on past water management experiences. Four specific management measures were considered in drawing down Allatoona Lake:

- Maintaining the existing guide curve
- Early September drawdown
- Extended November drawdown
- Phased drawdown

Management measures for modifying action zones considered the total number of action zones and the shape of action zones. Three variations of action zones were considered. The first includes four action zones derived from historic hydropower demands. The second modification to action zones assumes three action zones where the first two zones mimic current actions, and the new Zone 3 represents a drought level where only minimum flows would be released. Finally, the third modification of action zones at Allatoona Lake also assumes three action zones. The existing action zones 1 and 2 are shaped as they currently exist. Zone 3 is shaped to mimic the existing action zones with a linear increase from January to a single peak in May and a linear decrease to December.

H. Neely Henry Lake. In June 1999, APC requested a temporary 3-year variance to H. Neely Henry Lake's guide curve. The goal of the variance, granted by FERC in February 2001, was to maintain higher water levels during the winter (i.e., increase the winter pool level by 2 ft from 505 to 507 ft). On March 18, 2004, FERC issued an extension to operate on an interim basis using the variance pending a final decision on APC's relicensing application for its Coosa River projects. (The relicense application was filed with FERC by APC in July 2005; the licenses expired on July 31, 2007 and have been annually renewed until completion of the relicense process.) FERC and USACE prepared a joint Environmental Assessment addressing the effects of the proposed 2004 extension (FERC 2009). USACE has concurred with the proposal for the revised guide curve to be included in the new FERC license. Accordingly, the revised guide curve at H. Neely Henry Lake is a management measure considered in the ACT WCM update process. [NOTE: On June 20, 2013, following public review of the draft EIS for the ACT WCM update, FERC issued a new license for the APC projects on the Coosa River (No. 2146), which included the revised guide curve for H. Neely Henry Lake.]

Hydropower Generation

Four specific measures were considered for operations of hydropower generation:

- Current schedule at Allatoona Lake
- Modified schedule at Allatoona Lake (0 to 4 hours)
- Modified schedule at Allatoona Lake (0 to 6 hours)
- Hydropower drought operations

USACE generates hydropower at Allatoona Lake based on available storage, hydrologic status, and downstream conditions. The current manual states that full consideration will be given to meeting the

power contract amounts developed by SEPA. That consideration will be weighted with the other project purposes of the project to ensure proper project utilization. The amount of generation during non-flooding condition typically varies from 2 to 6 hours during the week. For instance, when Allatoona Lake is in Zone 1, 6 hours of generation would be made available. USACE considered varying the amount of generation it would plan to provide for each action zone at Allatoona Lake (e.g., 0 to 4 hours or 0 to 6 hours would be made available when in Zone 1). Similarly, USACE considered reducing the amount of generation that would be made available when operating under drought protocols. The goal of the modified generation schedule at Allatoona Lake was to provide greater operational flexibility to meet power demands within the system while conserving storage as variable climate conditions might dictate. Therefore, consideration was also given to reduced generation during the fall drawdown. The Carters Reregulation Dam allows for more consistent generation to meet hydropower demands. Therefore, there was no appreciable benefit to modifying the generation schedule at Carters Dam.

Fish and Wildlife Conservation

Management measures considered for fish and wildlife conservation operations were based on recommendations provided by the USFWS in its Planning Aid Letter (PAL) dated May 2010, Draft Fish and Wildlife Coordination Act Report (FWCAR) of December 2012, Final FWCAR of April 2014, previous discussions with the USFWS, and current USACE operations. The principal management measure considered by USACE from the USFWS coordination was seasonally varying minimum flows from Carters Reregulation Dam. The USFWS also recommended changes in releases under the drought plan for the Tulotoma snail downstream of the APC Jordan Dam and Lake. That recommendation was considered and addressed by APC and USFWS in coordination with USACE and was ultimately incorporated into the FERC license (issued June 2013) for continued operation of the APC Coosa River projects. The USFWS PAL and FWCARs included recommendations for developing alternatives and mitigation, hydrologic modeling, and methods used to evaluate the effects of USACE alternatives. Those recommendations were considered in updating the WCM.

USACE would continue to manage fish spawning operations at Allatoona Lake, as outlined in the South Atlantic Division Regulation SADR PDS-O-1 (May 31, 2010), *Lake Regulation and Coordination for Fish Management Purposes,* and draft SOP *Reservoir Regulation and Coordination for Fish Management Purposes* (Mobile District SOP 1130-2-9, draft, February 2005). The draft District SOP was developed in response to an earlier version of the SADR (2001). During the largemouth bass spawning period, from March 15 to May 15, USACE seeks to maintain generally stable or rising reservoir levels at Allatoona Lake. Generally stable or rising levels are defined as not lowering the reservoir levels by more than 6 inches, with the base elevation generally adjusted upward as levels rise from increased inflows or refilling of the reservoir.

USACE also would continue to operate fish passage lockages at Claiborne Lock and Dam and Millers Ferry Lock and Dam. During each spring since 2009 from February through May, USACE has operated the locks at Claiborne Lock and Dam and Millers Ferry Lock and Dam to facilitate the upstream passage of migratory fishes. USACE has cooperated with The Nature Conservancy, the USFWS, Alabama Department of Conservation and Natural Resources, Auburn University, and the Geological Survey of Alabama to develop a schedule to most effectively implement the operation. There are slight differences in the locking schedule each year and alterations can occur depending on local hydrologic conditions, especially flooding, which can prevent lock operation, and staffing schedules for the project site. During the spring of 2011, two fish locking cycles were performed each day. The operation consists of opening the lower lock gate and allowing fish to enter. The lock is allowed to remain open for 4 to 6 hours. The lock is then filled to the lake elevation, the upper gate is opened, and fish are allowed to freely enter and exit the lake for the next 4 to 6 hours, after which the cycle is repeated. Vessel passage, maintenance, safety, and other operational requirements continue unaffected by the fish passage schedule. Studies are

ongoing to determine the success and most appropriate techniques to employ to provide maximum benefit to fish populations.

Water Supply

The measures for water supply operations were based upon current water supply demand throughout the basin, and existing water supply storage agreements at USACE reservoirs. Water supply usage in 2006, which was the year of highest net withdrawals from the ACT Basin, was identified as representative of current water supply demand in the basin. Annual demands fluctuate, and the USACE considered it prudent to use the highest net withdrawals in estimating current demand, in order to estimate potential effects on system operations from basin-wide water supply uses. Accordingly, analysis of the no action alternative included the water supply withdrawals that were actually reported throughout the basin in 2006.

The USACE accommodates a portion of the overall basin water supply demand through water supply storage agreements at Carters Lake and Allatoona Lake. The USACE has employed a storage accounting methodology that tracks multiple storage accounts at those reservoirs, applying a proportion of inflows and losses, as well as direct withdrawals by specific users, to each account. This accounting indicates how much storage is available in each account at any particular time.

The USACE did not consider changes to those existing contracts, e.g., an additional reallocation of storage, or changes to the current storage accounting methodology, as part of the ACT WCM update process. Such actions would involve a separate analysis as part of a separate process, which would follow the completion of the WCM update process. Instead, for purposes of the ACT WCM update, the USACE took into account the current (2006) demand, as well as the availability of storage under existing water supply storage agreements at USACE reservoirs, in evaluating the alternatives in this EIS.

Thus, for purposes of the ACT WCM update, the no action alternative reflects the water supply usage that actually occurred in 2006. The measures for water supply operations considered in all other alternative plans assume water supply withdrawals to be based upon those that occurred throughout the basin in 2006, except that withdrawals from USACE reservoirs (Allatoona and Carters Lakes) would be limited for purposes of modeling to the amount of storage available in existing water supply storage agreements according to the USACE storage accounting methodology currently employed at those reservoirs.

Basin-wide Alternatives Evaluated

Management measures defined in previous sections were combined to address the objectives developed for water management of the ACT Basin.

Table ES-3 presents the basin-wide water management alternatives developed to meet the study objectives and insure that flood risk management operations would not be compromised. The formulation strategy employed to develop alternatives involved adding one measure at a time, determining the operation for that measure that may best satisfy the objectives, and then developing another alternative by adding another measure or, in some instances, considering a variation of the last added management measure. Accordingly, these alternatives build one upon another ultimately establishing the recommended plan for water management in the ACT Basin. The Burkett and Drago (A & B) alternatives represent early iterations of water management alternative development that incorporated concepts advanced by two long-standing water management leaders on the Mobile District staff. A summary of the alternatives carried forward for detailed impacts analysis is presented in the summary of the Description of the Proposed Action and Alternatives.

Table ES-3.
Summary of alternative management measures

Alternative	Current WCMs	USACE and APC supported navigation	APC projects			APCDOP				Carters Lake		
			APC current FERC license	H. Neely Henry Lake original guide curve	H. Neely Henry Lake new guide curve	APCDOP	Revised APCDOP	APCDOP with USFWS Enhancement	Revised APCDOP with USFWS Enhancement	240 cfs minimum flow	Seasonal flow	Action zones
No Action Alternative	XX		XX	XX						XX		
Drought Plan	XX	XX	XX	XX		XX				XX		
Burkett		XX	XX	XX		XX					XX	XX
Drago A		XX	XX	XX		XX					XX	XX
Drago B		XX	XX	XX		XX						
Plan A		XX	XX		XX	XX					XX	XX
Plan B		XX	XX		XX			XX			XX	XX
Plan C		XX	XX		XX		XX				XX	XX
Plan D		XX	XX		XX				XX		XX	XX
Plan E		XX	XX		XX		XX				XX	XX
Plan F		XX	XX		XX				XX		XX	XX
Plan G (Proposed Action Alternative)		XX	XX		XX				XX		XX	XX

Table ES-3 (continued)

Alternative	Allatoona Lake										
	240 cfs minimum flow	Current guide curve	Phased guide curve	Current action zones	3 action zones that mimic current zones	3 action zones that mimic 2007 conditions	4 action zones	Seasonal action zone shape	Hydropower Range - 0 to 6 hours	Hydropower Range - 0 to 4 hours	Drawdown hydropower reduced
No Action Alternative	XX	XX		XX							
Drought Plan	XX	XX		XX							
Burkett	XX	XX					XX	XX	XX		
Drago A	XX	XX				XX			XX		
Drago B	XX	XX		XX	XX				XX		
Plan A	XX	XX					XX	XX		XX	
Plan B	XX	XX					XX	XX		XX	
Plan C	XX	XX					XX	XX		XX	
Plan D	XX	XX					XX	XX		XX	
Plan E	XX		XX				XX	XX		XX	
Plan F	XX		XX				XX	XX		XX	
Plan G (Proposed Action Alternative)	XX		XX				XX	XX		XX	XX

Description of the Proposed Actions and Alternatives

USACE proposes to prepare an updated master WCM for the ACT Basin. The component parts of the master WCM would be nine project-level WCMs, presented as appendices. The following paragraphs present the No Action Alternative and the alternatives carried forward for further evaluation—Plans D, F, and G. Plan G is the Proposed Action and USACE Preferred Alternative.

No Action Alternative

The CEQ regulations require analysis of the *No Action Alternative* 40 CFR.1502.14. Inclusion of the No Action Alternative in this EIS is prescribed by CEQ regulations and serves as a benchmark against which federal actions can be evaluated. On the basis of the nature of the proposed action, the No Action Alternative represents no change from the current management direction or level of management intensity. The alternative would represent continuation of the current water control operations at each of the federal projects in the ACT Basin.

Current operations under the No Action Alternative include the following.

- Operations consistent with the Master Manual of 1951 and project-specific WCMs. For USACE, those manuals and their dates are Allatoona Reservoir (1993), Carters Reservoir (1979), Robert F. Henry Lock and Dam (1999), Millers Ferry Lock and Dam (1990), and Claiborne Lock and Dam (1993). For APC projects, the applicable manuals and their dates are Weiss Reservoir (1965), H. Neely Henry Reservoir (1979), Logan Martin Reservoir (1968), and R.L. Harris Reservoir (2003).
- APC operates 11 dams (10 reservoirs) under 6 FERC licenses, each one having specific operational requirements. The licenses for the Coosa River, Mitchell Lake, and Jordan Dam and Lake projects expired on August 31, 2007. On July 28, 2005, APC applied for one new operating license that would combine all the projects as Project No. 2146. The FERC licenses could be amended in light of APC's request to modify winter pool levels at the Weiss and Logan Martin lakes; however, the No Action Alternative does not include these APC-proposed modified winter pool levels. These proposed changes to winter pool levels and their potential implications for future water management activities in the ACT Basin and the WCM update process are discussed in more detail in Sections 2.1.1.1.4.3 and 2.1.1.1.4.5. [NOTE: On June 20, 2013, following public review of the draft EIS for the ACT WCM update, FERC issued a new license for the APC projects on the Coosa River (No. 2146). The new license did not include the proposed modifications to winter pool levels at Weiss and Logan Martin lakes.]
- The H. Neely Henry Lake, which operates under a revised guide curve (per a temporary variance initially granted by FERC in 2001 and effective pending relicensing of Project No. 2146), would return to operation under its original guide curve under the current FERC license. [NOTE: On June 20, 2013, following public review of the draft EIS for the ACT WCM update, FERC issued a new license for the APC projects on the Coosa River (No. 2146), which included the revised guide curve for H. Neely Henry Lake.]
- Specified flow requirements or targets apply to several projects. Allatoona Lake and Carters Lake must provide for a 240-cfs minimum flow. USACE has a flow target of 6,600 cfs from Claiborne Lock and Dam where the actual ability to meet the target depends on releases provided by APC and intervening flows from the Cahaba River and other tributaries. In accordance with a 1972 Letter Agreement between USACE and APC, APC ensures a combined 4,640-cfs release from JBT near Montgomery to support navigation during normal conditions.

- Two entities, the city of Cartersville, Georgia and CCMWA, have entered into water supply agreements for the use of 6,371 ac-ft and 13,140 ac-ft of storage, respectively, in Allatoona Lake for water supply. The modeling for the No Action Alternative includes the water supply withdrawals that actually were made by these entities in 2006. It also includes the returns that were made in that year. This year was chosen to represent "current" operations because it was the year of highest net withdrawals in the ACT Basin and greatest stress on the system from withdrawals.
- The city of Chatsworth has entered into a water supply agreement for the use of 818 ac-ft of storage in Carters Lake for water supply. As described above, the modeling for the No Action Alternative includes the water supply withdrawals (and returns) that actually were made in 2006.
- USACE would continue to manage fish spawning operations at Allatoona Lake. During the largemouth bass spawning period, from March 15 to May 15, USACE seeks to maintain generally stable or rising reservoir levels at Allatoona Lake.
- USACE would continue to operate fish passage lockages to facilitate the upstream passage of migratory fishes at Claiborne Lock and Dam and Millers Ferry Lock and Dam. The operation is conducted each spring from February through May and consists of opening the lower lock gate for 4 to 6 hours and allowing fish to enter. The lock is then filled to the lake elevation, the upper gate is opened, and fish are allowed to freely enter and exit the lake for the next 4 to 6 hours, after which the cycle is repeated. Since the spring of 2011, two fish locking cycles were performed each day; however, there are slight differences in the locking schedule each year, and alterations can occur depending on local hydrologic conditions, especially flooding which can prevent lock operation, and staffing schedules for the project site. Under the No Action Alternative, it is assumed that current fish passage operation would remain unchanged.

The following subsections describe key operational elements that apply to evaluating the No Action Alternative.

General System Operation

USACE operates reservoirs in the ACT Basin to provide for the authorized purposes of flood risk management, navigation, hydropower, recreation, water supply, water quality, and fish and wildlife conservation. USACE considers each of those authorized project purposes when making operational decisions, and those decisions affect how water is stored and released from the projects.

Certain APC projects (Weiss, H. Neely Henry, Logan Martin, and R.L. Harris lakes) are also required to operate for flood risk management and navigation. MOUs for each of the APC projects concerning the operation of non-USACE projects have been adopted by APC and USACE. WCMs developed for those APC projects are used to guide operations for flood risk management and navigation. The MOUs clarify the operational responsibilities of APC and USACE. Copies of the project MOUs are included in the current WCMs.

The conflicting water demands require that the system be operated in a balanced manner to meet all authorized purposes, while continuously monitoring the total system water availability to ensure that minimum project purposes can be achieved during critical drought periods.

The last major evaluations of the environmental consequences of the individual USACE reservoirs in the ACT Basin were included in project operations EISs completed in the 1970s. Since then incremental changes in project operations have occurred because of changes in hydropower contracts and operating schedules, changes in navigation flow requirements, and other changes related to water quality, environment, or other uses of the system.

Guide Curves and Action Zones

The guide curve for each federal project defines the top of conservation storage water surface elevation. Water management regulation decisions strive to maintain the pool elevation at the top of conservation elevation or at the highest elevation possible while meeting project purposes. Under the No Action Alternative, guide curves would remain as currently defined. Action zones are used to manage the lakes at the highest level possible within the conservation storage pool while balancing the needs of all authorized purposes with water conservation as a national priority used as a guideline.

Guide curves have been defined for two of USACE projects (Carters Lake and Allatoona Lake; and the four APC projects (Weiss, H. Neely Henry, Logan Martin, and R.L. Harris lakes); no guide curves exist for Claiborne Lake, William "Bill" Dannelly Lake (Millers Ferry Lock and Dam), or R.E. "Bob" Woodruff Lake (Robert F. Henry Lock and Dam). Additionally, action zones have been defined at Allatoona Lake. The zones are used to manage the lake at the highest level possible while balancing the needs of all the authorized purposes. Action Zone 1 is the highest in each lake and defines a reservoir condition where all authorized project purposes should be met. The lake level at the top of Zone 1 is the normal pool level or top of conservation pool (or the guide curve). As lake levels decline, Zone 2 defines increasingly critical system water shortages and prescribes reductions in reservoir releases as pool levels drop as a result of drier than normal or drought conditions. The action zones also provide guidance on meeting minimum hydropower needs at each project and determining the minimum releases for downstream purposes. Under the No Action Alternative, the current guide curve and action zones (at Allatoona Lake) would continue to serve as the basis for USACE management of the reservoir.

Alternative Plan D

Operations under Plan D would include the following:

- Implement the revised APCDOP with enhancements recommended by the USFWS (Table ES-4).
- Provide for seasonal navigation releases, coupled with seasonal maintenance dredging, to support commercial navigation in the Alabama River for a 9.0-ft or 7.5-ft channel depth as long as sufficient basin inflow above the APC projects is available. When sufficient flows cannot be provided to continue to support a minimum 7.5-ft navigation channel, navigation could be impeded and combined releases from APC projects (JBT) near Montgomery would be reduced to 4,640 cfs. If one or more of the drought operations triggers (low basin inflows, low composite conservation storage, or low state line flows) are met, minimum combined releases from JBT would be reduced below 4,640 cfs in accordance with specific protocols developed collaboratively between USACE and APC (discussed in detail in Section 4.2.2 of the EIS).
- APC projects on the Coosa and Tallapoosa Rivers would continue to operate under their current FERC licenses with specific operational requirements. FERC relicensing actions are underway for the Coosa River projects, and APC has requested to modify winter pool levels at the Weiss and Logan Martin lakes. Plan D does not include these APC-proposed modified winter pool levels. [NOTE: The new FERC license, issued on June 20, 2013, following public review of the draft EIS for the ACT WCM update, did not include the proposed modifications to winter pool levels at Weiss and Logan Martin lakes.]
- The APC project, H. Neely Henry Lake (Coosa River), which operates with a revised guide curve under a FERC license variance (with USACE concurrence), would continue to operate under its revised guide curve (Figure ES-2). [NOTE: The new FERC license, issued on June 20, 2013, following public review of the draft EIS for the ACT WCM update, included the revised guide curve for H. Neely Henry Lake.]

Table ES-4.
Revised APCDOP with USFWS enhancements

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Drought Level Response[a]	DIL 0 - Normal Operations											
	DIL 1: Low Basin Inflows or Low Composite or Low State Line Flow											
	DIL 2: DIL 1 criteria + (Low Basin Inflows or Low Composite or Low State Line Flow)											
	DIL 3: Low Basin Inflows + Low Composite + Low State Line Flow											
Coosa River Flow[b]	Normal Operation: 2,000 cfs			4,000 (8,000) cfs		4,000 – 2,000 cfs	Normal Operation: 2,000 cfs					
	Jordan 2,000 +/-cfs			4,000 +/- cfs		6/15 Linear Ramp down	Jordan 2,000 +/-cfs			Jordan 2,000 +/-cfs		
	Jordan 1,600 to 2,000 +/-cfs			2,500 +/- cfs		6/15 Linear Ramp down	Jordan 2,000 +/-cfs			Jordan 1,600 to 2,000 +/-cfs		
	Jordan 1,600 +/-cfs			Jordan 1,600 to 2,000 +/-cfs			Jordan 2,000 +/-cfs			Jordan 1,600 to 2,000 +/-cfs		Jordan 1,600 +/- cfs
Tallapoosa River Flow[c]	Normal Operations: 1200 cfs											
	Greater of: 1/2 Yates Inflow or 2 x Heflin Gage(Thurlow Lake releases > 350 cfs)				1/2 Yates Inflow					1/2 Yates Inflow		
	Thurlow Lake 350 cfs				1/2 Yates Inflow					Thurlow Lake 350 cfs		
	Maintain 400 cfs at Montgomery WTP (Thurlow Lake release 350 cfs)						Thurlow Lake 350 cfs			Maintain 400 cfs at Montgomery WTP (Thurlow Lake release 350 cfs)		
Alabama River Flow[d]	Normal Operation: Navigation or 4,640 cfs flow											
	4,200 cfs (10% Cut) - Montgomery				4,640 cfs - Montgomery					Reduce: Full – 4,200 cfs		
	3,700 cfs (20% Cut) - Montgomery					4,200 cfs (10% Cut) - Montgomery				Reduce: 4,200 cfs-> 3,700 cfs Montgomery (1 week ramp)		
	2,000 cfs Montgomery				3,700 cfs Montgomery		4,200 cfs (10% Cut) - Montgomery			Reduce: 4,200 cfs -> 2,000 cfs Montgomery (1 month ramp)		
Guide Curve Elevation	Normal Operations: Elevations follow Guide Curves as prescribed in License (Measured in Feet)											
	USACE Variances: As Needed; FERC Variance for Lake Martin											
	USACE Variances: As Needed; FERC Variance for Lake Martin											
	USACE Variances: As Needed; FERC Variance for Lake Martin											

a. Note: These are based on flows that will be exceeded when possible.
b. Jordan flows are based on a continuous +/- 5% of target flow.
c. Thurlow Lake flows are based on continuous +/- 5% of target flow: flows are reset on noon each Tuesday based on the prior day's daily average at Heflin or Yates.
d. Alabama River flows are 7-Day Average Flow.

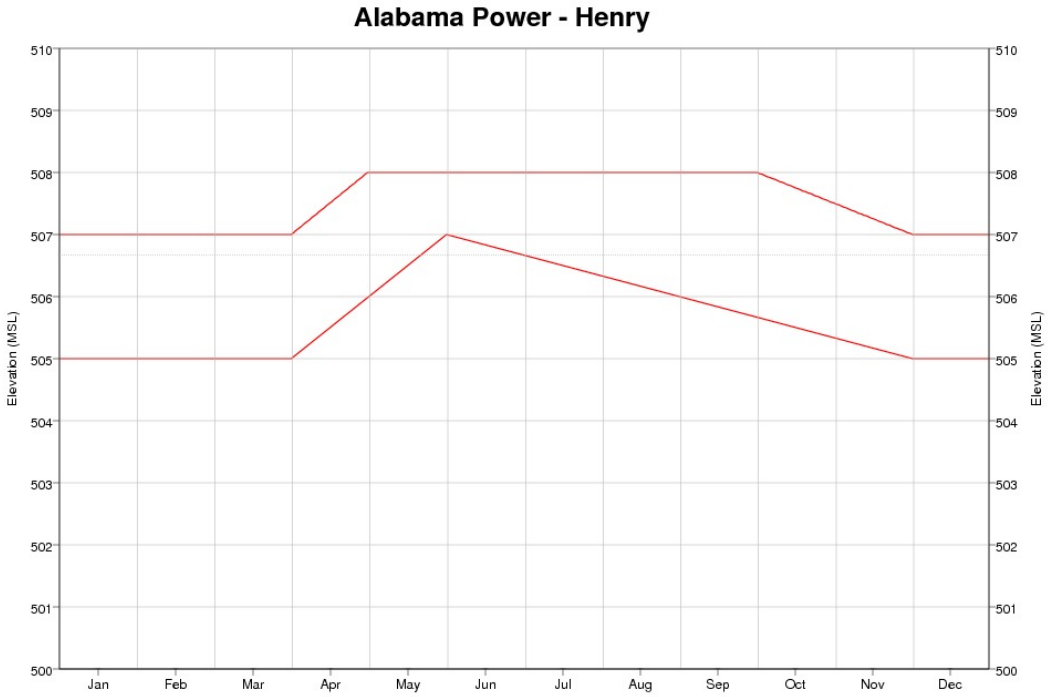


Figure ES-2. H. Neely Henry Lake revised guide curve (upper) and APC drought curve (lower).

- Specified flow requirements at Allatoona Lake would continue to provide for a 240-cfs minimum flow.
- The existing guide curve at Allatoona Lake would not change. Refined operations at Allatoona Lake would include use of four action zones shaped to mimic the seasonal demands for hydropower (Figure ES-3). Modifications to the hydropower schedule would be put in place to provide greater operational flexibility to meet power demands while conserving storage.
- The minimum flow requirement would remain 240 cfs from Carters Reregulation Dam. Refined operations at Carters Lake would include the use of two action zones to manage downstream releases (Figure ES-4). The top of the new action zone 2 begins at elevation 1,066 ft in January, increasing to 1,070.5 ft in May, dropping to 1,070 ft by October, and returning to elevation 1,066 ft through December. When Carters Lake is in action zone 1, minimum flow releases at Carters Reregulation Dam would be equal to or greater than the seasonal minimum flow.
- Two entities, the city of Cartersville, Georgia and CCMWA, have entered into water supply agreements for the use of 6,371 ac-ft and 13,140 ac-ft of storage, respectively, in Allatoona Lake for water supply. Total storage allocated to water supply in Allatoona Lake is 19,511 ac-ft.
- The city of Chatsworth has entered into a water supply agreement for the use of 818 ac-ft of storage in Carters Lake for water supply.
- USACE would continue to manage fish spawning operations at Allatoona Lake. During the largemouth bass spawning period, from March 15 to May 15, USACE seeks to maintain generally stable or rising reservoir levels at Allatoona Lake.
- USACE would continue migratory fish passage operations at Claiborne Lock and Dam and Millers Ferry Lock and Dam, as stated under the No Action Alternative.

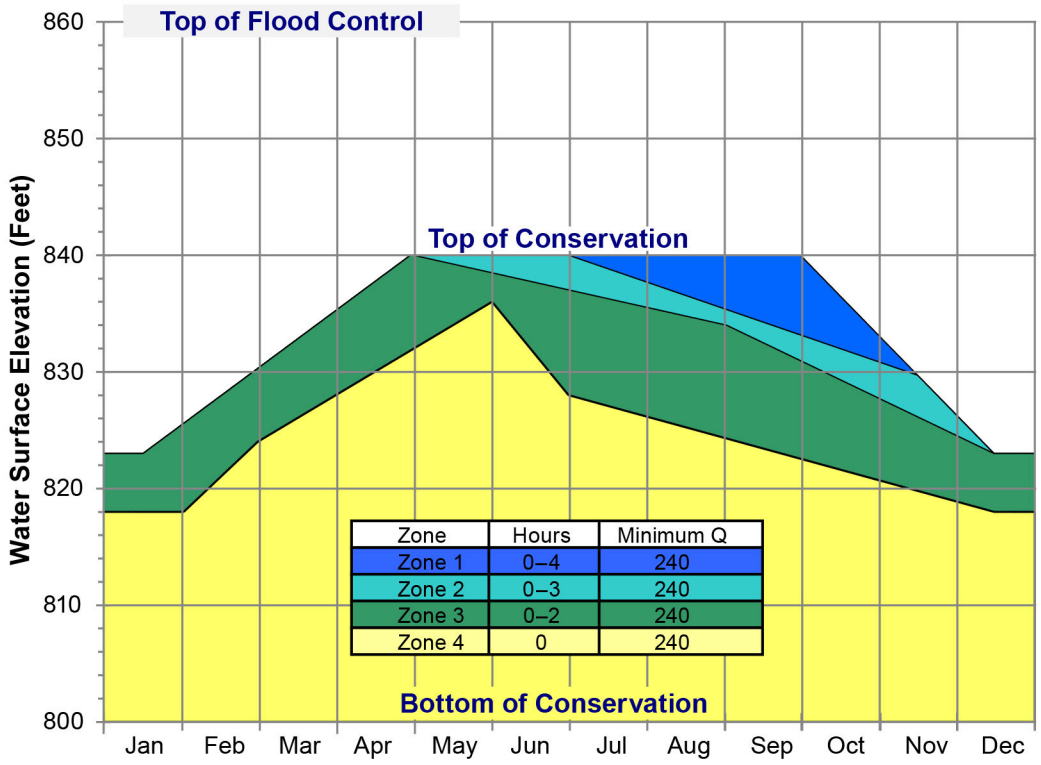


Figure ES-3. Operations under the Plan D at Allatoona Lake.

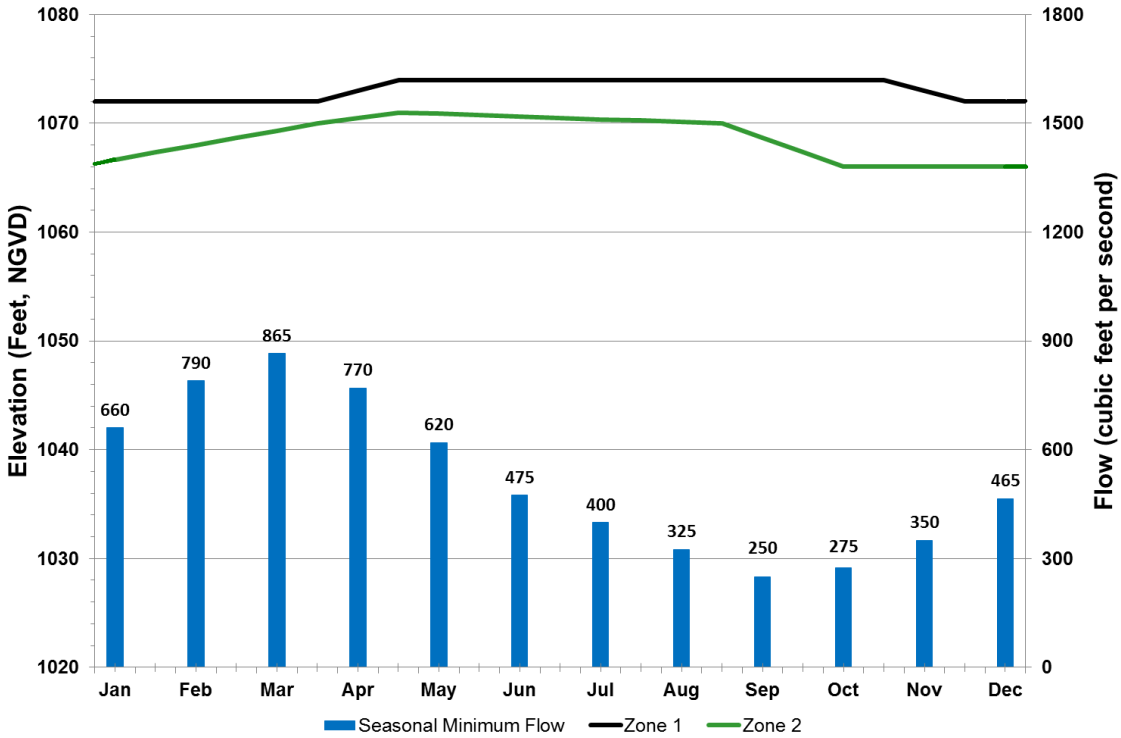


Figure ES-4. Carters Lake modified action zones.

Alternative Plan F

Operations under Plan F would include the following:

- Implement the revised APCDOP with enhancements recommended by the USFWS. The revised APCDOP with USFWS enhancement is depicted in Table ES-4.
- Provide for seasonal navigation releases, coupled with seasonal maintenance dredging, to support commercial navigation in the Alabama River for a 9.0-ft or 7.5-ft channel depth as long as sufficient basin inflow above the APC projects is available. When sufficient flows cannot be provided to continue to support a minimum 7.5-ft navigation channel, navigation could be impeded and combined releases from APC projects (JBT) near Montgomery would be reduced to 4,640 cfs. If one or more of the drought operations triggers (low basin inflows, low composite conservation storage, or low state line flows) are met, minimum combined releases from JBT would be reduced below 4,640 cfs in accordance with specific protocols developed collaboratively between USACE and APC (discussed in detail in Section 4.2.2 of the EIS).
- APC projects on the Coosa and Tallapoosa Rivers would continue to operate under their current FERC licenses with specific operational requirements. FERC relicensing actions are underway for the Coosa River projects, and APC has requested to modify winter pool levels at the Weiss and Logan Martin lakes. Plan F does not include these APC-proposed modified winter pool levels. [NOTE: The new FERC license, issued on June 20, 2013, following public review of the draft EIS for the ACT WCM update, did not include the proposed modifications to winter pool levels at Weiss and Logan Martin lakes.]
- The APC project, H. Neely Henry Lake (Coosa River), which operates with a revised guide curve under a FERC license variance (with USACE concurrence) would continue to operate under its revised guide curve (Figure ES-2). [NOTE: The new FERC license, issued on June 20, 2013, following public review of the draft EIS for the ACT WCM update, included the revised guide curve for H. Neely Henry Lake.]
- Specified flow requirements at Allatoona Lake would continue to provide for a 240-cfs minimum flow.
- The existing guide curve at Allatoona Lake would be revised to implement a phased fall drawdown period from early September through December (Figure ES-5). Refined operations at Allatoona Lake would include use of four action zones shaped to mimic the seasonal demands for hydropower. Modifications to the hydropower schedule would be put in place to provide greater operational flexibility to meet power demands while conserving storage. In Plan F, hydropower generation would not be reduced during annual drawdown in the fall. The WCM would define a range of hours for generation in each action zone but would not include the option to reduce production during fall drawdown when the demand is reduced.
- The current minimum flow requirement would remain 240 cfs from Carters Reregulation Dam. Refined operations at Carters Lake would include the use of two action zones to manage downstream releases (Figure ES-4). The top of the new action zone 2 begins at elevation 1,066 ft in January, increasing to 1,070.5 ft in May, dropping to 1,070 ft by October, and returning to elevation 1,066 ft through December. When Carters Lake is in action zone 1, minimum flow releases at Carters Reregulation Dam would be equal to the seasonal minimum flow.
- Two entities, the city of Cartersville, Georgia and CCMWA, have entered into water supply agreements for the use of 6,371 ac-ft and 13,140 ac-ft of storage, respectively, in Allatoona Lake for water supply. Total storage allocated to water supply is 19,511 ac-ft.

- The city of Chatsworth has entered into a water supply agreement for the use of 818 ac-ft of storage in Carters Lake for water supply.
- USACE would continue to manage fish spawning operations at Allatoona Lake. During the largemouth bass spawning period, from March 15 to May 15, USACE seeks to maintain generally stable or rising reservoir levels at Allatoona Lake.
- USACE would continue migratory fish passage operations at Claiborne Lock and Dam and Millers Ferry Lock and Dam, as stated under the No Action Alternative.

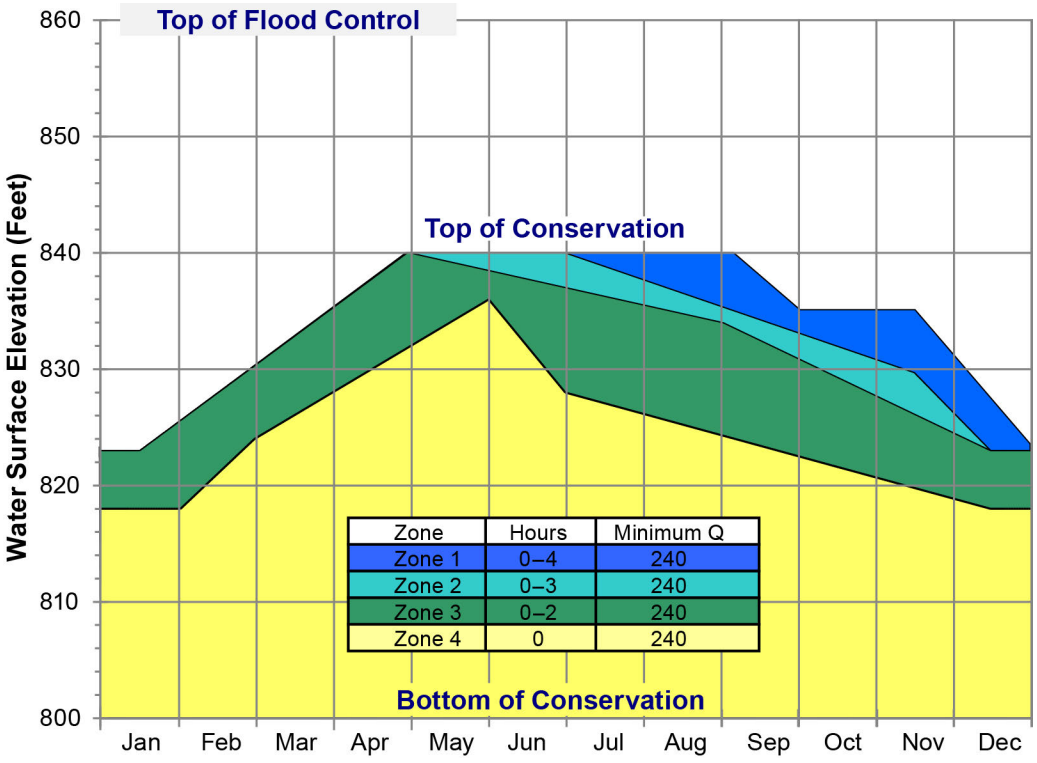


Figure ES-5. Operations under the Plan F at Allatoona Lake.

Alternative Plan G (Proposed Action Alternative)

Under the Proposed Action Alternative, USACE would continue to operate projects in the ACT Basin in a balanced manner to achieve all authorized project purposes. Operations under the Proposed Action Alternative include the following:

- Implement the revised APCDOP with enhancements recommended by the USFWS (see Table ES-4).
- Provide for seasonal navigation releases, coupled with seasonal maintenance dredging, to support commercial navigation in the Alabama River for a 9.0-ft or 7.5-ft channel depth as long as sufficient basin inflow above the APC projects is available. When sufficient flows cannot be provided to continue to support a minimum 7.5-ft navigation channel, navigation could be impeded and combined releases from APC projects (JBT) near Montgomery would be reduced to 4,640 cfs. If one or more of the drought operations triggers (low basin inflows, low composite conservation storage, or low state line flows) are met, minimum combined releases from JBT

would be reduced below 4,640 cfs in accordance with specific protocols developed collaboratively between USACE and APC (discussed in detail in Section 4.2.2 of the EIS).

- APC projects on the Coosa and Tallapoosa Rivers would continue to operate under their current FERC licenses with specific operational requirements. FERC relicensing actions are underway for the Coosa River projects, and APC has requested to modify winter pool levels at the Weiss and Logan Martin lakes. Plan G (the Proposed Action Alternative) does not include these APC-proposed modified winter pool levels. [NOTE: The new FERC license, issued on June 20, 2013, following public review of the draft EIS for the ACT WCM update, did not include the proposed modifications to winter pool levels at Weiss and Logan Martin lakes.]
- The APC project, H. Neely Henry Lake (Coosa River), which operates with a revised guide curve under a FERC license variance (with USACE concurrence) would continue to operate under its revised guide curve (Figure ES-2). [NOTE: The new FERC license, issued on June 20, 2013, following public review of the draft EIS for the ACT WCM update, included the revised guide curve for H. Neely Henry Lake.]
- Specified flow requirements at Allatoona Lake would continue to provide for a 240-cfs minimum flow.
- The existing guide curve at Allatoona Lake would be revised to implement a phased fall drawdown period from early September through December (Figure ES-6). Refined operations at Allatoona Lake would include use of four action zones shaped to mimic the seasonal demands for hydropower (Figure ES-6). Modifications to the hydropower schedule would be put in place to provide greater operational flexibility to meet power demands while conserving storage. Specifically, under the Plan G (the Proposed Action Alternative), hydropower generation would be reduced during annual drawdown in the fall (September through November).

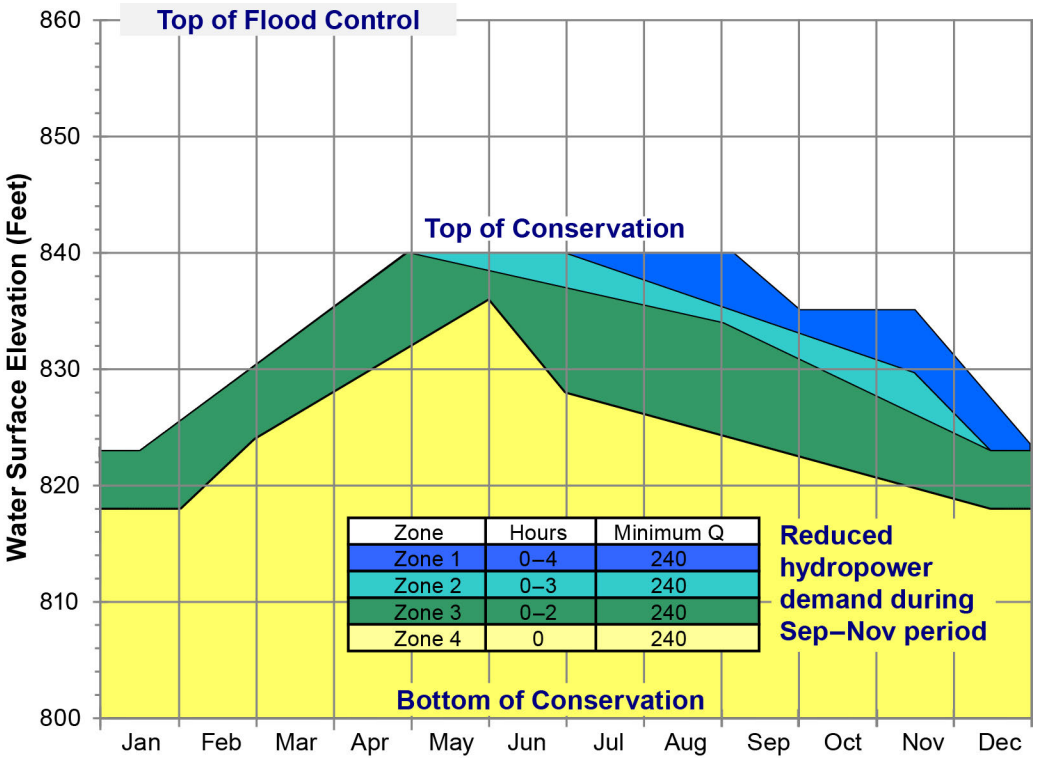


Figure ES-6. Operations under the Proposed Action Alternative at Allatoona Lake.

- The current minimum flow requirement would remain 240 cfs from Carters Reregulation Dam. Refined operations at Carters Lake would include the use of two action zones to manage downstream releases. The top of the new action zone 2 begins at elevation 1,066 ft in January, increasing to 1,070.5 ft in May, dropping to 1,070 ft by October, and returning to elevation 1,066 ft through December (Figure ES-4). When Carters Lake is in action zone 1, minimum flow releases at Carters Reregulation Dam would be equal to the seasonal minimum flow. Those minimum flow releases are based on the mean monthly flow upstream of Carters Lake. If Carters Lake elevations drop into action zone 2, minimum flow releases from Carters Reregulation Dam would be 240 cfs.
- Two entities, the city of Cartersville, Georgia and CCMWA, have entered into water supply agreements for the use of 6,371 ac-ft and 13,140 ac-ft of storage, respectively, in Allatoona Lake for water supply. Total storage allocated to water supply in Allatoona Lake is 19,511 ac-ft.
- The city of Chatsworth has entered into a water supply agreement for the use of 818 ac-ft of storage in Carters Lake for water supply.
- USACE would continue to manage fish spawning operations at Allatoona Lake. During the largemouth bass spawning period, from March 15 to May 15, USACE seeks to maintain generally stable or rising reservoir levels at Allatoona Lake. Generally stable or rising levels are defined as not lowering the reservoir levels by more than 6 inches, with the base elevation generally adjusted upward as levels rise from increased inflows or refilling of the reservoir.
- USACE would continue migratory fish passage operations at Claiborne Lock and Dam and Millers Ferry Lock and Dam, as stated under the No Action Alternative.

Environmental Consequences

The ACT WCM update process has been conducted in full consideration of the effects on important natural, socioeconomic, and cultural resources and in compliance with pertinent environmental laws and EOs intended to protect and conserve those resources. USACE Environmental Operating Principles have been applied during the update process.

The HEC-ResSim model was used to simulate flow operations in the ACT Basin and to provide a technical basis for the analysis of environmental effects. HEC-ResSim is a state-of-the-art tool for simulating flow operations in managed systems. The USACE Hydrologic Engineering Center (HEC) developed this software, which is now the standard for USACE reservoir operations modeling. The EIS describes the model and the modeling process in more detail. Most reservoirs are constructed for one or more of the following purposes: flood risk management, hydropower generation, navigation, recreation, water supply, water quality, and fish and wildlife conservation. The purposes typically define the goals and constraints that describe the reservoir's release objectives. Other factors that might influence the objectives include time of year, hydrologic conditions, water temperature, current pool elevation (or zone), and simultaneous operations by other reservoirs in a system. HEC-ResSim uses an original rule-based description of the operational goals and constraints that reservoir operators must consider when making release decisions.

For purposes of evaluating alternative operational plans for the ACT WCM update, a 70-year hydrologic period of record (1939 through 2008) was used to run the simulations presented and evaluated in the draft EIS for the WCM update. Historical water use data were provided by the appropriate state agencies to model water diversions in the ACT Basin. Net water withdrawals for all documented diversions throughout the ACT Basin for 2006 were used to model water diversions in the basin, except for diversions at Allatoona Lake (CCMWA and city of Cartersville) and Carters Lake (city of Chatsworth). In those cases, existing water supply storage agreement values were used in the model. Year 2006 represents

the greatest annual amount of water diversions in the ACT Basin during the period of simulation and, consequently, the year of greatest stress on the system from water withdrawals for human use. Starting with average monthly values for each diversion, average daily values were calculated for each month (by dividing by the number of days), resulting in a year of daily values. The values were repeated and applied to each calendar year in the simulation. In other words, the diversions were applied to hydrologic conditions for each year in the period of record in the model simulation.

For the WCM update and draft EIS, USACE initially determined that the 70-year hydrologic period of record (1939 – 2008) would provide a reasonable range of future hydrologic conditions by which to assess and compare the effects that would be expected from existing project operations (the No Action Alternative) and alternative water management plan updates. The model includes the following basic assumptions that apply to the simulations for the ACT Basin:

- All the current USACE and APC projects would be in place and operational over the entire period of record.
- Diversions (withdrawals and returns) would occur at 2006 levels over the entire period of record and would be incorporated into the model, with the exception of CCMWA, Cartersville, and Chatsworth withdrawals from Allatoona and Carters lakes as described above.
- USACE and APC projects in the ACT Basin would be operated over the entire period of record as they are currently operated (applicable to the No Action Alternative) or as they would be operated under each of the alternative water management plan updates.

Subsequent to the public review and comment on the draft EIS and further review by the USACE technical team, adjustments and updates were made to the HEC-ResSim modeling for the ACT Basin. The key revisions and updates to the modeling reflected in the final EIS for the WCM update include:

- The baseline condition (No Action Alternative) for analysis of alternatives was revised to reflect actual withdrawals by CCMWA and city of Cartersville from Allatoona Lake as well as the city of Chatsworth from Carters Lake. For purposes of the HEC-ResSim model, "actual withdrawals" are represented by actual water use reported throughout the basin in 2006, which represents the greatest annual amount of water diversions in the ACT Basin during the period of simulation and, consequently, the year of greatest stress on the system from water withdrawals for human use.. For all alternative plans for the WCM update, withdrawals from the USACE reservoirs by these entities continued to be based upon withdrawal rates commensurate with current water supply storage agreements with USACE.
- The hydrologic period of record for unimpaired flows and for model simulation of the ACT WCM update alternatives was extended from 70 years (1939-2008) to 73 years (1939-2011).
- Provisions for operation of the recently completed Hickory Log Creek reservoir, as described in the Section 404 permit for the project (2004), were incorporated into the HEC-ResSim model.
- Based on further review of available data during and following the comment period for the draft EIS, the USACE technical team made some adjustments to the navigation "template" for the months of November and December. The navigation template provides the technical basis for the monthly flow requirements necessary to support navigation channel depths in the Alabama River.
- Based on APC comments on the draft EIS for the WCM update, APC reservoir storage-elevation tables and other pertinent physical reservoir data were revised and updated in the model.
- Minor adjustments were made to the low basin inflow drought trigger table for the drought management plan.

- USACE used an upgraded version of the HEC-ResSim model (version 3.2) in lieu of HEC-ResSim version 3.1.

Based on the HEC-ResSim model updates described above, simulations were re-run for the water management alternatives considered in the draft EIS (No Action, Alternative D, Alternative F, and Alternative G [Proposed Action]), and the Environmental Consequences were updated accordingly.

In addition, further model simulations were conducted to better understand the sensitivity of the Proposed Action Alternative to the potential implications of (1) projected increases in long-range water supply demands in the basin and (2) a climate change scenario that would involve a long term reduction in rainfall/runoff in the basin. Both HEC-ResSim and HEC-5Q (addressing water quality) were run to compare the effects of the Proposed Action to these scenarios. These scenarios, the associated sensitivity analysis process, and the potential effects are discussed in more detail in the final EIS.

The environmental consequences of implementation of each of the alternatives on each of the resource areas analyzed (as compared to the No Action Alternative) are summarized below and in Table ES-5.

Table ES-5.
Summary of impacts

Resource area	No Action	Alternative Plan D	Alternative Plan F	Alternative Plan G (Proposed Action Alternative)
Water Quantity				
Flood risk management	----	No effect	No effect	No effect
Lake level conditions				
Carters Lake	----	Minor adverse	Minor adverse	Minor adverse
Allatoona Lake	----	Minor beneficial	Minor beneficial and adverse	Minor beneficial
Weiss Lake	----	Minor beneficial	Minor beneficial	Minor beneficial
H. Neely Henry Lake	----	Minor beneficial	Minor beneficial	Minor beneficial
Logan Martin Lake	----	Minor beneficial	Minor beneficial	Minor beneficial
R.L. Harris Lake	----	Minor beneficial	Minor beneficial	Minor beneficial
Lake Martin	----	Minor beneficial	Minor beneficial	Minor beneficial
R.E. “Bob” Woodruff Lake	----	Minor adverse	Minor adverse	Minor adverse
William “Bill” Dannelly Lake	----	Minor adverse	Minor adverse	Minor adverse
Claiborne Lake	----	Minor adverse	Minor adverse	Minor adverse
Stream flow conditions				
Coosawattee River downstream of Carters Reregulation Dam	----	Minor beneficial	Minor beneficial	Minor beneficial
Etowah River downstream of Allatoona Lake	----	No effect	Minor beneficial	Minor adverse
Coosa River at Rome	----	No effect	No effect	No effect
Alabama River at Montgomery	----	Minor beneficial and adverse	Minor beneficial and adverse	Minor beneficial and adverse
Alabama River downstream of Claiborne Lock and Dam	----	Minor beneficial and adverse	Minor beneficial and adverse	Minor beneficial and adverse
Drought management	----	Minor beneficial	Minor beneficial	Minor beneficial
Navigation conditions – Alabama River	----	Minor beneficial	Minor beneficial	Minor beneficial
Water withdrawals	----	No effect	No effect	No effect

Resource area	No Action	Alternative Plan D	Alternative Plan F	Alternative Plan G (Proposed Action Alternative)
Water Quality				
Water temperature—system wide over modeled period	----	Negligible	Negligible	Negligible
—median range of change in a dry weather year				
Etowah River	----	Negligible	Negligible	Negligible
Coosawattee and Oostanaula Rivers	----	Minor adverse	Minor adverse	Minor adverse
Coosa River	----	Negligible	Negligible	Negligible
Tallapoosa River	----	Minor adverse	Minor adverse	Minor adverse
Alabama River	----	Negligible	Negligible	Negligible
Oxygen demand—system wide over modeled period	----	Negligible	Negligible	Negligible
—median range of change in a dry weather year				
Etowah River	----	Negligible	Negligible	Negligible
Coosawattee and Oostanaula Rivers	----	Minor adverse	Minor adverse	Minor adverse
Coosa River	----	Negligible	Negligible	Negligible
Tallapoosa River	----	Negligible	Negligible	Negligible
Alabama River	----	Minor adverse	Minor adverse	Minor adverse
Phosphorus— system wide over modeled period	----	Negligible	Negligible	Negligible
—median range of change in a dry weather year				
Etowah River	----	Negligible	Negligible	Negligible
Coosawattee and Oostanaula Rivers	----	Negligible	Negligible	Negligible
Coosa River	----	Negligible	Negligible	Negligible
Tallapoosa River	----	Negligible	Negligible	Negligible
Alabama River	----	Negligible	Negligible	Negligible
Nitrogen— system wide over modeled period	----	Negligible	Negligible	Negligible
—median range of change in a dry weather year				
Etowah River	----	Negligible	Negligible	Negligible
Coosawattee and Oostanaula Rivers	----	Negligible	Negligible	Negligible
Coosa River	----	Negligible	Negligible	Negligible
Tallapoosa River	----	Negligible	Negligible	Negligible
Alabama River	----	Negligible	Negligible	Negligible
Chlorophyll a— system wide over modeled period	----	Negligible	Negligible	Negligible
—median range of change in a dry weather year				
Etowah River	----	Negligible	Negligible	Negligible
Coosawattee and Oostanaula Rivers	----	Negligible	Negligible	Negligible
Coosa River	----	Negligible	Negligible	Negligible
Tallapoosa River	----	Negligible	Negligible	Negligible
Alabama River	----	Negligible	Negligible	Negligible
Geology and soils	----	No effect	Minor adverse	Minor adverse
Climate change	----	No effect	No effect	No effect

Resource area	No Action	Alternative Plan D	Alternative Plan F	Alternative Plan G (Proposed Action Alternative)
Land Use				
Allatoona Lake	----	Minor beneficial	Minor beneficial	Minor beneficial
Carters Lake	----	No effect	No effect	No effect
R.E. “Bob” Woodruff Lake	----	No effect	No effect	No effect
William “Bill” Dannelly Lake	----	No effect	No effect	No effect
Claiborne Lock and Dam and Lake	----	No effect	No effect	No effect
Weiss Lake	----	Minor beneficial	Minor beneficial	Minor beneficial
H. Neely Henry Lake	----	Minor beneficial	Minor beneficial	Minor beneficial
Logan Martin Lake	----	Minor beneficial	Minor beneficial	Minor beneficial
R.L. Harris Lake	----	Minor beneficial	Minor beneficial	Minor beneficial
Biological resources				
Vegetation				
Etowah River from Allatoona Lake to Rome	----	Negligible	Negligible	Negligible
Coosawattee and Oostanaula Rivers - Carters Lake to Rome	----	No effect	No effect	No effect
Coosa River	----	No effect	No effect	No effect
Alabama River	----	No effect	No effect	No effect
Tallapoosa River	----	No effect	No effect	No effect
Wildlife				
Etowah River from Allatoona Lake to Rome	----	Negligible	Negligible	Negligible
Coosawattee and Oostanaula Rivers - Carters Lake to Rome	----	Negligible	Negligible	Negligible
Coosa River	----	Negligible	Negligible	Negligible
Alabama River	----	Negligible	Negligible	Negligible
Tallapoosa River	----	Negligible	Negligible	Negligible
Fish and aquatic resources (rivers)				
Coosawattee River downstream of Carters Reregulation Dam	----	Negligible	Negligible	Negligible
Etowah River downstream of Allatoona Lake	----	Negligible	Negligible	Negligible
Coosa River at Rome	----	Negligible	Negligible	Negligible
Alabama River at Montgomery	----	Negligible	Negligible	Negligible
Alabama River downstream of Claiborne Lock and Dam	----	Negligible	Negligible	Negligible
Fish and aquatic resources (reservoirs)	----	Negligible	Negligible	Negligible
Fish and Aquatic Resources (estuaries)	----	Negligible	Negligible	Negligible
Protected Species				
Coosawattee River downstream of Carters Reregulation Dam	----	Negligible	Negligible	Negligible
Etowah River downstream of Allatoona Lake	----	Negligible	Negligible	Negligible
Coosa River at Rome, Georgia	----	Negligible	Negligible	Negligible
Alabama River at Montgomery	----	Negligible	Negligible	Negligible

Resource area	No Action	Alternative Plan D	Alternative Plan F	Alternative Plan G (Proposed Action Alternative)
Alabama River downstream of Claiborne Lock and Dam	----	Negligible	Negligible	Negligible
Fish and Wildlife Management Facilities				
Dannelly Lake	----	Negligible	Negligible	Negligible
Arrowhead Game Management Office and Fishing Area	----	Negligible	Negligible	Negligible
Fish Hatcheries	----	Negligible	Negligible	Negligible
Socioeconomics				
M&I Water Supply	----	Minor beneficial and adverse	Minor beneficial and adverse	Minor beneficial and adverse
Navigation	----	Minor beneficial	Minor beneficial	Minor beneficial
Channel availability downstream of Claiborne Lock and Dam				
7.5-foot channel	50%-100%	56%-100%	56%-100%	56%-100%
9.0-foot channel	48%-98%	55%-99%	55%-99%	54%-99%
Hydropower	----	Minor adverse	Minor adverse	Minor adverse
Total system energy benefits	$222,300.000	$222,220,000	$222,230,000	$222,050,000
System dependable capacity (MW)	2,147.08	2,138.12	2,138.12	2,137.53
Energy benefit	----	-$ 83.000	-$ 78,000	-$255,000
Capacity benefit	----	-$881,000	-$881,000	-$ 939,000
Total hydropower benefits		-$964,000	-$959,000	-$1,194,000
Agricultural Water Supply	----	No effect	No effect	No effect
Flood risk management	----	No effect	No effect	No effect
0.2% flow at Kingston (cfs)				
1961	15,874	15,874	15,874	15,874
1979	38,136	37,895	37,885	37,885
1990	25,114	25,114	25,114	25,114
0.2% flow at Rome-Coosa (cfs)				
1961	82,878	82,878	82,878	82,878
1979	79,909	79,583	79,643	79,643
1990	80,362	80,311	80,311	80,311
Recreation	----	Minor beneficial and adverse	Minor beneficial and adverse	Minor beneficial and adverse
Allatoona Lake - percent of timepool level falls below:				
Initial Impact Level	9.1	9.5	9.3	10.0
Recreation Impact Level	28.4	30.3	33.1	37.3
Water Access Limited Level	29.5	27.8	25.8	20.4
Carters Lake - Percent of time pool level falls below:				
Initial Impact Level	0.5	2.7	2.7	2.7
Recreation Impact Level	0.0	0.2	0.2	0.2
Water Access Limited Level	0.0	0.0	0.0	0.0
Environmental Justice	----	No effect	No effect	No effect
Protection of children	----	No effect	No effect	No effect

Resource area	No Action	Alternative Plan D	Alternative Plan F	Alternative Plan G (Proposed Action Alternative)
Cultural resources	----	No effect	No effect	No effect
Percent of sites experiencing:				
Erosion	53	53	53	53
Deposition	27	27	27	27

Water Quantity

The following describe the expected effects of the No Action Alternative and Alternative Plans D and F and the Proposed Action Alternative (Plan G) on water quantity considerations, including flood risk management operations, reservoir water surface elevations and associated storage considerations, stream flow, drought operations, navigation conditions, and water withdrawals.

In the final EIS, "median" lake level and stream flow conditions in the basin are presented and discussed in lieu of "average" conditions. Median values were considered to provide a more representative characterization of conditions for evaluation and comparison among alternatives. Instead of a numeric average of a set of values over the modeled period of record, the median value represents the point at which 50 percent of the values are higher and 50 percent are lower. In addition, figures and tables present the 90 percent exceedance values, meaning that the values presented for each day would be exceeded 90 percent of the time over the period of record. The 90 percent exceedance values are representative of extremely dry conditions in the basin and low basin inflow to the reservoirs. These adjustments were made in response to several public comments requesting more information and greater focus on how the alternative plans perform under extreme drought conditions.

Flood Risk Management Operations

No Action Alternative. The No Action Alternative would continue to provide the current level of flood risk management at USACE and APC projects in the ACT Basin that are specifically authorized to operate for that purpose, including Allatoona Lake (USACE), Carters Lake (USACE), Weiss Lake (APC), H. Neely Henry Lake (APC), Logan Martin Lake (APC), and R.L. Harris Lake (APC).

Alternative Plan D. Plan D would incorporate the proposed winter guide curve change to APC's H. Neely Henry Lake. USACE has concurred with APC (and has indicated to FERC) that the change would have no adverse impact on flood operations in the ACT Basin. [NOTE: The new FERC license for APC Coosa River projects, issued on June 20, 2013, included the revised guide curve for H. Neely Henry Lake.] No changes to guide curves or current flood operations for Weiss, Logan Martin, or R.L. Harris lakes are included in Plan D. Thus, Plan D would have neither an adverse or beneficial impact with respect to existing flood operations in the ACT Basin.

Alternative Plan F. Plan F includes the revised fall phased drawdown guide curve for Allatoona Lake; the guide curves and current flood operations for the other ACT projects (both USACE and APC) would be the same as with Plan D. The proposed fall phased drawdown guide curve at Allatoona Lake necessitated an analysis to determine potential impacts on flood conditions downstream of the project. That analysis showed that the fall phased drawdown operation would have no impact on flood frequency flows at the Rome-Coosa gage, Georgia, for the 1961 hydrograph shape and would slightly reduce the flood frequency flows at the Rome-Coosa gage for the 1979 and 1990 hydrograph shapes. Except for the impacts of the fall phased drawdown at Allatoona Lake as described above, Plan F would have neither an adverse or beneficial impact on flood risk management operations in the balance of the ACT Basin.

Alternative Plan G (Proposed Action Alternative). With the Proposed Action Alternative, the Allatoona Lake fall phased drawdown guide curve feature would have the same beneficial effect on flood risk management operations downstream of Allatoona Lake as described for Plan F above. The additional water management measure for Allatoona Lake included in the Proposed Action Alternative (reduction of hydropower generation during the fall drawdown period) would have no adverse or beneficial effects on flood risk management operations at Allatoona Lake. Except for the impacts of the fall phased drawdown at Allatoona Lake, the Proposed Action Alternative would have neither an adverse or beneficial impact on flood risk management operations in the balance of the ACT Basin.

None of the alternatives include proposed winter guide curve revisions for APC's Weiss and Logan Martin lakes, which are under consideration as part of the ongoing FERC relicensing process for APC's Coosa River Hydropower Project. Under the FERC relicensing process, the potential effects of the proposed revisions on the flood risk management function of these projects will be considered. If the proposed revisions are approved by FERC, they would be addressed in a future update of the Master Manual. [NOTE: On June 20, 2013, following public review of the draft EIS for the ACT WCM update, FERC issued a new license for the APC projects on the Coosa River (No. 2146). The new license did not include the proposed modifications to winter pool levels at Weiss and Logan Martin lakes.]

Lake Level Conditions in the ACT Basin

Carters Lake

No Action Alternative. Median water surface elevations over the modeled period of record would generally follow the shape of the guide curve (elevation 1,074 ft in summer and 1,072 ft in winter) from the months of November through July. During August through October, median levels would be slightly below (up to 0.4 ft) the guide curve elevation for that period (1,074 ft). For the No Action Alternative at the 90 percent exceedance level, pool elevations would be 0.6 ft or less below the guide curve for the months of January through April. For the months of May through November when the guide curve is at elevation1,074 ft, daily water surface elevations for the No Action Alternative (90 percent exceedance) would fluctuate between 0.4 ft and 1.8 feet below the guide curve. Similar fluctuations below the guide curve would be expected to continue during the fall drawdown period and through the month of December. A water surface elevation of 1,072 ft (equal to the winter guide curve level and two ft below summer pool level) would likely be exceeded on 90 percent of the days during the modeled period of record. The lowest pool elevation that would be expected over the modeled period of record would be about elevation 1,063 ft, 9 ft below the winter guide curve level.

It should be noted that historically observed levels for Carters Lake and other reservoirs in the basin may not match modeled lake levels for the No Action Alternative. Model simulations use a 73-year hydrologic period of record (1939 – 2011). The model simulation is conducted assuming that: (1) all USACE and APC projects would be in place and operational over the entire period of record and (2) water withdrawals and returns over the entire period of record would equal those occurring during the year of highest net withdrawals from the basin (year 2006). Additionally, under extreme hydrologic conditions in the ACT Basin, extraordinary water management actions may have been required at certain projects in certain years to address special circumstances, and those specific management actions are not part of the simulation. Consequently, the model results do not necessarily match with observed data from any given year in the period of record. The reasons for these potential deviations are discussed in more detail in Section 6.1.1.2.1.1 of the EIS.

For No Action (and all other alternatives), the Carters Reregulation pool downstream of Carters Dam would continue to fluctuate widely on a daily basis as waters discharged into the reregulation pool from Carters Lake during peaking hydropower generation are pumped back into Carters Lake during off-peak

hours. There would likely be no discernible differences in pool levels and degree of fluctuation among any of the alternatives.

Alternative Plan D. With Plan D, median water surface elevations, with negligible deviations, would essentially equal pool levels produced under the No Action Alternative. The change in operations under Plan D to implement seasonal minimum flows downstream of Carters Reregulation Dam would have negligible effect on median daily water surface elevations in Carters Lake. At the 90 percent exceedance level for Carters Lake water surface elevations, Plan D would likely produce daily elevations that range from about 0.1 to 1.3 ft lower than the No Action Alternative from January through March. For the balance of the months, that difference would decrease to a range of about 0.1 to 0.6 feet. Implementation of seasonal minimum flows downstream of Carters Reregulation Dam is likely to be responsible for a slight decrease in Carters lake water surface elevations under drier conditions in the basin.

Lake elevation 1,072 ft would likely be exceeded over 86 percent of the days during the modeled period of record. The lowest pool elevation that would be expected over the modeled period of record would be about elevation 1,057 ft, 15 ft below the winter guide curve. During infrequent periods when extreme dry conditions prevail (less than 10 percent of the time), lake levels under Plan D would range from slightly lower to as much as 6 ft lower compared to the No Action Alternative. The Carters Reregulation Dam would continue to fluctuate widely on a daily basis under Plan D as described for the No Action Alternative.

Alternative Plan F. Implementing Plan F would likely result in the same effects on water surface elevations in Carters Lake as would result from Plan D. The Carters Reregulation Dam would continue to fluctuate widely on a daily basis as described for the No Action Alternative.

Alternative Plan G (Proposed Action Alternative). Implementing the Proposed Action Alternative would likely result in the same effects on water surface elevations in Carters Lake as would result from Plan D. The Carters Reregulation Dam would continue to fluctuate widely on a daily basis as described for the No Action Alternative.

Allatoona Lake

No Action Alternative. For the No Action Alternative, the median elevation would closely follow the project guide curve (top of conservation pool) from January through May. Beginning in early June, the median daily elevation would gradually decline through the summer months and into the early fall, such that by early October the median daily water surface elevation would be about seven ft below the top of conservation pool. The water surface elevation would gradually continue to decline from October through mid-December, generally at a slower rate than the decline in the guide curve elevation. By mid-December, the median daily water surface elevation would again closely follow the guide curve.

Water surface elevations at the 90 percent exceedance level would likely range two to three feet below the guide curve from January through May. From June through December at the 90 percent exceedance level, daily water surface elevations would steadily decline from about elevation 838.5 ft on June 1 to about 821 ft on December 31. Elevations for the No Action Alternative would be about 5.5 ft below the current guide curve elevation on August 1, 8.5 ft below on September 1, and about 7.8 ft below on October 1.

Alternative Plan D. With Plan D, modeling indicates that the median water surface elevation in Allatoona Lake over the modeled period of hydrologic record would be about the same as elevations for the No Action Alternative from January through May. Median daily elevations for Plan D would be slightly higher (up to 0.5 ft) than No Action during June and most of July. From August through mid-October, Plan D median daily elevations would be slightly below No Action (up to about one ft). From mid-October through late November, the Plan D elevations would be slightly higher than No Action (ranging

one to two feet higher). From late November through December, Plan D would follow the guide curve through the remaining portion of the fall drawdown period under the current guide curve configuration.

For Plan D, daily water surface elevations at the 90 percent exceedance level would likely range one to two ft above the No Action Alternative levels from January through mid-May, transitioning to slightly below the No Action Alternative (less than one ft) from mid-May to mid-August. Thereafter (September through December), the 90 percent exceedance water surface elevation for Plan D would be about one to two ft higher than the No Action Alternative elevations. This improvement in water surface elevation conditions at Allatoona Lake under Plan D at the median and 90 percent exceedance levels would largely be attributable to the revised action zones that would call for more conservative project operations to conserve storage with the onset of extremely dry conditions in the basin. Over the modeled period of record, implementing Plan D would be expected to provide an improvement of about 2.4 ft in the lowest level that Allatoona Lake might reach compared to the No Action Alternative.

Relative to established recreation impact levels at Allatoona Lake as described in the EIS, Plan D (compared to the No Action Alternative) would reflect no change in the number of years (69) over the modeled period of record that lake levels would likely decline below the Initial Impact level (69), an increase in the number of years that lake levels would likely decline below the Recreation Impact level (from 55 to 63), and a significant decrease in the number of years that lake levels would likely decline below the Water Access Limited level from 9 to 2. The reduction in the number of years over the period of record that lake levels would decline below the Water Access Limited level is noteworthy because that level is indicative of the most severe impact on public use of the lake.

Alternative Plan F. With Plan F, the median water surface elevation in Allatoona Lake over the modeled hydrologic period of record would be essentially the same as Plan D from the month of January through late November. From late November through mid-December, median daily water surface elevations would decline at a slower pace than the No Action Alternative and Plan D based on operations to follow the proposed fall phased drawdown guide curve (a feature of Plan F) rather than the current guide curve (a feature of No Action and Plan D). By mid-December, the median daily pool elevations for Plan F would likely be about four ft higher than No Action or Plan D elevations. By the end of December, Plan F median pool elevations would decline in accordance with the fall phased drawdown guide curve to the winter pool elevation of 823 ft. For Plan F, daily water surface elevations at the 90 percent exceedance level would be essentially the same as for Plan D, both providing for higher lake elevations under drought conditions than the No Action Alternative. Operation under Plan F would reflect an improvement of about 2.4 ft in the lowest level that Allatoona Lake might be expected to reach over the modeled period of record compared to the No Action Alternative. With respect to established recreation impact levels at Allatoona Lake, lake levels under Plan F would reach the Initial Impact level and Recreation Impact level slightly more often than Plan D and would reach the Water Access Limited level with the same frequency as Plan D over the modeled period of record (2 of 73 years).

Alternative Plan G (Proposed Action Alternative). With the Proposed Action Alternative, the median water surface elevation in Allatoona Lake over the modeled hydrologic period of record would closely match the guide curve and all the alternatives (including No Action) from the months of January through May. Plan G median pool elevations would be slightly higher (less than one foot) than No Action in June and July and slightly lower (less than one foot) than No Action in August through mid-September. Median elevations would likely decline slightly between mid-September through late November from about elevation 834 ft to 833 ft. By late November, Plan G median daily pool elevations would be about six ft higher than the No Action Alternative and five ft higher than Plans D and F. Plan G elevations match the phased drawdown guide curve from late November through December. The higher median lake levels in September through December would be attributable to incorporating (1) the revised action zones, (2) the fall phased drawdown guide curve, and (3) reduced hydropower generation into project operations. The management measure to reduce hydropower production in conjunction with the other measures

would be expected to result in notable improvement in median lake levels in October and November over all other alternatives.

For Plan G, daily water surface elevations at the 90 percent exceedance level over the modeled period of record would be essentially the same as for Plans D and F from January through September, with moderately improved lake level conditions compared to No Action between January and May and slightly lower between May and mid-August. However, for the remaining months of the year, Plan G would provide for substantially higher lake elevations under drought conditions than the No Action Alternative or Plans D and F. In mid-November, Plan G would be expected to provide lake elevations as much as three ft higher than Plans D and F and five ft higher than the No Action Alternative.

With respect to established recreation impact levels at Allatoona Lake, lake levels under the Proposed Action Alternative would reach the Recreation Impact level substantially less often than Plans D or F (49 years versus 63 and 69 years) and the Water Access Limited level the same number of years as Plans D and F over the modeled period of record.

APC Lakes (Coosa and Tallapoosa Rivers)

Operation of USACE reservoirs in the ACT Basin is closely linked to operation of the APC reservoirs. Consequently, the alternative water control plan revisions considered in this EIS potentially result in impacts on water surface elevations in APC reservoirs that include conservation storage. Those reservoirs are Weiss, H. Neely Henry, and Logan Martin lakes on the Coosa River and R.L. Harris Lake and Lake Martin on the Tallapoosa River. The effects of alternative plans on water surface elevations in those APC lakes are summarized below. The other APC projects in the ACT Basin (Lay Lake, Mitchell Lake, and Jordan Dam and Lake and Bouldin Dam projects on the Coosa River as well as Yates and Thurlow lakes on the Tallapoosa River) essentially operate as run-of-river facilities. The alternative water control plan revisions considered herein would have a negligible effect on the water surface elevations of these reservoirs.

APC Lakes (Coosa and Tallapoosa Rivers)—Weiss Lake

No Action Alternative. With the No Action Alternative, median daily water surface elevations over the modeled period of record would generally match the shape of the guide curve (referred to as rule curve by APC) from the months of January through June. From July through September median pool elevations would decline slightly below the guide curve (from up to 0.4 ft). The No Action Alternative would match the guide curve for the balance of the year. Daily water surface elevations at the 90 percent exceedance level over the modeled period of record would be expected to follow the project guide curve from January through late April. In May and June, the 90 percent exceedance water surface level would fluctuate slightly above and below elevation 563.5 ft, about 0.5 ft below the guide curve, thereafter declining steadily to a point about two ft below the guide curve on September 1 and about 1.5 ft below the guide curve on November 1. By early December, the 90 percent exceedance water surface elevations match the guide curve elevation, continuing through the balance of the month of December. The lowest pool elevation that would be expected over the modeled period of record for the No Action Alternative would likely be at about elevation 552 ft, six ft below the winter guide curve level. Water surface elevations for the No Action Alternative over the period of record would equal or exceed the winter pool level (elevation 558 ft) about 97 percent of the time.

Alternative Plan D. Median daily water surface elevations (Figure 6.1-9) would be equivalent to those for the No Action Alternative, except for the period from early July through the end of September when Plan D elevations would be slightly lower (by about 0.2 to 0.4 ft). These differences in median water surface elevations between No Action and Plan D are considered minor. At the 90 percent exceedance level, water surface elevations for Plan D would be equivalent to the guide curve for Weiss Lake and water

surface elevation for the No Action Alternative from the months of January through April. Thereafter, water surface elevations for Plan D would drop slightly below those for the No Action Alternative for the balance of the year. The elevation difference would vary from 0.1 ft to a maximum of about 0.5 ft in mid-June. These differences would be considered minor and unlikely to have an appreciable effect on existing purposes and uses of the lake. The lowest pool elevation that would be expected over the modeled period of record with Plan D would about elevation 556.1 ft, about two ft below the winter guide curve level and 4 ft higher than the lowest lake level expected to occur under the No Action Alternative. Proposed operational changes in the upstream USACE projects in the ACT Basin and drought operations measures in Plan D would likely have an overall minor adverse effect on daily median water surface elevations in Weiss Lake under normal conditions. Implementing drought measures in Plan D would be expected to provide notable improvement in lake levels at Weiss Lake during extreme drought conditions.

Alternative Plan F. On the basis of the model outputs, Plan F would be expected to have essentially the same effects on water surface elevations in Weiss Lake as described for Plan D.

Alternative Plan G (Proposed Action Alternative). On the basis of the model outputs, the Proposed Action Alternative would be expected to have essentially the same effects on water surface elevations in Weiss Lake as described for Plan D.

APC Lakes (Coosa and Tallapoosa Rivers)—H. Neely Henry Lake

No Action Alternative. With the No Action Alternative, median daily water surface elevations over the modeled period of record would generally match the guide curve in the FERC license in effect when the relicensing process was initiated. The only exception would occur from mid-August through September when median daily water surface elevations would decline up to about 0.4 ft below the summer guide curve elevation of 508 ft. Daily water surface elevations at the 90 percent exceedance level over the modeled period of record would be expected to equal the project guide curve from January through late April. From May through November, water surface elevations would fluctuate from about 0.4 ft to 1.6 ft below the guide curve. During the month of December, water surface elevations would be expected to closely follow the guide curve. The lowest pool elevation that would be expected over the modeled period of record for the No Action Alternative would likely be at about elevation 503.3 ft, 1.7 ft below the winter guide curve level.

Alternative Plan D. For Plan D, median daily water surface elevations in H. Neely Henry Lake over the modeled period of record would generally match the revised guide curve (previously in effect under a FERC interim-approved variance and included in the June 2013 FERC relicense of the Coosa River projects). The only exception would occur in the months of July through September when Plan D median pool elevations would decline up to about 0.4 ft below the summer guide curve elevation and marginally below median water surface elevations for the No Action Alternative. From October through December, water surface elevations for Plan D would be equivalent to the guide curve elevation applicable to Plan D. Actual differences in median water surface elevations between Plan D and No Action during the months of January through March and December would be two ft (and zero to two feet) during April and October through November. These differences are solely driven by the different guide curves applied to No Action and to Plan D.

At the 90 percent exceedance level, water surface elevations under Plan D would match the June 2013 FERC-approved guide curve from January through mid-April and would be up to two feet higher than the No Action Alternative. The elevations would peak in mid-May at about elevation 507.6 ft and would trend gradually downward to an elevation in the range of about 506.4 ft by the end of November, thereafter increasing to about elevation 507 ft by the end of December. Plan D water surface elevations at the 90 percent exceedance level would be higher than the No Action Alternative during the year, except during the month of June when the No Action Alternative would be marginally higher than Plan D. The

lowest lake elevation that would be expected over the modeled period of record with Plan D would be 504.9 ft (2.1 ft below the revised winter guide curve level). That would be a 1.4-ft improvement over the lowest level expected at H. Neely Henry Lake with the No Action Alternative.

Alternative Plan F. Plan F would be expected to have essentially the same effects on water surface elevations in H. Neely Henry Lake as described for Plan D above.

Alternative Plan G (Proposed Action Alternative). The Proposed Action Alternative would be expected to have essentially the same effects on water surface elevations in H. Neely Henry Lake as described for Plan D.

A*PC Lakes (Coosa and Tallapoosa Rivers)—Logan Martin Lake*

No Action Alternative. Median daily water surface elevations for the No Action Alternative over the modeled period of record would essentially match the project guide curve from the month of January through July. In August and September, median daily pool levels would decline slightly (up to about 0.5 feet below the guide curve in September). During October through December, median daily pool elevations would be expected to match the guide curve. Daily water surface elevations at the 90 percent exceedance level over the period of record would match the project guide curve from January through late April. Thereafter through the end of November, pool elevations at the 90 percent exceedance level would generally fluctuate from about 0.5 ft to two ft below the guide curve, with the largest deficit in August and September. In December, water surface elevations would be slightly below the guide curve elevation. The lowest pool elevation that would be expected over the modeled period of record for the No Action Alternative would likely be about elevation 456.2 ft, or 3.8 ft below the winter guide curve level.

Alternative Plan D. With Plan D, median daily water surface elevations in Logan Martin Lake over the modeled period of record would essentially match the project guide curve and elevations for the No Action Alternative for the months of January through June. From July through September, median daily pool elevations would likely decline below the guide curve elevation of 465 ft (in the range of 0.1 to 0.9 ft) and slightly below median elevations for the No Action Alternative (by zero to 0.4 ft). During October through December, median water surface elevations for Plan D would fall a minimal amount below the project guide curve and No Action Alternative elevations. Daily water surface elevations for Plan D at Logan Martin Lake at the 90 percent exceedance level would be nearly equivalent to elevations for the No Action Alternative with the following difference. From mid-May through August, pool elevations at the 90 percent exceedance level would be lower than the No Action Alternative by amounts varying from zero up to about 0.8 ft. Thus, under extremely dry conditions in the basin, Logan Martin Lake would be slightly lower during the summer season under Plan D. The lowest pool elevation that would be expected over the modeled period of record with Plan D would likely be at about elevation 458.1 ft (1.9 ft below the winter guide curve level), representing about a 1.9-foot improvement over the lowest level expected at Logan Martin Lake under the No Action Alternative.

Alternative Plan F. Plan F would be expected to have essentially the same effects on water surface elevations in Logan Martin Lake as described for Plan D.

Alternative Plan G (Proposed Action Alternative). On the basis of the model outputs over the modeled period of record, the Proposed Action Alternative would be expected to have essentially the same effects on water surface elevations in Logan Martin Lake as described for Plan D. The Proposed Action Alternative would be expected to produce slightly lower median lake elevations in September than Plans D and F, but the effect on project operations at Logan Martin Lake would be negligible.

APC Lakes (Coosa and Tallapoosa Rivers)—R.L. Harris Lake

No Action Alternative. Median daily water surface elevations for the No Action Alternative over the modeled period of record would generally equal the project guide curve elevation from January through April. Median pool elevations would gradually decline through the summer months (May – September), such that the median elevation for the No Action Alternative by the end of September would be about 1.7 ft below the summer guide curve level. During the balance of the year (October – December), median daily water surface elevations would range from 0.5 to 1.7 ft below the guide curve elevation. Daily water surface elevations at the 90 percent exceedance level over the period of record would range from about one to 2.5 ft below the guide curve elevation from January through April. The 90 percent exceedance pool elevation would peak at the end of May at about elevation 792.5 ft (about 0.5 below the summer guide curve elevation), thereafter declining to an elevation about 790 ft by the end of September (about 1.5 ft below the guide curve elevation). For the balance of the months of the year, 90 percent exceedance pool elevations would range from about one to 1.5 ft below the guide curve. The lowest pool elevation that would be expected over the modeled period of record for the No Action Alternative would likely be about elevation 773.6 ft, or 11.4 ft below the winter guide curve level.

Alternative Plan D. With Plan D, median daily water surface elevations in R.L. Harris Lake over the modeled period of record would be essentially equivalent to the median daily elevations for the No Action Alternative. Daily water surface elevations that would be exceeded 90 percent of days over the modeled period of record, representing extremely dry conditions in the basin, would be nearly equivalent to elevations for the No Action Alternative with the following difference. From June through mid-September, water surface elevations at the 90 percent exceedance level would be slightly lower than the No Action Alternative by amounts varying from zero up to about 0.5 ft. Thus, under extremely dry conditions in the basin, R.L. Harris Lake would be slightly lower during the summer season under Plan D. However, the lowest pool elevation that would be expected over the modeled period of hydrologic record with Plan D would likely be at about elevation 780.1 ft (4.9 ft below the winter guide curve level), reflecting an improvement of about 6.4 ft above the lowest level expected at R.L. Harris Lake for the No Action Alternative.

Alternative Plan F. Plan F would be expected to have essentially the same effects on water surface elevations in R.L. Harris Lake as described for Plan D.

Alternative Plan G (Proposed Action Alternative). On the basis of the model outputs, the Proposed Action Alternative would be expected to have essentially the same effects on water surface elevations in R.L. Harris Lake as described for Plan D.

APC Lakes (Coosa and Tallapoosa Rivers)—Lake Martin

No Action Alternative. Median daily water surface elevations for the No Action Alternative would generally match the guide curve elevations for the months of January through June. From July through mid-October, median pool elevations under the No Action Alternative would fall below the guide curve, with the largest deficit (about 1.2 ft) about September 1. From mid-October through December, water surface elevations would be expected to match the project guide curve. Daily water surface elevations at the 90 percent exceedance level over the period of record would match the project guide curve from January through mid-February. From mid-February through June, 90 percent exceedance pool levels would generally range from about one to two ft below the guide curve, peaking at an elevation of about 488.7 in early June. Thereafter, the pool elevations would gradually decline throughout the summer and early fall, ranging from about one to 3.6 ft below the project guide curve to an elevation about 482 ft by the end of November, returning to match guide curve elevations during the month of December. The lowest pool elevation that would be expected over the modeled period of record for the No Action Alternative would be about elevation 456.2 ft, or 23.8 ft below the winter guide curve level.

Alternative Plan D. With Plan D, median daily water surface elevations in Lake Martin would be expected to closely follow the guide curve the months of January through June. From July through mid-October, water surface elevations for Plan D would fall slightly below those for the No Action Alternative in the range of zero to 0.5 ft. From mid-October through December, water surface elevations for both Plan D and the No Action Alternative would match the project guide curve. Daily water surface elevations for Plan D at Lake Martin at the 90 percent exceedance level would be nearly equivalent to elevations for the No Action Alternative with the following difference. Between late April and mid-September, water surface elevations at the 90 percent exceedance level would be slightly lower than the No Action Alternative by amounts varying from zero up to about 0.8 ft. Thus, under extremely dry conditions in the basin, Lake Martin would be slightly lower than the No Action Alternative during the summer season under Plan D. The slight differences in water surface elevations (median and 90 percent exceeded) between Plan D and No Action are generally attributable to inclusion of a specific strategy for flows to support downstream navigation, when appropriate, coupled with specific drought management features for the basin that provide a more effective and clear guidelines governing releases to conserve storage under drought conditions, depending on the degree of severity of those conditions. The lowest pool elevation that would be expected with Plan D over the period of record would likely be about elevation 473.7 ft (6.3 ft below the winter guide curve level), reflecting an improvement of about 17.5 ft above the lowest level expected at Lake Martin for the No Action Alternative.

Alternative Plan F. Plan F would be expected to have essentially the same effects on water surface elevations in Lake Martin as described for Plan D.

Alternative Plan G (Proposed Action Alternative). On the basis of the model outputs, the Proposed Action Alternative would be expected to have essentially the same effects on water surface elevations in Lake Martin as described for Plan D.

R.E. "Bob" Woodruff Lake (Robert F. Henry Lock and Dam), William "Bill" Dannelly Lake (Millers Ferry Lock and Dam), and Claiborne Lake (Claiborne Lock and Dam)

No Action Alternative. With the No Action Alternative, R.E. "Bob" Woodruff Lake would likely operate at elevation 125 ft or greater about 93 percent of all days during the modeled period of record. For the remaining seven percent of the time over the modeled period, the pool elevation would be expected to vary between elevation 124 and 125 ft. For William "Bill" Dannelly Lake, the water surface elevation would likely be 80.4 ft or greater on about 94 percent of the days during the modeled period of record and would be expected to range between elevation 80.4 and 78 ft during the remaining 6 percent of the time. Those daily median elevations for the lakes are consistent and vary appreciably only during more extreme high-flow events (as high as elevation 129.8 ft for R.E. "Bob" Woodruff Lake and about elevation 82.7 ft for William "Bill" Dannelly Lake) and during more infrequent, drier periods that occur no more often than five to six percent of the time over the modeled period. Claiborne Lake, except for brief periods during high-flow conditions or extremely low-flow conditions, normally has a pool elevation of 36 ft. For brief periods, the lake can operate in the range between elevation 32 and 36 ft. Under extreme flood conditions, the water surface elevation at the lock and dam can temporarily rise as high as elevation 58 ft (1961 flood).

Alternative Plan D. With Plan D, R.E. "Bob" Woodruff Lake would likely operate at elevation 125 ft or greater on about 86 percent of all days over the modeled period of record. For the remaining 14 percent of the time, the pool elevation would be expected to vary between elevation 124 and 125 ft. About 86 percent of the time, pool elevations for the No Action Alternative and Plan D would be the same. During the remaining 14 percent of days over the period of record (generally representing drought conditions), pool levels under Plan D would be expected to be slightly lower than under the No Action Alternative. For William "Bill" Dannelly Lake, the water surface elevation under Plan D would likely be 80.4 ft or greater on about 87 percent of the days during the modeled period of record and would be expected to

range between elevation 80.4 and 78 ft during the remaining 13 percent of the time. In most of the remaining 13 percent of days over the period of record (generally representing drought conditions), pool levels with Plan D would be expected to be slightly lower the under the No Action Alternative. These differences associated with these rare occurrences are considered to be minor. That minor adverse effect under Plan D would be expected to extend through Claiborne Lake under drought conditions.

Alternative Plan F. Under Plan F, lake elevations for R.E. "Bob" Woodruff and William "Bill" Dannelly lakes over the modeled period of record would be essentially the same as with Plan D. Compared to the No Action Alternative, the effects of Plan F on water surface elevations at R.E. "Bob" Woodruff and William "Bill" Dannelly lakes would be negligible. Implementing Plan F would affect Claiborne Lake in the same manner as for Plan D.

Alternative Plan G (Proposed Action Alternative). With the Proposed Action Alternative, lake elevations for R.E. "Bob" Woodruff and William "Bill" Dannelly lakes over the modeled period of record would be essentially the same as with Plan D. Compared to the No Action Alternative, the effects of the Proposed Action Alternative on water surface elevations at R.E. "Bob" Woodruff and William "Bill" Dannelly lakes would be negligible. Implementing the Proposed Action Alternative would affect Claiborne Lake in the same manner as for Plan D.

Stream Flow Conditions in the ACT Basin

Coosawattee River downstream of Carters Reregulation Dam

No Action Alternative. Under the No Action Alternative, project operations at Carters Lake and Carters Reregulation Dam would continue as they are currently conducted to achieve federally authorized purposes. A continuous minimum release of 240 cfs from the reregulation dam is required. Over the modeled period of record, daily flows would be likely to exceed 1,000 cfs about 38 percent of the time and 300 cfs about 90 percent of the time. Flows would decline to the minimum release level of 240 cfs for the No Action Alternative on about seven percent of the days over the entire period of record.

Alternative Plan D. Median daily flows with Plan D over the modeled period of record, with minor deviations, would be essentially the same, with some minor deviations, as for the No Action Alternative. On the basis of the model results, inclusion of seasonally variable minimum flow targets in Plan D would not be expected to have appreciable effects on median flows over the period of record. At the 90 percent exceedance flow level, Plan D would be expected to meet the seasonally adjusted minimum flow releases throughout the year and, in some cases, would likely provide flows slightly above the monthly minimum flow targets. Thus, the seasonally adjusted minimum flow targets from the reregulation dam would likely be met in all but the most extreme drought occurrences. With Plan D, Coosawattee River flows downstream of Carters Reregulation Dam would be equal to those for the No Action Alternative on about 89 percent of days over the modeled period of record. For low-flow events that occur less than 10 percent of the time, flow levels with Plan D would likely be slightly improved compared to the No Action Alternative. Over the entire period of record, flows would be expected to decline to the minimum level of 240 cfs about four percent of time with Plan D and about eight percent of the time with the No Action Alternative, representing a substantial number of additional days during which the Carters Lake project would deliver flows above the minimum requirement of 240 cfs compared to the No Action Alternative. Plan D would successfully address the objective for seasonal minimum flows from Carters Reregulation Dam compared to the No Action Alternative with minimal effects on water surface elevations in Carters Lake and the Carters Reregulation Dam.

Alternative Plan F. Water management measures for Carters Lake in Plan F and in the Proposed Action Alternative are identical to those included in Plan D. Therefore, implementing Plan F would be expected

to have the same beneficial effects on flow conditions in the Coosawattee River downstream of Carters Reregulation Dam as Plan D.

Alternative Plan G (Proposed Action Alternative). Water management measures for Carters Lake in the Proposed Action Alternative are identical to those included in Plan D. The Proposed Action Alternative would be expected to have the same beneficial effects on flow conditions in the Coosawattee River downstream of Carters Reregulation Dam as Plan D.

Etowah River downstream of Allatoona Dam

No Action Alternative. With the No Action Alternative, model results over the modeled period of record indicate that median daily flows would likely range between 1,000 to 2,000 cfs through the year. Median daily flows from May through November exhibit a more uniform range (from about 1,200 to 1,800 cfs), indicating relatively consistent patterns of hydropower generation during those months. The highest median daily flows (about 2,000 cfs) would occur during the months of January, March, and mid-November through December. The 90 percent exceedance flow values for the No Action Alternative would be equal to the modeled minimum flow value downstream of Allatoona Dam (290 cfs), except for May and early December. Flows in May would be in the range of 700 to 800 cfs, and early December values would reach as high as 1,100 cfs. Both periods indicate that some hydropower generation consistently occurs even during extremely dry conditions. Daily flows would be expected to exceed 1,000 cfs on 73 percent of days over the period of record and exceed 290 cfs during 98 percent of days.

Alternative Plan D. Over the modeled period of record, median daily flows in the Etowah River downstream of Allatoona Dam would generally be expected to follow a pattern within a range of similar values as the No Action Alternative throughout the year. Exceptions would include lower median flows from mid-December through January and in the month of March and slightly higher flows in portions of September, October, and early December. The only noteworthy operational change at Allatoona Dam between the No Action Alternative and Plan D is the number and configuration of the action zones for the use of conservation storage in the lake, as described in the EIS. Compared to the No Action Alternative, flows at the 90 percent exceedance level for Plan D would be notably higher in portions of the months of December and January and higher (in the typical range of 400 cfs) in portions of the months of February through May. Otherwise, flow conditions from June through November at the 90 percent exceedance level would be essentially the same as the No Action Alternative. On an annual basis, the flow-duration curve with Plan D for the Etowah River downstream of Allatoona Dam would generally align, with minor deviations, with the curve for the No Action Alternative. Daily flows would be expected to exceed 1,000 cfs on 74 percent of days during the period of record and exceed 290 cfs during 82 percent of those days.

Alternative Plan F. Median daily flows downstream of Allatoona Dam with Plan F, with minor deviations, would likely follow the same seasonal pattern and similar values as Plan D from January through mid-August. Adding the phased fall drawdown feature coupled with the four-action zone configuration would result in daily flows in September that would range slightly higher than those with the No Action Alternative and Plan D (up to 300 cfs higher), slightly lower overall in October and November, and higher in December by up to 400 cfs. At 90 percent exceedance flow levels (representing extreme low flow conditions) Plan F would perform similarly to Plan D. Daily flows under Plan F would likely be notably higher in portions of the months of December and January and higher in portions of the months of February through May (in the typical range of 400 cfs). Otherwise, flow conditions from June through November at the 90 percent exceedance level would be essentially the same as the No Action Alternative. On an annual basis, the flow-duration curve with Plan F for the Etowah River downstream of Allatoona Dam would generally align, with minor deviations, with the curve for the No Action Alternative. Daily flows would be expected to exceed 1,000 cfs on 74 percent of days during the period of record and exceed 290 cfs during 81 percent of those days.

Alternative Plan G (Proposed Action Alternative). With the Proposed Action Alternative, median daily flows downstream of Allatoona Dam, with minor deviations, would likely follow the same seasonal pattern and similar values as Plan D from January through mid-August. Because of adding the phased fall drawdown feature coupled with the four-action zone configuration, and reduced hydropower during the fall drawdown period, median daily flows in the Etowah River under Plan G would be expected to be lower than the No Action Alternative and Plans D and F during the months of September through late November. The daily flows during this period may generally range from 100 to 500 cfs lower. From late November through December, flows would range higher than No Action and Plans D and F by about 200 to 400 cfs. At the 90 percent exceedance flow level, reflecting extreme low flow conditions, Plan G would perform similarly to Plan D. Daily flows under Plan G would likely be notably higher in portions of the months of December and January and higher in portions of the months of February through May (in the typical range of 400 cfs). Otherwise, flow conditions from June through November at the 90 percent exceedance level would be essentially the same as the No Action Alternative. Daily flows would be expected to exceed 1,000 cfs on 71 percent of days during the period of record (same as the No Action Alternative) and exceed 290 cfs during 83 percent of those days.

Coosa River at Rome, Georgia

No Action Alternative. Over the modeled period of record, median daily flows for the No Action Alternative would range from about 6,000 cfs in early January to a peak at about 10,300 cfs by early April. Median flows steadily decrease through late spring and summer months to a low of about 2,000 cfs in September and October. Thereafter, median daily flow increases to a level of about 5,200 cfs by the end of December. At the 90 percent exceedance level, flows for the No Action Alternative would range from about 3,000 cfs in January up to about 5,000 cfs in mid-March, generally declining to a minimum level of about 1,200 to 1,500 cfs in September. Daily flows at the 90 percent exceedance level would be expected to gradually increase to about 2,200 to 2,400 cfs by end of December. The annual flow-duration curve shows a maximum flow of 54,595 cfs, the minimum flow of 677 cfs, and the median annual flow would be 4,128 cfs.

Alternative Plan D. Median daily flows in the Coosa River at Rome with Plan D over the modeled period of record would be essentially the same as those with the No Action Alternative, with the exception of a minor deviation in October. During October, median daily flows with Plan D would likely decline slightly below flows for the No Action Alternative (in the general range of 300 cfs). At the 90 percent exceedance level, flows for Plan D would closely align with the No Action Alternative over most of the months of the year. In portions of March and in the lower flow period (August through October), Plan D would provide flows that would be slightly lower than the No Action Alternative (in the range of zero to ten percent). Plan D would produce slightly higher flows than the No Action Alternative during the month of May. That minor effect is principally associated with revisions to action zones at Allatoona Lake where declining lake levels into lower actions zones in the fall would be expected to dictate curtailed hydropower operations to conserve storage and, consequently, slightly reduced releases downstream. The annual flow-duration curve with Plan D is essentially the same as that for the No Action Alternative. On the basis of a review of model outputs over the modeled period of record, upstream changes in reservoir operations at Allatoona Lake and Carters Lake included in Plan D would not result in appreciable deviation in flow characteristics in the Coosa River at Rome compared to the No Action Alternative.

Alternative Plan F. Implementing Plan F would have essentially the same effects on flow characteristics in the Coosa River at Rome as those with Plan D.

Alternative Plan G (Proposed Action Alternative). With the Proposed Action Alternative, median daily flows in the Coosa River at Rome over the modeled period of record would be essentially the same as those for the No Action Alternative between January and the end of August. From September through about mid-November, median daily flows with the Proposed Action Alternative would likely decline

slightly below flows with the No Action Alternative. Median flows would be reduced in the range of 200 to a maximum of about 700 cfs during that period. From late November through December, median flows for the Proposed Action Alternative would increase above flows for the No Action Alternative. Flow differences during that period would be in the range of 150 to as much as 900 cfs higher than flows under the No Action Alternative.

At the 90 percent exceedance level, flows under Plan G would closely align with the No Action Alternative over most of the months of the year. In portions of March and in the lower flow period of August through October, Plan G would provide flows that would be lower than the No Action Alternative and slightly lower than Plans D and F. During the low flow period, flow reduction as a result of Plan G would be expected to generally range from zero to a maximum of about 20 percent compared to the No Action Alternative. Plan G would produce slightly higher flows than the No Action Alternative during the month of May and substantially higher flows during the month of December (up to about 25 percent higher).

Operational changes at upstream USACE projects included as part of the Proposed Action Alternative, particularly the water management measure to reduce hydropower generation at Allatoona Lake during the fall drawdown period, would somewhat shift releases in time over the period from September through December. However, according to model runs over the period of record, those adjustments are not expected to significantly affect the overall flow characteristics in the Coosa River at Rome compared to the No Action Alternative.

Alabama River at Montgomery, Alabama

No Action Alternative. For the No Action Alternative over the modeled period of record, median daily flows in early January would be about 21,000 to 25,000 cfs, gradually increasing to a peak at about 39,000 cfs by the end of March. Thereafter, median flows at Montgomery would decline rapidly during April through June to about 10,000 cfs by the end of June. Median flows would continue to trend downward to a minimum level of about 7,500 cfs in September. For the remainder of the year, median flows gradually increase to about 24,000 cfs by the end of December. At the 90 percent exceedance level for the Alabama River at Montgomery, flows would range from about 10,000 cfs in January up to about 17,000 cfs in March, generally declining to a minimum level of about 5,000 cfs by July. Flows would be expected to hold at that level until around mid-November, thereafter gradually increasing to about 10,000 cfs by the end of December.

Alternative Plan D. Median daily flows in the Alabama River at Montgomery with Plan D over the modeled period of record would, with minor deviations, track closely with those of the No Action Alternative. In October and November, median daily flows with Plan D would be slightly lower (ranging from zero to about ten percent lower) than flows with the No Action Alternative. In most of the remainder of the year, flows would tend to be almost equal to, or slightly higher, than flows under the No Action Alternative. At the 90 percent exceedance level, flows under Plan D would closely align with the No Action Alternative, except that Plan D flows would range from 0 to about 2,400 cfs higher between mid-April and mid-June. Between the months of July and mid-November, Plan D flows at the 90 percent exceedance level would be slightly lower than the No Action Alternative. These minor deviations are principally associated with adjustments in releases from APC's JBT projects that would address the navigation management and drought management strategies in Plan D. Plan D would be expected to meet the established combined minimum JBT release requirement of 4,640 cfs (weekly average) near Montgomery for non-drought conditions at least 96 percent of the time over the modeled period of record.

Alternative Plan F. On the basis of the model simulations over the period of record, implementing Plan F would be expected to have essentially the same effect on flow conditions in the Alabama River at Montgomery as Plan D.

Alternative Plan G (Proposed Action Alternative). Implementing the Proposed Action Alternative would be expected to have essentially the same effect on flow conditions in the Alabama River at Montgomery as Plan D.

Alabama River downstream of Claiborne Lock and Dam

Navigation reliability on the lower Alabama River between Claiborne Lock and Dam and the mouth of the river is correlated to flow values at Claiborne Lock and Dam and associated tail water stages, coupled with implementation of annual maintenance dredging of the navigation channel. The determination of those required flows, which vary seasonally, is discussed in detail in the EIS and Master Manual. For all alternatives presented herein, provision of a sufficient level of continued annual maintenance dredging is assumed. The reliability of navigation channel based on the degree to which the WCM alternatives can provide sufficient seasonal flows is discussed in the subsequent section of this Executive Summary addressing navigation conditions in the Alabama River.

No Action Alternative. With the No Action Alternative, median daily flows in the Alabama River downstream of Claiborne Lock and Dam and Lake over the modeled period of record for early January would be about 32,000 cfs, gradually increasing to a peak at slightly below 66,000 cfs by early April. Thereafter, median flows would decline rapidly through April and May to about 17,000 cfs by early June. Median flows would continue to trend downward to a minimum level of about 9,000 cfs by mid-September. For the remainder of the year, median flows gradually increase to about 32,000 cfs by the end of December. At the 90 percent exceedance level (representative of extremely dry conditions in the basin), flows would range from about 15,000 cfs in January up to 20,000 to 25,000 cfs in March, generally declining to minimum flow levels (6,600 cfs) by mid-June. Flows would be expected to hold at that level until around mid-November, thereafter gradually increasing to about 15,000 cfs by the end of December. Robert F. Henry Lock and Dam and Millers Ferry Lock and Dam have limited capability to reregulate flows sufficiently enough to have an appreciable effect on flows downstream of Claiborne Lock and Dam over time. The minimum flow target of 6,600 cfs for the Alabama River downstream of Claiborne Lock and Dam would be met 98 percent of the time over the modeled period of record with the No Action Alternative.

Alternative Plan D. Median daily flows in the Alabama River downstream of Claiborne Lock and Dam with Plan D over the modeled period of record would, with minor deviations, track closely with median flows for the No Action Alternative. In October and November, median daily flows with Plan D would be slightly lower than flows for the No Action Alternative. During most of the remainder of the year, flows would tend to be almost equal to, or slightly higher, than flows under the No Action Alternative. The water management measures in Plan D would represent adjustments to project operations to meet navigation needs when sufficient flows are available coupled with a specific strategy to terminate navigation flows and activate drought management operations with progressively stringent release criteria as conditions dictate. Those objectives would be at least partially met by Plan D without substantial change in the overall flow characteristics of the Alabama River downstream of Claiborne Lock and Dam. Plan D would be expected to meet the minimum flow target of 6,600 cfs for the Alabama River downstream of Claiborne Lock and Dam at least 95 percent of the time over the modeled period of record.

Alternative Plan F. Implementing Plan F would be expected to have the same effect on overall flow conditions in the Alabama River downstream of Claiborne Lock and Dam as with Plan D.

Alternative Plan G (Proposed Action Alternative). Implementing the Proposed Action Alternative would be expected to have the same effect on overall flow conditions in the Alabama River downstream of Claiborne Lock and Dam as with Plan D.

Drought Management

No Action Alternative. The No Action Alternative does not include a specific plan or strategy for operating USACE and APC projects in the ACT Basin under drought conditions. Drought conditions have been traditionally managed as they have occurred, and drought management actions have been coordinated among USACE, APC, the states, and key stakeholders. Statewide drought management plans have been developed in recent years to facilitate coordination of drought management activities, but they do not include specific drought plans for the projects in the ACT Basin.

Alternative Plan D. Plan D would be expected to trigger Drought Level 1 operations 122 times over the modeled period of record. Drought Level 1 would be expected to be triggered more than once in any year. Drought Levels 2 and 3 could be triggered much less frequently—26 and 5 occurrences, respectively, over the modeled period of record.

Alternative Plan F. Plan F would be expected to provide the essentially the same results as Plan D with respect to drought management provisions for the ACT Basin. Incorporating the fall phased drawdown guide curve configuration at Allatoona Lake would contribute to a slight decrease in the number of Drought Level 1 occurrences compared to Plan D (122 versus 119) but no change to the number of occurrences for Drought Levels 2 and 3 over the modeled period of record.

Alternative Plan G (Proposed Action Alternative). The Proposed Action Alternative would be expected to provide the similar results as Plan D with respect to drought management provisions for the ACT Basin. Drought Level 2 occurrences would be expected to slightly increase (26 to 30 occurrences) over the period of record; the percent of time under Drought Levels 1 and 2 would slightly increase on the basis of a marginal increase in the times when the state line flow trigger would be exceeded.

Navigation Conditions—Alabama River

No Action Alternative. With all the alternatives, model results were reviewed to assess conditions that would support commercial navigation on the Alabama River over the entire period of hydrologic record (1939–2011) and over the 37-year period of record (1975–2011) during which the navigation infrastructure on the Alabama River upstream to Montgomery was fully constructed and operational. Review of the 37-year period of record enabled comparison to observed navigation conditions over the period. Observed values generally reflect a lower number of years in which 9-ft depths were actually available than the modeled results for the No Action Alternative. In some months, the numbers were substantially lower. The differences in channel availability are likely to be primarily the result of (1) limited and variable seasonal maintenance dredging driven by limited funding and declines in commercial traffic, and (2) the model's ability to more precisely operate the system according to the established rules, whereas actual operations might not have had the same procedural clarity. Further, seasonal flow requirements below APC projects at Montgomery that are necessary to adequately support downstream channel depths have not been well documented in the past. The model results for the 73-year period of hydrologic record and the shorter 37-year navigation period of record yielded relatively similar results in terms of navigation channel reliability over the two periods. Therefore, this summary addresses model results over the longer period of record.

With the No Action Alternative, model outputs indicate that flows between December and May would likely provide for a 9-ft navigation channel in 44 or more years over the modeled period (61 or more years between January and March). However, even with seasonal dredging of the navigation channel, 9-ft channel depths would likely be considerably less available between June and November, ranging from 32 of 73 years for June to as low as 11 of 73 years for September. Flows sufficient to support full 9-ft channel depths would be expected to be available at least 85 percent of the days in December through May. The percent of time that flows would likely exceed those necessary to sustain 9-ft channel depths

would gradually decline from June through September, ranging from 74 percent for June to about 53 percent for September. For October and November, the percent of time that target navigation flows for those months would be exceeded would likely be about 66 percent and 79 percent, respectively.

The number of years that a minimum 7.5-ft navigation channel would likely be available under the No Action Alternative over the period of record represents a notable increase over the availability of a 9-ft channel, particularly in April through June and November through December. Nonetheless, under the No Action Alternative, the number of years during which flows to support a minimum 7.5-ft channel depth would likely remain relatively low for July through October, dropping as low as 13 of 73 years for September. Flows sufficient to support a minimum 7.5-ft channel would be expected to be available at least 91 percent of the days in December through May. The percent of time that flows would likely exceed those necessary to sustain a 7.5-ft channel depth would gradually decline from June through September, ranging from 81 percent for June to about 60 percent for September. For October and November, the percent of time that target navigation flows would be exceeded would likely be about 71 percent and 83 percent, respectively.

Under the No Action Alternative, navigation channel conditions would be likely to continue to deteriorate, and commercial navigation use of the Alabama River would likely continue its decline.

Alternative Plan D. For the entire modeled period of record, operations under Plan D would likely result in an appreciable overall increase in the number of years during which a full 9-ft navigation channel would be available compared to the No Action Alternative. The increase would be particularly significant in April through October. Availability of full 9-ft navigation depth during those months would likely increase by a range from 10 years (for September) to 25 years (for August). The simulation results also indicate that more modest increases over the No Action Alternative would likely occur in most of the remaining months (November through March), when navigation channel availability is already relatively high under existing conditions.

Under Plan D, the availability of 7.5-ft channel depths (by month) over the entire modeled period of record would follow a similar pattern to that of the 9-ft channel. Plan D would be expected to provide sufficient flows to support a minimum 7.5-ft navigation channel from December through June during at least 80 percent of the 73 years modeled. Plan D would likely result in an appreciable increase in availability of the 7.5-ft channel depth in May through October compared to the No Action Alternative. Availability of the 7.5-ft navigation depth in those months would likely increase by a range from 13 years (for May) to 24 years (for August) compared to the No Action Alternative. More modest increases over the No Action Alternative would likely occur in most of the remaining months (November through April).

Over the simulated period of record, the percent of time that flows downstream of Claiborne Lock and Dam and Lake would be expected to exceed the levels needed to support both 9 and 7.5-ft channel depths in the Alabama River would increase under Plan D compared to the No Action Alternative. The increase is likely to be most notable in May through August for both navigation depths, where increases ranging from eight to 11 percent above the No Action Alternative would be expected for 9-ft depths according to the model results and four to nine percent for 7.5-ft depths. More modest increases would likely occur in the remaining eight months of the year. Key features incorporated into Plan D—establishing updated and more realistic flow targets to support navigation, coupled with drought plan triggers and operating protocols to better identify and respond to conditions in the ACT Basin under which navigation flows cannot be sustained—would result in improved management of the basin to meet navigation objectives on balance with other water resource objectives and requirements.

Alternative Plan F. Plan F would be expected to have the same effects as Plan D on the availability of navigation channel depths at the 9-ft and 7.5-ft levels in the Alabama River downstream of Montgomery,

except for marginal deviations between October and December. Those deviations relate to changes in releases from Allatoona Lake associated with the fall phased down guide curve, and the effects would be inconsequential to navigation.

Alternative Plan G (Proposed Action Alternative). The Proposed Action Alternative would be expected to have the same effects as Plan D on the availability of navigation channel depths at the 9-ft and 7.5-ft levels in the Alabama River downstream of Montgomery, except for marginal deviations between October and December. Those deviations relate to changes in releases from Allatoona Lake associated with the fall phased down guide curve and the reduced hydropower generation during the fall drawdown. Those effects would be inconsequential to downstream navigation.

Water Withdrawals

No Action Alternative. Existing information was reviewed to determine if current operating conditions for ACT Basin projects, even under record drought conditions (e.g., 2007–2008), might have imposed unacceptable effects or constraints on water withdrawals or associated intake structures. The No Action Alternative would not be expected to result in such effects on existing M&I water withdrawals in the ACT reservoirs or along the primary rivers of the ACT Basin. The No Action Alternative reflects the M&I water withdrawals that were actually made in 2006 from the ACT reservoirs and along the primary rivers of the ACT basin. However, as discussed in section 4.2.6 and Appendix C, the available storage under existing water supply agreements at USACE reservoirs may not be sufficient to accommodate the 2006 level of water supply withdrawals under all conditions.

Alternative Plan D. Water management measures incorporated into Plan D would generally improve lake level conditions under extreme drought conditions compared to the No Action Alternative. Thus, water withdrawals and intake structures would be less vulnerable under Plan D. Plan D would not likely change flow conditions in the rivers enough to increase the vulnerability of existing water withdrawals to low water conditions. The amount of storage made available by USACE in its reservoirs for water supply is unchanged under the alternative, and the alternative assumes that water supply users would make full use of that storage to satisfy anticipated water supply needs. However, as discussed in section 4.2.6 and Appendix C, the available storage under existing water supply agreements at USACE reservoirs may not be sufficient under all conditions to accommodate the 2006 level of water supply withdrawals from those reservoirs. Alternative Plan D assumes that withdrawals from USACE reservoirs would be limited to the amount available in water supply storage under existing agreements, as measured by the storage accounting methodology that the USACE currently employs at those reservoirs.

Alternative Plan F. Plan F would likely have similar effects as Plan D. Implementing Plan F would not be expected to have any effect on existing M&I water withdrawals in the ACT reservoirs or along the primary rivers of the ACT Basin. The amount of storage made available by USACE in its reservoirs for water supply is unchanged under the alternative, and the alternative assumes that water supply users would make full use of that storage to satisfy anticipated water supply needs. However, as discussed in section 4.2.6 and Appendix C, the available storage under existing water supply agreements at USACE reservoirs may not be sufficient under all conditions to accommodate the current (2006) level of water supply withdrawals from those reservoirs. Alternative Plan F assumes that withdrawals from USACE reservoirs would be limited to the amount available in water supply storage under existing agreements, as measured by the storage accounting methodology that the USACE currently employs at those reservoirs.

Alternative Plan G (Proposed Action Alternative). The Proposed Action Alternative would likely have similar effects as Plan D. Implementing the Proposed Action Alternative would not be expected to have any effect on existing M&I water withdrawals in the ACT reservoirs or along the primary rivers of the ACT Basin. The amount of storage made available by USACE in its reservoirs for water supply is

unchanged under the alternative, and the alternative assumes that water supply users would make full use of that storage to satisfy anticipated water supply needs. However, as discussed in section 4.2.6 and Appendix C, the available storage under existing water supply agreements at USACE reservoirs may not be sufficient under all condition to accommodate the current (2006) level of water supply withdrawals from those reservoirs. The Proposed Action Alternative assumes that withdrawals from USACE reservoirs would be limited to the amount available in water supply storage under existing agreements, as measured by the storage accounting methodology that the USACE currently employs at those reservoirs.

Water Quality

The HEC-5Q model was linked with the HEC-ResSim model and used to evaluate the effects of ACT project operations on basin water quality. The benefit of using the HEC-5Q model is its ability to simulate the entire riverine and reservoir system in a single model. The HEC-5Q model includes both point source and nonpoint source loads, which consist of BOD, nitrogen, phosphorous, and DO. The modeled period was 2001-2008 to represent the recent point and nonpoint contributions. The purpose of simulating conditions over this period was not to capture historical changes in water quality; rather, the intent was to capture the range of potential hydrologic conditions that influence water quality. The modeled period includes wet, dry, and normal flow conditions, which allows a display of the water quality response to varying hydrologic conditions.

No Action Alternative. Under the No Action Alternative, water quality would be expected to improve from existing conditions. Georgia would be expected to more precisely define the ACT system's assimilative capacity as part of the Georgia Statewide Water Plan. Alabama would be expected to manage resources consistent with current regulations by developing wasteload allocations, managing its National Pollutant Discharge Elimination System (NPDES) program, and controlling nonpoint sources. APC would be expected to continue to comply with its regulatory requirements.

Alternative Plan D

Understanding that management of water quality is an adaptive process, the overall effect of Plan D on water quality would be expected to be negligible. Similar to the No Action Alternative, states would be expected to more precisely define the ACT system's assimilative capacity by managing resources consistent with current regulations defined by their NPDES program and water quality standards. The water quality modeling presented in this EIS assumed there were no changes in loads from point source discharges between alternatives. That was assumed to predict the change from the No Action Alternative for various alternatives. However, under low-flow conditions, some NPDES permits limit point source discharges, and permit conditions may be temporarily changed during extreme low-flow conditions. Water management activities may affect water quality under low flow conditions such that the state regulatory agency may consider reevaluation of NPDES permits to confirm the system's assimilative capacity. As in past years of low-flow conditions, water users can coordinate directly with USACE to notify USACE of their needs. USACE will periodically notify users when releases are made during these low-flow conditions.

Water Temperature. The proposed operational changes between Plan D and other alternatives evaluated would be negligible; little effect would be expected on water temperature between alternatives.

Oxygen Demand. The proposed operational changes between Plan D and other alternatives evaluated would be expected to have a negligible effect on dissolved oxygen (DO) for much of the ACT Basin. During dry-weather conditions, similar to 2007, DO could be reduced because of changes in stream flow and the ability to assimilate nutrients when compared to the No Action Alternative, but again, the difference would be negligible.

Phosphorus. The proposed operational changes between Plan D and other alternatives evaluated would be negligible in much of the ACT Basin.

In 2008 a 0.06 milligram per liter (mg/L) median growing season total phosphorus target was set by USEPA, Alabama Department of Environmental Management (ADEM), and Georgia Environmental Protection Division (EPD) in a Weiss Lake total maximum daily load. Median total phosphorus upstream of Weiss Lake over the modeled period would be expected to fluctuate but would not be expected to increase by more than 0.005 mg/L. In periods of dry weather, total phosphorus concentrations in Alternative D are less than, or equal to, the No Action Alternative throughout most of the ACT Basin.

Nitrogen. The concern for nitrogen is similar to phosphorus, in that it influences algal growth, but it also more directly influences DO. For that reason, ammonia and nitrate, components of total nitrogen, are often regulated in point source discharges. Generally, the greatest changes in nitrogen would be expected during dry-weather conditions when drought operations are triggered. Similar to total phosphorus, total nitrogen concentrations are expected to decrease in Plan D as compared to the No Action Alternative during the growing season critical period.

Chlorophyll a. Little change in chlorophyll *a* would be expected in the ACT Basin over a period of various flow conditions during the growing season.

The proposed operational changes between Plan D and other alternatives evaluated are negligible in much of the ACT Basin. The difference between the alternatives evaluated is the greatest in the Coosa River and upstream of Weiss Lake during periods of dry weather. According to modeled results, Weiss Lake would be expected to experience a notable increase in median chlorophyll *a* of over 40 micrograms per liter (µg/L) at the upstream portion of the lake during dry years because of a shift in the location of peaking chlorophyll *a* concentrations. That degree of change in chlorophyll *a* illustrates the system's limited ability to assimilate nutrient loads under drought conditions. Overall, for the most critical year (2007 - the year with highest predicted chlorophyll *a*), the growing season chlorophyll *a* in Weiss Lake near the Stateline decreased when compared to the No Action Alternative.

Alternative Plan F

Managing water quality is adaptive. As stream flows change, a waterbody's ability to assimilate pollutants is changed. The overall effect of Plan F on water quality would be expected to be negligible. Similar to the No Action Alternative, states would be expected to more precisely define the ACT system's assimilative capacity by managing resources consistent with current regulations defined by their NPDES program and water quality standards.

Water Temperature. The proposed operational changes in Plan F would be expected to have little effect on water temperature in the ACT Basin. The difference between the alternatives evaluated is rarely greater than 0.9 °F (0.4 °C) throughout the system.

Oxygen Demand. Similar to Plan D, the proposed operational changes in Plan F would be expected to have little effect on DO in the ACT Basin. Depressed DO during extreme dry-weather conditions would be the expected result of changing the timing and quantity of stream flows, which would be expected to affect the system's ability to assimilate nutrients.

Phosphorus. Similar to Plan D, the proposed operational changes between Plan F and other alternatives evaluated would be negligible in much of the ACT Basin.

Nitrogen. Similar to Plan D, the proposed operational changes in Plan F would be expected to have a negligible effect on nitrogen when compared with other parameters. Similar to phosphorus, median total

nitrogen concentrations are expected to be lower in Plan F compared to the No Action Alternative with the exception of the Coosawattee and Alabama rivers, where median concentrations will be slightly higher particularly in dry-weather years.

Chlorophyll a. Similar to Plan D, the proposed operational changes between Plan F and other alternatives evaluated would be negligible in much of the ACT Basin. Overall, for the most critical year (2007 - the year with highest predicted chlorophyll *a*), the growing season chlorophyll *a* in Weiss Lake near the Stateline decreased when compared to the No Action Alternative.

Alternative Plan G (Proposed Action Alternative)

The overall effect of the Proposed Action Alternative on water quality would be expected to be negligible. State agencies would continue to apply adaptive management techniques to more precisely define the ACT system's assimilative capacity. Water management activities may affect water quality under low flow conditions such that the state regulatory agencies may consider reevaluation of NPDES permits to confirm the system's assimilative capacity.

Water Temperature. The operational changes in the Proposed Action Alternative would be expected to have little effect on water temperature in the ACT Basin.

Oxygen Demand. The operational changes in the Proposed Action Alternative would be expected to have variable results in the ACT Basin. The greatest changes in median DO would be expected during dry-weather conditions. The timing and quantity of flow influence the system's ability to assimilate oxygen-demanding pollutants that results in changes in DO. During low-flow conditions, some NPDES permits limit point source discharges, and permit conditions may be temporarily changed during extreme low-flow conditions.

Phosphorus. The operational changes in the Proposed Action Alternative would be expected to have a negligible effect on median total phosphorus over a period of various flow conditions (wet, dry, and normal).

Nitrogen. The operational changes in the Proposed Action Alternative would be similar to Plan D. Although nitrogen would be expected to have a negligible effect when compared with other water quality parameters.

Chlorophyll a. The operational changes in the Proposed Action Alternative would be expected to have a negligible effect on algal growth over a period of various flow conditions (wet, dry, and normal). As with other alternatives, during periods of dry weather, changes in median total phosphorus from the No Action Alternative would be expected to influence algal growth. Therefore, the Proposed Action Alternative would be expected to increase algal growth in the headwaters of Weiss Lake. However, for the most critical year (2007 - the year with highest predicted chlorophyll *a*), the growing season chlorophyll *a* in Weiss Lake near the Stateline decreased when compared to the No Action Alternative.

Geology and Soils

No Action Alternative. Shoreline erosion trends on Allatoona Lake indicate that the highest rates occurred during the first 30 years since impoundment and have slowed since. That change in rate is due to the winnowing of fine soil particles by wave action over the first several years since impoundment. Left behind are more robust gravel, cobble, and bedrock shorelines that have become more erosion resistant as time passed. Under the No Action Alternative, it is likely that the Allatoona Lake shoreline will continue to erode at the present rate, and lake sedimentation will continue at the present rate. Because of the topography and geology/soil conditions at Carters Lake, shoreline erosion and lake sedimentation is not

considered to be an appreciable issue under the No Action Alternative. The FERC EA (FERC 2009) in support of the new license for the APC Coosa River reservoirs (June 2013) addresses specific measures the APC will take to address erosion "hot spots" associated with current operations in the basin.

Alternative Plan D. Plan D would have no quantifiable effect on shoreline erosion or lake sedimentation at Allatoona Lake, Carters Lake, or the APC reservoirs in the basin compared to the No Action Alternative and, thus, is not a concern for geology and soils.

Alternative Plan F. Plan F would not have an appreciable effect on shoreline erosion or lake sedimentation at Allatoona Lake, Carters Lake, or the APC reservoirs in the basin compared to the No Action Alternative. The phased guide curve at Allatoona Lake would create a longer period, approximately 5 weeks longer than the current condition, when the pool would be held at 835 ft. That would create a possibility of slightly increased shoreline erosion at elevation 835 ft and just above it.

Alternative Plan G (Proposed Action Alternative). The Proposed Action Alternative would not have an appreciable effect on shoreline erosion or lake sedimentation at Allatoona Lake, Carters Lake, or the APC reservoirs in the basin compared to the No Action Alternative. The phased guide curve at Allatoona Lake would create a longer period, approximately 5 weeks longer than the current condition, when the pool would be held at 835 ft. That would create a possibility of slightly increased shoreline erosion at elevation 835 ft and just above it.

Climate Change

No Action Alternative. No greenhouse gas (GHG) emissions would be associated with implementing the No Action Alternative. The alternative would not have any direct effect on the climate and would not contribute to global warming. Although there would be no direct effects, the No Action Alternative would constitute a less conservative approach to water management under future conditions associated with climate and sea level rise when compared to other proposed alternatives. Future project operations under the plan may be affected by conditions related to climate change. Long-term moderate adverse effects would be expected. Those would be indirect effects on water resources and water management within the framework of future climate scenarios.

Alternative Plan D. No GHG emissions would be associated with Plan D, and the plan would not have any direct effect on the climate or contribute to global warming. Future project operations under the plan may be affected by conditions related to climate change. Long-term minor beneficial effects would be expected. Those would be indirect effects on water resources and water management within the framework of future climate scenarios. Implementing Plan D would constitute a more effective approach to water management under future conditions associated with reductions in available precipitation when compared to the No Action Alternative.

Alternative Plan F. No GHG emissions would be associated with Plan F, and the plan would not have any direct effect on the climate or contribute to global warming. Future project operations under the plan may be affected by conditions related to climate change. Long-term minor beneficial effects would be expected. Those would be indirect effects on water resources and water management within the framework of future climate scenarios. Implementing Plan F would constitute a more effective approach to water management under future conditions associated with reductions in available precipitation when compared to the No Action Alternative.

Alternative Plan G (Proposed Action Alternative). No GHG emissions would be associated with Plan G, and the plan would not have any direct effect on the climate or contribute to global warming. Future project operations under the plan may be affected by conditions related to climate change. Long-term minor beneficial effects would be expected. Those would be indirect effects on water resources and water

management within the framework of future climate scenarios. Implementing the Proposed Action Alternative would constitute a more effective approach to water management under future conditions associated with reductions in available precipitation when compared to the No Action Alternative.

Land Use

No Action Alternative. No effects would be expected. The No Action Alternative would see the continuation of the current water control operations at each of the federal projects in the ACT Basin; the current action zones would be assumed to remain in effect unchanged. Therefore, effects on land use would be expected to be the same as they have been in the past, with deviations in lake elevations caused by seasonal and yearly variations in flow and climatic conditions.

Alternative Plan D

Allatoona Lake. Long-term minor beneficial effects would be expected. Under Plan D, USACE would not modify the guide curve (normal pool elevation) of 840 ft, but it would modify the lake's action zones from two zones to four zones, with the four action zones shaped to mimic the seasonal demands for hydropower. The action zones would be used to manage the lake at the highest level possible for recreation and other purposes. Implementing Plan D would not change Allatoona Lake's shoreline land use allocations or zoning around the lake and, therefore, would not affect land use compatibility.

During a very dry year (i.e., infrequent occurrences representative of drought conditions) the lake elevation could range from a low of about 818 ft in the winter to high of about 834 ft in the spring. Normal pool elevation is 840 ft. The lower lake elevations during a drought have minor to significant effects on land use. Changes in lake elevation would not change the lake's shoreline land use allocations but would make the land use less desirable. Effects would range from minor, where the exposed shoreline and lower water levels would reduce the usability of these areas for their intended land use (such as public recreation and limited development for boat docks), to severe where the shoreline could not be used for its intended use, such as public recreation, limited development, or protected shoreline land use because of exposed shoreline and lake bed and impaired water access.

Carters Lake. No adverse effects on land use would be expected from implementing the Plan D WCM update. Under Plan D, the proposed WCM measures would not modify the guide curve (normal pool elevation) of 1,074 ft in the summer and 1,072 ft in the winter, but they would include the use of two action zones. The action zones would be used to manage downstream releases to improve conditions for fish and wildlife conservation. Implementing Plan D would not change Carters Lake shoreline land use or zoning around the lake and therefore would not affect land use compatibility.

Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake. No effects would be expected. The Robert F. Henry Lock and Dam project is a run-of-river project. Lake levels are typically fairly stable with minimal fluctuation. Plan D would not change the operation of the Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake. It would continue to be operated as a run-of-river project with R.E. "Bob" Woodruff Lake's normal pool elevation maintained at about 125 ft.

Millers Ferry Lock and Dam and William "Bill" Dannelly Lake. No effects would be expected. The Millers Ferry project is a run-of-river project. Lake levels are typically fairly stable with minimal fluctuation. Plan D would not change the operation of Millers Ferry Lock and Dam or William "Bill" Dannelly Lake.

Claiborne Lock and Dam and Lake. No effects would be expected. Claiborne Lock and Dam and Lake is operated as a run-of-river project and remains mostly within the original river banks. Plan D would not

change the operation of Claiborne Lock and Dam and Lake. It would continue to be operated as a run-of-river project with normal pool elevation maintained at about 36 ft.

Non-USACE-Owned Projects. Long-term minor beneficial effects would be expected. Plan D drought plan measures would likely result in improved flow conditions at both APC and USACE projects. The improvement in flow would represent a beneficial impact during drought.

Alternative Plan F

Plan F effects on land use would be similar to those stated above for Plan D. The proposed measures for Allatoona Lake operations would provide for more effective management of conservation storage and would likely provide for an overall improvement in lake levels, particularly under drier conditions. The Plan F proposal to implement a phased guide curve in the fall season would further benefit land use by extending the fall lake drawdown over a longer period, sustaining the lake at a higher level through mid-November, as compared to the No Action Alternative. Plan F proposed management measures would not be likely to have an appreciable effect on land use of Carters Lake because the Carters Lake pool daily median elevation would be expected to be about the same as under the No Action Alternative. Plan F drought plan measures would likely provide for improved conditions in APC lakes and USACE projects downstream of Allatoona Lake and Carters Lake that would be beneficial to land use during drought occurrences.

Alternative Plan G (Proposed Action Alternative)

Under the Proposed Action Alternative, effects on land use would be similar to those for Plans D and F. As with Alternative F, proposed measures for Allatoona Lake operations would provide for more effective management of conservation storage and would likely provide for an overall improvement in lake levels, particularly under drier conditions. The Proposed Action Alternative would implement a phased guide curve in the fall season, which would further benefit land use by extending the fall lake drawdown over a longer period, sustaining the lake at a higher level through mid-November, as compared to the No Action Alternative. The Proposed Action Alternative's additional measure to reduce hydropower production for September through November to facilitate the fall phased drawdown would likely provide additional improvement to fall lake levels, as compared to the No Action Alternative. The Proposed Action Alternative management measures would not likely have an appreciable effect on land use of Carters Lake because the Carters Lake pool daily average elevation would be expected to be about the same as under the No Action Alternative. The Proposed Action Alternative drought plan measures would likely provide for improved conditions in APC lakes and USACE projects downstream of Allatoona Lake and Carters Lake that would be beneficial to land use during drought occurrences.

Biological Resources

Vegetation – Etowah River from Allatoona Lake to Rome

No Action Alternative. There would be no change in the degree of floodplain (lateral) connectivity under the No Action Alternative and, thus, no adverse effects on riparian, wetland, or submerged aquatic vegetation in the lake or downstream of the lake.

Alternative Plan D. The median surface elevation of Allatoona Lake under Plan D closely tracks that of the No Action Alternative (baseline). An occasional reduction of discharge from the dam by up to 800 cfs would not be expected to adversely affect the riparian, wetland, or submerged aquatic vegetation in this portion of the ACT Basin.

Alternative Plan F. Surface elevation in Allatoona Lake and median daily discharge in the Etowah River downstream of Allatoona Lake to Rome, Georgia, under Plan F would be similar to those for Plan D, with minor differences that would not be expected to adversely affect riparian, wetland, or submerged aquatic vegetation in this portion of the basin.

Alternative Plan G (Proposed Action Alternative). Plan G would be have essentially the same effect as alternatives D and F on riparian, wetland, and submerged aquatic vegetation in Allatoona Lake and downstream of the dam..

Vegetation – Coosawattee and Oostanaula Rivers from Carters Lake to Rome

No Action Alternative. There would be no change in the degree of floodplain (lateral) connectivity under the No Action Alternative, and thus, no adverse effects on riparian, wetland, and submerged aquatic vegetation would be expected on Carters Lake and downstream to Rome, Georgia.

Alternative Plan D. Compared to the No Action Alternative, vegetative resources would not likely be affected as a result of minor changes in lake level and downstream releases attributable to Plan D.

Alternative Plan F. No effects on vegetative resources would be expected as a result of changes in lake level and downstream releases attributable to Plan F.

Alternative Plan G (Proposed Action Alternative). No effects on vegetative resources would be expected as a result of changes in lake level and downstream releases attributable to Plan G.

Vegetation – Coosa River

The alternative WCM revisions considered in this EIS result in potential effects on water surface elevations in APC reservoirs on the Coosa River that include conservation storage (Weiss, H. Neely Henry, and Logan Martin lakes). Median daily water surface elevations at these reservoirs for Plans D, F, and G are sometimes higher or lower than for the No Action Plan, but never differ from the No Action Plan by more than two ft. The other APC projects on the Coosa River (Jordan Dam and Lake, Bouldin Dam, Lay Lake, and Mitchell Lake) essentially operate as run-of-river facilities, and the alternative WCM revisions would have a negligible effect on the water surface elevations of those reservoirs.

No Action Alternative. There would be no change in the degree of floodplain (lateral) connectivity under the No Action Alternative, and thus, no adverse effects on riparian, wetland, or submerged aquatic vegetation would be expected in the reservoirs or downstream of reservoirs in the Coosa River.

Alternative Plan D. Plan D would produce nearly identical results in median daily discharge to the Coosa River at Rome, Georgia, and in the APC lakes on the Coosa River as the No Action Alternative, with some minor variations occurring from October to December. No adverse effects on the riparian, wetland, or submerged aquatic vegetation would be expected in the reservoirs or downstream of reservoirs in the Coosa River as a result of Plan D.

Alternative Plan F. As flow and lake level conditions along the Coosa River would be nearly identical to those of Plan D, no effects on the vegetative resources of the Coosa River would be expected from implementing Plan F.

Alternative Plan G (Proposed Action Alternative). A minor effect on river dynamics could be produced by implementing Plan G, but no effects on the vegetative resources of the Coosa River would be expected.

Vegetation – Alabama River

No Action Alternative. There would be no change in the degree of floodplain (lateral) connectivity under the No Action Alternative, and thus, no adverse effects on riparian, wetland, or submerged aquatic vegetation would be expected in the Alabama River.

Alternative Plan D. No effects on the vegetative resources of the Alabama River would be expected from implementing Plan D.

Alternative Plan F. No effects on the vegetative resources of the Alabama River would be expected from implementing Plan F.

Alternative Plan G (Proposed Action Alternative). No effects on the vegetative resources of the Alabama River would be expected from implementing Plan G.

Vegetation – Tallapoosa River

The alternative WCM revisions considered in this EIS result in potential effects on water surface elevations in APC reservoirs on the Tallapoosa River that include conservation storage (R.L. Harris Lake and Lake Martin). Median daily water surface elevations in R.L. Harris Lake over the modeled period of record would be essentially equivalent to the median daily elevations for the No Action Alternative and median daily water surface elevations at Lake Martin for Plans D, F, and G are sometimes lower than for the No Action Alternative, but never differ from the No Action Alternative by more than 0.5 ft. The other APC projects on the Tallapoosa River (Yates and Thurlow lakes) essentially operate as run-of-river facilities, and the alternative WCM revisions would have a negligible effect on the water surface elevations of those reservoirs.

No Action Alternative. There would be no change in the degree of floodplain (lateral) connectivity under the No Action Alternative, and thus, no adverse effects on riparian, wetland, and submerged aquatic vegetation would be expected in the Tallapoosa River.

Alternative Plan D. Median daily flows on the Tallapoosa River were not modeled, but it can be inferred from the negligible difference in water surface elevations on the reservoirs that changes in flows downstream of the reservoirs would also be negligible for Plan D. No effects on riparian, wetland, and submerged aquatic vegetation of the Tallapoosa River would be expected from implementing Plan D.

Alternative Plan F. The effects of implementing Plan F on the Tallapoosa River would be virtually the same as those of implementing Plan D. No effects on the vegetative resources of the Tallapoosa River would be expected from implementing Plan F.

Alternative Plan G (Proposed Action Alternative). The effects of implementing Plan G on the Tallapoosa River would be virtually the same as those of implementing Plan D. No effects on the vegetative resources of the Tallapoosa River would be expected from implementing Plan G.

Wildlife – Etowah River from Allatoona Lake to Rome

The effects of implementing the No Action Alternative and Plans D, F, and G on non-aquatic wildlife resources would be expected to be negligible. The primary mechanism by which wildlife resources could be affected by implementing the alternative WCM revisions is through an effect on water quality. The analyses of effects on wildlife resources below, therefore, rely on the analysis of water quality effects, and adverse effects would not be expected from minor changes in water quality.

No Action Alternative. There would be negligible change in water quality conditions under the No Action Alternative, and thus, any effects on wildlife resources in the Etowah River to Rome, Georgia reach would not be expected to be adverse.

Alternative Plan D. The evaluations of water quality conducted for the EIS indicate that some changes in water quality parameters in the Etowah River could be expected under Plan D. Overall, however, changes in water quality in the Etowah River under Plan D would be expected to have no adverse effect on wildlife resources.

Alternative Plan F. The assessment of effects stated above for Plan D applies equally to Plan F, and thus, would be expected to have no adverse effect on wildlife resources.

Alternative Plan G (Proposed Action Alternative). The assessment of effects above for Plan D apply equally to Plan G and, thus, would be expected to have no adverse effect on wildlife resources.

Wildlife – Coosawattee and Oostanaula Rivers to Rome

No Action Alternative. There would be negligible change in water quality conditions under the No Action Alternative, and thus, no adverse effects on aquatic wildlife resources would be expected in the Coosawattee and Oostanaula Rivers from Carters Lake to Rome, Georgia.

Alternative Plan D. The drought plan implemented under Plan D would decrease DO downstream of Carters Lake, with the greatest variations in DO occurring in dry years from May through October. DO would recover to concentrations near those modeled for the No Action Alternative about 20 mi downstream of the dam. The lowest concentrations of DO downstream of Carters Lake would be expected to remain above concentrations critical to biological resources. Median water temperatures downstream of the confluence of the Coosawattee and Oostanaula Rivers would be expected to decrease by nearly 0.9 °F (0.5 °C) in dry-weather conditions. Changes in water temperature in the Coosawattee River would be expected to have no adverse effects on wildlife resources.

Alternative Plan F. The assessment of effects stated above for Plan D applies equally to Plan F, and thus, no adverse effects on wildlife resources would be expected in the Coosawattee and Oostanaula Rivers from Carters Lake to Rome, Georgia.

Alternative Plan G (Proposed Action Alternative). The assessment of effects stated above for Plan D applies equally to Plan G, and thus, no adverse effects on wildlife resources would be expected in the Coosawattee and Oostanaula Rivers from Carters Lake to Rome, Georgia.

Wildlife – Coosa River

No Action Alternative. There would be negligible change in water quality conditions under the No Action Alternative, and thus, no adverse effects on wildlife resources would be expected in the Coosa River.

Alternative Plan D. The greatest changes from the No Action Alternative in biochemical oxygen demand would be expected in the upper Coosa River. Nitrogen on the Coosa River would be elevated upstream of Weiss Lake and then drop downstream of Weiss Lake under Plan D, most likely in response to algal growth and dilution of point source loads. Although median DO would be expected to decrease from the No Action Alternative, concentrations would be expected to remain above 4 mg/L during the growing season of a dry-weather year and have no adverse effects on wildlife resources under Plan D.

Alternative Plan F. The proposed operational changes between Plan D and Plan F would be negligible in much of the ACT Basin. The difference between the alternatives evaluated is the greatest in the Coosa

River during periods of dry weather, but they still would be expected to have no adverse effects on wildlife resources.

Alternative Plan G (Proposed Action Alternative). The effects discussed under Plan D apply equally to Plan G. No adverse effects on wildlife resources under Plan G would be expected.

Wildlife – Alabama River

No Action Alternative. There would be negligible change in water quality conditions under the No Action Alternative, and thus, no adverse effects on wildlife resources would be expected in the Alabama River.

Alternative Plan D. Little change in water temperature would be expected in the Alabama River. Upstream of the Robert F. Henry Lock and Dam, median water temperatures would be expected to increase by 1.8 °F (1 °C). Increasing median water temperature during low-flow periods by 1.8 °F (1 °C) would not be expected to significantly affect wildlife resources.

Alternative Plan F. The effects discussed under Plan D would apply equally to Plan F. No adverse effects on wildlife resources under Plan F would be expected.

Alternative Plan G (Proposed Action Alternative). The effects discussed under Plan D apply equally to Plan G. No adverse effects on wildlife resources under Plan G would be expected.

Wildlife – Tallapoosa River

No Action Alternative. There would be negligible change in water quality conditions under the No Action Alternative, and thus, no adverse effects on wildlife resources would be expected in the Tallapoosa River.

Alternative Plan D. Little change in water temperature would be expected in the Tallapoosa River under Plan D. The highest water temperatures would be expected to decrease downstream of Lake Martin. DO would be expected to fluctuate downstream of dams from May through October in a representative dry year, and those fluctuations would be expected to occur at conditions above water quality standards (about 4 mg/L downstream of dams). Little change would be expected in median concentrations of total phosphorus and nitrogen in the Tallapoosa River. Those water quality effects would not be expected to adversely affect wildlife resources in the Tallapoosa River.

Alternative Plan F. The effects discussed under Plan D apply equally to Plan F. No adverse effects on wildlife resources under Plan F would be expected.

Alternative Plan G (Proposed Action Alternative). The effects discussed under Plan D apply equally to Plan G. No adverse effects on wildlife resources under Plan G would be expected.

Fish and Aquatic Resources (Rivers) – Coosawattee River downstream of Carters Reregulation Dam

No Action Alternative. USFWS has recommended seasonal minimum flow targets ranging from 240 cfs to 865 cfs. The No Action Alternative would be expected to meet the recommended monthly targets from 76 percent of the time (during October) to 100 percent of the time (during September). Water quality conditions would be expected to improve under the No Action Alternative as states adhere to defined regulations regarding wasteload allocation and managing NPDES facilities and nonpoint sources. As such, there would be no adverse effects on fish and aquatic resources.

Alternative Plan D. Plan D would be expected to meet the USFWS-recommended monthly minimum flow targets at least 94 percent of the time (during all months of the year). Compared to the No Action Alternative, the overall effects of operational features on flow and water quality conditions under Plan D would be negligible and would be expected to have little or no effect on fish and aquatic resources in the Coosawattee River downstream of Carters Reregulation Dam.

Alternative Plan F. The effects of operational features on flow and water quality conditions with Plan F would be similar to those of Plan D and would not be expected to exert adverse effects on fish and aquatic resources in the Coosawattee River downstream of Carters Reregulation Dam.

Alternative Plan G (Proposed Action Alternative). The effects of operational features on flow and water quality conditions with Plan G would be similar to those of Plan D. Thus, compared to the No Action Alternative, the effects of operational features on flow and water quality conditions under Plan G would be negligible and not expected to adversely affect fish and aquatic resources on the Coosawattee River downstream of Carters Reregulation Dam.

Fish and Aquatic Resources (River) – Etowah River downstream of Allatoona Lake

No Action Alternative. Modeling over the period of hydrologic record (1939–2011) indicates that median daily flows would likely range between 1,000 to 2,000 cfs through the year. Overall, there would be no adverse effects on fish and aquatic resources.

Alternative Plan D. Median daily flows in the Etowah River downstream of Allatoona Dam for Plan D would generally be expected to follow a similar pattern within a range of similar values as the No Action Alternative throughout the year. Operational changes proposed under Plan D would slightly decrease flows in September and increase flows in December. The magnitude of the expected changes in both flow and water quality would be relatively minor and not cause adverse effects on fish or aquatic resources.

Alternative Plan F. Plan F incorporates the four action zone configuration and phased drawdown for Allatoona Lake presented in Plan D. Median daily flows downstream of Allatoona Dam for Plan F, with minor deviations, would likely follow the same seasonal pattern and similar values as Plan D from January through mid-August, and result in daily flows in September ranging slightly higher than those for the No Action Alternative and Plan D, slightly lower overall in October and November, and higher in December by up to 400 cfs. No significant change in water temperature or DO would be expected. The effects of operational features on flow and water quality conditions under Plan F would be negligible and not expected to affect fish and aquatic resources on the Etowah River downstream of Allatoona Lake.

Alternative Plan G (Proposed Action Alternative). The effects of operational features on flow and water quality conditions under this alternative would be negligible and not expected to affect fish and aquatic resources on the Etowah River downstream of Allatoona Lake.

Fish and Aquatic Resources (River) – Coosa River at Rome, Georgia

No Action Alternative. Water quality conditions would be expected to improve under the No Action Alternative as states adhere to defined regulations regarding wasteload allocation and managing NPDES facilities and nonpoint sources. Overall, no adverse effects would be expected on fish and aquatic resources.

Alternative Plan D. The effects of operational features on flow and water quality conditions under Plan D would be negligible and not expected to adversely affect fish and aquatic resources on the Coosa River at Rome.

Alternative Plan F. The effects of Plan F on flow characteristics in the Coosa River at Rome would be expected to be similar to those of Plan D.

Alternative Plan G (Proposed Action Alternative). The effects of operational features on flow and water quality conditions under Plan G would be negligible and not expected to adversely affect fish and aquatic resources on the Coosa River at Rome.

Fish and Aquatic Resources (River) – Alabama River at Montgomery, Alabama

No Action Alternative. Under the No Action Alternative, the 4,640 cfs combined minimum release requirement from JBT near Montgomery would be met 99 percent of the time. Water quality conditions are expected to improve under the No Action Alternative as states adhere to defined regulations regarding wasteload allocation and managing NPDES facilities and nonpoint sources. No adverse effects, or only minimal ones, to fish and aquatic resources would be expected under the No Action Alternative.

Alternative Plan D. The effects of operational features on flow and water quality conditions under Plan D would be negligible and not expected to adversely affect fish and aquatic resources on the Alabama River downstream of Montgomery.

Alternative Plan F. The effects of operational features on flow and water quality conditions under Plan F would be similar to those of Plan D and not expected to adversely affect fish and aquatic resources on the Alabama River downstream of Montgomery.

Alternative Plan G (Proposed Action Alternative). The effects of operational features on flow and water quality conditions under Plan G would be similar to those of Plan D and not expected to adversely affect fish and aquatic resources on the Alabama River downstream of Montgomery.

Fish and Aquatic Resources (River) – Alabama River downstream of Claiborne Lock and Dam

No Action Alternative. Under the No Action Alternative, the 6,600 cfs minimum flow target would be met 98 percent of the time over the period of record. Water quality conditions would be expected to improve under the No Action Alternative as states adhere to defined regulations regarding wasteload allocation and managing NPDES facilities and nonpoint sources. No adverse effects, or only minimal ones, to fish and aquatic resources would be expected under the No Action Alternative.

Alternative Plan D. The effects of operational features on flow and water quality conditions under Plan D would be negligible and not expected to adversely affect fish and aquatic resources on the Alabama River downstream of Claiborne Lock and Dam.

Alternative Plan F. The effects of operational features on flow and water quality conditions with Plan F would be similar to those of Plan D and not expected to adversely affect fish and aquatic resources on the Alabama River downstream of Claiborne Lock and Dam.

Alternative Plan G (Proposed Action Alternative). The effects of operational features on flow and water quality conditions under Plan G would be similar to those of Plan D and not expected to adversely affect fish and aquatic resources on the Alabama River downstream of Claiborne Lock and Dam.

Fish and Aquatic Resources (Reservoirs)

No Action Alternative. On the basis of fisheries performance measures developed by USFWS as part of the 1998 Comprehensive Study, the No Action Alternative would maintain marginally higher habitat suitability than Plans D, F, and G. Differences would be attributable to proposed operational changes

during the fall drawdown period and is most noticeable between the No Action and Proposed Action Alternatives (Plan G) during the rearing and summer habitat critical periods. Overall, the differences are negligible compared to the overall range of mean daily acceptability level values that are observed over the course of these critical periods. The differences would not result in any appreciable change in fish habitat among alternatives. Because the proposed operational changes would be most significant at Allatoona Lake, the lack of any notable change in fish habitat is applicable to other facilities in the ACT Basin, where the influence of the proposed modifications would be dampened. For that reason, the remaining downstream reservoirs were excluded from further analysis.

Current lock operations at Claiborne Lock and Dam and Millers Ferry Lock and Dam provide passage for migratory fishes on alternating 4- to 6-hour intervals in February through May. Under the No Action Alternative, lock operations would remain unchanged, thus upstream and downstream passage would not be affected.

Alternative Plan D. On the basis of modeled water surface elevations over the period of record, implementing Plan D would offer no significant change to fish habitat over the No Action Alternative. Operational changes would be most pronounced at Allatoona Lake. Thus, the lack of any notable change in fish habitat is applicable to other facilities in the ACT Basin, where the influence of the proposed modifications would be dampened.

The continued operation of the Claiborne Lock and Dam and Millers Ferry Lock and Dam for the purposes of providing fish passage would remain unchanged and thus would not be affected under Plan D.

Alternative Plan F. Effects would be the same as those stated above for Plan D.

Alternative Plan G (Proposed Action Alternative). Effects would be the same as those stated above for Plan D.

Fish and Aquatic Resources – Estuaries

No Action Alternative. Flows modeled over the period of record in the Alabama River downstream of Claiborne Lock and Dam peak at just below 66,000 cfs at the end of March, declining to a minimum of approximately 9,000 cfs by mid-September. Under the No Action Alternative, the established 6,600 cfs minimum flow target downstream of Claiborne Lock and Dam would be met 98 percent of the time over the period of record. Water quality conditions would be expected to improve under the No Action Alternative as states adhere to defined regulations regarding wasteload allocation and managing NPDES facilities and nonpoint sources. There would be no or only minimal adverse effects on fish or aquatic resources under the No Action Alternative.

Alternative Plan D. Changes in flow characteristics and water quality as far downstream as the Mobile Bay estuary would be expected to be minimal or non-detectable under Plan D. The flow management operations for flow and water quality conditions under Plan D would not be expected to affect fish or aquatic resources in Mobile Bay. Occasional differences in flow from the No Action of 1,000-2,000 cfs could be expected downstream of Claiborne Lock and Dam, but flow would still peak at just below 66,000 cfs at the end of March, and decline to a minimum of approximately 9,000 cfs by mid-September.

Alternative Plan F. Flow management operations for flow and water quality conditions under Plan F would be similar to those of Plan D and not expected to affect fish or aquatic resources in Mobile Bay.

Alternative Plan G (Proposed Action Alternative). Flow management operations for flow and water quality conditions under Plan G would be similar to those of Plan D and not expected to affect fish or aquatic resources in Mobile Bay.

Protected Species

There are 58 federally protected species in the ACT Basin, predominately fishes, mussels, snails, and plants. The USACE prepared a Biological Assessment pursuant to the informal consultation procedures of Section 7 of the ESA for the Proposed Action Alternative (Plan G). The BA was prepared in accordance with the criteria for analysis as defined in the ESA Section 7 Consultation Handbook. The environmental baseline for the analysis in the BA considered the effects of past and ongoing human and natural factors leading to the current status of the species and its habitat (including designated critical habitat) within the project area. The flow regime used for the environmental baseline for the BA was described using post-1983 flow records, because this period represented the complete hydrology of the current configuration of the federal and non-federal reservoir projects in the ACT Basin that influence the river flows in the action area. The model simulation for the Proposed Action Alternative (Plan G) was performed using "actual withdrawals" which are represented by actual water use reported throughout the basin in 2006, except that the withdrawals from USACE reservoirs were limited, for purposes of modeling, to the amount of storage available according to the USACE storage accounting methodology. The highest observed consumptive demands (year 2006) were imposed as a conservative estimate of potential M&I demands.

This environmental baseline condition differs somewhat from the 73-year period of hydrologic record (1939-2011) which defines the basis for simulation of the No Action Alternative and Plan D, Plan F, and Plan G for the overall NEPA analysis. The effects of Plan G on protected species in the following summary are based upon the analysis in the BA. Discussions of the potential effects of Plan D and Plan F are qualitative and based upon the determination from model outputs that these plans generally would change flow and water quality conditions throughout the ACT Basin less than the Proposed Action Alternative (Plan G) when compared to the No Action Alternative. The modeled flow and water quality conditions resulting from simulations with the Section 7 environmental baseline and with the full hydrologic period of record are not likely to be dramatically different.

The BA was provided to the USFWS on February 18, 2014. The assessment found that several of the species present in the ACT Basin exist outside the range of aquatic habitats potentially affected by changes in the flow regime or water quality. Accordingly, Plan G would not be expected to affect these species. For the remaining federally listed species in the ACT Basin that could potentially be affected by Plan G, the BA concluded that Plan G may affect, but would not likely adversely affect, those species. The BA also concluded that the Plan G would not have a cumulative effect on listed species, and for some species the Plan G could represent a minor improvement.

During informal consultation with USFWS, USACE made minor amendments to the BA, including a proposal to conduct characterization and assessment of stream conditions and habitat features for the amber darter and mussels in the Coosawattee River below the Carters Reregulation Dam. The habitat assessment will provide additional data to support the conclusions of the BA. On March 20, 2014, USFWS concurred with the USACE BA, as amended.

Protected Species – Coosawattee River downstream of Carters Reregulation Dam

This segment of the ACT Basin is inhabited by several federally listed species of freshwater mussels, fish and a single snail species. Critical habitat has been designated for mussels, including the southern acornshell, ovate clubshell, southern clubshell, upland combshell, triangular kidneyshell, Alabama

moccasinshell, Coosa moccasinshell, southern pigtoe and fine-lined pocketbook. The federally threatened goldline darter and federally endangered interrupted rocksnail also exist along this reach.

No Action Alternative. Conditions under the No Action Alternative are generally consistent with the environmental baseline condition established for evaluation of effects on protected species in the BA. Thus, the No Action Alternative would not be expected to adversely affect protected species on the Coosawattee River downstream of Carters Reregulation Dam.

Alternative Plan D. Changes in flow and water quality, with respect to temperature and dissolved oxygen values, would be expected to be minor under Plan D and of less magnitude than would likely occur under Plan G (Proposed Action Alternative), which was evaluated in the USACE BA for Section 7 consultation. Thus, compared to the No Action Alternative, the effects of Plan D on flow and water quality conditions would not be expected to have adverse effects on protected species of the Coosawattee River downstream of Carters Reregulation Dam.

Alternative Plan F. The effects of Plan F on flow and water quality conditions would be similar to those for Plan D. Therefore, Plan F would not be expected to adversely affect protected species of the Coosawattee River downstream of Carters Reregulation Dam.

Alternative Plan G (Proposed Action Alternative). The USACE BA compared Plan G to the environmental baseline condition, and adverse effects to listed species would not be expected. During informal Section 7 consultation with USFWS, the USACE agreed, subject to currently available and future funding, to implement several conservation measures to more conclusively confirm that there would be no adverse effect on the amber darter and mussel habitat downstream of the reregulation dam. The measures were included in an addendum to the BA. The USFWS concurred with the BA, as amended, by letter dated March 20, 2014.

Protected Species – Etowah River downstream of Allatoona Lake

Federally listed species in the Etowah River downstream of Allatoona Dam include eight freshwater mussel species, three fish species and two snail species. Critical habitat has not been established along this reach. With exception to two mussel species and one fish species, which are federally threatened, all are currently listed as endangered.

No Action Alternative. Conditions under the No Action Alternative are generally consistent with the environmental baseline condition established for evaluation of effects on protected species in the BA. The No Action Alternative is not expected to adversely affect protected species on the Etowah River downstream of Allatoona Lake.

Alternative Plan D. Changes in both flow and water quality would be expected to be minor under Plan D and of even less magnitude than would likely occur under Plan G (Proposed Action Alternative), which was evaluated in the USACE BA for Section 7 consultation. Plan D would not be expected to adversely affect protected species on the Etowah River downstream of Allatoona Dam.

Alternative Plan F. The effects of Plan F on flow and water quality conditions would be similar to those for Plan D. Thus, compared to the No Action Alternative, Plan F would not be expected to adversely affect protected species on the Etowah River downstream of Allatoona Dam.

Alternative Plan G (Proposed Action Alternative). The USACE BA compared Plan G to the environmental baseline condition, as described in Section 6.5.4 above. As a result, adverse effects to listed species would not be expected on the Etowah River downstream of Allatoona Dam. By letter dated

March 20, 2014, the USFWS concurred with the determination in the USACE BA that Plan G may affect, but is not likely to adversely affect, federally listed endangered or threatened species in the project area.

Protected Species – Coosa River at Rome, Georgia

Federally listed species in the Coosa River at Rome includes eleven freshwater mussel species, two fish species and two snail species. Critical habitat has not been established along this reach. All species are federally endangered, except two species of mussels which are federally threatened.

No Action Alternative. The No Action Alternative would not involve an appreciable change to current conditions. Conditions under the No Action Alternative would generally be consistent with the environmental baseline condition established for evaluation of effects on protected species in the BA. The No Action Alternative would not be expected to adversely affect protected species on the Coosa River at Rome.

Alternative Plan D. Changes in both flow and water quality under Plan D would be of even less magnitude than would likely occur under Plan G (Proposed Action Alternative), which was analyzed in detail in the USACE BA for Section 7 consultation. Consequently, Plan D would not be expected to adversely affect protected species on the Coosa River at Rome and downstream.

Alternative Plan F. The effects of Plan F on flow and water quality conditions would be similar to those for Plan D. Thus, compared to the No Action Alternative, Plan F would not be expected to adversely affect protected species on the Coosa River at Rome.

Alternative Plan G (Proposed Action Alternative). The USACE BA compared Plan G to the environmental baseline condition. As a result, adverse effects to listed species would not be expected on the Coosa River at Rome. By letter dated March 20, 2014, the USFWS concurred with the determination in the USACE BA that Plan G may affect, but is not likely to adversely affect, federally listed endangered or threatened species in the project area.

Protected Species – Alabama River at Montgomery, Alabama

This segment of the ACT Basin is inhabited by several federally listed species, including three species of freshwater mussels (inflated heelsplitter, heavy pigtoe and southern clubshell), one fish species (Alabama sturgeon) and a single snail species (tulotoma snail). Critical habitat has been designated for the Alabama sturgeon. Although the flow requirements for the habitat of the endangered Alabama sturgeon are poorly understood, the potential effects of the Proposed Action Alternative (Plan G) were evaluated in the BA by considering the extent of changes in flow conditions in the critical habitat area resulting from Plan G compared to the existing flow conditions in the river.

No Action Alternative. The No Action Alternative would not involve an appreciable change to current conditions. Conditions under the No Action Alternative would generally be consistent with the environmental baseline condition established for evaluation of effects on protected species in the BA. The No Action Alternative would not be expected to adversely affect protected species on the Alabama River downstream of Montgomery.

Alternative Plan D. The effects of Plan D on flow and water quality conditions would be minor compared to the No Action Alternative. Plan D would not be expected to adversely affect protected species on the Alabama River downstream of Montgomery..

Alternative Plan F. The effects of Plan F on flow and water quality conditions would be similar to those for Plan D. Thus, compared to the No Action Alternative, Plan F would not be expected to adversely affect protected species on the Alabama River downstream of Montgomery.

Alternative Plan G (Proposed Action Alternative).

Flow and water quality conditions under Plan G would likely be similar to those of Plan D. Compared to the No Action Alternative, Plan G would not be likely to adversely affect protected species on the Alabama River downstream of Montgomery. The simulation for the BA, performed in accordance with the Section 7 Consultation Handbook, indicated that the simulated Plan G flow regime is nearly identical to the environmental baseline flow regime with the exception that Plan G would result in higher flows during drought periods than the environmental baseline condition. This is likely a beneficial effect to sturgeon and is not likely to adversely affect other protected species.

By letter dated March 20, 2014, the USFWS concurred with the determination in the USACE BA that Plan G may affect, but is not likely to adversely affect, federally listed endangered or threatened species in the project area.

Protected Species – Alabama River downstream of Claiborne Lock and Dam

Federally listed species in the Alabama River downstream of Claiborne Lock and Dam and Lake include the inflated heelsplitter and heavy pigtoe (mussels), Alabama sturgeon (fish) and tulotoma snail. Critical habitat for Alabama sturgeon extends down to Mobile Bay. Although the flow requirements for the habitat of the endangered Alabama sturgeon are poorly understood, the potential effects of the Plan G were evaluated by considering the extent of changes in flow conditions in the critical habitat area compared to the environmental baseline condition (as defined in the Section 7 Consultation Handbook). USACE concluded in the BA that the Proposed Action Alternative (Plan G) would have minimal effects compared to the environmental baseline for the Alabama River, and consequently would not be likely to have adverse effects on listed species , USFWS concurred with this finding by letter dated March 20, 2014.

No Action Alternative. The No Action Alternative would not involve an appreciable change to current conditions. Conditions under the No Action Alternative would generally be consistent with the environmental baseline condition established for evaluation of effects on protected species in the BA. The No Action Alternative would not be expected to adversely affect protected species on the Alabama River downstream of Claiborne Lock and Dam.

Alternative Plan D. Compared to the No Action Alternative, the effects of Plan D on flow and water quality conditions are not expected to adversely affect protected species on the Alabama River downstream of Claiborne Lock and Dam.

Alternative Plan F. The effects of Plan F on flow and water quality conditions would be similar to those for Plan D. Thus, compared to the No Action Alternative, Plan F would not be expected to adversely affect protected species on the Alabama River below Claiborne Lock and Dam.

Alternative Plan G (Proposed Action Alternative). The effects of Plan G on flow and water quality conditions in the Alabama River below Claiborne Lock and Dam are similar to those of Plan D. The BA notes the same potential effects from flow that are noted under Plan G for the Alabama River at Montgomery, Alabama, and downstream. Implementation of Plan G would not likely affect federally listed endangered or threatened species in the project area. By letter dated March 20, 2014, the USFWS concurred with this determination in as presented in the USACE BA.

Fish and Wildlife Management Facilities – William "Bill" Dannelly Lake

No Action Alternative. Changes in water surface elevations under the No Action Alternative would be negligible and would not be expected to affect water withdrawals necessary for management of the facilities.

Alternative Plan D. Plan D would be expected to have no effect on William "Bill" Dannelly Lake fish and wildlife management facilities.

Alternative Plan F. Plan F would be expected to have no effect on William "Bill" Dannelly Lake fish and wildlife management facilities.

Alternative Plan G (Proposed Action Alternative). Plan G would be expected to have no effect on William "Bill" Dannelly Lake fish and wildlife management facilities.

Fish and Wildlife Facilities – Arrowhead Game Management Office and Fishing Area

No Action Alternative. The Arrowhead Game Management Office and Arrowhead Public Fishing Area collectively withdraw approximately 0.35 mgd of surface water from Armuchee Creek, a tributary to the Oostanaula River. Both facilities are well upstream of the confluence the Oostanaula River and, therefore, would not be expected to be affected by the No Action Alternative.

Alternative Plan D. As described for the No Action Alternative, Plan D would be expected to have no effect on the Arrowhead Game and Management Office and Fishing Area facilities.

Alternative Plan F. As described for the No Action Alternative, Plan F would be expected to have no effect on the Arrowhead Game and Management Office and Fishing Area facilities.

Alternative Plan G (Proposed Action Alternative). As described for the No Action Alternative, Plan G would be expected to have no effect on the Arrowhead Game and Management Office and Fishing Area facilities.

Fish and Wildlife Facilities – Fish Hatcheries

No Action Alternative. The fish hatcheries in operation in the ACT Basin include Eastboga Fish Hatchery, Alabama Aquatic Diversity Center, and Summerville Fish Hatchery. All three facilities use groundwater in their operations and thus would not be affected by the No Action Alternative.

Alternative Plan D. As described for the No Action Alternative, Plan D would be expected to have no effect on the ACT Basin fish hatcheries.

Alternative Plan F. As described for the No Action Alternative, Plan F would be expected to have no effect on the ACT Basin fish hatcheries.

Alternative Plan G (Proposed Action Alternative). As described for the No Action Alternative, Plan G would be expected to have no effect on the ACT Basin fish hatcheries.

Socioeconomics

M&I Water Supply

No Action Alternative. Under the No Action Alternative, the operation of USACE projects in the ACT Basin would be expected to remain unchanged. Therefore, effects on M&I water supply would be expected to be the same as they have been in the past. The No Action Alternative reflects the M&I water withdrawals that were actually made in 2006 from the ACT reservoirs and along the primary rivers of the ACT basin. However, as discussed in section 4.2.6 and Appendix C, the available storage under existing water supply agreements at USACE reservoirs may not be sufficient under all conditions to accommodate the 2006 level of water supply withdrawals.

Alternative Plan D. Plan D would have a minimal effect on the M&I water supply available in the ACT Basin. The amount of storage made available by USACE in its reservoirs for water supply is unchanged under the alternative, and the alternative assumes that water supply users would make full use of that storage to satisfy anticipated water supply needs. However, as discussed in section 4.2.6 and Appendix C, the available storage under existing water supply agreements at USACE reservoirs may not be sufficient under all conditions to accommodate the current (2006) level of water supply withdrawals from those reservoirs. Alternative Plan D assumes that withdrawals from USACE reservoirs would be limited to the amount available in water supply storage under existing agreements, as measured by the storage accounting methodology that the USACE currently employs at those reservoirs

Alternative Plan F. Plan F would have a minimal effect on the M&I water supply available in the ACT Basin. The amount of storage made available by USACE in its reservoirs for water supply is unchanged under the alternative, and the alternative assumes that water supply users would make full use of that storage to satisfy anticipated water supply needs. However, as discussed in section 4.2.6 and Appendix C, the available storage under existing water supply agreements at USACE reservoirs may not be sufficient under all conditions to accommodate the current (2006) level of water supply withdrawals from those reservoirs. Alternative Plan F assumes that withdrawals from USACE reservoirs would be limited to the amount available in water supply storage under existing agreements, as measured by the storage accounting methodology that the USACE currently employs at those reservoirs.

Alternative Plan G (Proposed Action Alternative). The Proposed Action Alternative would have a minimal effect on the M&I water supply available in the ACT Basin. The Proposed Action Alternative would be anticipated to provide an increase in the median annual pool elevation for Allatoona Lake of 0.12 percent, along with a decrease in the median annual pool elevation for Carters Lake of 0.03 percent. These slight changes in median pool elevations indicate that the reliability of water supply for the existing water storage agreements would not be expected to be affected.

The amount of storage made available by USACE in its reservoirs for water supply is unchanged under the alternative, and the alternative assumes that water supply users would make full use of that storage to satisfy anticipated water supply needs. However, as discussed in section 4.2.6 and Appendix C, the available storage under existing water supply agreements at USACE reservoirs may not be sufficient under all conditions to accommodate the current (2006) level of water supply withdrawals from those reservoirs. The Proposed Action Alternative assumes that withdrawals from USACE reservoirs would be limited to the amount available in water supply storage under existing agreements, as measured by the storage accounting methodology that the USACE currently employs at those reservoirs.

Navigation

No Action Alternative. The No Action Alternative would provide the required flows and depth needed to support a 7.5-ft channel over 90 percent of the period of record for January and 50 percent of the time in

September. Because of higher flows in the winter and spring, channel availability is much higher from December through May. The No Action Alternative would provide the required flows and depth needed to support a 9-ft channel over 90 percent of the period of record for January and 46 percent of the time in September. Because of higher flows in the winter and spring, channel availability is much higher from December through May.

Alternative Plan D. Plan D would provide similar 7.5-ft navigation channel availability to the No Action Alternative in January (about 95 percent) and 55 percent availability in September. Because of higher flows in the winter and spring, channel availability is much higher from December through May under Plan D, similar to the No Action Alternative. Plan D would provide similar 9-ft channel availability to the No Action Alternative in January (about 92 percent) and over 49 percent availability in September. Because of higher flows in the winter and spring, channel availability is much higher from December through May under Plan D, similar to the No Action Alternative.

Alternative Plan F. Effects on the channel availability of the 7.5-ft and 9-ft channel depths would be similar to those described above with Plan D.

Alternative Plan G (Proposed Action Alternative). Effects on the channel availability of the 7.5-ft and 9-ft channel depths would be similar to those described above with Plan D.

Hydropower

No Action Alternative. Under the No Action Alternative, the operation of USACE projects in the ACT Basin would be expected to remain unchanged. Under the No Action Alternative 5,701,466 megawatt-hours (MWh) will be generated by system hydropower plants with an energy benefit of $234.1 million. The dependable capacity under the No Action Alternative is estimated to be 2,147.55 MW.

Alternative Plan D. Implementing Alternative Plan D would result in less than a one percent decrease in average annual energy (5,703,884 MWh) when compared to the No Action Alternative (5,701,466 MWh) or a reduction of 2,418 MWh.

Alternative Plan F. When compared to the No Action Alternative, Alternative Plan F would result in an increase in system generation of 2,012 MWh. From January through August, the simulation shows a two percent or less increase in power generation for all four alternative flows scenarios compared to the baseline condition. The majority of the loss in generation for the alternatives occurs between September and November with a peak increase occurring in October, amounting to almost six percent. All alternative flow scenarios show an increase in generation in December.

Alternative Plan G (Proposed Action Alternative). Effects under the Proposed Action Alternative would be similar to those under Plan F. When compared to the No Action Alternative, the Proposed Action Alternative would result in a decrease in system generation of 33,800 MWh or about 0.6 percent. From January through August, the simulation shows a two percent or less increase in power generation for all four alternative flows scenarios compared to the baseline condition. The majority of the loss in generation under the Proposed Action Alternative would occur between September and November with a peak increase (almost 6 percent) in October. The Proposed Action Alternative would result in an increase in generation in December.

Agricultural Water Supply

No Action Alternative. Under the No Action Alternative, the operation of USACE projects in the ACT Basin would be expected to remain unchanged. Therefore, effects on agricultural water supply would be expected to be the same as they have been in the past.

Alternative Plan D. In the ACT Basin, surface water supplies the majority of the water used for agricultural irrigation. The primary sources of surface water for agricultural use in the ACT Basin are smaller tributaries to the Alabama, Coosa, and Tallapoosa Rivers or from farm ponds constructed for that purpose. The proposed changes to the water control operations in the ACT Basin will have no effect on water availability for agricultural irrigation purposes in the basin.

Alternative Plan F. Effects would be the same as those with Plan D.

Alternative Plan G (Proposed Action Alternative). Effects would be the same as those with Plan D.

Flood Risk Management

No Action Alternative. Under the No Action Alternative, the operation of USACE projects in the ACT Basin would be expected to remain unchanged. Therefore, effects on flood risk management would be expected to be the same as they have been in the past.

Alternative Plan D. Plan D has no proposed changes to operation that would significantly affect flood risk management at Allatoona Lake. Therefore, flood risk management capabilities of USACE reservoir on the ACT Basin would not be affected.

Alternative Plan F. Effects would be the same as with Plan D.

Alternative Plan G (Proposed Action Alternative). Effects would be the same as with Plan D.

Recreation

No Action Alternative. Under the No Action Alternative, the operation of USACE projects in the ACT Basin would be expected to remain unchanged. Therefore, effects on recreation would be expected to be the same as they have been in the past.

Alternative Plan D. At Allatoona Lake, with the No Action Alternative and Plan D, the pool level would be within the Initial Impact range (837 ft to 835 ft) between 9 and 10 percent of the time. With the No Action Alternative, Allatoona Lake levels would be within the Recreation Impact range (835 ft to 828 ft) approximately 28 percent of the time over the period of record (1939–2008). Under Plan D, Allatoona Lake levels would be within the Recreation Impact range approximately 30.1 percent of the time. Lake levels would be in the Water Access Limited range (828 ft and below) approximately 28.5 percent of the time over the period of record under the No Action Alternative and about 26.9 percent of the time under Plan D, slightly less often than the No Action Alternative.

At Carters Lake, pool levels would be in the Initial Impact range (1,068 ft to 1,060 ft) about 0.5 percent of the time over the period of record under the No Action Alternative and about 2.5 percent of the time under Plan D. Pool levels would not be expected to decline into the Recreation Impact range (1,060 ft to 1,055 ft) under the No Action Alternative, while under Plan D levels would likely decline into that range about 0.2 percent of the time. The lake level would not be expected to decline into the Water Access Limited range (1,055 ft and below) with the No Action Alternative or Plan D over the period of record.

Alternative Plan F. With the No Action Alternative and Plan F, Allatoona Lake pool levels would be within the Initial Impact range between 9 and 10 percent of the time. Allatoona Lake levels would be expected to be within the Recreation Impact range approximately 28 percent of the time over the period of record under the No Action Alternative and approximately 33.1 percent of the time under Plan F. Lake levels would be expected to be in the Water Access Limited range approximately 28.5 percent of the time

over the period of record under the No Action Alternative and about 24.8 percent of the time under Plan F, which would be about 3.7 percent less often than the No Action Alternative.

At Carters Lake, effects would be the same as described for Plan D.

Alternative Plan G (Proposed Action Alternative). With the No Action Alternative and the Proposed Action Alternative, Allatoona Lake pool levels would be within the Initial Impact range 9.6 and 10.2 percent of the time, respectively. Allatoona Lake levels would be expected to be within the Recreation Impact range approximately 28 percent of the time over the period of record under the No Action Alternative and approximately 36.9 percent of the time under the Proposed Action Alternative. Lake levels would be expected to be in the Water Access Limited range approximately 28.5 percent of the time over the period of record under the No Action Alternative and only about 19.9 percent of the time under the Proposed Action Alternative. That would result in a reduction in the percentage of time over the period of record that lake levels would be expected to decline into the Water Access Limited range of 8.6 percent, or 2,297 days.

At Carters Lake, effects would be the same as those described for Plan D.

Environmental Justice

No Action Alternative. Seasonal fluctuations in the water surface elevations under the No Action Alternative, even with relatively normal rainfall conditions in the basin, could create minor inconveniences to local residents, including low-income and minority populations, who use USACE and APC reservoirs for fishing and other forms of recreation. Those uses might be more constrained during extreme drought years, but these constraints and associated effects would not likely be disproportionately higher for low-income and minority populations. All lake users could be affected under such conditions, which might last for months at a time but would be temporary.

Alternative Plan D. Plan D would incorporate a new action zone at Carters Lake, revisions to the actions zones at Allatoona Lake, and specific drought management measures for the APC lakes and USACE lakes downstream of Montgomery. The measures in Plan D would likely provide for more effective management of water surface levels and conservation storage in USACE and APC lakes during drought conditions. Under Plan D, lake levels in extreme drought conditions generally would not be expected to decline as much as they would for the No Action Alternative. Overall, public access and use of the lakes would be improved for a greater portion of the time for all users, including minority and low-income users.

Alternative Plan F. Plan F would have essentially the same effects as described for Plan D with respect to minority and low-income populations.

Alternative Plan G (Proposed Action Alternative). The Proposed Action Alternative would have essentially the same effects as described for Plan D with respect to minority and low-income populations.

Protection of Children

No Action Alternative. Operation of large reservoir projects provide increased opportunities for public access and use, particularly in the form of water-based recreation, which inherently includes a level of health and safety risk to both adults and children. USACE pursues extensive measures at operating projects, many of which are directly focused on children, to minimize risks and promote safe use of the projects by visitors. The environmental health and safety activities at USACE projects would be expected to continue and would be adjusted over time as needs change. Existing water management activities at the

reservoirs would not impose any undue risks to children that are not effectively addressed by the above activities.

Alternative Plan D. Plan D would have the same effects relative to protection of children as described for the No Action Alternative. No additional risks would be imposed by the proposed updates to water management practices.

Alternative Plan F. Plan F would have the same effects relative to protection of children as described for the No Action Alternative. No additional risks would be imposed by the proposed updates to water management practices.

Alternative Plan G (Proposed Action Alternative). Plan G would have the same effects relative to protection of children as described for the No Action Alternative. No additional risks would be imposed by the proposed updates to water management practices.

Cultural Resources

No Action Alternative. Under the No Action Alternative, the operation of USACE projects in the ACT Basin would be expected to remain unchanged. Therefore, effects on cultural resource sites would be expected to be the same as they have been in the past. Sites that have not been preserved in the past could be lost in the future. In areas where conservation measures have not been implemented along the shoreline, the continued exposure would likely result in continued effects on cultural resource sites.

Alternative Plan D. Under Plan D, the rate of erosion at cultural resources sites would be expected to increase at some sites and decrease at others. It is unlikely that implementing Plan D would reduce the percentage of sites (53 percent of the sites known and unknown) undergoing erosion or deposition from the No Action Alternative. The percentage of sites that undergo the effects of erosion and deposition would be expected to remain about the same as for the No Action Alternative.

Alternative Plan F. Under Plan F, it is unlikely that the percentage of sites (53 percent of the sites known and unknown) undergoing erosion or deposition would be changed from the No Action Alternative.

Proposed Action Alternative. The Proposed Action Alternative would not be expected to change the occurrence of sites undergoing erosion or deposition from the No Action Alternative. Nearly 50 percent of the time, water surface elevations are the same between each alternative. The Proposed Action Alternative would not be expected to change the total number of sites affected in the ACT Basin.

Sensitivity Analysis

As a result of agency and public review of the draft EIS for the ACT WCM update process, as well as a USACE external peer review by a panel of independent subject matter experts, USACE performed an analysis of the sensitivity of the Proposed Action Alternative (Plan G) to (1) increased future water demands in the basin, (2) reduced basin inflows to the ACT reservoirs that may potentially be the result of climate change impacts on precipitation in the region, and (3) increased air temperatures that are considered likely to occur as a result of climate change. These scenarios are referred to as Plan G-DI (demand increase), Plan G-FR (flow reduction), and Plan G-TI (temperature increase), respectively. Table ES-6 presents a summary of expected incremental effects associated with the three scenarios described above. The paragraphs that follow in this section briefly describe the potential effects for each scenario and for each resource area in the table compared to the Proposed Action Alternative (Plan G). More detailed information on the sensitivity analysis is presented in Section 6.9 of the EIS.

Table ES-6.
Proposed Action Alternative (Plan G) – expected incremental effects with future water demand increase (DI), reduced basin inflow (FR), and air temperature increase (TI)

Resource Area	Incremental environmental effects		
	Proposed Action Alternative (PAA) with future water demand increase (Plan G-DI)	PAA with reduced basin inflows (climate change) (Plan G-FR)	PAA with air temperature increase (climate change) (Plan G-TI)
Water Quantity			
Flood Risk Management	None	None	None
Lake Levels/Storage			
Carters Lake	Negligible	Minor adverse	None
Allatoona Lake	Negligible	Minor adverse	None
APC Lakes (Weiss Lake, H. Neely Henry, Logan Martin, Harris, Martin)	Negligible	Minor adverse	None
Alabama River Lakes ("Bob" Woodruff, "Bill" Dannelly, Claiborne)	Negligible	Negligible	None
Stream Flow			
Coosawattee River below Carters Reregulation Dam	Negligible	Minor adverse	None
Etowah River below Allatoona Dam	Negligible	Moderate adverse	None
Coosa River at Rome, GA	Negligible	Moderate adverse	None
Alabama River at Montgomery, AL	Negligible	Moderate adverse	None
Alabama River below Claiborne L&D	Negligible	Moderate adverse	None
Drought Management / Operations	Negligible	Moderate adverse	None
Navigation Flow Targets	Negligible	Moderate adverse	None
Water Withdrawals Intakes	None	None	None
Water Quality			
Temperature	Negligible	Minor adverse	Adverse
Dissolved oxygen	Negligible	Negligible	Adverse
Total phosphorous	Negligible	Minor adverse	Negligible
Total nitrogen	Negligible	Minor adverse	Negligible
Chlorophyll *a*	Negligible	Negligible	Negligible
Biological Resources			
Vegetation	None	None	Negligible
Wildlife resources	Negligible	Negligible	Negligible
Fish and aquatic resources	Negligible	Minor to moderate adverse or beneficial	Minor to moderate adverse
Protected species	None	Minor to moderate adverse or beneficial	Minor to moderate adverse
Socioeconomic Resources			
M&I water supply	None	None	None
Navigation	Negligible	Moderate adverse	None
Hydropower	Minor adverse	Moderate adverse	None
Agricultural water supply	None	None	None
Flood risk management	None	None	None
Recreation	Negligible	Moderate adverse	None
Property values and taxes	None	Negligible	None
Environmental justice	None	None	None
Protection of children	None	None	None
Other Resource Areas (soils/geology, land use, air quality, cultural resources, etc.)	None	None	None

Increased Future Water Demands (Plan G-DI).

Future water demands for the sensitivity analysis were derived from a Planning and Management Consultants, Ltd., (PMCL) methodology used during the ACF-ACT Comprehensive Study during the 1990's and updated in 2008 in response to section 134 of Public Law 110-161, "The Consolidated Appropriations Act, 2008". P.L. 110-161 directed USACE to provide information regarding water use in the ACT and ACF basins, including "an estimated projection of total water usage in the respective basins over the next 25 years." USACE Mobile District developed a Section 134 report based on the PCML methodology, updated population data, and updated water use data to develop a 25-year estimate of water demands using 2006 as the baseline year (2006 – 2031). Year 2006 demands were selected by USACE to represent current withdrawals because they reflect the year of highest net withdrawals from the ACT Basin and, to date, the year of greatest stress on the system from water withdrawals. Water demand projections from this effort for the year 2030 were used in the HEC-ResSim and HEC-5Q models for comparison to Plan G (current conditions). Overall, the 2030 demand projections would represent about a 30 percent increase over 2006 water demand levels.

Water Quantity. Plan G-DI would not have an adverse impact on the flood risk management purpose and function for the pertinent ACT Basin projects compared to Plan G.

Based upon the HEC-ResSim model simulation, Carters Lake and Allatoona Lake would likely experience slight declines (generally less than 0.1 ft), predominately in the late summer and early fall months, with Plan-G-DI compared to Plan G. Similar results would be expected in the APC lakes affected by this WCM update process (Weiss, H.N. Henry, Logan Martin, R.L. Harris, and Martin). The USACE Alabama River lakes ("Bob" Woodruff, "Bill" Dannelly, and Claiborne lakes) would not experience a perceptible change in lake levels with Plan G-DI compared to Plan G.

Streamflow at three key locations within the upper portion of ACT Basin (Coosawattee River downstream of Carters Reregulation Dam, Etowah River downstream of Allatoona Dam, and the Coosa River at Rome) would likely experience minimal decreases under Plan G-DI compared to Plan G. Slightly larger differences would be expected under extreme low flow conditions. The percent of time during which monthly 7Q10 flows for the Coosa River at Rome, Georgia, would be met would be slightly lower with Plan G-DI. However, those changes would be minor, ranging from 0.1 percent lower for the month of March to 1.7 percent lower for September. For the Alabama River in the vicinity of Montgomery, Alabama and downstream of Claiborne Lock and Dam at the lower end of the basin, streamflow differences between Plan G and Plan G-DI would be expected to be negligible.

Compared to Plan G, Plan G-DI would result in minimal changes to the number of occurrences and percent of time that drought operations would be in effect for the ACT Basin. Plan G-DI would be expected to have negligible effects with respect to the percent of time that navigation flow targets for both 7.5-ft and 9-ft channel depths would likely be met compared to Plan G. Water intake structures would not be exposed to increased risk of insufficient flows or reservoir levels under Plan G-DI compared to Plan G.

Water Quality. Plan G-DI would have an overall negligible impact on water quality in the ACT Basin projects.

The projected changes between Plan G and Plan G-DI would likely be minor, with temperature and dissolved oxygen being the most affected constituents. The water temperature would be expected to increase by less than 1°F (0.5°C) throughout the ACT Basin. HEC-5Q model results for Plan G-DI indicate no impact on water temperature. The greatest variation between Plan G and Plan G-DI occurs during the 2003 representative wet-year. During the 2007 representative dry-year, change in water temperature is negligible. Dissolved oxygen decreased between Plan G and Plan G-DI, often by less than 0.1 mg/L, during the May through October critical period. Responses in DO appeared to be inversely

proportional to the responses in temperature throughout the ACT Basin. This change is expected due to the relationship between DO and temperature.

Compared to Plan G, Plan G-DI would have a negligible impact in much of the ACT Basin on nutrient concentrations. Throughout the ACT Basin, the difference in median total phosphorus concentrations is near zero in both representative wet- and dry-weather years. Variability in concentrations between the Plan G and Plan G-DI was greatest in the dry-weather years in the ACT Basin, with concentrations in the 95th percentile occurrence increasing by nearly 0.004 mg/L in some reaches. Similar to total phosphorus, the expected flow and climate changes between Plan G and Plan G-DI would have a negligible impact in much of the ACT Basin on total nitrogen concentrations. Throughout the ACT Basin during the modeled period the median concentrations differed by less than 0.01 mg/L. Growth in chlorophyll *a* typically varies by less than 1 µg/L from the G-DI scenario over Plan G. However, under dry-weather conditions, changes in temperature and flow would be expected to affect the system's ability to assimilate nutrient loads causing algal growth, algal growth increased by more than 1 µg/L in some locations.

Biological Resources.

Vegetation. It was determined that, for the Proposed Action Plan (Plan G), no effects on the vegetative resources would be expected for any of the river systems. The high degree of water regulation in the ACT Basin prevents extreme flooding, and generally restricts water to the main channel, keeping it out of the historic floodplain downstream of the major dams. Plan G-DI would result in only minor changes in lake levels and flows, and would also not be expected to affect vegetation.

Wildlife. Plan G-DI would have a noticeable but negligible effect on DO concentrations, and cause some changes in temperature, with rare and isolated occurrences of temperature increases of up to 3°F. Such changes in water quality would not be expected to affect upland wildlife in the ACT Basin.

Fish and Aquatic Resources. Water temperature changes would be expected in some of the rivers under Plan G-DI. In general, water temperatures would be slightly higher than for Plan G. Slight changes in water temperature would not be expected to affect fish and other aquatic resources, either directly or indirectly through associated slight decreases in DO that could occur. Throughout the ACT Basin, DO would be expected to decrease between Plan G and Plan G-DI, often by less than 0.1 mg/L, during the May through October critical periods.

Protected Species. Plan G-DI would generally result in slightly lower, but negligible, differences in median flow conditions in all of the rivers in the ACT Basin compared to Plan G. Minor alterations to flow regimes may provide a slight benefit to some species, while simultaneously providing less optimal conditions for other species. Compared to Plan G, DO levels would slightly decrease for Plan G-DI, frequently by 0.1 mg/L or less during the critical May through October period. Other water quality parameters analyzed in the sensitivity analysis, including total phosphorus, total nitrogen, and chlorophyll *a* show negligible incremental effects for Plan G-DI.

Socioeconomic Resources. Plan G-DI would have negligible incremental effects on socioeconomics resources in the ACT Basin compared to Plan G, including M& I and agricultural water supply availability, flood risk management operations, navigation target flows, and reservoir recreation areas and activities. Plan G-DI would likely result in slight declines in hydropower benefits compared to Plan G, but these declines would be on the order of 0.5 percent or less. Property values and taxes would not likely be affected with Plan G-DI. Increased future water demands (Plan G-DI) would not be expected to result in incremental adverse effects on environmental justice and protection of children objectives in the ACT Basin.

Other Resource Areas. Compared to Plan G, Plan G-DI would not likely result in appreciable increased effects on other natural and human resource considerations, including soils and geology, climate conditions, land use, aesthetics, air quality, transportation and traffic, and cultural resources.

Reduced Basin Inflows (Plan G-FR).

To assess the sensitivity of the Proposed Action Alternative (Plan G) to potential effects of reduced precipitation and or/altered precipitation patterns in the southeast region in the future associated with climate change, USACE conducted an HEC-ResSim model simulation over the 73-year period of record, assuming a 15 percent reduction in basin inflow throughout the basin (Plan G-FR). Additionally, a model simulation was performed with HEC-5Q for Plan G-FR to assess the sensitivity of Plan G to this scenario. As discussed in the EIS, these assumptions are comparable to the expected change in available precipitation for individual counties in the ACT Basin before 2050, and conservative when compared to the average expected decrease of 8.7 percent for these counties.

Water Quantity. Plan G-FR would not have an adverse incremental impact on the flood risk management function for the pertinent ACT Basin projects compared to Plan G.

Based upon HEC-ResSim model simulation to compare Plan G with the Plan G-FR scenario, the following effects on lake level conditions would be expected;

- Carters Lake – The Plan G-FR scenario would likely produce daily median pool elevations slightly lower (ranging from zero up to about 0.3 ft) than Plan G for the months of June through December. Plan G-FR would have a negligible effect on median levels from the months of January through May. At the 90 percent exceedance level, indicative of extreme drought conditions, pool levels would likely be lower, fluctuating throughout all months in the range from about 0.5 ft to 3.5 ft below those expected under Plan G. Overall, these differences would represent a relatively minor adverse effect on Carters Lake levels.
- Allatoona Lake – The Plan G-FR scenario would likely produce daily median pool elevations essentially the same as for Plan G from December through most of June. Median elevations from July through November would likely be slightly lower than those for Plan G (ranging from about 0.2 ft to 0.6 ft lower). At the 90 percent exceedance level, Plan G-FR lake elevations would likely be lower throughout the year, typically ranging from about 0.5 ft to 1.5 ft below those expected for Plan G. Overall, these differences would represent a relatively minor adverse effect on Allatoona Lake levels.
- ACT APC lakes (Weiss, H. N. Henry, Logan Martin, R. L. Harris, Lake Martin) – For Weiss, Logan Martin, R.L. Harris, and Lake Martin, the Plan G-FR scenario would likely result in slightly reduced median daily pool levels from July through November (ranging from 0.1 ft to 1.0 ft depending on the specific lake) and negligible deviations on the lakes from December through June. At the 90 percent exceedance level, Plan G-FR lake elevations would likely be slightly lower throughout the year (typically ranging from about 0.1ft to 1.3 ft depending on the specific lake) compared to Plan G. Overall, differences produced under the reduced basin inflow scenario would be expected to have a relatively minor adverse effect on APC lake levels in the ACT Basin.
- USACE Alabama River lakes ("Bob" Woodruff, "Bill" Dannelly, and Claiborne) – These projects basically function as run-of-river reservoirs which maintain relatively stable pool levels at all times, primarily in support of the navigation project purpose. Modeled pool levels for the three USACE Alabama River lakes under Plan G would not be appreciably affected under the Plan G-FR scenario.

Based upon HEC-ResSim model simulation to compare Plan G with the Plan G-FR scenario, the following effects on flow conditions at selected locations in the ACT Basin would be expected:

- Coosawattee River downstream of Carters Reregulation Dam – Median flows for the Plan G-FR scenario would generally tend to range between about 10 and 30 percent lower than Plan G. Under extreme drought conditions (90 percent exceedance flows), flow conditions for Plan G-FR would be the essentially same as Plan G. Modeled flows at this level would basically be equivalent to the monthly minimum flow targets established for Plan G. The seasonal (monthly) minimum flow targets would typically be met about one to two percent less often in any given month (the month of March would be four percent). Incrementally, Plan G-FR would have a moderate adverse effect on Coosawattee River flows compared to Plan G.
- Etowah River downstream of Allatoona Dam – Median daily flows for the Plan G-FR scenario would likely be lower than Plan G from August through mid-January (by about 200 to 400 cfs) and from mid-February through mid-April (by up to about 400 cfs). At the 90 percent exceedance level, Plan G-FR flows would generally be at the modeled minimum flow (290 cfs) from mid-January through November. Flows for Plan G would likely be higher only in December through mid-January and about 400 cfs higher during much of the time from February through mid-May compared to Plan G-FR. Incrementally, the Plan G-FR scenario would likely have an overall minor adverse effect compared to Plan G.
- Coosa River at Rome, Georgia – Median daily flows for Plan G-FR from the month of December through May over the modeled period of record (the wetter portion of the year) would likely range from about 14 to 18 percent lower than Plan G. During the period that is generally dryer (June through November), median daily flows would tend to be about eight to 14 percent lower than Plan G. Median daily flows for Plan G-FR during September and October would range as low as 1,800 to 2,000 cfs. At the 90 percent exceedance level, Plan G-FR would produce stream flows at Rome, Georgia that would have a similar seasonal pattern and percent reduction as median daily flows compared to Plan G. During the months of September and October, 90 percent exceedance flows would range as low as 1,200 to 1,300 cfs for the Plan G-FR scenario. Plan G-FR would reduce the percent of time that monthly 7Q10 values would be equaled or exceeded for the Coosa River at Rome, Georgia compared to Plan G. Overall, these decreases in "percent of time exceeded" (by month) would range from about three to nine percent. The most notable declines would be expected to occur in the drier months (August through November) and would likely be in the range of seven to nine percent. Monthly 7Q10 values in the Coosa River at Rome is an important parameter for ACT water management, as it is the location for one of the triggers in Plan G (GA/AL state line flow) for initiating drought operations in the ACT Basin. The Plan G-FR scenario would likely have a moderate adverse effect on flow conditions in the Coosa River at Rome, Georgia compared to Plan G.
- Alabama River at Montgomery, AL – The Plan G-FR scenario would likely produce median daily flows for the months of December through May ranging from about 11 to 16 percent lower than Plan G. From June through November, median daily flows for Plan G-FR would tend to be about eight to 12 percent lower than Plan G. For Plan G-FR, median daily flows during September and October would range as low as 6,500 to 8,500 cfs. At the 90 percent exceedance level. Plan G-FR basin inflows would produce stream flows at Montgomery that would have a similar seasonal pattern and percent reduction as median daily flows compared to Plan G. During the months of September and October, flows would range as low as 4,000 to 5,000 cfs. Plan G-FR would likely have a moderate adverse effect on flow conditions compared to Plan G.
- Alabama River downstream of Claiborne Lock and Dam – Plan G-FR would likely result in median flows that are reduced during the typically wetter months of December through May in the range of 15 to 25 percent. Flow reductions during June through November would likely be in

the range of six to ten percent. At the 90 percent exceedance level, similar reductions would likely be observed during December through May. From June through November, flows for Plan G-FR would likely be below the minimum flow target of 6,600 cfs most of the time. Plan G-FR would likely have a moderate adverse effect on flow conditions compared to Plan G.

Under the Plan G-FR scenario, drought operations would likely be triggered more frequently and remain in effect for longer periods. Drought Level 1 occurrences would increase by 27 percent, Level 2 occurrences by 55 percent, and Level 3 occurrences by 33 percent. Plan G-FR would dramatically increase the percent of time in drought operations (at all three levels of severity) compared to Plan G. Under Plan G-FR, the percent of time in *normal operations* over the 73-year modeled period of record would decrease by 10 percent. The percent of time in the established levels of drought operations would likely increase as follows: Drought Level 1 – 46 percent; Drought Level 2 – 64 percent; and Drought Level 3 – 50 percent. The drought operations trigger most affected by Plan G-FR compared to Plan G would be the state line flow trigger, followed by the basin inflow trigger, and the composite conservation storage trigger.

Plan G-FR would be expected to have adverse effects with respect to the percent of time that navigation flow targets for both 9-ft and 7.5-ft channel depths would likely be met compared to Plan G under current conditions. For both the 9-ft and 7.5-ft channel depths, the Plan G-FR scenario would have a minor adverse effect on the percent of time that navigation flow targets would be met for the months of December through April (from one to six percent lower than Plan G). For the months of May through November, the reductions in the percent of time that sufficient navigation flows would be available would be larger (ranging from five to about 14 percent lower than Plan G). However, even under this scenario, flows below Claiborne Lock and Dam would likely be sufficient to support navigable depths (at either the 9-ft or 7.5-ft level) over 70 percent of the time during seven months of the year. Only in the month of September would sufficient navigation flows be available less than 50 percent of the time.

Water intake structures would not be exposed to increased risk of insufficient flows or reservoir levels under Plan G-FR compared to Plan G.

Water Quality. The Proposed Action Alternative (Plan G) with reduced basin inflow, representing a potential climate change scenario, would have minor impacts on water quality in the ACT Basin.

The projected changes between Plan G and Plan G-FR are minor; there was no overall trend in water temperature changes throughout the ACT Basin. Median changes in temperature were less than 0.5°F (0.3°C) in most reaches of the ACT Basin over a range of flow conditions. Deviation from Plan G simulated temperatures for Plan G-FR was greatest in the representative dry-weather year. There was a noticeable but negligible difference in DO concentrations between Plan G and Plan G-FR over a range of flow conditions. Responses in DO appeared to be inversely proportional to the responses in temperature throughout the ACT Basin. This change is expected due to the relationship between DO and temperature.

The Plan G-FR scenario would be expected to cause a slight increase in total phosphorus concentrations in much of the ACT Basin compared to Plan G. The increases occur throughout the modeled period, but are most pronounced in the representative dry-weather year. Median concentrations rarely increase by more than 0.01 mg/L, although the 95^{th} percentile occurrence concentrations increase by as much as 0.02 mg/L. There are numerous wastewater dischargers in the ACT Basin. Loads from both point and nonpoint sources were not varied in modeling scenarios, and were held constant in all years to demonstrate how water quality is affected by changing hydrologic conditions. The Plan G-FR scenario increased the percentage of point source loading in the ACT Basin, thereby increasing the contributing load of nutrients to the basin. The increase in the wastewater loads directly correlates to the increase in total phosphorus concentrations in the basin. Similarly, Plan G-FR would be expected to cause a slight increase in total nitrogen concentrations in much of the ACT Basin compared to Plan G. The increases

occur throughout the modeled period, but are most pronounced in the representative dry-weather year. Median total nitrogen increases ranged between 0.0 mg/L and 0.1 mg/L, and the 95th percentile occurrence increases never exceeded 0.12 mg/L during the dry-weather period.

Little change in chlorophyll *a* would be expected in the ACT Basin for Plan G-FR over a period of various flow conditions during the growing season. Growth in chlorophyll *a* typically varies by less than 1 µg/L from Plan G-FR compared to Plan G. In dry-weather conditions, changes in temperature and flow would be expected to affect the system's ability to assimilate nutrient loads causing algal growth. During the representative dry year, the change in median chlorophyll *a* concentrations was less than 1 µg/L, although there was some variation in the extreme upper and lower percentiles. This indicates that the ACT Basin is able to assimilate the increased nutrient loads without effecting algal growth.

Biological Resources.

Vegetation. Plan G-FR would result in slightly lower water levels in the reservoirs than Plan G, but these negligible decreases in water levels would not affect vegetation.

Wildlife. Slight changes in flow and water quality that would be expected due to Plan G-FR would not have an adverse impact on upland wildlife compared to Plan G under current conditions.

Fish and Aquatic Resources. The negligible decreases in water levels in the reservoirs that would be expected with Plan G-FR compared to Plan G would not affect fish and aquatic resources. Reduced flows under Plan G-FR would be a greater concern. Differences in flow values (expressed in percent change) were calculated to compare flow conditions under Plan G to Plan G-FR at five locations in the ACT Basin. For each of the five locations, the differences were calculated at five different percentile levels covering the range from high to low flow occurrences (90^{th}, 75^{th}, 50^{th}, 25^{th}, and 10^{th}). Other than the Etowah River immediately below Allatoona Dam, where the 10^{th} percentile flow value equals the required minimum flow for either condition, the percent change in flow ranges from about a 10 to 22 percent reduction as a result of the Plan G-FR scenario. With a couple of minor exceptions at locations immediately downstream of dams, the larger differences most likely would occur at the 90^{th} and 75^{th} percentile levels (i.e, under higher flow conditions). Plan G would have a relatively high degree of sensitivity to a potential climate change scenario involving a reduction in basin inflows as high as 15 percent. Decreases in flow that would be expected in this scenario could potentially result in minor impacts to fish and aquatic resources.

Reduction in flow can also affect other habitat variables such as dissolved oxygen, flow velocity, sedimentation, and channel bed characteristics. Habitat suitability indices for fish often have suitability index graphs for average velocity during critical periods or in particular habitats such as pools or riffles, because optimal velocities vary by species. Flow reduction in a river could potentially change the fish assemblage in the stream as some species are negatively impacted by the change and other species benefit.

Plan G-FR would result in only minor changes in water temperature and noticeable but negligible difference in DO concentrations. Water quality changes in the ACT Basin that would be expected as a result of the reduced inflow would have negligible effects on fish and aquatic life.

Protected Species. This sensitivity analysis does not evaluate the potential impacts to individual species. However, reductions in flow could benefit some species and negatively impact others. Although the flow reductions do not result in large changes in temperature or dissolved oxygen in rivers in the ACT Basin, reduced flows may potentially change the fish assemblage in the stream as some species are negatively impacted by the change and other species benefit. Stream flow affects sediment transport which could

affect fish and mussels if sediment deposits in different areas or in greater depths than under current conditions, but predictions for specific species cannot be made.

Socioeconomic Resources. The Proposed Action Alternative with 15 percent reduced basin inflows (Plan G-FR) would likely result in little effect on some socioeconomic resources in the ACT Basin and a slight to moderate effects on others, as summarized below.

M&I Water Supply Availability. Plan G-FR would be expected to have no incremental effect on the M&I water supply availability in Allatoona Lake or Carters Lake compared to Plan G.

Navigation. Plan G-FR would have an adverse effect on the ability to meet navigation channel flow targets compared Plan G. For the months of May through December, the Plan G-FR scenario would result in a decline in the percent of time that the established navigation flow targets (for either a 9-ft or 7.5-ft channel depth) would be equaled or exceeded. The incremental declines in monthly values for Plan G-FR would range from two to 13 percentage points compared to Plan G. Plan G-FR would be expected to have incremental adverse implications for navigation in the ACT Basin.

Hydropower. With the Plan G-FR scenario, total ACT system hydropower benefits would be substantially affected compared to Plan G. Plan G-FR would likely result in a substantial decline in ACT total hydropower benefits (approximately 12 percent) compared to Plan G.

Agricultural Water Supply. Plan G-FR would likely result in slightly to moderately reduced stream flow conditions in the rivers of the ACT Basin. Reduced stream flow during certain periods could potentially result in some adverse effects on surface water availability for agricultural water supply. Groundwater withdrawals for agricultural water supply would likely not be appreciably affected by Plan G-FR.

Flood Risk Management. Plan G-FR would have a negligible incremental effect on flood risk management capabilities in the basin.

Recreation. Plan G-FR would slightly increase the percent of time over the modeled period of record that pools levels at Carters Lake and Allatoona Lake would decline below the established impact levels for recreation activities. The increases would be expected to have an incremental minor adverse effect on recreational activities at these projects. APC reservoirs would likely experience minor incremental lake levels declines for Plan G-FR compared to Plan G. USACE Alabama River lake levels would not be appreciably affected by Plan G-FR.

Property Values and Tax Revenues. Plan G-FR would be expected to have minor adverse incremental effects on lake level conditions in affected USACE and APC reservoirs. These effects could, in turn, potentially have some minor adverse implications for the value of property around the lakes over time, along with the associated tax revenues.

Environmental Justice and Protection of Children. Plan G-FR would not be expected to have adverse incremental effects on minority and low-income populations. Some of the lake level benefits for improved shoreline access during extreme droughts associated with Plan G may be partially diminished by the incremental effects of reduced basin inflows. Plan G-FR would have no incremental adverse effects with respect to the environmental health and safety of children.

Other Resource Areas. Compared to Plan G, reservoir management activities in the ACT Basin with the Plan G-FR scenario would not be expected to have appreciable increased effects on other natural and human resource considerations, including: soils and geology, land use, aesthetics, air quality, transportation and traffic, and cultural resources.

Air Temperature Increase (Plan G-TI).

HEC-5Q model runs were conducted with the historic basin inflows and a projected temperature increase associated with climate change (Plan G-TI) to independently assess the potential effects on water quality conditions and other resource considerations compared to Plan G. The HEC-5Q model for Plan G-TI increased the air temperature basin wide by 1.8 °F (1 °C). Various climate studies for the southeastern U.S. indicate that an increase of one degree Celsius would be expected in the next 100-years. Increasing air temperature would be expected to affect only water quality and the biological resources that depend on water quality in the basin. The effects of the Plan G-TI scenario are briefly discussed below.

Water Quantity. No incremental effects would be expected with Plan G-TI.

Water Quality. Plan G-TI would be expected to increase water temperatures by about 1.0 °F (0.5 °C) throughout the ACT Basin compared to Plan G. Increased air temperature would be expected to slightly decrease DO concentrations throughout the ACT Basin. As water temperature would increase, the maximum solubility of oxygen in water would decrease, resulting in lower DO concentrations. Increased air temperature with Plan G-TI would be expected to have little effect on total phosphorus and total nitrogen in the waters in the ACT Basin. Generally, the Plan G-TI scenario would not affect median concentrations of chlorophyll *a* and would decrease the highest concentrations, 95th percentile occurrences.

Biological resources. The Plan G-TI scenario would not affect vegetation of upland wildlife. Potential changes in total phosphorous, total nitrogen, and chlorophyll *a* would be expected to have negligible effect on water quality and, consequently, little effect on aquatic resources. Minor changes in water temperature and DO could put stress on fish and aquatic life considering that DO concentration would already be low during dry weather years. This additional decrease in DO could negatively affect aquatic life, including threatened and endangered species although those effects would be expected to be minor.

Socioeconomic Resources. No incremental effects would be expected with Plan G-TI.

Other resource areas. No incremental effects would be expected with Plan G-TI.

Sensitivity Analysis Conclusions. Increased future water demands (Plan G-DI), as considered herein through the year 2030, would likely have minor overall incremental effects on relevant resource areas of interest compared to Plan G. Project operations in the ACT Basin under the Proposed Action Alternative (Plan G) would not be highly sensitive to increased future water demands in the basin. Nonetheless, detailed basin-wide and site-specific analyses may be appropriate and necessary in the future to more accurately assess impacts and adapt project WCMs as future conditions in the basin may dictate.

Plan G would be highly sensitive to a 15 percent reduction in basin inflows (Plan G-FR), which is considered to be a reasonable representation of the hydrologic effects associated with a potential climate change scenario in the region. The estimate of climate change effects is highly uncertain and could potentially be more or less pronounced than the assumptions upon which this sensitivity analysis is based. Among the natural resource considerations most sensitive to a future decline in basin inflows would be flow conditions downstream of reservoirs or at other key points in the system that may be important for one or more reasons, (e.g., navigation flow targets, ecological function, water quality, etc.). Hydropower benefits would likely be substantially reduced as well under the Plan G-FR scenario.

Plan G would not be highly sensitive to increased air temperatures that could potentially be encountered in the ACT Basin as part of a climate change scenario. There would likely be some expected adverse effects on water quality and biological resources as a result of the Plan G-TI scenario, but these overall effects would be minor.

As natural and human-induced conditions unfold in the future that may affect project operations in the ACT Basin, USACE personnel would monitor and review changing conditions and evaluate whether future updates to the ACT WCM are needed to adapt project operations to pertinent changing conditions.

Cumulative Effects

Cumulative effects in ecosystems are defined as, "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions" (40 CFR Parts 1500–1508). Constructing dams in riverine ecosystems abruptly, severely, and permanently alters many important physical and biological processes involving the movement of water, energy, sediments, nutrients, and biota. Seventeen major dams impound mainstem channels of the ACT Basin, eliminating, fragmenting, and dramatically altering riverine habitat.

USACE conducted a preliminary survey in 2002 of existing reservoirs in the ACT Basin in Alabama and Georgia that are not on the mainstem rivers of the ACT Basin. The survey identified 280 reservoirs in the ACT Basin (Alabama and Georgia) that are 20 ac or larger (USACE, Mobile District 2002). The total surface area of the reservoirs is about 17,220 ac, an average reservoir size of about 62 ac. Those existing impoundments serve a variety of purposes, including water supply for livestock and irrigation, fish and wildlife conservation, recreation, M&I water supply, and other localized uses. Hundreds of other smaller ponds and impoundments are scattered across the ACT Basin. Those other reservoirs in the ACT Basin represent a total surface area in the range of about 10 percent of the total surface area of the 17 primary impoundments addressed in this EIS.

To meet projected future demands for public water supply, Georgia, Metropolitan North Georgia Water Planning District (MNGWPD), and the affected counties have undertaken a number of actions. Those efforts, which include both instituting aggressive conservation measures and developing new sources of water, are described in detail in Section 2.1.1.2.5. A 2008 study by the Georgia Environmental Finance Authority (GEFA) identifies ongoing and potential future investments in new reservoirs to address water supply needs in the state. The 2008 study revealed that one existing local reservoir project (Sharpe Creek Reservoir in Carroll County, Georgia) has the potential to expand storage volume about 2.5 times above the current level of about 3,400 ac-ft. At the time of the 2008 study, one proposed new reservoir (Richland Creek in Paulding County, Georgia) was in the permitting process (still underway). Dawson County Water Supply Reservoir (Russell Creek, Dawson County, Georgia) and Indian Creek Reservoir (Indian Creek, Carroll County, Georgia) are now in the permitting process. The study identified 56 other locations in the upper ACT Basin in Georgia that have been determined generally suitable for future water supply reservoir development. Future development at any of those locations would be highly speculative. Similar regional or state-wide studies have not been completed in Alabama; however, there are no known plans for water supply reservoir development in the Alabama portion of the ACT Basin.

The three new reservoirs and the reservoir with expansion potential described above are planned as alternate or back-up sources for existing demand or are expected to address localized increases in water demand within the western and northwestern portions of the metro Atlanta area. Those reservoir projects would represent a marginal overall increase in water use for public supply. Other than the additional loss and fragmentation of stream habitat as discussed below, these local water supply reservoir projects are likely to have an insignificant overall effect on water quantity aspects of the ACT Basin. This conclusion is generally supported by the sensitivity analysis for increased future water demands as described in the previous section.

Various private sector hydroelectric power interests have pursued steps to acquire a license from FERC for nonfederal hydroelectric power development at Claiborne Lock and Dam, beginning as early as 1983 and continuing to the present time. These efforts are discussed in detail in the EIS. It is likely that a

cost-effective project to retrofit Claiborne Lock and Dam to produce hydroelectric power could eventually occur because of greater emphasis on developing clean energy sources, increased fossil fuel costs, and reduced environmental issues associated with retrofitting an existing structure versus developing a new power generation source. A hydropower facility at Claiborne Lock and Dam would operate as a run-of-river facility. Waters released from Millers Ferry Lock and Dam, plus any intervening basin inflows to Claiborne Lake, would pass through a hydropower generation facility, up to its capacity, rather than over the spillway. Flows in excess of the plant capacity would pass over the spillway. Flow and water quality conditions downstream would not be markedly different from present conditions.

Similar nonfederal hydropower development efforts have been pursued for the Carters Reregulation Dam between 1982 and March 2011, as discussed in detail in the EIS. No active pursuit of nonfederal hydropower development is underway at this time, but it is likely that a cost-effective project to retrofit the Carters Reregulation Dam to produce hydroelectric power could eventually occur in the future. A nonfederal hydropower facility at the Carters Reregulation Dam would likely be expected to continue to meet established minimum flow requirements downstream of the project. No substantial new environmental issues or cumulative impacts would be expected with nonfederal hydropower development at the Carters Reregulation Dam.

Demands for public water supply and agricultural water supply in the ACT Basin have steadily increased since 1950 and are expected to continue to increase in the future. Agricultural water supply represents less than 5 percent of surface water withdrawals in the ACT Basin. As water conservation measures associated with public water supply (particularly in portions of the ACT Basin in the metro Atlanta area) become more institutionalized through education, incentives, and enforceable laws/regulations, the rate of increase in water demand is likely to appreciably decline. Industrial water use in the ACT Basin has declined dramatically in the past 40 years with the decline of the manufacturing sector of the economy. Overall, those declines, which are expected to continue in the future, tend to offset increased demands for public water supply and agricultural water supply. Water requirements for thermoelectric power production in the Georgia portion of the ACT Basin has declined as more efficient methods for cooling water have been employed. Water withdrawals for thermoelectric power production in Alabama increased dramatically between 1970 and 2000, thereafter remaining fairly constant. Cooling water withdrawals associated with thermoelectric power generation is essentially a nonconsumptive use.

More aggressive conservation measures could be likely to reduce or curtail the growth of current water demands, as would implementing any feasible water reuse projects. In the portion of the ACT Basin in the metro Atlanta area, interbasin transfers are likely to continue for the foreseeable future, reflecting a minor net loss of water from the Coosa River Basin to the Chattahoochee River Basin. Existing laws and regulatory mechanisms limiting interbasin transfers in Georgia would likely have to be modified to substantially expand interbasin transfers. More specific recommendations for addressing future shortfalls in water supply will likely be addressed in regional water plans developed by the regional water councils established under the ongoing Georgia State-Wide Water Planning process. No future water supply reservoir projects are anticipated in the Alabama portion of the ACT Basin.

One effect of the conversion of flowing water habitat to still water by construction of dams along the mainstem rivers of the ACT Basin and tributaries has been the decline or loss of river-dependent species of freshwater fishes, mussels, and snails. The habitat fragmentation effects of dams in the ACT Basin have resulted in declines in habitat for anadromous fishes. USACE, APC, and other reservoirs in the ACT Basin have changed the frequency of floodplain inundation in some areas and altered the ecology of the river. New dams in the ACT Basin would replicate many of those impacts elsewhere in the tributary streams and add to the cumulative alteration of natural flow regimes and habitat fragmentation. Depending on location, size, operating modes, amid other factors, new dams to meet water supply demands could adversely affect, and possibly extirpate, some protected aquatic species.

Human-induced inputs of various stressors into aquatic and terrestrial ecosystems can further compromise the ability of an ecological system to support a healthy biota. As growth (that is, increased density of human habitation) continues, the impacts on terrestrial ecosystems and wetlands adjacent to waterbodies in the basin are expected to become more degraded in spite of various levels of regulation or conservation efforts (e.g., stream buffers and wetland mitigation requirements). If, however, additional attention is given to protecting the integrity of floodplains and restrictions are placed on land cover conversions from residential/suburban/urban development, those areas could retain their function in fluvial processes. Those factors are expected to have some influence on conditions in tributaries, but they are expected to have little, if any, impact on the inundation of floodplains and wetlands in the Alabama, Coosa, and Tallapoosa River corridors. Those systems are largely driven by reservoir operations.

The region of influence for land use is the project land and the adjacent shoreline. The Proposed Action Alternative to manage project pool levels and flow requirements would have minor effects on lake elevation levels (principally at Allatoona Lake and Carters Lake), in turn affecting the project shoreline. Therefore, the focus of the land use analysis is on the project land over which USACE has proprietary or managerial jurisdiction, and the immediately adjacent land. The Proposed Action Alternative to prepare an updated Master Manual for the ACT Basin would not change the land use allocations or zoning. The Proposed Action Alternative would not change established land uses, disrupt or divide established land use configurations, represent a substantial change in existing land uses, or be inconsistent with adopted land use plans. Therefore, no cumulative effects would be expected.

Mobile Bay estuary faces a variety of anthropogenic pressures, including coastal urban development and associated pollution, upland urban development and associated pollution, fishery pressures, sea level rise, dredging, and coastal erosion and wetland destruction. Flow manipulation undoubtedly adds to the cumulative effect of existing anthropogenic stressors. Amid such pressure, even with variable system conditions, the Mobile Bay estuary has remained a productive estuarine ecosystem.

In general, flow alteration in the watershed could potentially affect the estuary, including commercial fisheries. The proposed updates to the ACT Master Manual are likely to have negligible effects on the ecological function of the Mobile Bay estuary. The ACT Basin contributes roughly 50 percent of the total flow to the Mobile River/Bay, and the balance is contributed by uncontrolled inflow from the Black Warrior-Tombigbee Basin. Additionally, modeling of the No Action Alternative and the Proposed Action Alternative indicate that differences in the flow regime at the most downstream points in the ACT Basin (e.g., Claiborne Lock and Dam) are negligible.

As human population density continues to rise along with associated habitat and water quality impacts, estuarine conditions can be expected to respond negatively, even with associated regulatory or conservation measures. However, if additional attention is given to protecting the integrity of the estuary, restrictions are placed on land cover conversions to residential/suburban/urban development, and attention is paid to aggressive restoration and protection of habitat and water quality, the estuary could continue to function with minimal adverse impact.

Water quality is influenced by a number of factors, including pollutant loads and in-stream flows (water quantity). Pollutant loads include both point and nonpoint sources of pollution. Point sources of pollution are regulated by USEPA through the NPDES under the Water Pollution Act of 1972 as amended. Nonpoint sources of pollution are also targeted to reduce pollutant loads under the Water Pollution Act of 1972 as amended through TMDLs. Enforcement of reductions is varied because of limited resources. As activities in the ACT Basin change from forested to urban land cover, especially in the headwaters areas of the Etowah River basin, peak flows in the system are likely to increase, and base flows in the system are likely to decrease. Urban land cover generally decreases interception of rainfall and infiltration, increasing stormwater runoff. That would be expected to result in less assimilative capacity during periods of low flow because base flow decreases.

Implementing Plan D, Plan F, or the Proposed Action Alternative would result in cumulative effects on water quality in the ACT Basin. The combination of a change to the flow regime and continued discharges during low-flow conditions by some entities holding NPDES permits would affect water temperature, nitrogen, phosphorus, and chlorophyll *a*. For the most part, those effects would be uneven throughout the course of the affected project area and would be expected to occur only during low-flow periods.

A waterbody's ability to assimilate pollutants is dependent on the amount of water in-stream, especially during low-flow periods. That is why the HEC models have been developed to ascertain the relationship between quantity and quality in the ACT Basin. Agencies regulating water quality in rivers and reservoirs will continue to monitor for impairment and improvement and enforce reductions until standards are met. That balance of what is allowable and what is discharged is an ongoing cycle of monitoring, assessment, and implementation. It is assumed that over time violations of the water quality standard will decrease because of reductions achieved through the Water Pollution Act of 1972 as amended.

Regardless of changes in reservoir operation, populations in the ACT Basin are expected to increase in the future, thus bringing more people into potential contact with known significant archaeological sites along the lakeshores and waterways. Increased human interaction is likely to increase the impact of access due to vandalism or artifact collection.

Mitigation

Mitigation includes measures to avoid, reduce, minimize, or compensate for adverse impacts that could result from a selected course of action. As potential water management measures were identified and alternative plans were developed and analyzed for the update to the Master Manual for the ACT Basin, potential mitigative actions were identified and considered in the planning process.

The iterative process USACE employed for formulation and evaluation of water management alternatives, coupled with substantial coordination with the USFWS, APC, and others, provided a strong framework for considering the incremental effects of the various components of the alternative plans and adjusting proposed operations to minimize adverse effects on the natural environment, as well as social, cultural, and economic impacts.

Implementing Plan D, Plan F, or the Proposed Action Alternative may result in adverse effects on water quality at various locations in the ACT Basin during low-flow conditions that may necessitate reevaluation of NPDES permits. Affected water quality parameters include water temperature and pollutants (nitrogen, phosphorus, and chlorophyll *a*).

Reevaluation of wasteload allocations from point sources in the upper Coosa River and Alabama River may be appropriate to ensure that current discharge permits do not violate water quality standards when in-stream flow changes from the No Action Alternative. Georgia EPD and ADEM base discharge permits on 7Q10 conditions; the system's 7-day minimum flow from the previous 10-year period. In some permits, restrictions are placed on discharges during low-flow conditions similar to what occurred in 2007. Georgia EPD and ADEM may determine that it would be appropriate to reevaluate stream flows in the upper Coosa River and Alabama River to ensure that NPDES permitted facilities do not violate water quality standards under extreme low flow conditions. The water quality model developed during this EIS made assumptions regarding point source discharges that might not apply during low-flow conditions. The states may elect to update NPDES permits to limit discharges during certain in-stream flow conditions.

From the analysis of the Proposed Action Alternative and other alternatives, specific compensatory mitigation measures would not be required. No specific mitigation commitments are included in the

Proposed Action Alternative and Plans D and F, but all those plans incorporate specific measures to improve conditions for fish and wildlife, such as promoting fish spawning through reservoir operations practices and facilitating fish passage by way of specific lock operations protocols.

Water management inherently involves adapting to unforeseen conditions. The development of water control criteria for the management of water resource systems is conducted throughout all phases of a water control project. The water control criteria are based on sound engineering practices using the latest approved models and techniques for all reasonably foreseeable conditions. Further refinements or enhancements of the water control procedures might be needed to account for changed conditions resulting from unforeseen conditions, new requirements, additional data, or changed social or economic goals. However, it is necessary to define the water control plan in precise terms at a particular time to assure carrying out the intended functional commitments in accordance with the authorizing documents (EM 1110-2-3600 Management of Water Control Systems). Because adverse impacts of the water control plan might occur because of unforeseen conditions, actions would be taken within applicable authority and policies, and in coordination with others, to address those conditions when they occur through the implementation of temporary deviations to the water control plan, such as interim operation plans.

Such temporary deviations from the approved water control plan might have impacts that go beyond the scope of the current evaluation. Because it is not possible to predict the entire range of possible water management responses to extraordinary circumstances, an evaluation of each potential action, including compliance with NEPA, would be made at the time of its consideration.

Other NEPA Considerations

Irreversible or Irretrievable Commitments of Resources. The Proposed Action is not consumptive in nature. Update of the WCMs for the ACT Basin would be expected to have generally positive effects on resources (e.g., potential reduction of damages from flooding). The Proposed Action would not result in irreversible or irretrievable commitments of resources

Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity. Update of the WCMs for the ACT Basin would not be expected to alter substantially the present relationship between short-term uses of man's environment and maintenance and enhancement of long-term productivity.

1 Purpose, Need, and Scope

1.1 Introduction

This environmental impact statement (EIS) evaluates the proposal by the U.S. Army Corps of Engineers (hereafter referred to as USACE or Corps) to adopt an updated *Master Water Control Manual* (WCM or Master Manual) for the Alabama-Coosa-Tallapoosa (ACT) Basin. This EIS has been prepared to comply with the requirements of the National Environmental Policy Act of 1969 (NEPA), as amended (42 *United States Code* [U.S.C.] section 4321−4347); the Council on Environmental Quality's (CEQ's) *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (Title 40 *Code of Federal Regulations* [CFR] Parts 1500–1508); and Engineering Regulation (ER) 200-2-2, *Environmental Quality—Procedures for Implementing NEPA* (33 CFR Part 230).

The ACT Basin comprises 22,739 square miles (sq mi) in Georgia and Alabama. USACE operates five reservoir projects within the ACT Basin and is responsible for channel maintenance for that portion of the Alabama River from Mile 0 to Claiborne Lock at Mile 72:

- Allatoona Lake, Georgia
- Carters Lake and Carters Reregulation Dam, Georgia. Carters Lake functions as a single system.
- Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake, Alabama
- Millers Ferry Lock and Dam and William "Bill" Dannelly Lake, Alabama
- Claiborne Lock and Dam and Lake, Alabama

USACE must operate and manage those projects as a system to meet authorized purposes, which include: flood risk management, hydropower, navigation, fish and wildlife conservation, recreation, water quality, and water supply. USACE is also responsible for the review and approval of the flood risk management plans and Reservoir Regulation Manuals (Reservoir Manuals) for the following Alabama Power Company reservoir projects in the ACT Basin: Weiss Lake, H. Neely Henry Lake, and Logan Martin Lake on the Coosa River and R.L. Harris Lake on the Tallapoosa River. The updated ACT Basin Master Manual and individual reservoir WCMs are in Appendix A. In 2006, USACE adopted and began to use the term "flood risk management" in lieu of the traditional terms "flood control" and "flood damage reduction." This term more appropriately characterizes the USACE mission to manage and reduce risk of loss of life and property damage associated with flood events (USACE IWR 2009). Therefore, "flood risk management" has been used throughout this EIS to describe that mission area.

1.2 Purpose and Need

The master operating manual for the ACT Basin dates to 1951 and does not include WCMs for any projects completed after the Allatoona Lake project. The individual reservoir manuals were completed as the projects came on line. Section 7 of the Flood Control Act of 1944 provides that "On and after December 22, 1944, it [will] be the duty of the Secretary of the Army to prescribe regulations for the use of storage allocated for flood risk management or navigation at all reservoirs constructed wholly or in part with [f]ederal funds provided on the basis of such purposes, and the operation of any such project [must] be in accordance with such regulations...." (Title 33 *United States Code* [U.S.C.] section 709).

The purpose of the proposed action is to update the ACT WCM as directed by Secretary of the Army Peter Geren on October 18, 2007. Specifically, the purpose and need for this federal action is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law, and to implement those operations through updated water control

plans and manuals. Conditions in the basin (population, socio-economic, land use, infrastructure, demand for water resources, etc.) have changed substantially since the federal reservoirs were authorized and constructed, and a variety of applicable federal and state environmental laws have been passed and implemented. Operation of the federal reservoir projects in the basin both affect, and are affected by, current conditions in the basin and must comply with current laws and regulations. This action will result in updated plans and manuals that reflect operations under existing congressional authorizations taking into account changes in basin hydrology and demands due to years of growth and development; new/rehabilitated structural features; and environmental issues (for more detail, see Section 3.1.9, WCMs).

There is also a need for a comprehensive basin-wide drought contingency plan in accordance with pertinent USACE regulations. Both the WCM and the drought contingency plan are needed to accomplish specific congressionally authorized and general statutory project purposes in the basin.

Updated WCMs are also needed to

- Capture project and system operations that have been refined over the years because of changes in basin hydrology and withdrawals/consumption that resulted from years of growth and development
- Reflect drought contingency requirements to account for new data and operational changes
- Update data reflecting basin conditions
- Account for new or rehabilitated project structural features
- Meet environmental objectives for water quality, endangered species, and fish spawns
- Capture and use real-time data provided by additional gages and monitoring devices installed since the last manual updates
- Use the latest computer models and techniques to evaluate and establish guidelines for project operations
- Improve and streamline methods for data exchange between USACE and other agencies

Any proposed changes to the ACT Basin water control operations that would significantly affect other project purposes or require substantial structural modifications would require feasibility-level studies and congressional authorization. Such studies are not consistent with the purpose and need of updating the WCM. Accordingly, this EIS does not address any proposed changes to water management practices that exceed existing congressional authority. Further, to the extent that existing operations must be adjusted to come into compliance with applicable law, such changes will be included as part of any proposed action.

1.3 Scope of the EIS

The purpose of scoping is to determine the range of issues to be addressed and to identify the significant issues to be analyzed in depth with respect to the proposed action. The process also helps to deemphasize insignificant issues, thereby allowing USACE to identify the range of actions, alternatives, and impacts to be considered in the EIS for the update of the Master WCM. This EIS identifies, documents, and evaluates environmental effects of operating USACE projects in the ACT Basin under alternative management regimes that could reasonably be expected to accomplish the purpose and need of the proposed federal action. The purpose of the EIS is to inform decision makers and the public of the likely environmental consequences of the proposed action and alternatives. The range of actions, alternatives, and impacts considered in this EIS are driven by the requirements set forth by Congress and Corps policies for operation of the projects. This EIS considers only operational changes within existing

congressional authorities and does not consider operational changes that would require additional authority. Accordingly, this EIS does not consider major operational changes to flood risk management storage or reallocation of storage to meet future water supply needs. As further described in the EIS, the scope pertains to the geographic areas potentially affected by the proposed action within the ACT Basin and the area of potential environmental effect, which varies by resource.

Environmental impact analysis must be proportionate to the nature and scope of the action, the complexity and level of anticipated effects on important resources, and the capacity of USACE decisions to influence those effects in a productive, meaningful way from the standpoint of environmental quality. The environmental analysis for this EIS is commensurate with the diverse array of operations associated with the proposed action. The *project site* for the proposals include the entire ACT Basin. The region of influence (ROI) for each of the environmental resources and socioeconomic conditions is resource-dependent.

1.4 Public Involvement

Under regulations issued by the CEQ,[1] the evaluation of potential environmental effects of federal actions is open to the public. Public participation in the NEPA process promotes both open communications between the public and USACE and better decision making. All persons and organizations that have a potential interest in the proposed action, including minority, low-income, disadvantaged, and Native American groups, are urged to participate in the NEPA environmental analysis process.

Public participation opportunities with respect to the proposed action are guided by CEQ regulations and USACE regulations.[2] Those regulations provide for making five major aspects of public participation available in conjunction with preparation of this EIS: (1) issuance of a Notice of Intent (NOI) to prepare an EIS, (2) scoping, (3) public review of the draft EIS, (4) public meeting on the draft EIS, and (5) public review of the final EIS. Each of those steps in the process provides for public involvement and is briefly discussed below. Throughout the process, the public can obtain information on the status and progress of the proposed action and the EIS through the USACE, Mobile District Public Affairs Office by calling 251-690-2505. Additionally, interested persons can visit the USACE, Mobile District Web site at www.sam.usace.army.mil. Additionally, section 310(b) of WRDA 1990 requires public participation in changes to reservoir operation criteria. For this update, the public participation has been accomplished through the NEPA process.

1.4.1 Notice of Intent

The NOI informing the public of the preparation of an EIS is the first formal step in the NEPA public involvement process. The agency proposing the action publishes the NOI in the *Federal Register* before the start of the scoping process. The NOI includes a description of the proposed action and gives the name and address of an agency contact person. The NOI declaring the USACE intent to prepare an EIS for the proposed action was published in the *Federal Register* on November 9, 2007. A supplement to the NOI was published in the *Federal Register* on August 22, 2008, announcing that four public scoping meetings would be held during September as part of the USACE review and update of the WCM for the ACT Basin. The public was invited to attend the scoping meetings, which provided information on the WCM update process and afforded USACE the opportunity to receive input from the public about issues and concerns regarding that process.

[1] CEQ Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act, 40 CFR Parts 1500–1508, November 1978.

[2] ER 200-2-2, Procedures for Implementing NEPA, March 1988.

1.4.2 Scoping Process

In the fall of 2008, the USACE Mobile District conducted public scoping for preparation of this EIS. The purpose of the scoping, in accordance with the requirements of NEPA, is to solicit input from other agencies and the public. Such input would help identify all the relevant issues and alternatives that should be addressed in the EIS and identify sources of supporting documentation for a decision on implementing a Master WCM update and updating reservoir-specific water control plans to be included as appendices to the Master WCM. Copies of coordination letters are included in Appendix B.

It is designed to involve the public early in the EIS process. Public comments are solicited through mailings, media advertisements, and both agency and public scoping meetings. While informal comments are welcome at any time throughout the process, the scoping period and the scoping meeting provide formal opportunities for public participation in and comment on the environmental impact analysis process.

The USACE scoping objectives were to identify public and agency concerns; clearly define the environmental issues and alternatives to be examined in the EIS, including the elimination of insignificant issues; identify related issues that originate from separate legislation, regulations, or Executive Orders (EOs) (e.g., endangered species or environmental justice concerns); identify state and local agency requirements that must be addressed; and identify available sources of data, studies, or tools that could provide information valuable in preparing the EIS.

In 2008 the USACE scoping process consisted of the following elements:

- Publishing in the *Federal Register* an NOI to prepare an EIS
- Publishing in the *Federal Register* an announcement of the dates and locations of four public scoping meetings
- Updating the existing mailing list by means of an initial postcard requesting accurate contact information
- Distributing a newsletter and a public notice announcing public scoping meetings and locations to federal, state, and local agencies and officials; stakeholders; and other interested parties
- Preparing and launching a Web site that described the NEPA process and all the public involvement activities planned during EIS preparation and served as a tool for collecting public comments and updating the project mailing list
- Distributing a press release to media outlets
- Sending agency scoping and tribal consultation letters by e-mail
- Sending agency scoping and tribal consultation letters by the U.S. Postal Service
- Holding a federal agency meeting and Web conference to inform the agencies and solicit comments
- Hosting a Stakeholder's Workshop to share the new and improved version of reservoir simulation software called Hydrologic Engineering Center (HEC)-Reservoir Simulation (HEC-ResSim) Model with all stakeholders groups involved with water management issues in the basin
- Holding four public scoping meetings at strategic locations throughout the ACT Basin to inform the public about the proposed action and to solicit oral and written comments on the issues that should be addressed in the EIS
- Reviewing and evaluating the oral and written comments received during the open comment period

- Publishing the scoping report on a Web site at www.sam.usace.army.mil
- Distributing a newsletter announcing publication of the scoping report to federal, state, and local agencies and officials; stakeholders; tribes; and other interested parties

USACE conducted public scoping in fall 2008 to initiate preparation of the EIS regarding implementation of an updated Master WCM for the ACT Basin in Alabama and Georgia. On September 11, 2008, USACE Mobile District hosted a web conference, and 10 representatives from 6 federal agencies participated: U.S. Fish and Wildlife Service (USFWS), Southeastern Power Administration (SEPA), U.S. Environmental Protection Agency (USEPA) Region 4, Natural Resources Conservation Service (NRCS), Federal Energy Regulatory Commission (FERC), and National Oceanic and Atmospheric Administration (NOAA)–National Marine Fisheries Service. Additionally, government-to-government tribal consultation letters were sent electronically on October 1, 2008, and by mail on October 15, 2008. The letters were sent by U.S. Mail to 26 federally recognized American Indian tribes.

Scoping meetings for the general public were held at four strategic locations in the ACT Basin between September 15 and September 18, 2008:

- September 15, 2008: Kennesaw, Georgia
- September 16, 2008: Rome, Georgia
- September 17, 2008: Gadsden, Alabama
- September 18, 2008: Montgomery, Alabama

1.4.3 Public Comments

The public scoping effort for updates to the WCM resulted in comments from 117 individuals, organizations, and agencies. The agencies consisted of federal, state, and local governments. The federal agencies that submitted comments were SEPA and USFWS. Alabama and Georgia submitted comments through their associated state agencies.

Table 1.4-1 depicts the 11 subject matter categories of the comments received and the percentage of comments in each category.

Table 1.4-1.
Comments categorized by segment

Category	Percent of comments
Water Resources	29%
Economic Resources	17%
Ecological Resources	11%
Other	11%
Recreation	10%
NEPA	10%
Baseline Conditions	4%
Public Communications/Newsletters	3%
Scoping Meetings	3%
Cultural Resources	1%
Agriculture	1%
Total	100%

Full details on the public's comments are presented in the USACE scoping report, which is at www.sam.usace.army.mil. The following discusses categories of most interest to those who responded with comments.

Water Resources. The Water Quantity/Water Supply and Water Quality categories received the most discussion of any of the resource categories. Such comments were directed at maintaining and protecting public water supplies and water supply storage allocations, particularly in Allatoona Lake. Maintaining higher lake level in the fall and winter was of interest for several of the reservoirs, but concerns were also expressed on ensuring adequate flood risk management if winter pool levels are increased.

Economic Resources. Economic Resources categories were the second-most selected and included flood risk management, hydropower, navigation, and recreation. Nearly 10 percent of the responders selected the Recreation category as an area of high concern. Typically considered as an economic resource to local communities and the states, the Recreation category comments were more often about quality of life issues rather than economic issues. Combined with flood risk management, hydropower, and navigation, economic issues accounted for 17 percent of the total selected areas of interest.

Ecological Resources. The Ecological Resources category, including Fisheries and Threatened and Endangered Species was selected by 10 percent of the responders, with water level and habitat preservation issues receiving the largest number of specific comments. Comments suggest that USACE should ensure sufficient quality and quantity of water be provided in such a manner to resemble the natural riverine flow regime. That flow regime should provide aquatic habitat conditions that support a diversity of endemic aquatic species (including fish, plants, mussels, and other invertebrates) and their life cycle requirements. Because many peer review studies indicate that release flows and flow patterns do not protect aquatic wildlife at federal or private projects, the biological response to those managed environmental flows should be evaluated and, if necessary, adjusted to meet the objective of maintaining ecological integrity.

Other Resources and Categories. The Other category was selected by 11 percent of responders, with more than 50 percent of the comments received in the category being related to water level issues in the reservoirs and the transfer of water from one basin to another basin (interbasin transfer). Many of the water level comments were not related directly to water level effects on other basin resources but were more directed toward the aesthetics of not having a full reservoir or not having sufficient water in the reservoirs to maintain higher flows in the rivers. Subcategories of comments include those pertaining to interbasin water transfers, potential postponement of the WCM update, M&I return flows, drought management planning, and modeling tools.

More detail of the comments received is provided in the section to follow.

1.4.4 Analysis of Public Comments

As described in more detail in Section 4, stakeholder comments assisted in identifying water resources/water management problems and in identifying measures (or alternatives) that the public desired to be considered in updating the WCM. Considering the purpose and need for this EIS, USACE developed screening criteria to guide information gathering, to help identify solutions, and to formulate alternative plans. Further, the screening criteria helped define the scope of proposed updates to the Master WCM EIS and to identify relevant public/agency issues and concerns to be addressed in the EIS. The screening criteria, which are summarized below, guided the consideration of input received from the

public and from federal and state agencies as well as suggestions from within USACE. Any proposed water management measure (or alternative) considered in the update process for the ACT WCM EIS

1. Should meet the purpose and need of the proposed federal action
2. Should address one or more of the congressionally authorized project purposes
3. Should not require a reallocation of storage for water supply
4. Should not increase flood risk above the current level
5. Should be consistent with the contemporary water resources needs of the basin to the extent practicable
6. Should support the operation of the projects in the ACT Basin as a system
7. Should not increase the risks to public safety in the facility or downstream of the project
8. Should not exceed the physical limitations of or increase the risks to the structural integrity of the projects
9. Should not violate the USACE responsibilities under the Endangered Species Act (ESA)

In addition to their application in considering public and agency input to defining the general scope of the WCM update and identify relevant issues and concerns to be considered, those criteria were also used to conduct initial screening of potential water management measures for more detailed evaluation and possible inclusion in one or more of the WCM update alternatives. The initial screening process is described in more detail in Section 4.

The following paragraphs provide additional discussion of the screening criteria.

1. A measure (or alternative) should meet the purpose and need of the proposed federal action.

As explained in Section 1.2, the purpose of the proposed action is to update the WCM for the ACT Basin to determine how federal projects should be operated for their congressionally authorized purposes, taking into account changes in basin hydrology and demands from years of growth and development; new/rehabilitated structural features; and environmental issues. Any proposed changes that would require feasibility-level studies and congressional authorization such as changes that would significantly affect other project purposes or require substantial structural modifications are not consistent with the purpose and need of updating the WCM.

2. A measure (or alternative) should address one or more of the congressionally authorized project purposes.

In accordance with USACE governing regulations water control plans are prepared giving appropriate consideration to all applicable congressional acts relating to the operation of federal facilities. For the ACT Basin, the congressional acts include the authorizing legislation, referenced project documents, and the subsequent general authorities (e.g. the Fish and Wildlife Coordination Act, Federal Water Project Recreation Act-Uniform Policies, Clean Water Act (CWA), the ESA, the Flood Control Act of 1944 and the Water Supply Act).

3. A measure (or alternative) should not require a reallocation of storage for water supply.

USACE has the discretionary authority to consider such requests; however, this is a separate and distinct discretionary authority that USACE is not pursuing as part of this WCM update. Further, such a measure would not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for the projects' authorized purposes, in light of current conditions and applicable law, and to implement those operations through an updated Master WCM of the ACT Basin.

4. A measure (or alternative) should maintain at least the current level of flood risk management protection.

USACE operates projects in the ACT Basin to maintain the level of flood risk management that the U.S. Congress intended when authorizing the system and projects. Continued growth and development in the ACT Basin floodplain serves as an additional constraint on the level of flood risk management that must be provided. Any proposed action must not significantly alter the level of flood protection intended by Congress in its authorizing language or increase the current levels, frequency, and duration of flood protection.

5. A measure (or alternative) should be consistent with the contemporary water resources needs of the basin to the extent practicable.

Engineering Manual (EM) 1110-2-3600(2)(1)(b) and (3)(1)(b) states than an overarching goal of water control plans is to account for changing local conditions and needs in the basin. Even after the projects are constructed, a need often arises for further refinements or enhancements of the water control procedures, to account for changed conditions resulting from new requirements, additional data or changes in the basin. Such changes, however, must be consistent with the project's authorized purposes.

6. A measure (or alternative) should operate the projects in the ACT Basin as a system.

Authorizing documents call for operation of the projects proposed for the ACT Basin as a system. In accordance with EM 1110-2-3600 the operation of a multiple project system such as the ACT Basin requires integrated WCM and plans whereby projects are regulated jointly to achieve the overall river basin management objectives.

7. A measure (or alternative) should not increase the risk to public safety in the facility or downstream of the project.

Pursuant to ER 1110-2-240(6) (g) and EM 1110-2-3600 one of the prime requirements in project or system regulation is the safety of the users of the facility and the general public at the projects and downstream of the projects. USACE operates the projects and systems in full compliance with USACE safety regulations. Measures (or alternatives) that would increase the risk to the facility, the facility personnel or the general public were not considered.

8. A measure (or alternative) that exceeds the physical limitations of or increases the risks to the structural integrity of the projects should not be considered.

The federal action is an updated WCM that inherently must reflect existing infrastructure and authorized project purposes. Therefore, measures (or alternatives) that would modify the physical projects and would require additional authorizations or study should not be considered. Structural changes to constructed projects are subject to specific study and approval processes, which cannot be accomplished within a WCM/plan update.

9. Any measure (or alternative) that violates the USACE responsibilities under the ESA will not be considered.

As part of its WCM update, USACE planned to enter into consultation with the USFWS at the appropriate time during the process regarding potential effects on threatened and endangered species in the ACT Basin. Consultation with the USFWS was conducted and subsequently completed in March 2014.

USACE reviewed the comments/suggestions received during scoping as categorized in Appendix L of the Scoping Report and developed summaries of the major themes. The major comments/suggestions received during the scoping process are listed below together with a statement of whether or how the

comment/suggestion will be considered in updating the WCM. The USACE responses are summarized in tables to follow, and the number preceding the comment/suggestion refers to an entry in the table.

1.4.4.1 Water Quantity/Supply

WS1. Higher lake levels at several reservoirs should be maintained in the fall and winter.

- Raising the pool levels at USACE reservoirs would reduce the available flood risk management storage and require a reallocation of that storage to some other purpose. USACE has the discretionary authority to consider such requests, and in updating the WCMs, USACE will consider whether guide curves can be modified without adversely affecting flood risk management.

WS2. If winter pool levels are increased, flood protection should not be adversely affected.

- Raising the pool levels at USACE reservoirs would reduce the available flood risk management storage and require a reallocation of that storage to some other purpose. USACE has the discretionary authority to consider such requests, and in updating the WCMs, USACE will consider whether guide curves can be modified without adversely affecting flood risk management.

WS3. Maintain higher winter pool levels at Allatoona Lake, especially during drought.

- Changes to Allatoona Lake guide curve will be considered when updating water control plans and manuals. USACE will develop a drought plan as part of the WCM update. The plan will guide releases from Allatoona Lake during drought.

WS4. Maintain a winter pool of 830 feet (ft) at Allatoona Lake.

- Changes to Allatoona Lake guide curve will be considered when updating water control plans and manuals.

WS5. Maintaining higher lake levels during drought will benefit numerous basin resources.

- Changes to Allatoona Lake guide curve will be considered when updating water control plans and manuals.

WS6. USACE should consider the far-reaching effects of water management in the ACT Basin as it affects communities well beyond the boundaries of the basin itself.

- Impacts of changes to water management practices will be described in the EIS.

WS7. In the interest of recreation, keep Allatoona Lake pool levels constant.

- Holding the Allatoona Lake pool level constant would eliminate the additional flood protection afforded by the fall and winter drawdown to 823 ft. Any considered water management alternative should maintain at least the current level of flood risk management protection.

WS8. Atlanta should look for other resources for its drinking water.

- Determining the appropriate sources of water supply for the Atlanta area is a local responsibility, not a USACE responsibility.

WS9. Desalination is a potential solution to regional water supply shortages.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for the projects' authorized purposes, in light of current conditions and applicable law.

WS10. Alabama had no restrictions on water use, while Georgia had significantly curtailed water use during 2007 drought.

- Measures considered by various water users to reduce the consumption of water in the ACT Basin will be described in the EIS, to the extent that information is available to USACE. Requiring the implementation of such measures, however, is generally a state and local responsibility, not a USACE responsibility. In updating the water control plans and manuals, USACE developed a drought management plan that emphasizes conservation of storage when drought conditions exist.

WS11. Water restrictions during drought should apply basin-wide.

- Measures considered by various water users to reduce the consumption of water in the ACT Basin will be described in the EIS, to the extent that information is available to USACE. Requiring the implementation of such measures, however, is generally a state and local responsibility, not a USACE responsibility. In updating the water control plans and manuals, USACE developed a drought management plan that emphasizes conservation of storage when drought conditions exist.

WS12. The EIS should evaluate a potential reallocation of storage in Allatoona Lake and Carters Lake for water supply.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

WS13. Determine the Basin's limit for water supply during drought.

- USACE will consider the water supply needs of the region consistent within the limits of its existing authorities. The purpose and need of this effort is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law, and to implement those operations through an updated Master WCM of the ACT Basin. The effort is not a comprehensive study designed to resolve the long-term water supply needs of the region.

WS14. USACE should impose surcharges on water supply storage used to supply needs outside the ACT Basin.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

WS15. The federal government should require all new construction to have a rainfall recycling program.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

WS16. Limit growth in the Atlanta area to the carrying capacity of its water resources.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law. Controlling/regulating growth is a local responsibility, not a USACE responsibility.

WS17. Refuse any increase in storage allocation in Allatoona Lake without assurance that withdrawn water will be returned to the Etowah River as highly treated wastewater.

- Regulating wastewater discharges and interbasin transfers is a local responsibility, not a USACE responsibility.

WS18. Consider the impacts of new and proposed water supply reservoirs upstream of Allatoona Lake.

- USACE will consider the impacts of existing and proposed water supply reservoirs upstream of Allatoona Lake. However, this effort is not a comprehensive study designed resolve the long-term water supply needs of the region.

WS19. Consider altering the hydropower generation schedule in the context of water supply and water quality/fish and wildlife conservation.

- The effects of considered water management changes on water quality downstream of Allatoona Lake and Carters Lake will be taken into account when updating the water control plans and manuals. Flow needs for fish and wildlife conservation and threatened and endangered species will be determined through consultation with the USFWS.

WS20. In updating the WCM, USACE should consider the water supply needs identified in the Metropolitan North Georgia Water Planning District's (MNGWPD's) Plans.

- USACE will consider the water supply needs of the region consistent within the limits of its existing authorities. The purpose and need of this effort is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law, and to implement those operations through an updated Master WCM of the ACT Basin. The effort is not a comprehensive study designed to resolve the long-term water supply needs of the region.

WS21. Consider the water supply needs of users beyond the boundary of the ACT Basin.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

Table 1.4-2 summarizes the water supply comments received by category.

Table 1.4-2.
Summary of water supply comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
WS1	X								
WS2	X								
WS3	X								
WS4	X								
WS5	X								
WS6	X								
WS7	X								
WS8			X						
WS9		X							
WS10			X						
WS11			X						
WS12		X		X					
WS13		X							
WS14		X							
WS15		X							
WS16		X	X						
WS17			X						
WS18	X								
WS19	X								
WS20	X								
WS21		X	X						

Note: T&E = threatened and endangered

1.4.4.2 Water Quality

WQ1. Allatoona Lake's level must be kept higher in both the summer and winter to reduce the damage to the lake bank.

- Changes to Allatoona Lake guide curve will be considered when updating water control plans and manuals.

WQ2. Allatoona Lake level must be kept at a higher level to reduce the negative effects from the concentration of point and nonpoint source pollutants with decreased pool volume, particularly during the winter drawdown.

- Changes to Allatoona Lake guide curve will be considered when updating water control plans and manuals.

WQ3. Maintain higher winter pool levels at Allatoona Lake, especially during drought.

- Changes to Allatoona Lake guide curve was considered when updating water control plans and manuals.

WQ4. Maintain a winter pool of 830 ft at Allatoona Lake.

- Changes to Allatoona Lake guide curve was considered when updating water control plans and manuals.

WQ5. The WCM update should consider sediment and nutrient loadings to Allatoona Lake from urban activities, various industrial and municipal discharges, sudden fluctuations in elevation of water at the lake that worsen the lake shoreline erosion, sediment loading reductions on volume of storage, and faulty septic tank/leach fields adjacent to or on USACE properties at Allatoona Lake.

- Water quality management and control of point and non-point sources of pollution off USACE project lands is principally the responsibility of the states. Water quality will be taken into account when updating water control plans and manuals as well as the impacts of shoreline erosion and sedimentation.

WQ6. Current reservoir operations have a detrimental effect on water quality, including existing and potential effects on dissolved oxygen (DO), temperature, pH, conductivity, and nutrient (particularly phosphates) and organic material dynamics.

- Water quality management is primarily the responsibility of the states. In accordance with ER 1110-2-8154, USACE has an objective to ensure that water quality, as affected by a USACE project and its operation, is suitable for project purposes, existing water uses, and public safety and is in compliance with applicable federal and state water quality standards. The effects of considered water management changes on water quality in USACE reservoirs will be taken into account when updating the water control plans and manuals. Release from USACE dams are not subject to CWA sections 401 and 402.

WQ7. USACE should monitor water quality in reservoirs and tailwaters to detect, report, and mitigate possible water quality issues that might affect benthic and pelagic species.

- Water quality management is primarily the responsibility of the states. In accordance with ER 1110-2-8154, USACE has an objective to ensure that water quality, as affected by a USACE project and its operation, is suitable for project purposes, existing water uses, and public safety and is in compliance with applicable federal and state water quality standards. The effects of considered water management changes on water quality in USACE reservoirs will be taken into account when updating the water control plans and manuals.

WQ8. Quality of the water in Allatoona Lake is of extreme concern as development around the lake is proceeding at an alarming rate.

- Regulation and control of development around Allatoona Lake on nongovernment-owned land is a local responsibility, not a USACE responsibility.

WQ9. USACE should work with county commissioners in Cobb County, Georgia, to discuss the possible effects on the lake and the quality of drinking water as the commissioners make zoning and growth decisions.

- Regulation and control of development around Allatoona Lake on nongovernment-owned land is a local responsibility, not a USACE responsibility.

WQ10. Flow in the Oostanaula and Etowah Rivers might not be adequate to provide drinking water and to assimilate wastewater in the area if more water is retained in Carters Lake or Allatoona Lake.

- The effects of considered water management changes on water quality downstream of Allatoona Lake and Carters Lake will be taken into account when updating the water control plans and manuals. With respect to waste assimilation needs, this update of the

water control plans and manuals will consider permitted waste discharge loads. However, USACE does not operate to accommodate waste assimilation needs except as required by dam minimum flow requirements contained in project authorizing documents.

WQ11. The quality of water coming down the Coosa River to Gadsden declines as flows decrease.

- The effects of considered water management changes on water quality downstream of Allatoona Lake and Carters Lake will be taken into account when updating the water control plans and manuals.

WQ12. During drought, water quality at H. Neely Henry Lake is greatly diminished, and water quality will further decline if diversion of water in Georgia continues.

- The effects of considered water management changes on water quality downstream of Allatoona Lake and Carters Lake will be taken into account when updating the water control plans and manuals.

WQ13. Sewer infrastructure and subsequent effluent effects should be part of the cost of land being developed.

- Such a measure is not a federal government responsibility. Additionally, such an alternative does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law, and to implement those operations through an updated Master WCM of the ACT Basin.

WQ14. USACE should meet all state water quality standards for at least *Fish and Wildlife* classified waters.

- Water quality management and control of point and non-point sources of pollution off USACE project lands is principally the responsibility of the states. In accordance with ER 1110-2-8154, USACE has an objective to ensure that water quality, as affected by a USACE project and its operation, is suitable for project purposes, existing water uses, and public safety and is in compliance with applicable federal and state water quality standards. The effects of considered water management changes on water quality in USACE reservoirs will be taken into account when updating the water control plans and manuals. Release from USACE dams are not subject to CWA sections 401 and 402.

WQ15. Alter releases from Allatoona Dam to improve DO and restore temperatures to pre-dam conditions.

- In accordance with ER 1110-2-8154, USACE has an objective to ensure that water quality, as affected by a USACE project and its operation, is suitable for project purposes, existing water uses, and public safety and is in compliance with applicable federal and state water quality standards. The effects of considered water management changes on water quality in USACE reservoirs will be taken into account when updating the water control plans and manuals. Releases from USACE dams are not subject to CWA sections 401 and 402.

WQ16. Conduct a study to determine appropriate minimum releases from Allatoona Dam.

- The effects of considered water management changes on water quality downstream of Allatoona Lake and Carters Lake will be taken into account when updating the water control plans and manuals. Flow needs for fish and wildlife conservation and threatened and endangered species will be determined through consultation with the USFWS.

Table 4.2-3 summarizes the water quality comments received by category.

Table 1.4-3.
Summary of water quality comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
WQ1	X								
WQ2	X								
WQ3	X								
WQ4	X								
WQ5	X								
WQ6	X								
WQ7	X								
WQ8			X						
WQ9			X						
WQ10	X								
WQ11	X								
WQ12	X								
WQ13			X						
WQ14	X								
WQ15	X								
WQ16	X								

Note: T&E = threatened and endangered species.

1.4.4.3 Flood Risk Management

FDR1. Flood risk management is one of the primary purposes for ACT Basin federal dams and at four Alabama Power Company (APC) dams.

- Any alternative considered by USACE should maintain at least the current level of flood risk management protection, as authorized by Congress.

FDR2. USACE should revise current flood risk management to reflect the 50 years of basin alterations that have occurred since the original design of the flood risk management.

- The updated water control plans and manuals will include the most recent available data regarding basin conditions.

FDR3. Economic analysis of flood risk management must reflect the established levee system in the vicinity of Rome, Georgia.

- Any alternative considered by USACE should maintain at least the current level of flood risk management protection, as authorized by Congress.

FDR4. Established priority for releases should be developed, and only releases for authorized purposes or releases that have been approved through legislative actions should drive the decision process.

- USACE will consider a range of measures when updating water control plans and manuals to achieve congressionally authorized purposes of the ACT projects, taking into account the needs of the entire basin.

FDR5. If the winter pool is raised at Allatoona Lake, USACE needs to consider flood potential of Rome.

- Any alternative considered by USACE should maintain at least the current level of flood risk management protection, as authorized by Congress.

FDR6. Provide for flood risk management at Rome.

- Any alternative considered by USACE should maintain at least the current level of flood risk management protection, as authorized by Congress.

FDR7. Operation of Allatoona Lake must comply with congressional authorization.

- In updating the water control plans and manuals, USACE will consider all congressionally authorized purposes for the ACT Basin projects.

FDR8. Flood risk management operations should be updated on the basis of recent climatology data.

- The updated the water control plans and manuals will include the most recent available data regarding basin conditions.

Table 1.4-4 summarizes the flood risk management comments received by category.

Table 1.4-4.
Summary of flood risk management comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
FDR1	X								
FDR2	X								
FDR3		X							
FDR4	X								
FDR5	X								
FDR6	X								
FDR7	X								
FDR8	X								

Note: T&E = threatened and endangered

1.4.4.4 Hydropower

HP1. USACE needs to consider that the economic benefits from hydropower production at Allatoona Lake are minimal compared to the value of its recreational uses.

- USACE will consider economic benefits in the update of WCMs and plans.

HP2. Allatoona Lake levels need to remain high for the benefit of many basin resources, including hydropower production.

- USACE will consider a range of measures when updating water control plans and manuals to achieve congressionally authorized purposes of the ACT projects, taking into account the needs of the entire basin.

HP3. If other basin resources are competing for the ACT Basin water, hydropower either needs to get its share of the water capacity from the projects or be compensated fairly for the loss (compensation meaning cost of replacement power).

- In writing the EIS, USACE will consider the effect of water management changes on hydropower.

HP4. The WCM update and the EIS should appropriately consider the water requirements to maintain long-term operations at Plant Bowen and Plant Hammond.

- USACE is not specifically authorized, or otherwise obligated, to operate ACT Basin projects to meet certain minimum flows at the Bowen and Hammond plants. All ACT Basin projects are operated for their congressionally authorized purposes.

HP5. A surcharge should be levied on users of hydropower generated by Allatoona Lake for the purpose of mitigating environmental degradation in the Etowah River downstream of the dam.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

HP6. The WCM and EIS must reflect the congressional mandate to generate hydropower.

- In updating the water control plans and manuals, USACE will consider all congressionally authorized purposes for the ACT Basin projects.

Table 1.4-5 summarizes the hydropower comments received by category.

Table 1.4-5.
Summary of hydropower comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
HP1	X								
HP2	X								
HP3	X								
HP4			X						
HP5		X							
HP6	X								

Note: T&E = threatened and endangered

1.4.4.5 Navigation

NV1. USACE has not provided the necessary funding or other needs to provide cost-effective and reliable commercial navigation. The updated manual and EIS need to address those deficiencies and incorporate requirements to fully restore navigation, a primary project purpose, while other goals and needs are extraneous.

- Historically, USACE has generally received sufficient resources to maintain the navigation channel and locks for navigation. Under current budgeting criteria, the Alabama River is considered a *low use commercial waterway* and must compete with

other such waterways for funding or have funds added by Congress. USACE will consider a range of measures when updating water control plans and manuals to achieve congressionally authorized purposes of the ACT projects. However, the update of the WCM is not the appropriate vehicle for addressing budgetary issues.

NV2. The operation of the Alabama River under an updated WCM should generate the highest output of benefits associated with those project purposes specifically authorized by Congress.

- USACE will consider a range of measures when updating water control plans and manuals to achieve congressionally authorized purposes of the ACT projects.

NV3. Any economic reanalysis that might be conducted as part of the EIS process should comply with the new *Principles and Guidelines* authorized in Water Resources Development Act 2007 (WRDA 2007), specifically, the use of multiple objectives, including public safety. Moreover, regional economic development of past capital investments in the project should be treated as sunk costs in a reanalysis while recognizing the waterway's unused transport capacity relative to other modes and resulting environmental and social benefits.

- The new *Principles and Guidelines* authorized in WRDA 2007 are not yet applicable to the USACE activities such as the update of the ACT WCMs.

NV4. Channel buoys are needed in the river in the vicinity of Gadsden.

- Placement of channel markers (aids to navigation) is a U.S. Coast Guard responsibility, not a USACE responsibility.

NV5. The updated WCM should promote efficient and effective maintenance of the navigation channel in the Alabama River.

- In updating the water control plans and manuals, USACE will consider how to support navigation on the ACT Basin given the constraints in the Alabama River.

NV6. USACE should renew the agreement with APC to provide weekly flow of 32,480 cubic feet per second (cfs).

- In updating the update of the water control plans and manuals, USACE will consider the flow requirements of the APC projects.

NV7. USACE should improve the reliability of the navigation channel in the Alabama River by constructing additional training works.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

NV8. USACE should ensure that the Alabama River and its tributaries are sufficiently maintained to contribute to flow requirements below Claiborne Lake.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

NV9. USACE should not dredge the Alabama River during drought.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

Table 1.4-6 summarizes navigation comments received by category.

Table 1.4-6.
Summary of navigation comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
NV1	X								
NV2	X								
NV3		X							
NV4			X						
NV5	X								
NV6	X								
NV7		X							
NV8		X							
NV9		X							

Note: T&E = threatened and endangered

1.4.4.6 Recreation

RC1. USACE should increase the winter pool level up to as high as 840 ft and should delay reductions in lake water levels from as early as the 4th of July to much later into the fall.

- Flood risk management is an expressly authorized purpose of the Allatoona Lake project, and USACE must consider it in making operational decisions.

RC2. Raise winter pool level at Allatoona Lake by 4 ft.

- Raising the pool at Allatoona Lake would reduce the available flood risk management storage and require a reallocation of that storage to some other purpose. USACE has the discretionary authority to consider such requests. However, that is a separate and distinct discretionary authority that USACE is not pursuing as part of this WCM update, which is being conducted to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

RC3. Raise summer pool level of Allatoona Lake to 842 ft.

- Raising the pool at Allatoona Lake would reduce the available flood risk management storage and require a reallocation of that storage to some other purpose. USACE has the discretionary authority to consider such requests. However, that is a separate and distinct discretionary authority that USACE is not pursuing as part of this WCM update, which is being conducted to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

RC4. USACE should study an annual winter drawdown to elevation 823 ft to determine if higher winter lake levels Allatoona Lake can be maintained.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

RC5. The economic value of the sport fishing industry in Alabama was estimated (2006) to exceed $1.4 billion and provide more than 14,600 jobs.

- USACE will consider economic benefits when updating the WCMs and plans.

RC6. USACE needs to consider that the ability of recreational boaters to access both impounded and riverine waters is directly related to launching facilities being fully functional at low water conditions.

- o USACE will consider recreational impacts when updating the water control plans and manuals.

RC7. Water levels and connectivity in backwater areas of the ACT Basin are important as nursery areas for rearing stages of many sport fish and important invertebrate species, and need to be maintained.

- o USACE will consider the effects of proposed water management changes on reservoir fisheries.

RC8. Realizing that one of Allatoona Lake's primary functions is for downstream flood risk management, there still needs to be a review of the historical data to allow for better management of the lake levels.

- o In the update of water control plans and manuals, USACE will consider improvements that can be made in managing Allatoona Lake for flood risk management.

RC9. Currently, the water level required for Allatoona Lake seems substantially lower than what should be required for flood risk management.

- o In the update of water control plans and manuals, USACE will consider improvements that can be made in managing Allatoona Lake for flood risk management.

RC10. Higher water levels during the off-peak season would help the lake in the areas of pollution and recreation, while maintaining safe flood risk management on the basis of historical data and lake level limits.

- o USACE will consider a change in the guide curve at Allatoona Lake when updating the water control plans and manuals.

RC11. On the basis of historical weather patterns, USACE now has data to determine the wet seasons and more accurately depict when the lake needs to be at its lowest point.

- o In updating the water control plans and manuals, USACE will include the most recent available data regarding basin conditions.

RC12. If the guide curve could be adjusted to keep the water levels higher for later periods during the year, the benefits would accrue to both recreation and lake aesthetics (water quality), with the added benefit of drought remediation or protection.

- o USACE will consider a change in the guide curve at Allatoona Lake in updating the water control plans and manuals.

RC13. Some flexibility should be built into the WCM so that during periods of drought or of predicted flooding the levels and release curves could be temporarily adjusted to accommodate the immediate needs.

- o In updating water control plans and manuals, USACE will consider improvements that can be made in managing Allatoona Lake for flood risk management.

RC14. Reopen day use and campgrounds at Allatoona Lake that have been closed.

- o Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

RC15. During the winter, portions of Allatoona Lake are unusable.

- USACE will consider a change in the guide curve at Allatoona Lake in updating the water control plans and manuals.

RC16. USACE should consider possible changes to the guide curve for Allatoona Lake related to winter drawdown.

- USACE will consider a change in the guide curve at Allatoona Lake in updating the water control plans and manuals.

RC17. Raise the conservation pool level of Lake Martin to 479 ft.

- Such a measure does not meet the purpose and need which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law. Lake Martin is an APC project and any proposal to modify their project is APC's prerogative, not a USACE responsibility.

Table 1.4-7 summarizes the recreation comments received by category.

Table 1.4-7.
Summary of recreation comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
RC1					X				
RC2					X				
RC3			X		X				
RC4			X						
RC5	X								
RC6	X								
RC7	X								
RC8	X								
RC9	X								
RC10	X								
RC11	X								
RC12	X								
RC13	X								
RC14		X							
RC15	X								
RC16	X								
RC17		X	X						

Note: T&E = threatened and endangered

1.4.4.7 Ecological Resources

ER1. USACE should ensure sufficient quality and quantity of water be provided in such a manner to resemble the natural riverine flow regime, which should provide aquatic habitat conditions that support a diversity of endemic aquatic species (including fish, plants, mussels, and other invertebrates) and their life cycle requirements.

- USACE will consider alternatives to current operations. However, the purpose and need of the proposed federal action is to update the water control plans and manuals to determine how the federal projects in the ACT Basin should be operated for their congressionally authorized purposes, in light of current conditions and applicable law, rather than to restore the ACT Basin to pre-project conditions. Any reasonable alternative must satisfy this purpose and need.

ER2. The biological response of aquatic wildlife to the managed environmental flows should be evaluated and, if necessary, adjusted to meet the objective of maintaining ecological integrity.

- In updating the water control plans and manuals, USACE will consult with USFWS under the ESA regarding the operations of the ACT Basin. USACE will consider a range of measures to achieve congressionally authorized purposes of the ACT projects, taking into account the needs of the entire basin and complying with the requirements of applicable laws and regulations.

ER3. USACE should consider conserving/recovering as many of the natural flow conditions (e.g., base, seasonal, and minimum/maximum flow levels, frequency/duration of low/high pulse flows, flow rise/fall rates and frequency of flow reversals) are important, even critical, to the long-term maintenance and protection of the basin's riverine fauna and habitats.

- USACE will consider alternatives to current operations. However, the purpose and need of the proposed federal action is to update the water control plans and manuals to determine how the federal projects in the ACT Basin should be operated for their congressionally authorized purposes, in light of current conditions and applicable law, rather than to restore the ACT Basin to pre-project conditions. Any reasonable alternative must satisfy this purpose and need.

ER4. The USACE WCM update process should address effects on the vegetation ecology of adjacent wetlands and floodplain forests, as well as the wildlife resources dependent on them including migratory birds.

- In updating the water control plans and manuals, USACE will consult with USFWS under the ESA regarding operations of the ACT Basin. USACE will consider a range of measures to achieve congressionally authorized purposes of the ACT projects, taking into account the needs of the entire basin and complying with the requirements of applicable laws and regulations.

ER5. Development of an updated WCM for the ACT Basin by USACE should reflect wildlife conservation actions identified in Alabama's Comprehensive Wildlife Conservation Strategy where appropriate.

- In updating the water control plans and manuals, Corps will consult with USFWS under the ESA regarding the operations of the ACT Basin. USACE will consider a range of measures to achieve congressionally authorized purposes of the ACT projects, taking into account the needs of the entire basin and complying with the requirements of applicable laws and regulations.

ER6. Current dam operations at Allatoona Lake have detrimental downstream effects on water quality and the natural flow regime in the Etowah River, including DO levels, water temperatures, and flows.

- In accordance with ER 1110-2-8154, USACE has an objective to ensure that water quality, as affected by a USACE project and its operation, is suitable for project purposes, existing water uses, and public safety and is in compliance with applicable federal and state water quality standards. In updating the water control plans and manuals, USACE will take into account the effects of considered water management changes on water

quality in USACE reservoirs. Releases from USACE dams are not subject to CWA sections 401 and 402.

ER7. The USACE WCM update should consider, as mitigation, installing some method to increase DO levels in the Etowah River downstream of Allatoona Lake.

- In accordance with ER 1110-2-8154, USACE has an objective to ensure that water quality, as affected by a USACE project and its operation, is suitable for project purposes, existing water uses, and public safety and is in compliance with applicable federal and state water quality standards. In updating the water control plans and manuals, USACE will take into account the effects of considered water management changes on water quality in USACE reservoirs. Releases from USACE dams are not subject to CWA sections 401 and 402.

ER8. If tailrace temperatures are significantly altered from natural conditions, USACE should consider a retrofit at Allatoona Lake that would more closely approximate natural water temperature distributions.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

ER9. Determine whether modifications at Carters Reregulation Dam are needed to achieve temperatures and DO levels that would naturally occur in an unimpaired scenario.

- In accordance with ER 1110-2-8154, USACE has an objective to ensure that water quality, as affected by a USACE project and its operation, is suitable for project purposes, existing water uses, and public safety and is in compliance with applicable federal and state water quality standards. In updating the water control plans and manuals, USACE will take into account the effects of considered water management changes on water quality in USACE reservoirs. Releases from USACE dams are not subject to CWA sections 401 and 402.

ER10. USACE should compile and analyze the ramping rates exiting Carters Reregulation Dam to the Coosawattee River under existing operations.

- In updating the water control plans and manuals, USACE will consult with USFWS under the ESA regarding the operations of the ACT Basin. USACE will consider a range of measures to achieve congressionally authorized purposes of the ACT projects, taking into account the needs of the entire basin and complying with the requirements of applicable laws and regulations.

ER11. If downstream ramping rates are significantly different from ramping rates that would occur naturally in an unimpaired scenario, USACE should consider an alternative mode of operations at Carters Reregulation Dam that would more closely mimic natural flow variability, at least during the portion of the year that is most sensitive to aquatic organisms in the downstream Coosawattee River.

- In updating the water control plans and manuals, USACE will consult with USFWS under the ESA regarding the operations of the ACT Basin. USACE will consider a range of measures to achieve congressionally authorized purposes of the ACT projects, taking into account the needs of the entire basin and complying with the requirements of applicable laws and regulations.

Table 1.4-8 summarizes the ecological resources comments received by category.

Table 1.4-8.
Summary of ecological resources comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
ER1			X						
ER2			X						
ER3			X						
ER4	X								
ER5	X								
ER6	X								
ER7	X								
ER8		X							
ER9	X								
ER10	X								
ER11	X								

Note: T&E = threatened and endangered

1.4.4.8 Fisheries

FS1. USACE should continue to facilitate research on fish passage at Corps dams in the ACT Basin, with the goal of implementing reservoir operations that allow riverine species to travel their historic migration pathways.

- In updating the ACT WCM, USACE will consider a continuation of fish passage techniques at Alabama River projects.

FS2. The USACE aquatic analysis must cover all effects on fish populations in both the river and in downstream reservoirs, not just threatened and endangered species.

- In preparing the EIS, USACE will consider the environmental impact of considered changes in water management alternatives to fish and wildlife conservation.

FS3. Reduce peak flows for hydropower and provide windows of no peak flows during the spawning season.

- In updating the water control plans and manuals, USACE will consult with USFWS under the ESA regarding the operations of the ACT Basin. USACE will consider a range of measures to achieve congressionally authorized purposes of the ACT projects, taking into account the needs of the entire basin and complying with the requirements of applicable laws and regulations.

FS4. Riverine Community Habitat Assessment and Restoration Concept (RCHARC) should be used to evaluate alternative flow regimes.

- RCHARC has been determined to be inappropriate for evaluating flow regimes in the ACT Basin.

Table 1.4-9 summarizes the fisheries comments received by category.

Table 1.4-9.
Summary of fisheries comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
FS1	X								
FS2	X								
FS3	X								
FS4						X			

Note: T&E = threatened and endangered

1.4.4.9 Threatened and Endangered Species

TE1. USACE should evaluate all direct and indirect effects of manual revisions on aquatic species throughout the ACT Basin, particularly T&E species and particularly in Etowah and Coosa Rivers (including main channel and bypass reach below Weiss Lake).

- USACE will consult with USFWS under section 7 of the ESA regarding threatened and endangered species.

TE2. USACE should consider federally listed species, other species that might be on the brink of requiring federal protection under ESA, and their associated habitat requirements in its analyses of the alternatives being considered under the ACT WCM update NEPA process.

- USACE will consult with USFWS under section 7 of the ESA regarding threatened and endangered species.

TE3. USACE should conduct surveys of federally listed fishes and freshwater mollusks to accurately assess the potential impacts of the USACE alternative actions.

- USACE will consult with USFWS under section 7 of the ESA regarding threatened and endangered species. A mollusk survey will be conducted in the upper Coosa River Basin. (The mollusk survey for selected reaches of the Coosa River drainage was subsequently completed by USACE in 2011 (Dinkins and Hughes 2011) in consultation with USFWS.)

TE4. Release sufficient flow from Allatoona Lake to aid in restoration and reintroduction efforts of federally protected species on the *Dead River* downstream of Weiss Lake.

- USACE will consult with USFWS under section 7 of the ESA regarding threatened and endangered species.

Table 1.4-10 summarizes the threatened and endangered species comments received by category.

Table 1.4-10.
Summary of threatened and endangered comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
TE1	X								
TE2	X								
TE3	X								
TE4	X								

Note: T&E = threatened and endangered

1.4.4.10 Other

OT1. Lake levels and the amount of water that is being released downstream to Alabama and Florida are of primary concern, especially during the drought periods.

- In updating the water control plans and manuals, USACE will include development of a drought management plan.

OT2. USACE needs to try to reduce the amount that they allow out to go downstream as much as possible to maintain water levels.

- USACE will consider a range of measures when updating water control plans and manuals to achieve congressionally authorized purposes of the ACT projects.

OT3. In the winter, the winter pool should not be reduced as much as it has been, even if USACE has to do so temporarily because of the drought conditions that were suffered this past year.

- When updating water control plans and manuals, USACE will consider changes to Allatoona Lake guide curve.

OT4. It is in the best interest of all concerned to maintain summer pool elevation as long as practical, and to minimize length of time lake is held down in the winter; and that, in general, Allatoona Lake is well managed by USACE.

- When updating water control plans and manuals, USACE will consider changes to Allatoona Lake guide curve.

OT5. Erosion occurring along Bouldin Canal is encroaching on private property.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

OT6. The ACT WCM should be flexible so that USACE can be more responsive to current needs.

- In updating the water control plans and manuals, USACE will include the most recent available data regarding basin conditions.

OT7. Lake Wedowee flows are not sufficient to support the flow requirements placed on R.L. Harris Lake after mid-May until November.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law. Lake Wedowee/R.L. Harris Lake is an APC project, and any proposal to modify the project is APC's prerogative, not USACE's.

OT8. R.L. Harris Lake operations are subjected to excessive downstream flow requirements.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law. Lake Wedowee/R.L. Harris Lake is an APC project, and any proposal to modify the project is APC's prerogative, not USACE.

OT9. Raise the Lake Wedowee winter pool elevation from 785 ft to 789 ft.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law. Lake Wedowee/R.L. Harris Lake is an APC project, and any proposal to modify the project is APC's prerogative, not USACE.

OT10. Include an operating range curve for Lake Wedowee similar to Lake Martin.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law. Lake Wedowee/R.L. Harris Lake is an APC project, and any proposal to modify the project is APC's prerogative, not USACE.

OT11. Expand capacity of Allatoona Lake by dredging, especially in Allatoona Creek.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

OT12. Maintain lake levels at H. Neely Henry Lake at 507 ft to 508 ft year-round.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law. H. Neely Henry Lake is an APC project, and any proposal to modify the project is APC's prerogative, not USACE.

OT13. USACE does not maintain Allatoona Lake guide curve in either drought or normal conditions.

- The ability to maintain the guide curve at Allatoona Lake or any other reservoir is a function of rainfall and inflow.

OT14. Expand the capacity of Allatoona Lake by dredging and placing material on existing sand bars.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

Table 1.4-11 summarizes the other comments received by category.

Table 1.4-11.
Summary of other comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
OT1	X								
OT2	X								
OT3	X								
OT4	X								
OT5		X							
OT6	X								
OT7		X	X						
OT8		X	X						
OT9		X	X						
OT10		X	X						
OT11		X							
OT12		X	X						
OT13	X								
OT14		X							

Note: T&E = threatened and endangered

1.4.4.11 Interbasin Transfer

IT1. USACE should lead an Environmental Impact Study, in conjunction with USEPA, to determine the deleterious effect that current and planned increases of interbasin transfers have on Allatoona Lake, the upper Etowah River, and the ACT Basin.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

IT2. Interbasin transfers will destroy the Coosa River Basin chain of lakes.

- Decisions regarding location and volumes of wastewater discharges are a state responsibility, not USACE.

IT3. There should be no interbasin transfers.

- Decisions regarding location and volumes of wastewater discharges are a state responsibility, not USACE.

IT4. Determine the effect of interbasin transfers on Allatoona Lake.

- In preparing the EIS, USACE will consider the effects of interbasin transfers associated with existing water supply storage contracts at Allatoona Lake.

IT5. The most significant impact on water availability is interbasin transfer.

- Decisions regarding location and volumes of wastewater discharges are a state responsibility, not USACE.

Table 1.4-12 summarizes the interbasin transfer comments received by category.

Table 1.4-12.
Summary of interbasin transfers comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
IT1		X							
IT2			X						
IT3			X						
IT4	X								
IT5			X						

Note: T&E = threatened and endangered

1.4.4.12 Request for Postponement

RP1. The FERC relicensing process offers the opportunity for APC and USACE to work together to develop optimal operating parameters for the Tallapoosa River reservoirs.

- USACE and APC will cooperate in developing a drought plan for the ACT Basin and other water management issues.

RP2. USACE should suspend the revision of the ACT WCM update until the ACT litigation is resolved by the courts.

- The suggestion does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

RP3. USACE should delay update of an ACT WCM until water management issues on APC projects have been resolved.

- The suggestion does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

Table 1.4-13 summarizes the requests for postponement comments received by category.

Table 1.4-13.
Summary of requests for postponement comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
RP1	X								
RP2		X							
RP3		X							

Note: T&E = threatened and endangered

1.4.4.13 M&I Return Flows

RF1. USACE should study and implement operating rules that increase yield of federal projects via return flows and return flow credits, thereby encouraging communities to invest in environmentally responsible projects that maximize the rates of return water to the basin. Doing so would also encourage implementation of conservation measures and improvements to system integrity designed to decrease *unaccounted for water* and policies to increase sewerage and decrease septic use.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

RF2. USACE should evaluate rules that afford credit for other *made flows* such as those resulting from upstream releases from dedicated storage projects, such as the Cobb County–Marietta Water Authority (CCMWA) and City of Canton Hickory Log Creek Reservoir.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

RF3. USACE should also make use of this process to evaluate appropriate storage accounting mechanisms that accurately and fairly apportion reservoir inflows to the respective stakeholders.

- This suggestion does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

RF4. USACE should clarify its policy with respect to return flows and consider granting all parties a right to return flow credits similar to the rights CCMWA has under its current water supply storage agreement.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

Table 1.4-14 summarizes the return flow comments received by category.

Table 1.4-14.
Summary of return flow comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
RF1		X							
RF2		X							
RF3		X							
RF4		X							

Note: T&E = threatened and endangered

1.4.4.14 Drought Management Plan

DM1. USACE needs to develop and incorporate a comprehensive, basin-wide drought management plan including all ACT Basin projects, public and private, using the lessons learned during the 2007–2008 drought period.

- USACE will develop a revised drought plan as part of the WCM update.

DM2. The drought plan should adequately identify water quality and quantity needs at various times of the year.

- USACE will develop a revised drought plan as part of the WCM update.

DM3. USACE should evaluate alternative operating rules that prudently and conservatively balance downstream flow requirements with the ability to capture and store water for use in times of drought.

- USACE will consider a range of measures when updating the water control plans and manuals to achieve congressionally authorized purposes of the ACT projects, taking into account the needs of the entire basin.

DM4. The operating rules must afford USACE maximum management flexibility to quickly adapt to changing inflow conditions and should be evaluated and incorporated into any updated WCM for the ACT Basin.

- USACE will develop a revised drought plan as part of the WCM update.

DM5. Give consideration to a more trigger-driven management of lakes during drought, something that would incrementally reduce outflows.

- USACE will develop a revised drought plan as part of the WCM update.

DM6. During droughts, minimize the amount of water being released from Allatoona Lake.

- USACE will develop a revised drought plan as part of the WCM update.

DM7. USACE should practice adaptive management decision making that is responsive to each situation.

- USACE will develop a revised drought plan as part of the WCM update.

DM8. Drought plans and flood risk management plans should be flexible to allow for short-term, temporary adjustment.

- USACE will develop a revised drought plan as part of the WCM update.

Table 1.4-15 summarizes the drought management plan comments received by category.

Table 1.4-15.
Summary of drought management plan comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
DM1	X								
DM2	X								
DM3	X								
DM4	X								
DM5	X								
DM6	X								
DM7	X								
DM8	X								

Note: T&E = threatened and endangered

1.4.4.15 Impact Mitigation

IM1. USACE should establish a goal to develop a fish passage plan for all USACE locks and dams in the ACT Basin.

- In updating the ACT WCM, USACE will consider a continuation of fish passage techniques at Alabama River projects.

IM2. USACE should include an analysis of the impact of aquatic habitat loss due to the construction (1962–1975) of Carters Lake on the Coosawattee River in the ACT WCM update draft EIS and, as a result, appropriate mitigation measures should be determined and implemented.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

IM3. USACE should consider terrestrial habitats under its ownership as potential locations for out planting federally listed plants if the need arises.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

Table 1.4-16 summarizes the impact mitigation comments received by category.

Table 1.4-16.
Summary of impact mitigation comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
IM1	X								
IM2		X							
IM3		X							

Note: T&E = threatened and endangered

1.4.4.16 Modeling Tools

MT1. USACE should focus the ACT WCM update EIS process on the authorized purposes of the projects (hydropower, navigation, and flood risk management).

- USACE will consider a range of measures when updating water control plans and manuals to achieve congressionally authorized purposes of the ACT projects, taking into account the needs of the entire basin.

MT2. Determine the critical yield of each reservoir using most updated hydrologic and climate conditions.

- The critical yield of ACT reservoirs was determined and documented in *The Federal Storage Reservoir Critical Yield Analyses, Alabama-Coosa-Tallapoosa and Apalachicola-Chattahoochee-Flint Basins* (Critical Yield Report), February 2010 in response to congressional direction in reports accompanying the Energy and Water Development and Related Agencies Appropriations Act, 2010 (H.R. 3183; Public Law [P.L.] 111-85).

MT3. Establish a baseline for any proposed changes to the water control or master manuals.

- In updating the water control plans and manuals, USACE will consider all congressionally authorized purposes for the ACT Basin projects. Baseline conditions for analysis and comparison of water management alternatives have been defined as current reservoir operations as they have evolved over time in response to laws, regulations, policy, and new technical information, which is consistent with CEQ's definition of the No Action Alternative. With respect to water withdrawals and returns in the basin, the baseline condition for analysis is represented by actual values from year 2006, the year of highest net withdrawals from the ACT Basin and the year of greatest stress on the system from water withdrawals.

MT4. Assess whether any changes to baseline conditions are necessary to comply with existing laws and regulations designed to protect the environment.

- In updating ACT water control plans and manuals, USACE will consider whether any changes to baseline conditions are necessary to comply with existing laws and regulations designed to protect the environment.

MT5. Analyze any proposed modifications to the baseline to develop the proposed operations for each reservoir.

- In updating ACT water control plans and manuals, USACE will consider the effects of considered water management changes on water quality in USACE reservoirs.

MT6. USACE should use existing tools developed in recent years by APC in studying changes to the existing reservoir regulation manuals for the Weiss Lake and Logan Martin Lake developments on the Coosa River as part of the FERC relicensing process.

- USACE considered continued use of HEC-5 rather than HEC-ResSim for river system modeling but concluded that HEC-ResSim is easier to use and has superior capabilities.

MT7. Models to be used in the WCM update should be developed in a transparent process where model and underlying data can be shared with the stakeholders for evaluation and comment.

- In October 2008, USACE conducted a HEC-ResSim workshop with potential model users. As the HEC-ResSim model for the ACT Basin was further refined and baseline model runs were conducted, USACE conducted a second stakeholders workshop in May 2011. Refer to the introduction to Section 4 of this EIS and Appendix C (HEC-ResSim Modeling Report) for more information on coordination of the model.

MT8. The HEC-ResSim should replace the HEC-5 model only after the technical staffs of the three states and USACE agree that the HEC-ResSim model is a better tool to evaluate the ACT Basin.

- USACE considered continued use of HEC-5 rather than HEC-ResSim for river system modeling but concluded that HEC-ResSim is easier to use and has superior capabilities.

MT9. It is inappropriate and premature for USACE to develop the HEC-ResSim model without input from the states and without sufficient time for the states to develop expertise required to evaluate the HEC-ResSim results.

- USACE considered continued use of HEC-5 rather than HEC-ResSim for river system modeling but concluded that HEC-ResSim is easier to use and has superior capabilities.

MT10. USACE should use the agreed upon HEC-5 model developed during the Comprehensive Study and used in the negotiations of the allocation formula under the ACT Basin Compact unless USACE and states agree on a new model development.

- USACE considered continued use of HEC-5 rather than HEC-ResSim for river system modeling but concluded that HEC-ResSim is easier to use and has superior capabilities.

MT11. USACE should hold a public meeting with interested parties to discuss the appropriate modeling platforms to be used for the ACT WCM development.

- In October 2008, and subsequently in May 2011, USACE conducted a HEC-ResSim workshop with potential model users.

MT12. USACE should establish a technical working group of water modelers from interested stakeholders who are familiar with the HEC-ResSim to facilitate information sharing and involvement with the WCM update process.

- In October 2008, and subsequently in May 2011, USACE conducted a HEC-ResSim workshop with potential model users.

MT13. APC believes that USACE should use other existing models and tools (suggested by APC in a May 16, 2008, letter to USACE) developed for studying changes to the existing reservoir regulation manuals on the Coosa River, Weiss Lake, and Logan Martin Lake developments as part of its recent FERC relicensing process.

- USACE considered continued use of HEC-5 rather than HEC-ResSim for river system modeling but concluded that HEC-ResSim is easier to use and has superior capabilities.

MT14. A significant issue in the APC's relicensing process is the potential for changing the guide curves to increase pool elevations at Lake Martin during certain times of the year. APC has already completed an initial evaluation of changing the guide curve, but additional studies and consultation among stakeholders are needed to fully evaluate the impacts of the changes on flood risk management, navigation, power generation, water quality, and other project and river basin resources.

- USACE and APC will cooperate in developing a drought plan for the ACT Basin and other water management issues.

MT15. APC intends to incorporate modeling of the R.L. Harris Lake existing operations into the final Lake Martin Study Plan so that it can determine potential effects on the R.L. Harris Lake of any guide curve changes at the Lake Martin project. However, APC believes that the relicensing of the Lake Martin project should be substantially completed before USACE undertakes any comprehensive update of the ACT WCM.

- USACE and APC will cooperate in developing a drought plan for the ACT Basin and other water management issues.

MT16. USACE should define a baseline operation that reflects the projects' congressionally authorized purposes.

- In updating the water control plans and manuals, USACE will consider all congressionally authorized purposes for the ACT Basin projects. Baseline conditions for analysis and comparison of water management alternatives have been defined as current reservoir operations as they have evolved over time in response to laws, regulations, policy, and new technical information, which is consistent with CEQ's definition of the No Action Alternative. With respect to water withdrawals and returns in the basin, the baseline condition for analysis is represented by actual values from year 2006, the year of highest net withdrawals from the ACT Basin and the year of greatest stress on the system from water withdrawals.

MT17. Before using HEC-ResSim for the ACT Basin, USACE should determine that HEC-ResSim properly models APC's Tallapoosa River project operations, uses appropriate elevation-storage curves for Weiss Lake and R.L. Harris Lake, and properly models APC hydropower generation.

- USACE considered continued use of HEC-5 rather than HEC-ResSim for river system modeling but concluded that HEC-ResSim is easier to use and has superior capabilities.

MT18. USACE update of WCMs should focus on the authorized project purposes.

- USACE will consider a range of measures when updating water control plans and manuals to achieve congressionally authorized purposes of the ACT projects, taking into account the needs of the entire basin.

MT19. USACE should determine whether any changes are required to comply with existing laws and regulations.

- In updating the water control plans and manuals, USACE will consider the effects of considered water management changes on water quality in USACE reservoirs.

MT20. USACE should ensure that the FERC re-licensing of APC's Coosa projects and Lake Martin are contingent on and subject to the updated WCM for the ACT Basin.

- USACE and APC will cooperate in developing a drought plan for the ACT Basin and other water management issues.

Table 1.4-17 summarizes the modeling tool comments received by category.

Table 1.4-17.
Summary of modeling tool comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
MT1	X								
MT2		X							
MT3	X								
MT4	X								
MT5	X								
MT6						X			
MT7	X								
MT8						X			
MT9						X			
MT10						X			
MT11	X								
MT12	X								
MT13						X			
MT14	X								
MT15	X								
MT16	X								
MT17						X			
MT18	X								
MT19	X								
MT20	X								

Note: T&E = threatened and endangered

1.4.4.17 NEPA Process-Scope of ACT WCM Update EIS

PS1. Because of the length and complexity of the ACT Basin, USACE should look comprehensively at the system when determining the proper scope of the EIS and evaluate impacts of and alternatives to the management of its reservoirs.

- In updating the water control plans and manuals, USACE will take into account the effects of considered water management changes on the environment throughout the ACT Basin.

PS2. The scope of the EIS should encompass the entire ACT Basin down to Mobile Bay, and the Apalachicola-Chattahoochee-Flint (ACF) Basin, the latter because of ongoing and proposed interbasin transfers of water.

- In updating the water control plans and manuals, USACE will take into account the effects of considered water management changes on the environment throughout the ACT Basin.

PS3. USACE should thoroughly consider and analyze the present and proposed future operations of the APC projects and ensure that the operations of the USACE reservoirs, including Allatoona Lake, are not subordinate to the needs of APC's private projects.

- o USACE and APC will cooperate in developing a drought plan for the ACT Basin and other water management issues.

PS4. The WCM update process should consider USACE' compliance with existing environmental laws. Specifically, USACE should coordinate with USFWS, USEPA, and appropriate state agencies in Alabama and Georgia to ensure that the WCMs are compliant with the ESA and the CWA, as well as the Water Supply Act and the Flood Control Act.

- o The update of the ACT WCMs and plans will be accomplished in accordance with all applicable laws and regulations.

PS5. The purpose of the update to the WCM should be to develop an operational plan that most effectively manages the water resources in the ACT Basin for the highest and best use.

- o USACE will consider a range of measures when updating water control plans and manuals to achieve congressionally authorized purposes of the ACT projects, taking into account the needs of the entire basin. However, this effort is not a comprehensive study to address the long-term water resources problems and needs of the basin.

Table 1.4-18 summarizes the NEPA process and scope comments received by category.

Table 1.4-18.
Summary of NEPA process and scope comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
PS1	X								
PS2	X								
PS3	X								
PS4	X								
PS5	X								

Note: T&E = threatened and endangered

1.4.4.18 Impact Analysis

IA1. Revisions to the ACT WCM will have obvious consequences to the current uses of Allatoona Lake for the amounts of water released downstream, and for the aquatic habitat in the lake the rest of Etowah and Coosa River Basins. Because of those consequences, USACE must base decisions on objective and transparent body of scientific data to underpin its comparative analysis of water release alternatives.

- o In updating the water control plans and manuals, USACE will include the most recent available data regarding basin conditions.

IA2. USACE should conduct an analysis of cumulative impacts of maintaining or increasing flows out of Allatoona Lake to enhance ecological function in the Coosa River below Jordan Dam and Lake.

- Such a measure does not meet the purpose and need, which is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law. Flows below Jordan Dam and Lake are the responsibility of APC, not USACE.

IA3. USACE should conduct an analysis of cumulative effects of FERC relicensing process of eight APC dams in the ACT Basin.

- The environmental effects of the operations of the APC projects under the proposed FERC license are documented in Final Environmental Assessment (EA) for Hydropower License Coosa River Hydroelectric Project—FERC Project No. 2146-111 Alabama and Georgia, December 2009.

IA4. USACE should evaluate any indirect impacts of proposed changes to the WCM.

- USACE will consider the direct, indirect and cumulative impacts of the federal action.

IA5. USACE should not take any water management actions that will have an adverse impact on upstream stakeholders without a full environmental and economic impact study.

- USACE will consider the direct, indirect, and cumulative impacts of the federal action.

Table 1.4-19 summarizes the impact analysis comments received by category.

Table 1.4-19.
Summary of impact analysis comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
IA1	X								
IA2		X							
IA3		X							
IA4	X								
IA5	X								

Note: T&E = threatened and endangered

1.4.4.19 Alternatives

AL1. USACE should thoroughly analyze the entire range of reasonable operating alternatives and not simply document existing operations.

- USACE will consider alternatives to current operations. However, the purpose and need of the proposed federal action is to update the water control plans and manuals to determine how the federal projects in the ACT Basin should be operated for their congressionally authorized purposes, in light of current conditions and applicable law. Any reasonable alternative must satisfy that purpose and need.

AL2. USACE must not constrain itself at the outset to consider alternative plans that are limited by USACE legal authority to change existing operations.

- USACE will consider alternatives to current operations. However, the purpose and need of the proposed federal action is to update the water control plans and manuals to determine how the federal projects in the ACT Basin should be operated for their congressionally authorized purposes, in light of current conditions and applicable law. Any reasonable alternative must satisfy that purpose and need.

AL3. USACE should consider all reasonable alternatives to determine the highest and best use of reservoir storage given current conditions in the basin.

- USACE will consider alternatives to current operations. However, the purpose and need of the proposed federal action is to update the water control plans and manuals to determine how the federal projects in the ACT Basin should be operated for their congressionally authorized purposes, in light of current conditions and applicable law. Any reasonable alternative must satisfy that purpose and need.

AL4. If congressional approval is required to implement the preferred water control operations, then USACE should seek such approval.

- The purpose and need of the proposed federal action is to update the water control plans and manuals to determine how the federal projects in the ACT Basin should be operated for their congressionally authorized purposes, in light of current conditions and applicable law. Any reasonable alternative must satisfy that purpose and need.

AL5. USACE should consider dam operations at Allatoona Lake that would more closely mimic the natural flow regime, such as implementing a non-peaking window during the portion of the year that is most sensitive to aquatic organisms in the downstream Etowah River.

- In updating the water control plans and manuals, USACE will consult with USFWS under the ESA regarding the operations of the ACT Basin. USACE will consider a range of measures when updating water control plans and manuals to achieve congressionally authorized purposes of the ACT projects, taking into account the needs of the entire basin and complying with the requirements of the ESA.

AL6. Comparison of the baseline and other operation alternatives for potential relative effects should use the RCHARC or other similar methodology as was done in the ACT Basin water allocation draft EIS.

- RCHARC has been determined to be inappropriate for evaluating flow regimes in the ACT Basin.

AL7. The Hickory Log Creek Reservoir permit should be considered as a proposed modification of the operations of the reservoir during this aspect of the manual update process.

- Hickory Log Creek operations, as currently permitted in the USACE Section 404 permit, are included as part of the baseline conditions for analysis of water control plan update

alternatives for USACE projects in the ACT Basin. Consideration of other operational scenarios for Hickory Log Creek does not meet the purpose and need of this federal action.

AL8. Other proposed reallocations of water storage need to be assessed in the process including Georgia's new water supply plan that includes various assumptions and projections regarding their use of water from USACE reservoirs, Allatoona Lake, and Carters Lake.

- USACE will consider the water supply needs of the region consistent within the limits of its existing authorities. The purpose and need of this effort is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law, and to implement those operations through an updated Master WCM of the ACT Basin. This effort is not a comprehensive study designed to resolve the long-term water supply needs of the region.

AL9. A determination should be made whether USACE has the authority to undertake the reallocation or must seek congressional authorization to implement the proposed reallocations.

- Section 301 of the Water Supply Act of 1958 provides that "Modifications of a reservoir project heretofore authorized, surveyed, planned, or constructed to include storage [for water supply] which would seriously affect the purposes for which the project was authorized, surveyed, planned, or constructed, or which would involve major structural or operational changes shall be made only upon the approval of Congress." As part of the ACT WCM update, USACE is not proposing any additional storage reallocations for water supply.

AL10. USACE should develop and analyze alternatives that will make the most efficient use of the water resources within the ACT Basin.

- In updating the water control plans and manuals, USACE will consider potential management changes that would result in more efficient use of water resources within the limits of congressionally authorized purposes and applicable law.

AL11. USACE should consider alternatives that include aggressive water conservation measures and other proposed reservoirs in the basin.

- Measures considered by various water users to reduce the consumption of water within the ACT Basin will be described in the EIS, to the extent that information is available to USACE. Requiring the implementation of such measures, however, is generally a state and local responsibility, not USACE. In updating the water control plans and manuals, USACE developed a drought management plan that emphasizes conservation of storage when drought conditions exist.

AL12. USACE should consider other potential mechanisms to increase the yield of Allatoona Lake such as reducing the seasonal drawdown and other guide curve changes.

- USACE will consider changes to Allatoona Lake guide curve when updating water control plans and manuals.

Table 1.4-20 summarizes the alternatives comments received by category.

Table 1.4-20.
Summary of alternatives comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
AL1	X								
AL2			X						
AL3	X								
AL4		X							
AL5	X								
AL6						X			
AL7		X							
AL8				X					
AL9				X					
AL10	X								
AL11			X						
AL12	X								

Note: T&E = threatened and endangered

1.4.4.20 Baseline Conditions

BC1. Establishing the baseline must originate with the original congressional authorizations or following any approved reallocations.

- In updating the water control plans and manuals, USACE will consider all congressionally authorized purposes for the ACT Basin projects. Baseline conditions for analysis and comparison of water management alternatives have been defined as current reservoir operations as they have evolved over time in response to laws, regulations, policy, and new technical information, which is consistent with CEQ's definition of the No Action Alternative. With respect to water withdrawals and returns in the basin, the baseline condition for analysis is represented by actual values from year 2006, the year of highest net withdrawals from the ACT Basin and the year of greatest stress on the system from water withdrawals.

BC2. The current flood risk management operations must be revised to reflect the 50 years of basin alterations that have occurred since the original design of the flood risk management operations.

- In updating water control plans and manuals, USACE will consider improvements that can be made in managing Allatoona Lake for flood risk management.

BC3. There must be established priority for releases. Only releases for authorized purposes or releases that have been approved through legislative actions should drive the decision process.

- The purpose and need of this federal action is to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

BC4. USACE should use the currently approved WCMs for each reservoir, e.g., the 1979 water control plan for Carters Lake and the 1962 water control plan for Allatoona Lake, to establish baseline or no action conditions for evaluating alternatives operations under the ACT WCM update process.

- In updating the water control plans and manuals, USACE will consider all congressionally authorized purposes for the ACT Basin projects. Baseline conditions for analysis and comparison of water management alternatives have been defined as current reservoir operations as they have evolved over time in response to laws, regulations, policy, and new technical information, which is consistent with CEQ's definition of the No Action Alternative. With respect to water withdrawals and returns in the basin, the baseline condition for analysis is represented by actual values from year 2006, the year of highest net withdrawals from the ACT Basin and the year of greatest stress on the system from water withdrawals.

BC5. With the expiration of the ACT Compact, the *live and let live* provision has well expired, and there can be no expectation that water withdrawals in excess of contract amounts will be incorporated into the *baseline* conditions.

- In updating the water control plans and manuals, USACE will consider all congressionally authorized purposes for the ACT Basin projects. Baseline conditions for analysis and comparison of water management alternatives have been defined as current reservoir operations as they have evolved over time in response to laws, regulations, policy, and new technical information, which is consistent with CEQ's definition of the No Action Alternative. With respect to water withdrawals and returns in the basin, the baseline condition for analysis is represented by actual values from year 2006, the year of highest net withdrawals from the ACT Basin and the year of greatest stress on the system from water withdrawals. Actual withdrawal/return values for 2006 for CCMWA, Cartersville, and Chatsworth are used for the baseline condition.

BC6. The baseline should be based on the amount of storage currently under contract and should assume that the contract amounts establish limits or caps on the amount of water that can be withdrawn for water supply purposes.

- In updating the water control plans and manuals, USACE will consider all congressionally authorized purposes for the ACT Basin projects. Baseline conditions for analysis and comparison of water management alternatives have been defined as current reservoir operations as they have evolved over time in response to laws, regulations, policy, and new technical information, which is consistent with CEQ's definition of the No Action Alternative. With respect to water withdrawals and returns in the basin, the baseline condition for analysis is represented by actual values from year 2006, the year of highest net withdrawals from the ACT Basin and the year of greatest stress on the system from water withdrawals. Actual withdrawal/return values for 2006 for CCMWA, Cartersville, and Chatsworth are used for the baseline condition.

BC7. The baseline should not assume that the current practice of allowing water withdrawals in excess of contract amounts by the CCMWA will be continued in the future.

- In updating the water control plans and manuals, USACE will consider all congressionally authorized purposes for the ACT Basin projects. Baseline conditions for analysis and comparison of water management alternatives have been defined as current reservoir operations as they have evolved over time in response to laws, regulations, policy, and new technical information, which is consistent with CEQ's definition of the No Action Alternative. With respect to water withdrawals and returns in the basin, the baseline condition for analysis is represented by actual values from year 2006, the year of highest net withdrawals from the ACT Basin and the year of greatest stress on the system from water withdrawals. Actual withdrawal/return values for 2006 for CCMWA are used for the baseline condition.

Table 1.4-21 summarizes the baseline conditions comments received by category.

Table 1.4-21.
Summary of baseline conditions comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
BC1	X								
BC2	X								
BC3		X							
BC4	X								
BC5	X								
BC6	X								
BC7	X								

Note: T&E = threatened and endangered

1.4.4.21 Agriculture

AG1. Raising and lowering Allatoona Lake levels taxes the surrounding agriculture.

- In updating the water control plans and manuals, USACE will take into account the effects of considered water management changes on resources in the ACT Basin.

AG2. The only time the lake level should change is during heavy rains (lower levels for flood risk management) or drought (high levels to maintain stability of lake).

- In updating the water control plans and manuals, USACE will take into account changes to Allatoona Lake guide curve. Raising the winter pool at Allatoona Lake would reduce the available flood risk management storage and require a reallocation of that storage to some other purpose. USACE has the discretionary authority to consider such requests. However, that is a separate and distinct discretionary authority that USACE is not pursuing as part of this WCM update, which is being conducted to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

AG3. USACE should keep Allatoona Lake water levels high for the benefit of all resources indicated.

- In updating the water control plans and manuals, USACE will take into account changes to Allatoona Lake guide curve will be considered.

Table 1.4-22 summarizes the agriculture comments received by category.

Table 1.4-22.
Summary of agriculture comments

Scoping comments	Within the criteria	Does not meet purpose & need	Not congressionally authorized	Requires water supply reallocation	Does not maintain flood protection	Does not meet current needs	Violates system operations criteria	Detrimental to structural integrity & safety	Affects T&E species
AG1	X								
AG2			X						
AG3	X								

Note: T&E = threatened and endangered

1.4.5 Public Review of the Draft EIS

The Draft EIS for the update of the ACT Basin Water Control Manual was filed with EPA on February 22, 2013 and formally released for public review on March 1, 2013 when the Notice of Availability (NOA) of the EIS was published in the Federal Register. Agencies (federal, state, and local), tribes, and interested organizations and individuals were invited to review and comment on the document. The comment period was initially scheduled to end on May 1, 2013. In response to multiple requests for extension, USACE and agreed to extend the comment period until May 31, 2013, providing a total of 90 days for agency and public comment. During the comment period, public workshops on the draft EIS and WCM were held in four cities within the ACT Basin during the week of March 25, 2013: Kennesaw, Georgia on March 25; Rome, Georgia on March 26; Gadsden, Alabama on March 27; and Montgomery, Alabama on March 28. Technical experts were available at the workshops to answer questions from agencies and members of the public, and administrative staff members were present to receive public comments. A cumulative total of 129 persons attended these workshops, either representing various agencies and organizations or as interested individual citizens.

Seventy (70) comments on the draft EIS were submitted by agencies (Federal, state, and local), private organizations, and individuals. A list of those who submitted comments is presented in Appendix B (Pertinent Correspondence) of the final EIS.

1.4.6 Final EIS

As provided for in CEQ regulations for implementing NEPA, USACE considered all comments provided by the public and agencies on the draft EIS. Copies of all comments received and USACE responses to those comments are included in the comment-response section of the Final EIS (Appendix B – Pertinent Correspondence). Additionally, USACE incorporated pertinent revisions and updates to the EIS WCM based on input received during the public review process. The key revisions and updates to the documents included in the final EIS for the WCM update include:

- The baseline condition for analysis of alternatives was revised to reflect actual withdrawals by CCMWA and city of Cartersville from Allatoona Lake as well as the city of Chatsworth from Carters Lake. For purposes of the HEC-ResSim model, “actual withdrawals” are represented by

actual water use reported throughout the basin in 2006. The actual withdrawal amounts in 2006 are the highest levels of net water supply withdrawal reported basin-wide and represent the greatest stress placed on the system to date from withdrawals. As presented in the draft EIS, withdrawals from the reservoirs by these entities had been limited to the volume of water in the current water supply storage agreements. The HEC-ResSim model for the ACT Basin was updated accordingly.

- Based on further review of available data during and following the comment period for the draft EIS, USACE technical team determined that revisions of the navigation "template" would be appropriate. The navigation template provides the technical information upon which flow requirements necessary to maintain the navigation channel in the Alabama River are based. The HEC-ResSim model for the ACT Basin was updated to incorporate these revisions.
- Provisions for operation of the recently completed Hickory Log Creek reservoir, as permitted in the Section 404 permit for the project (2004), were incorporated into the HEC-ResSim model. The Hickory Log Creek reservoir operation was not considered as part of the baseline condition but was included in the simulation of the WCM update alternatives. Details of the Hickory Log Creek operation, as modeled in HEC-ResSim, are provided in the modeling report (Appendix C), The final EIS includes an updated description of Hickory Log Creek reservoir and its relationship to the ACT WCM update.
- The hydrologic period of record for HEC-ResSim model simulation for the ACT WCM update process was extended from 70 years (1939-2008) to 73 years (1939-2011).
- Based on the HEC-ResSim model updates described above, model simulations were re-run for the water management alternatives considered in the draft EIS (No Action, Alternative D, Alternative F, and Alternative G (Proposed Action), and the Environmental Consequences were updated accordingly.
- In order to better understand the sensitivity of the Proposed Action Alternative to the potential implications of climate change and increased future water demands in the ACT Basin, model simulations were conducted to address (1) a climate change scenario that would involve a long term reduction in rainfall in the basin and (2) projected increases in long-range water supply demands in the basin. Both HEC-ResSim and HEC-5Q were run to compare the Proposed Action to these scenarios. These scenarios, the associated sensitivity analyses, and potential effects are discussed in more detail in Section 6.9 (Sensitivity Analysis) and 6.10 (Cumulative Effects).
- The FERC license for the APC Coosa River Projects was finalized and issued in June 2013, following the publication and review of the draft EIS for the ACT WCM update. The EIS document was updated accordingly, including discussion of the pertinent effects of the June 2013 FERC license on the ACT WCM update process.
- The EIS was updated to include a description of the most recent activities by non-Federal hydropower interests and FERC related to potential development of non-Federal hydropower facilities at Carters Reregulation Dam and Claiborne Lock and Dam.
- Other minor corrections and updates were incorporated into the final EIS based on public comments and new information.

USACE will make the final EIS available to agencies (federal, state, and local), American Indian tribes, private organizations, and interested individuals for review and will place copies in local libraries in the basin. The final EIS will be available for public review for 30 days following publication of the NOA of the final EIS in the Federal Register.

1.4.7 Record of Decision

No sooner than 30 days after filing the final EIS with USEPA and publication of the NOA for the final EIS in the *Federal Register*, USACE will prepare a record of decision (ROD) that will state the decision in regard to the update of the ACT Basin Master WCM and the individual project WCMs, summarize alternatives that were considered and relevant factors that were balanced in making the decision, and identify means that have been adopted to mitigate for adverse effects. USACE will notify the public of the ROD in a newsletter distribution to the project mailing list, press releases to local newspapers radio and television news, and on the project website.

1.5 Impact Analysis Performed

An interdisciplinary team of environmental scientists, biologists, planners, economists, engineers, archaeologists, and historians has analyzed the proposed action and alternatives in light of existing conditions and has identified relevant beneficial and adverse effects associated with the action. Section 2 (Affected Environment) describes "current" environmental conditions in the ACT Basin as of 2012, during the preparation of the draft EIS, or to the latest extent that information was available. Any exceptions are specifically noted in the document. An understanding of existing conditions provided a framework for water management as described in Section 3 (Framework for Decision Making), to define the proposed action. The alternative formulation process along with descriptions of measures and alternatives considered is presented in Section 4. The No Action Alternative, Proposed Action Alternative, and other viable alternatives are defined in Section 5. The expected effects of the proposed action and alternatives carried forward for detailed consideration are described in Section 6 (Environmental Consequences) for each environmental resource area. Section 6 also addresses the potential for cumulative effects and summarizes potential mitigation measures.

Environmental resources addressed in this EIS include water resources (quantity and quality), geology and soils, climate, land use, biological resources and ecosystems, socioeconomic resources (including environmental justice), aesthetic resources, and cultural resources.

2 Affected Environment

This section of the EIS describes the physical and social conditions of the geographic area in which the impacts of the proposed action and alternatives are expected to occur, referred to as the region of influence (ROI). The *affected environment* serves as a baseline from which potential environmental and socioeconomic effects likely to result from proposed changes in the way USACE would manage projects within the ACT Basin will be identified and evaluated. More importantly, the baseline will help demonstrate how those proposed changes may affect the functioning of the ACT Basin as a whole. The ACT Basin is shown in Figure 2.0-1.

The resource areas addressed in this section are water resources (quantity and quality), geology and soils, climate change, land use, biological resources, socioeconomics, air quality, noise, traffic and transportation, cultural resources, and hazardous and toxic materials. Navigation, hydropower, recreation, and environmental justice areas are addressed in the socioeconomics discussion.

Much of the baseline information referenced in this section of the EIS was developed during the ACT and ACF (Apalachicola-Chattahoochee-Flint) Basins Comprehensive Study. The Comprehensive Study was undertaken in the 1990s by Alabama, Florida, Georgia, and USACE for both the ACT and ACF basins, as directed by a memorandum of agreement (MOA) among the three states and the Department of the Army. More detailed background information on events leading to the MOA and the Comprehensive Study is presented in Section 3.1.10 of the EIS. The study was consensus-based, requiring the approval of all the participants on all of the study elements. The specified purpose of the Comprehensive Study was

> *… to determine the capabilities of the water resources of the basins, to describe the water resource demands of the basins, and to evaluate alternatives which utilize the water resources to benefit all users groups within the basins*.

The Comprehensive Study provided technical understanding of the water resources in both river basins and basin-specific tools to evaluate water management alternatives. The various elements of the Comprehensive Study that were approved and funded included:

- Process Support – Population and employment forecasts; Database; Public Involvement
- Water Resources Availability – Surface water; Groundwater
- Water Demand – Agricultural; Environmental; Power; Municipal and Industrial; Navigation; Recreation; Water Quality
- Comprehensive Management Strategy – Basin-wide Management; Coordination Mechanism

The Comprehensive Study provided substantial baseline information and analytical tools that have been used in support of the ACT WCM update and EIS process along with more recently developed information from other sources.

The affected environment section depicts conditions as they exist, based upon the most recent available data for each resource. The level of detail provided is commensurate with the intensity, context, and duration of the potential effects on a given resource. Further, ROI varies by resource on the basis of a variety of factors including natural boundaries, geopolitical boundaries, and the likely extent of effects on the resource. Where particularly relevant to understanding the current conditions of a given resource, historical context is also provided.


TENNESSEE
Chattanooga
N
Carters Dam
Gainesville
Weiss Dam
Allatoona Dam
Marietta
H. Neely Henry Dam
Atlanta
Birmingham
ALABAMA
Coosa River
Tallapoosa River
Harris Dam
GEORGIA
Logan Martin Dam
Lay Dam
La Grange
Mitchell Dam
Jordan Dam
Lake Martin Dam
Macon
Walter Bouldin Dam
Yates Dam
Thurlow Dam
Columbus
Montgomery
R.F. Henry Lock and Dam
Millers Ferry Lock and Dam
Claiborne Lock and Dam
Albany
Dothan
Alabama River
Mobile
FLORIDA
Pensacola
Tallahassee
Gulf of Mexico
0 25 50
Miles
LEGEND
ACT Basin Boundary
State Boundary
State Capital
City
Urban Area
Surface Water
USACE Dam
Dam Owned by Other Entity (i.e. Alabama Power)
ACT Basin

Figure 2.0-1

This ACT Basin EIS includes the Alabama, Coosa, and Tallapoosa rivers and all areas in the basin boundaries from the headwaters downstream to the mouth of the Alabama River, where it joins the Tombigbee River to form the Mobile River. The overall scope of the EIS also addresses the area downstream of the confluence of the Alabama and Tombigbee rivers, including Mobile River and Mobile Bay. The ACT Basin (22,739 sq mi) has approximately the same drainage area size as the Tombigbee River basin (20,200 sq mi). Thus, flows from the ACT Basin are roughly half of the total flow in the Mobile River downstream of the juncture of the Alabama and the Tombigbee rivers. This EIS addresses resources downstream from that point but not to the level of detail of other resources in the ACT Basin because of the limited overall effect of operation of the ACT projects on Mobile River and Mobile Bay resources.

2.1 Water Resources

This section examines the complex interrelationships among surface water, groundwater, and the numerous competing demands on water resources in the ACT Basin. A significant amount of information that is used in this section was developed and approved during the Comprehensive Study in the 1990s by Alabama, Florida, Georgia, and USACE, which were partners in the study. Substantial water quantity and quality data that are considered in this EIS have been collected and analyzed since the Comprehensive Study by USACE; U.S. Geological Survey (USGS); USEPA; Alabama, Florida, and Georgia; and other parties. The following water quantity and water quality sections (Sections 2.1.1 and 2.1.2, respectively) describe the affected environment, presenting an overview of the resources in the ACT Basin. The environmental consequences of the alternatives on water resources are presented in Section 6 of this EIS.

The water quantity modeling completed by USACE provided the basis for evaluating impacts on water availability, in-stream flows, and reservoir water level elevations. The USFWS used that information to evaluate potential effects on biological resources in accordance with its responsibilities under the Fish and Wildlife Coordination Act and ESA. The USACE Hydrologic Engineering Center (HEC) completed water quality modeling. Alabama and Georgia also provided substantial input, including input on point source loadings and monitored data, for the water quality model.

2.1.1 Water Quantity Affected Environment

This water quantity discussion addresses the amount of water in the ACT Basin by examining such issues as flow rates, flow durations, reservoir water levels, and groundwater quantities. There are many factors that can affect water quantity, including: weather conditions; municipal and industrial (M&I) consumption; agricultural use for irrigation; the operation of thermoelectric power plants; and dams that provide for hydropower and flood risk management. This section discusses the quantity of water in the ACT Basin under existing conditions.

In the southeast United States, rain falls nearly every month. However, the need for water in the summer and fall often is greater than the supply of water in the river basin. An important function of the many reservoirs in the ACT Basin is to store water when there is an abundance of rain and to release water when there is less rain, ensuring that all water needs can be met throughout the year. This management of water is a complex process that must consider the many competing demands for water in the basin, take past and future hydrologic conditions into consideration, and determine the most appropriate operating conditions for all the reservoirs in the basin to optimize the use of water. USACE takes an active role in water management in the ACT Basin to supply water to meet the various competing demands.

The various uses of water in the ACT Basin include hydropower, navigation, water quality (such as assimilative capacity for wastewater discharges) and water supply, flood risk management, fish and wildlife habitat, and recreation. Water demands can be consumptive or non-consumptive. *Consumptive*

demands withdraw water from the basin for some purpose and return only a portion or none of it back to the basin. Consumptive uses include municipal, industrial, agricultural, and some forms of thermoelectric power generation. For purposes of this analysis, agricultural water supply withdrawals are assumed to provide no return flow to the surface water streams. In contrast, hydropower demand is a *non-consumptive* use of water. It uses the flow in the river to drive turbines to generate electricity, but no water is withdrawn or lost from the system. Water demands and uses within the ACT Basin are discussed in more detail in Section 2.1.1.2.

In considering basin water management, it is critical to account for the various withdrawals/losses and returns/gains to the system. Water is lost through evapotranspiration (total of evaporation and plant transpiration), M&I water withdrawals, thermoelectric power withdrawals, agricultural water withdrawals, groundwater withdrawals, and interbasin transfers. Water is returned, or added, to the basin through precipitation; treated municipal, industrial, and thermoelectric power plant discharges; groundwater baseflow contribution; and interbasin transfers. Figure 2.1-1 illustrates schematically the gains and losses of water to the basin.

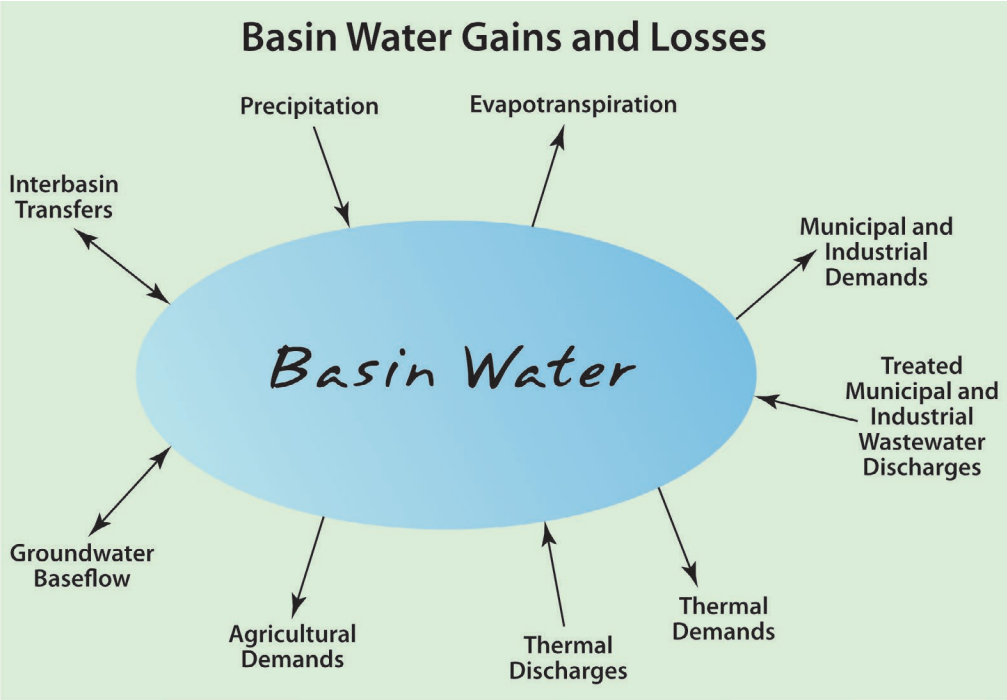


Figure 2.1-1. Illustration of basin water gains and losses.

Water resources in the ACT Basin include both surface water and groundwater. Significant interaction occurs in the basin between the surface water and groundwater, with groundwater providing substantial baseflow for some streams. Surface water hydrology in the ACT Basin is also greatly influenced by various management activities associated with its 17 major dams. The reservoirs formed by those dams attenuate high river flows during wet periods and augment low flows during dry-weather periods.

2.1.1.1 Physical Characteristics

Physical characteristics include precipitation and land use, and they largely affect water quantity and quality. The sections that follow describe the influence of these characteristics on basin hydrology.

2.1.1.1.1 Precipitation

Average yearly precipitation in the ACT Basin ranges from 49 inches to 65 inches per year (in/yr), and precipitation falls every month. Precipitation amounts are highest in the mountain ecoregions and the Southeastern Plains ecoregion because of orographic effects and tropical moist air, respectively. Precipitation is normally highest in late winter and early spring, and then again in late summer because of tropical storms and depressions. Over half of the water that falls as precipitation in the ACT Basin is returned to the atmosphere via evapotranspiration (direct evaporation plus transpiration by plants). Evapotranspiration can range from 30 to 42 inches of water per year and increases from north to south (USACE, Mobile District 1998a).

Yearly rainfall amounts can be highly variable from year to year as seen in Figure 2.1-2 and Figure 2.1-3, with yearly totals ranging over 35 inches in a 3-year span (SERCC 2010). The wet and drought periods produced by these variations in rainfall are cyclical in nature, and the differences in rainfall can be attributed to changes in climate and weather patterns. Periods of heavy rainfall can be caused by el Niño events, which bring heavy winter rain to the southeast, and active hurricane seasons, which can bring heavy rainfall in the late summer and fall. Droughts are loosely associated with la Niña events but are more likely caused by atmosphere-ocean climate variability and by internal atmosphere variability. (Seager et al. 2009).

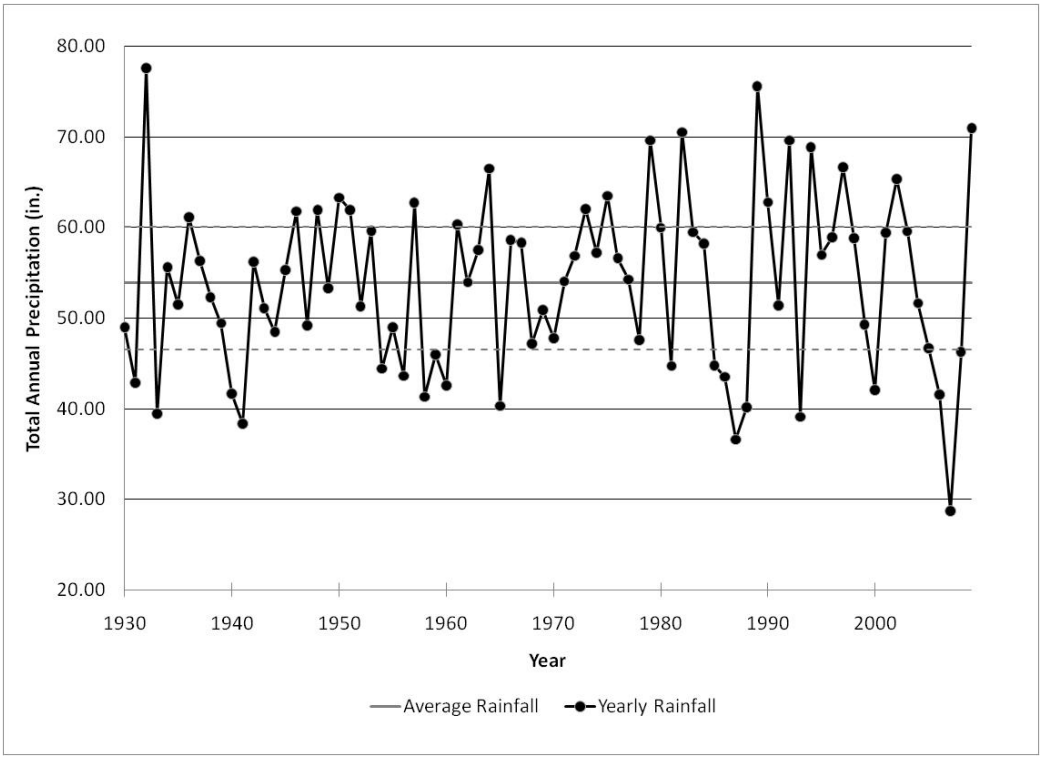


Figure 2.1-2. Yearly precipitation, with 25th and 75th percentile, Rome, Georgia.

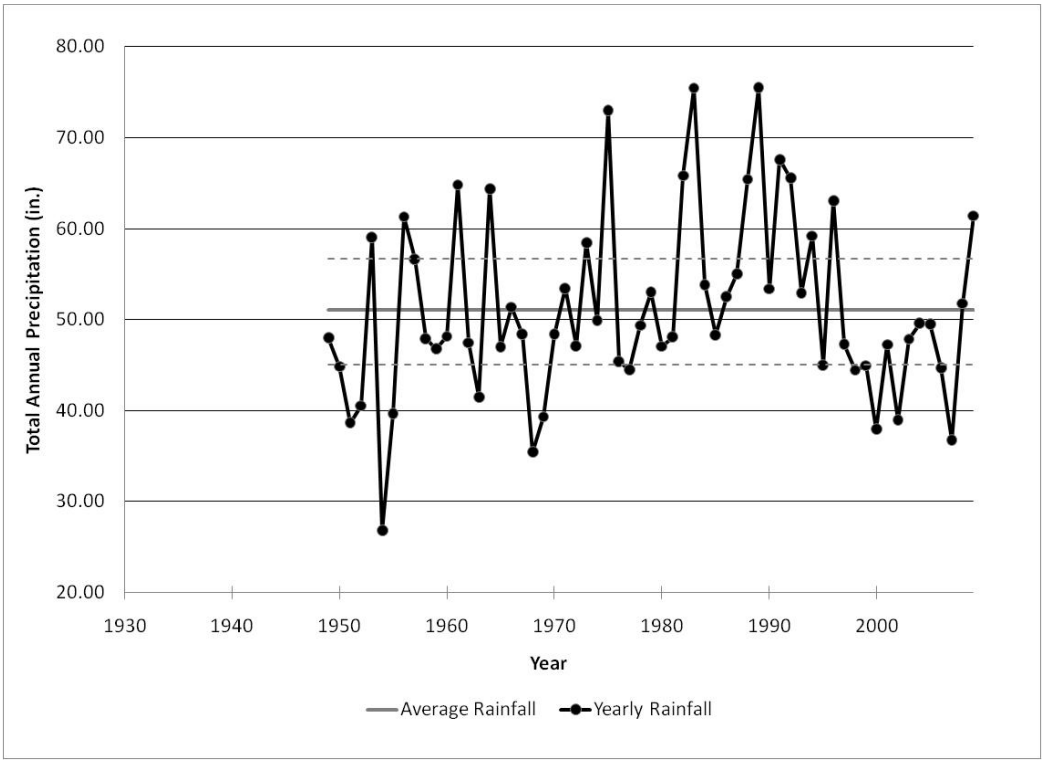


Figure 2.1-3. Yearly precipitation, with 25th and 75th percentile, Montgomery, Alabama.

During the past 8 decades the ACT Basin has experienced numerous droughts, many of which have been considered severe. The effects of each drought have varied across the ACT Basin. For instance, the 1929 to 1932 drought exceeded the 25-year recurrence interval in the north central portion of Alabama but only exceeded the 10-year recurrence interval for the northeast portion of the ACT Basin in Alabama and Georgia. The recurrence interval is the average time between drought and wet periods; although, it is important to note that actual occurrence time can be less. In 1938 to 1945 the northeastern portion of Alabama experienced a drought with a recurrence interval of 25 years, and the northwestern portion of Georgia experienced a drought with a recurrence interval of 50 years. Alabama experienced a statewide, sustained drought from 1950 to 1963, ranging from 27- to 60-year recurrence intervals. From 1950 to 1957 north Georgia experienced a 25-year recurrence interval drought (Jeffcoat et al. 1991; USGS 2000).

Two droughts occurred in Alabama and Georgia in the 1980s, the second of which lasted from 1984 to 1989 and caused water shortages in both states. In the extreme northern portions of the ACT Basin, the 1984 to 1989 drought was the worst known until that time. Precipitation from December 1985 through July 1986 was less than 40 percent of normal. Birmingham, Alabama and Chattanooga, Tennessee received only about 17 inches of precipitation. The drought climaxed in July 1986, exacerbated by extremely high temperatures (USACE, Mobile District 2010a). In north Georgia the drought had a magnitude of 50 to 100-year recurrence interval, causing over one third of the private wells across the state to run dry (USGS 2007). Water supplies had to be transported to numerous communities in east central Alabama (Jeffcoat et al. 1991).

Another multiyear drought affected the ACT Basin between 1998 and early 2003, resulting in severe effects on water use and operation of USACE reservoirs. The drought reached peak severity in summer 2000, accompanied by all-time record high temperatures in many areas (USACE, Mobile District 2010a).

The 2006 to 2008 drought was by far the most devastating recorded in Alabama and western Georgia. Precipitation declines began in December 2005. These shortfalls continued through winter 2006-07 and spring 2007, exhibiting the driest winter and spring in the period of record. The drought reached peak intensity in 2007, resulting in a D-4 Exceptional Drought Intensity (the worst measured) throughout the summer of 2007. Reservoirs across the ACT Basin dropped to extremely low levels. Rainfall in areas of north Georgia where the headwater streams of the ACT Basin was as low as 20 inches for the entire year (USACE, Mobile District 2010a).

During wet periods, severe flooding has occurred in the ACT Basin. Major floods have been caused by hurricanes and tropical storms, such as flooding caused by Hurricane Ivan in 2004 and Hurricane Frederick in 1979. Flooding damage from hurricanes can reach billions of dollars. Storm events can also cause major flooding, such as in 2009 when Alabama and Georgia saw major flooding in the fall because of an el Niño event. Major flooding also occurred in Alabama in January 1991 because of a 4-day storm event (Jeffcoat et al. 1991; USGS 2009a).

The intensity of drought and wet periods is exacerbated by changes in land use and population demand on resources. Severe droughts and increased development in the area have resulted in shortages and restrictions on limited surface-water supplies.

More detailed information on precipitation and extreme weather events has been included the ACT Master Manual and individual project WCMs (Appendix A to the EIS).

2.1.1.1.2 The Relationship between Land Use and Water Quantity

Land use can significantly alter watershed hydrographs through increases in impervious surfaces and increases in anthropogenic water consumption.

Most land in the ACT Basin is forested. Large quantities of water are consumed and lost by forests via rainfall interception and evapotranspiration. Following pine plantation harvesting, water yields can increase as much as 35 percent because of decreases in interception and evapotranspiration. Forested ecosystems have high stream baseflows and low, lengthy storm peaks compared to other common land uses because of high infiltration and permeability rates. Forest cover, such as leaves and mulch, reduces rain drop velocities, allowing for higher infiltration, and soils have organic concentrations with higher porosities, allowing for higher permeability. During high storm flows, wetland forests, often streamside, can store large quantities of water and reduce downstream flooding impacts.

Agriculture in the ACT Basin uses both surface water and groundwater for crop irrigation and livestock watering. Groundwater usage for irrigation is highest in the Alabama River Basin, where groundwater supplies just over 50 percent of the water needed for crop irrigation and is lowest in the Coosa River Basin where groundwater only supplies 15 percent of the water needed for crop irrigation. Livestock agriculture is throughout the state, and farmers use both groundwater and surface water to water livestock. Water used for crop irrigation is considered to be 100 percent consumptive because it is incorporated into crops or lost through evapotranspiration (Hutson et al. 2009).

Agricultural land uses also produce larger storm flows during rain events because of the reduced soil cover compared to forested areas. Runoff rates from agriculture are similar to rates in low- and medium-density residential areas.

Urban areas significantly affect water quantity because of the high percentages of impervious cover and increases in water consumption. Rainfall falling on impervious surfaces is immediately transported to streams, causing high peak flows. Urban areas also have large areas of land with significantly reduced infiltration and permeability rates, such as grassy and barren land. Such areas also shed water extremely quickly during storm events. Because less infiltration occurs in residential and industrial areas, very little groundwater recharge occurs, and stream baseflows are reduced.

Most water removed from the basin for M&I water demands is returned to the basin as treated waste, but demands can alter natural channel flow. Water is lost from the system through evapotranspiration, interbasin transfers, and thermoelectric water demands. Municipal water suppliers used both surface and ground water, depending on supply levels. Water is often returned downstream of the supply source, and groundwater is often returned to the system as surface water. Water use for hydropower is non-consumptive, but hydropower dams can alter natural flow regimes because large releases occur during high power need times. Water used for thermoelectric power generation is moderately consumptive to non-consumptive. Water withdrawals and returns are discussed in more detail in Section 2.1.1.2.

2.1.1.1.3 Surface Water—Rivers

The three main rivers in the ACT Basin are the Alabama, Coosa, and Tallapoosa. The Coosa and Tallapoosa join to form the Alabama River about two-thirds of the way downstream in the basin. The Coosa and Tallapoosa rivers have numerous smaller tributary rivers. Relevant characteristics of the main rivers are described below. The ACT Basin and its principal rivers are illustrated in Figure 2.0-1. Figure 2.1-4 provides longitudinal views of the Alabama, Coosa, Etowah, and Tallapoosa rivers, including the locations of dams and reservoirs.

Rivers in the ACT Basin include both natural (unregulated) and regulated rivers. Natural rivers exhibit a more consistent pattern, responding to precipitation and drought periods as expected with short periods of high flows and prolonged periods of low flows, respectively. Regulated streams exhibit a variable pattern, with daily variations because of hydropower operations (most prominent below peaking projects), and lower flood peaks and higher sustained minimum flows through dry periods as the upstream reservoirs augment low flows. The variable stream flow patterns associated with reservoir operations in the ACT Basin are described in more detail in Section 2.1.1.1.4.

The highest monthly average flows for those rivers occur in the later winter/early spring months of February to April, which is typically the rainy season. Through late spring and summer, low precipitation and high evapotranspiration combine to reduce river flows. The lowest average monthly flow typically occurs at the end of the summer in September.

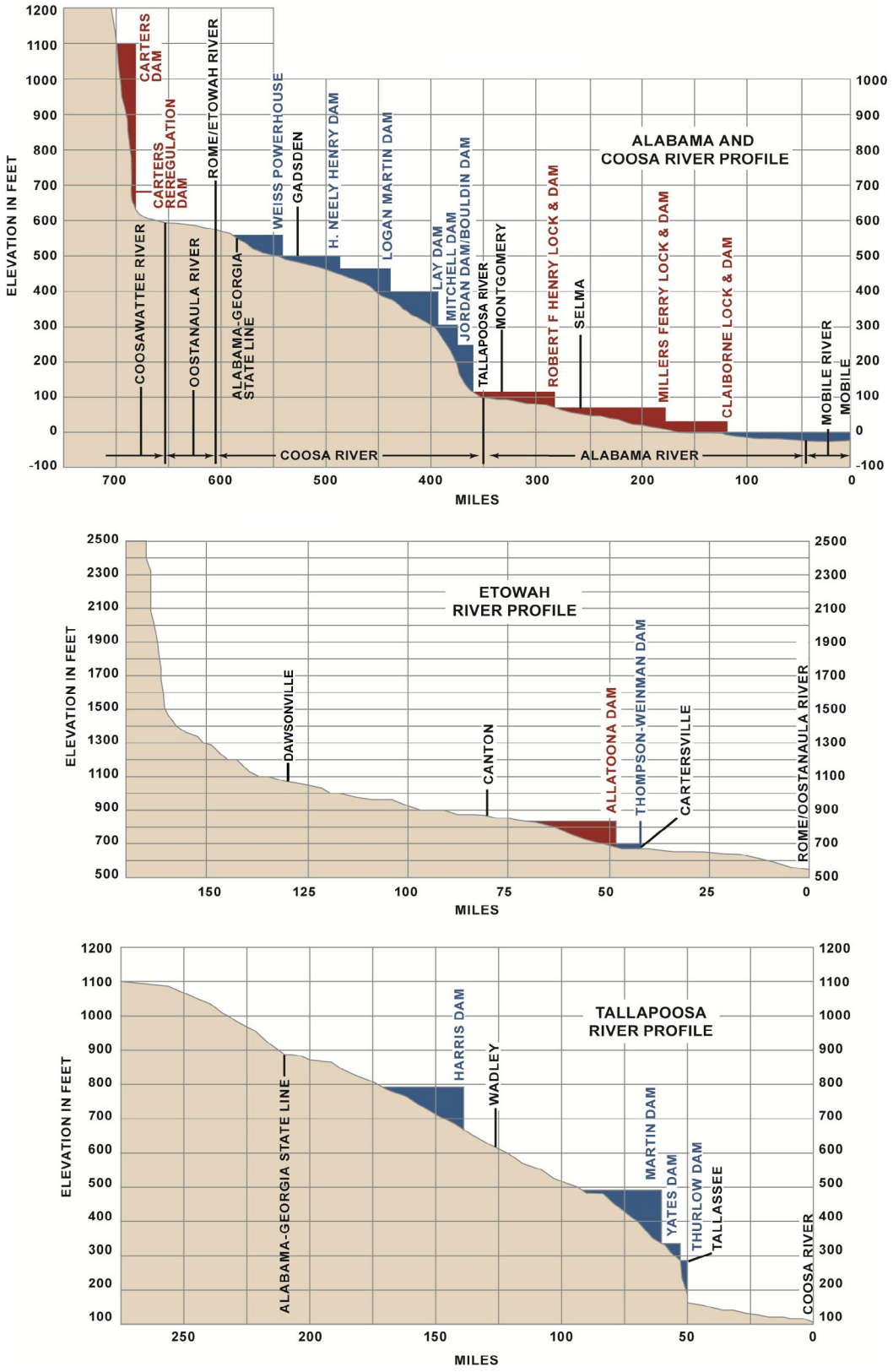


Figure 2.1-4. Longitudinal profiles of the Alabama, Coosa, Etowah, and Tallapoosa Rivers (ACT Basin).

2.1.1.1.3.1 Coosa River

The Coosa River Basin originates in the Blue Ridge Mountains and extends to Wetumpka, Alabama, north of Montgomery, Alabama. The basin has a drainage area of 10,156 sq mi. The Coosa River has several main tributary streams that significantly affect flows in the river.

The Coosa River Basin begins in southeast Tennessee with the Conasauga River. The Conasauga River drains an area of 727 sq mi, about 20 percent of which is in Tennessee and 80 percent in Georgia. The Conasauga River has a fairly steep slope of 35.5 feet per mile (ft/mi) for the upper 41 mi through the mountains, then it falls at a more gentle slope of 3 ft/mi for the 47 mi to its mouth. The Conasauga River joins the Coosawattee River (drainage area of 865 sq mi) to form the Oostanaula River, which is a primary tributary to the Coosa River. The Coosawattee River initially falls at a steep rate of 29 ft/mi for 19 mi, then falls at a more gentle slope of 2 ft/mi for the 27 mi to its mouth. Two dams are on the Coosawattee River: Carters Lake and Carters Reregulation Dam. Carters Lake, about 27 mi upstream of the confluence of the Coosawattee and Conasauga rivers, is a peaking hydropower facility that causes a regular pulsing of downstream flows and is the only hydropower facility in the basin with pumpback capabilities. Carters Reregulation Dam was constructed to return the stream flow to a more normal pattern, removing the pulsing caused by the peaking facility. The dam also serves as the lower reservoir for the pumpback operation. With the upper reservoir (Carters Lake) and the lower reservoir (Carters Reregulation Dam), water is released from Carters Lake during peak electrical demands and pumped back from Carters Reregulation Dam to Carters Lake during off-peak times. The Cartecay and Ellijay rivers are two primary tributaries to the Coosawattee River (USACE, Mobile District 1997).

The Oostanaula River, downstream of the confluence of the Conasauga and Coosawattee rivers near Resaca, Georgia, flows south for 47 mi to join the Etowah River at Rome. At that point, the Oostanaula and Etowah rivers form the Coosa River. The Oostanaula River has a drainage area of 2,150 sq mi. The slope of the river is relatively flat, with a fall averaging one ft/mi. The Etowah River begins in the Blue Ridge Mountains near Dahlonega, Georgia, and flows about 150 mi southwest to its confluence with the Oostanaula River at Rome, Georgia. The Etowah River basin drains an area of 1,861 sq mi, all in Georgia. The Etowah River has a very steep slope initially, falling at a rate of 45 ft/mi. Thereafter, the slope of the river flattens significantly, averaging about 4.5 ft/mi for 93 mi to Allatoona Lake. Allatoona Dam is about 48 mi above Rome near Cartersville, Georgia (USACE, Mobile District 1997). Downstream of Allatoona Dam, the slope is 3.2 ft/mi to its mouth at Rome, Georgia. A low head dam, known as the Thompson-Weinman Dam is on the Etowah River at Cartersville, about 3.5 mi downstream of Allatoona Dam. This low head dam, dating to the early 1900s, provided Cartersville's first electricity and was used by local industry as a power supply up until the late 1900s. The dam no longer serves a useful purpose.

The Oostanaula and Etowah rivers converge near Rome, Georgia, to form the Coosa River. The Coosa River flows 286 mi from Rome, Georgia, to north of Montgomery, Alabama, where it joins the Tallapoosa River to form the Alabama River. The river falls approximately 420 ft in 267 mi, or 1.6 ft/mi, in a series of six successive pools, from its source to Jordan Dam and Lake. Seven APC dams form continuous, impoundments over nearly the entire length of the Coosa River, with each dam discharging into the upper end of the next downstream impoundment. These seven dams are Weiss Lake, H. Neely Henry Lake, Logan Martin Lake, Lay Lake, Mitchell Lake, Jordan Dam and Lake, and Bouldin Dam. The upper three APC projects operate as hydropower peaking facilities, with releases occurring several hours each weekday and with no releases on the weekends. The lower four APC projects operate generally as run-of-river projects for hydropower production and to maintain stable flows from Jordan Dam and Lake over the weekends when the upstream peaking facilities do not operate. Because the reservoirs provide continuous inundation from one dam to the next, the effects of the peaking operation are tempered and attenuated.

The first of these seven dams is 60 mi downstream of Rome, and the last is 19 mi above the confluence with the Tallapoosa River. As required by their FERC license (USACE, Mobile District 1997), the APC projects on the Coosa River are operated to maintain a continuous minimum flow at Jordan Dam and Lake, which varies seasonally and is discussed in more detail in Section 2.1.1.1.4.8. The Coosa River channel varies from 300 to 500 ft wide, with banks 25 ft high along the floodplain. Numerous tributaries enter the Coosa River downstream of Rome, Georgia. The largest of those is the Chattooga River, which has a drainage area of 675 sq mi.

The capacity of the Coosa River within its banks varies substantially throughout the river's length. Capacity is about 15,000 cfs at Rome, Georgia, and about 50,000 cfs near Gadsden, Alabama (USACE, Mobile District 1997). Historically, average daily flows at the USGS gage on the Coosa River at Rome, Georgia, have been as low as 720 cfs (in August 2008) and as high as 64,600 cfs (in January 1947) and 64,200 cfs in more recent years (March 1990) (USGS 2009b).

Flow data at several gages in the Coosa River basin are summarized in Table 2.1-1. USGS data for water years 1976 through 2009 were used. That period represents the time after the final dam in the Coosa River Basin was completed (Carters Lake became operational in 1975). The Etowah River gage above Cartersville (02394000) and Coosa River gage near Rome (02397000) have longer periods of record (1949–2009). Review of the longer period of record indicates that mean monthly discharges are similar to the figures presented in Table 2.1-1 (generally within 5 to 10 percent).

Table 2.1-1.
Mean monthly flows (cfs) at selected gage stations in the Coosa River Basin

Gage station	Period of record	Discharge (cfs)	Month											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
02382500 Coosawattee River at Carters, GA	1976 to 2009	Monthly Mean (MMD)	1,180	1,320	1,620	1,570	1,210	889	828	680	552	591	715	938
		Highest MMD	2,384	4,651	4,861	4,004	2,455	1,596	2,247	1,536	972	1,852	2,008	2,527
		(Year)	(1978)	(1990)	(1990)	(1977)	(2003)	(2003)	(1976)	(2003)	(2004)	(1989)	(1977)	(2004)
		Lowest MMD	250	247	248	296	425	327	328	332	299	224	222	248
		(Year)	(2008)	(2008)	(2008)	(2008)	(1988)	(2008)	(1988)	(2008)	(1998)	(1998)	(1998)	(2007)
02394000 Etowah River at Allatoona Lake above Cartersville, GA	1976 to 2009	Monthly Mean (MMD)	2,080	1,890	2,210	2,220	1,990	1,480	1,540	1,300	1,220	1,500	2,020	2,120
		Highest MMD	4,710	5,187	6,533	5,520	5,321	3,463	4,028	3,524	2,464	5,880	5,316	5,447
		(Year)	(1993)	(1996)	(1990)	(1976)	(1980)	(2003)	(2005)	(1984)	(2004)	(1989)	(1977)	(1983)
		Lowest MMD	322	306	493	360	445	541	430	423	399	448	635	339
		(Year)	(2008)	(2008)	(2002)	(1988)	(2007)	(2007)	(1986)	(1986)	(1986)	(1986)	(2007)	(2007)
02397000 Coosa River near Rome, GA	1976 to 2009	Monthly Mean (MMD)	8,660	9,370	11,400	9,580	6,980	4,560	4,430	3,280	3,110	3,610	5,180	6,780
		Highest MMD	16,950	31,130	29,220	24,630	23,490	11,700	14,470	9,360	8,013	15,440	14,130	18,640
		(Year)	(1993)	(1990)	(1990)	(1977)	(2003)	(1989)	(2003)	(1984)	(2004)	(1989)	(1977)	(1983)
		Lowest MMD	1,951	2,912	3,115	2,262	1,485	1,338	1,341	1,337	1,410	1,097	1,395	1,533
		(Year)	(2008)	(2000)	(1988)	(2007)	(2007)	(2007)	(1986)	(2007)	(1999)	(2007)	(2007)	(2007)

2.1.1.1.3.2 Tallapoosa River

The Tallapoosa River begins in northwest Georgia, 40 mi west of Atlanta, at an elevation of 1,145 ft. The river flows 235 mi into Alabama to join the Coosa River north of Montgomery. The basin drains a total area of 4,680 sq mi, of which 15 percent are in Georgia and 85 percent in Alabama. From its source, the river falls at a rate of 12 ft/mi for the first 15 mi, then descends at a more gradual rate of 3.4 ft/mi. In the lower reach from Thurlow Lake to its mouth, the river falls at a rate of 1.6 ft/mi.

APC constructed four dams across the Tallapoosa River. The upper two projects (R.L. Harris Lake and Lake Martin) are hydropower peaking facilities that generally operate several hours each weekday and do not generate power on the weekends. The two downstream projects (Yates and Thurlow lakes) operate as run-of-river facilities, slightly reregulating peak releases and maintaining downstream minimum flows over the weekends when the upstream projects do not operate.

The river's width varies from 250 ft to 700 ft and has banks that are 20 ft high along the flood plain. The principal tributary streams are the Little Tallapoosa River and Sougahatchee, South Sandy, Uphapee, and Hillabee creeks (USACE, Mobile District 1997). The river has a capacity of 2,500 cfs in the upper reaches, 22,000 cfs near Wadley, Alabama, and 60,000 cfs just downstream of Thurlow Lake (USACE, Mobile District 1997). Historically, flows at the USGS gage on the Tallapoosa River at Wadley, Alabama, have been as low as 41 cfs (in August 1987) and as high as 103,000 cfs (in May 2003) (USGS 2009c).

Flow data at two stream gages in the Tallapoosa River basin are summarized in Table 2.1-2. USGS data for water years 1984 through 2009 were used. That period represents the time after the final dam on the Tallapoosa river Basin was completed (R.L. Harris Lake [APC] became operational in 1983). The Tallassee gage has a much longer period of record (1928–2009). Review of the longer period of record indicates that mean monthly discharges are similar to the numbers presented in Table 2.1-2 between November and March but are appreciably larger (in the range of 15 to 25 percent) than the numbers presented in Table 2.1-2 for April through October.

Table 2.1-2.
Monthly flows (cfs) at selected gage stations in the Tallapoosa River Basin

Gage station	Period of record	Discharge (cfs)	Month											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
02414500 Tallapoosa River at Wadley, AL	1984 to 2009	Monthly Mean (MMD)	3,090	4,210	4,690	2,440	2,560	1,790	1,930	1,380	1,140	1,240	2,090	2,450
		Highest MMD	6,757	10,890	13,270	5,162	14,320	4,819	7,058	4,331	3,180	5,599	6,246	8,336
		(Year)	(1993)	(1990)	(1990)	(2005)	(2003)	(2003)	(2005)	(1984)	(2004)	(1995)	(1992)	(1983)
		Lowest MMD	299	1,607	1,294	542	380	520	527	383	320	234	185	220
		(Year)	(2008)	(1986)	(1988)	(1986)	(2007)	(1986)	(1988)	(2007)	(1990)	(1986)	(2007)	(2007)
02418500 Tallapoosa River downstream of Tallassee, AL	1984 to 2009	Monthly Mean (MMD)	5,210	6,260	6,120	3,630	3,770	3,490	3,330	2,810	2,600	2,750	4,350	5,380
		Highest MMD	10,510	18,060	22,970	8,202	18,630	13,350	13,230	9,205	6,153	9,145	8,831	12,920
		(Year)	(1993)	(1990)	(1990)	(1998)	(2003)	(1989)	(2003)	(1984)	(2009)	(1995)	(1995)	(1983)
		Lowest MMD	404	651	613	432	381	1,336	814	638	923	681	488	407
		(Year)	(2008)	(2008)	(2007)	(2007)	(1988)	(1985)	(1988)	(2007)	(1986)	(1986)	(2007)	(2007)

2.1.1.1.3.3 Alabama River

The confluence of the Coosa and Tallapoosa rivers forms the Alabama River near Wetumpka, Alabama, north of Montgomery. The Alabama River, excluding the Coosa and Tallapoosa River tributary areas, drains an area of 7,940 sq mi, all of which is in Alabama. Montgomery, the largest city on the river, is about 14 mi downstream from the source of the Alabama River. The river meanders generally in a westerly direction for 100 mi to Selma and then southwesterly 210 mi to join the Tombigbee River. The Alabama and Tombigbee rivers merge to form the Mobile River near Calvert, Alabama. The Alabama River has a relatively flat slope, averaging 0.3 ft/mi. The channel varies in width from 400 to 600 ft with banks 10 ft high (USACE, Mobile District 1997).

The Cahaba River is a major tributary of the Alabama River. The Cahaba River originates on the southern slope of Cahaba Mountain northeast of Birmingham, Alabama, at an elevation of approximately 1,200 ft. The river drains an area of 1,825 sq mi. It flows southwesterly and southerly for 196 mi where it joins the Alabama River 17 mi downstream from Selma, Alabama, within William "Bill" Dannelly Lake. The Cahaba River has an average slope of 15 ft/mi for the first 25 to 30 mi, then drops to a slope of 2.5 ft/mi for 44 mi, and finally flattens to a slope of 0.6 ft/mi to its mouth.

USACE constructed three multipurpose dams on the Alabama River. Robert F. Henry Lock and Dam, 30 mi above Selma and 245 mi above the mouth, and Millers Ferry Lock and Dam, 73 mi downstream of Selma and 142 mi above the mouth; each has a navigation lock, a hydroelectric powerhouse and spillway section. Claiborne Lock and Dam, 82 mi above the mouth, has only a navigation lock and spillway section. The Alabama River has a carrying capacity that varies from 100,000 to 150,000 cfs (USACE, Mobile District 1997). Historically, daily mean flows at the USGS gage on the Alabama River at Montgomery, Alabama, have been as low as 255 cfs (in June 1975) and as high as 275,000 cfs (in February 1961). The lowest annual seven-day minimum at the Montgomery gage was 1,910 cfs (in December 2007) (USGS 2009d). Daily mean flows at the USGS gage on the Alabama River at Claiborne Lock and Dam and Lake have been as low as 1,540 cfs (in October 2007) and as high as 255,000 cfs (in March 1990). The lowest annual 7-day minimum at the Claiborne Lock and Dam and Lake gage was 2,540 cfs (in December 2007) (USGS 2009e).

Flow data at two gages on the Alabama River and one gage on the Cahaba River are summarized in Table 2.1-3. USGS data for water years 1976 through 2009 were used, which coincide closely with the period used for Table 2.1-1 and Table 2.1-2. The Alabama River gage near Montgomery, Alabama (02420000), and the Cahaba River gage near Marion Junction, Alabama (02425000), both have longer periods of record (1927–2009 and 1938–2009, respectively). However, review of the longer periods of record indicate that mean monthly discharges do not vary appreciably (generally within 5 to 10 percent) from the figures presented in Table 2.1-1.

2.1.1.1.3.4 Navigation

Navigation is an important use of water resources in the ACT Basin. The development of the Alabama and Coosa rivers was authorized by Congress in section 2 of the River and Harbor Act of 1945 (P.L. 79-14) for navigation (from the confluence of the Alabama and Tombigbee rivers upstream to Rome, Georgia), flood risk management, power development and other purposes, as described in House Document (H.D.) 414, 77th Cong., 1st Session. The 1945 act was modified on June 28, 1954, by P.L. 83-436 enacted by the 83rd Congress, which suspended the authorization for federal power development of hydropower and authorized private interests (APC) to construct a series of dams on the Coosa River for the purpose of generating hydropower subject to licensing requirement under the Federal Power Act. Section 4 of P.L. 83-436 contemplated future navigation on the Coosa River and provided that "the dams constructed by the licensee shall provide a substantially continuous series of pools and shall include basic provisions for the future economical construction of navigation facilities."

Table 2.1-3.
Monthly flows (cfs) at selected gage stations in the Alabama and Cahaba River Basins

Gage station	Period of record	Discharge (cfs)	Month											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
02420000 Alabama River near Montgomery, AL	1976 to 2009	Monthly Mean (MMD)	23,400	35,000	42,700	36,300	23,300	14,700	14,200	10,300	10,500	11,300	17,600	25,700
		Highest MMD	38,250	101,100	107,200	127,200	79,410	59,320	47,100	33,200	27,710	23,940	42,870	74,420
		(Year)	(2009)	(1990)	(1990)	(1979)	(2003)	(1989)	(2003)	(1984)	(2009)	(1979)	(2004)	(1983)
		Lowest MMD	6,098	12,400	10,510	6,186	4,681	4,513	4,929	4,210	4,113	3,646	2,430	2,294
		(Year)	(2008)	(2009)	(2007)	(2007)	(1986)	(1986)	(2008)	(1988)	(1986)	(2007)	(2007)	(2007)
02428400 Alabama River at Claiborne Lock and Dam and Lake near Monroeville, AL	1976 to 2009	Monthly Mean (MMD)	46,500	53,100	64,800	48,600	27,600	18,000	15,200	12,200	11,700	14,800	21,000	32,300
		Highest MMD	90,120	126,000	145,000	147,600	62,250	62,470	59,580	44,030	37,580	49,420	65,300	93,480
		(Year)	(1993)	(1990)	(1990)	(1979)	(1980)	(1989)	(1989)	(1984)	(2009)	(1995)	(1992)	(1983)
		Lowest MMD	7,846	12,820	15,700	9,125	6,083	5,029	4,495	4,575	4,592	4,152	3,653	2,937
		(Year)	(2008)	(2009)	(2007)	(2007)	(2007)	(2007)	(2008)	(2007)	(2007)	(2007)	(2007)	(2007)
02425000 Cahaba River near Marion Junction, AL	1976 to 2009	Monthly Mean (MMD)	4,110	4,920	5,950	4,770	2,550	1,670	1,530	943	1,190	1,030	1,660	2,650
		Highest MMD	10,450	15,960	14,970	17,100	9,466	5,504	6,661	2,348	6,530	3,394	5,588	10,360
		(Year)	(1998)	(1990)	(1980)	(1979)	(2003)	(2003)	(2005)	(2003)	(2009)	(1995)	(2004)	(1983)
		Lowest MMD	816	1,324	1,333	645	461	304	399	278	305	302	313	408
		(Year)	(1981)	(2000)	(2007)	(1986)	(2007)	(2007)	(2008)	(2007)	(2000)	(2000)	(2008)	(2007)

Note: For the Montgomery gage, no data were available for water years 1991 through 2001.

After P.L. 83-436, Congress requested a report on the Coosa River navigation project. The resulting report, submitted to Congress in January 1960 (H.D. 86-320), recommended that the navigation project for the Coosa River from Montgomery to Gadsden be accomplished after the waterway to Montgomery was assured. The plan of improvement identified in H.D. 86-320 provided for a waterway 9 ft deep with widths of 200 ft to Montgomery, Alabama, and 150 ft to Rome, Georgia. The authorized waterway downstream of Montgomery was essentially completed in 1972 with the completion of the Robert F. Henry Lock and Dam near Selma, Alabama. Operational aspects of the completed portion of the navigation channel downstream of Montgomery are discussed later in this section.

For the uncompleted Coosa River Navigation project, the Public Works Appropriations Bill for Fiscal Year (FY) 1974 required a report to update the project economics and long-range project costs. Completed in December 1973, the report used generalized construction cost indices without the benefit of current traffic surveys or engineering investigations. A detailed economic and cost evaluation was performed and submitted to Congress in 1978. Although the report does not make recommendations, it contained estimates of benefits and costs for five alternatives. The *optimum* alternative had a benefit to cost ratio of 0.46 to 1. The plan for the Coosa River segment of the waterway between Montgomery and Gadsden, Alabama, was further modified by the WRDA of 1986 to authorize planning, engineering and design for the project generally in accordance with the plans contained in Design Memorandum No. 1, General Design, which was dated May 1982 (USACE, Mobile District 1982). Since then, no further work has been pursued on the navigation aspects of the Coosa River segment of the waterway.

Commercial barge lines use rivers to move bulk materials by barge. The Alabama River from Montgomery downstream to its confluence with the Tombigbee River to form the Mobile River, and thereafter downstream to Mobile, Alabama provides an important navigation route for commercial barge traffic, serving as a valuable regional economic resource (see Section 2.6.1). Sufficient flows, coupled with the congressionally authorized navigation features, are required to provide usable water depths to support navigation. To provide for the authorized 9-ft-deep by 200-ft-wide navigation channel from the mouth of the Alabama River to Montgomery, Alabama, there are three locks and dams on the Alabama River (discussed in Sections 2.1.1.1.4.15 through 2.1.1.1.4.17), and a combination of dredging, river training works, and flow augmentation, which support navigation depths on the river.

Annual maintenance dredging requirements over the full length of the authorized project were described in the 1974 Final EIS for the Alabama-Coosa rivers navigation project (USACE Mobile District, 1974a). In 1987, revisions and updates to the navigation maintenance plan for the project were described in a Final Supplement to the EIS for the project (USACE Mobile District 1987). Minor adjustments to the navigation maintenance plan have occurred since 1987, but no major updates or revisions have been necessary. Dredging plans are reviewed for continued compliance with the Clean Water Act (CWA) and other relevant requirements, including NEPA, every five years in conjunction with renewal of state water quality certification under Section 401 of the CWA. That process was most recently completed when the state of Alabama issued water quality certification for continued maintenance dredging and dredged material disposal for the Alabama River on March 31, 2009.

A minimum depth of 7.5 ft can provide a limited amount of navigation. Under low-flow conditions, even the 7.5-ft depth has not been available at all times. Over the period from 1976 to 1993, the 7.5-ft navigation channel was available 79 percent of the time and the 9-ft navigation channel was available 72 percent of the time. Since 1993, the percentage of time that these depths have been available has declined further. During the discussions and development of navigation flow support concept drought plan with APC, USACE and APC agreed to transition to a navigation channel depth less than 9-ft before complete suspension during drought operation. The designated navigation template provided estimated flow requirements for channel depths ranging from 7.5-ft to 9-ft at half foot increments. The agencies decided to use the lowest available channel depth flows for transition navigation channel. There is enough flexibility in the navigation plan to support shallower channel depth if required flow data are

provided. In short, USACE and APC agreed to a navigation plan that provides necessary navigable channel flows. The actual channel depth will vary with the USACE ability to dredge.

Flows for navigation are most needed in the unregulated part of the lower Alabama River downstream of Claiborne Lock and Dam. When flows are available, Claiborne Lock and Dam is operated to provide the full navigation depth of 9 ft. When river conditions or funding available for dredging of the river indicates that project conditions (9-ft channel) will probably not be attainable in the low water season, the dam has on occasion been operated to provide flows for a Table 2.1-1 reduced project channel depth as determined by surveys of the river. In recent years funding for dredging has been curtailed, requiring higher flows to provide the design navigation depth. In addition, recent droughts in 2000 and 2007 had a severe impact on the availability of navigation depths in the Alabama River. During 2007 the APC further reduced flows during the dry months, increasing effects on the navigation channel.

Figure 2.1-5 depicts the historic annual channel depth availabilities computed for 1970–2007.

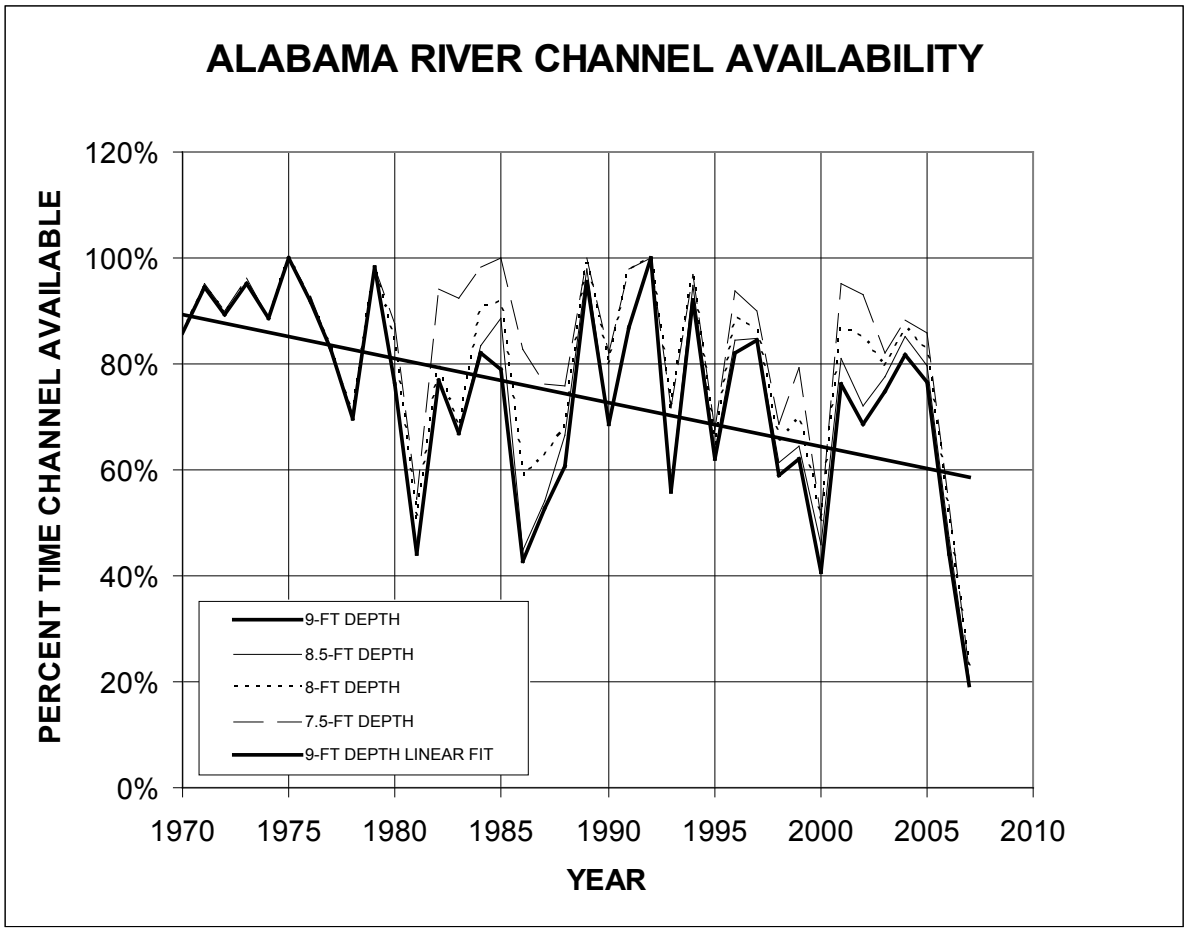


Figure 2.1-5. Alabama River channel availability from 1970 to 2007.

A linear fit trend line shows the trend for the period of record. During periods of low flow, the available navigation depth in the channel decreases. Alternatively, high-flow conditions in the channel raise the stage elevation allowing for deeper navigation depths and more channel availability. However, during a large flood event, banks have a tendency to erode, and there is generally more shoaling throughout the channel once the flood subsides.

The southern portions of the ACT Basin experienced drought conditions in the year 2000. That resulted in a design channel depth being met less than 50 percent of the time. The year 2006–2007 also experienced the historical drought of record. In 2006 the 9-ft design depth was available only 44 percent of the time and 19 percent of the time in 2007.

Figure 2.1-6 through Figure 2.1-11 illustrate the correlation between the available navigation depth and the amount of channel flow during drought and normal to above normal summer flows. Figure 2.1-6 and Figure 2.1-7 immediately below represent the drought year 2000. A navigation depth of only 5 ft was maintained between July and October.

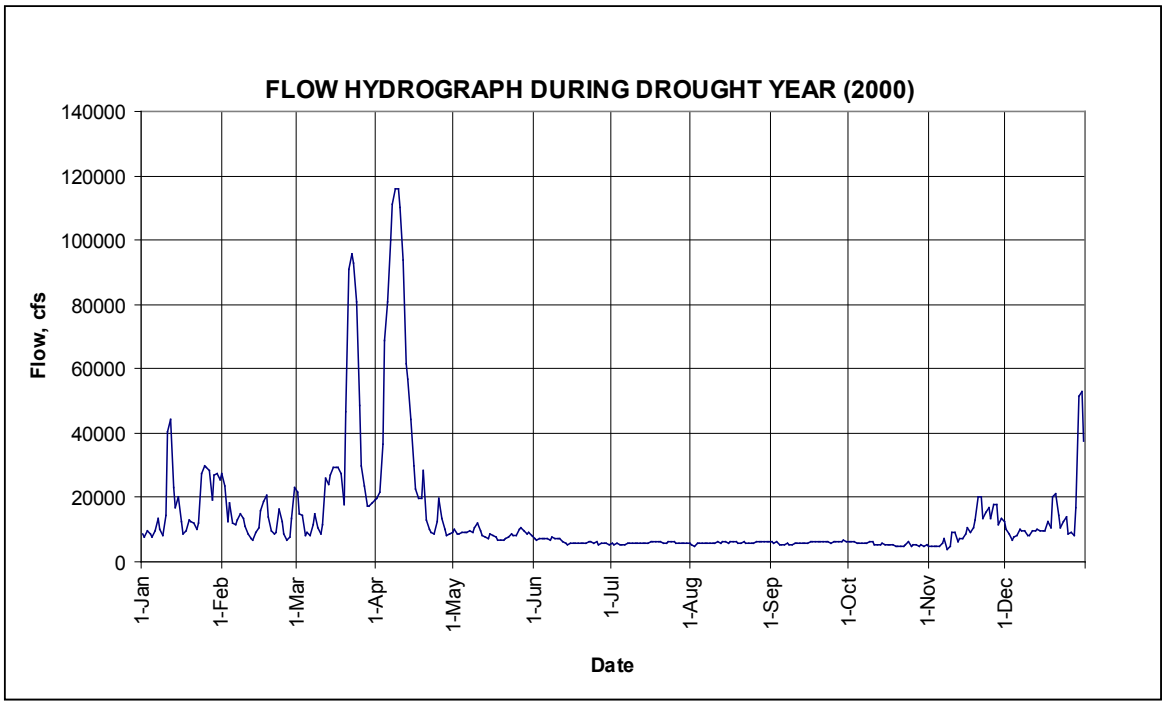


Figure 2.1-6. Flow hydrograph for a drought year (2000) on the Alabama River.

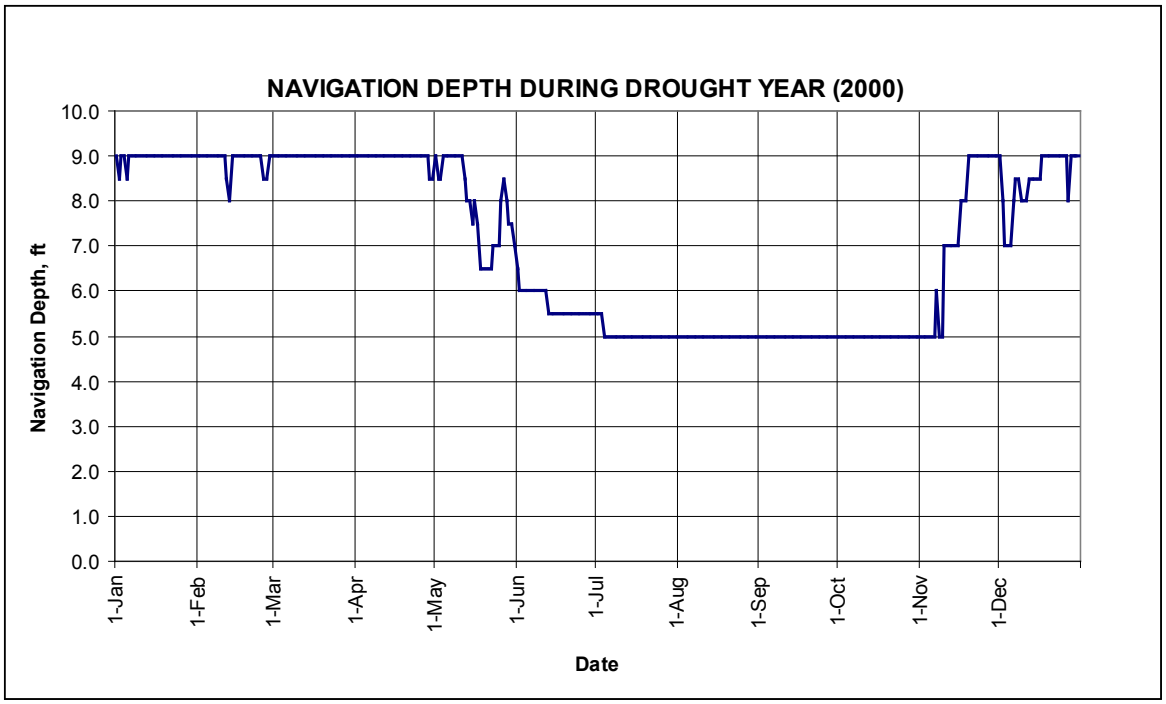


Figure 2.1-7. Navigation depths for a drought year (2000) on the Alabama River.

Figure 2.1-8 and Figure 2.1-9 represent a normal summer in a high-flow year during which the full navigation depth of 9 ft is maintained.

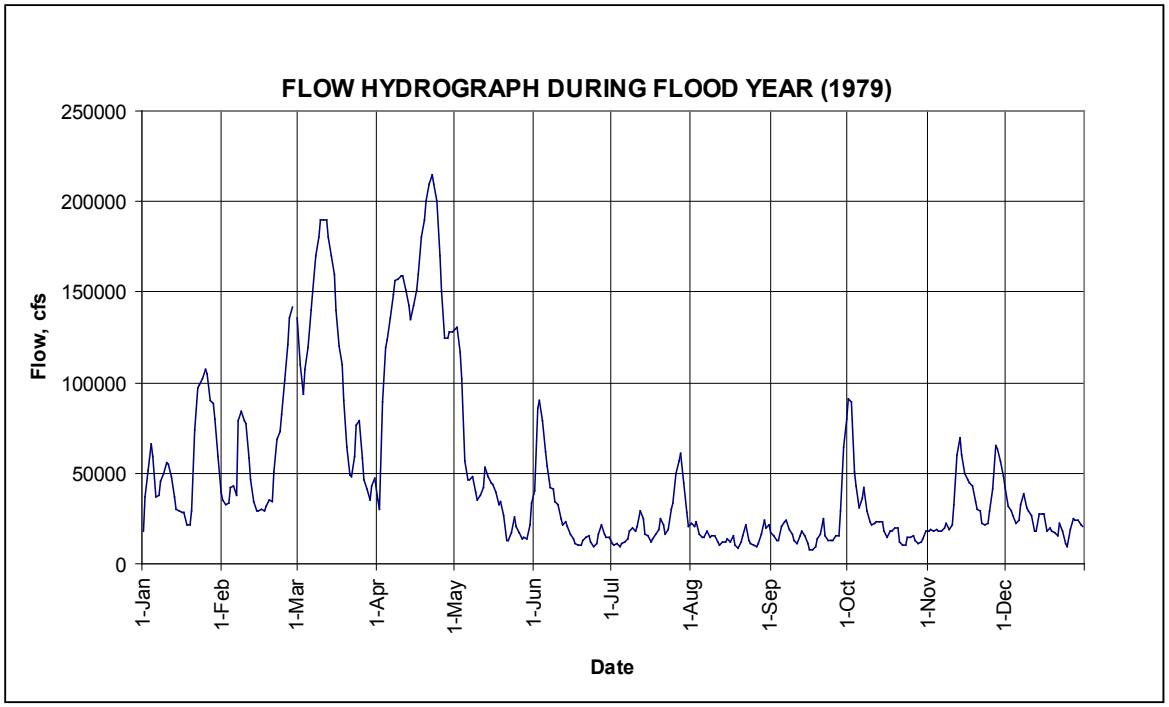


Figure 2.1-8. Flow hydrograph for a flood year (1979) on the Alabama River.

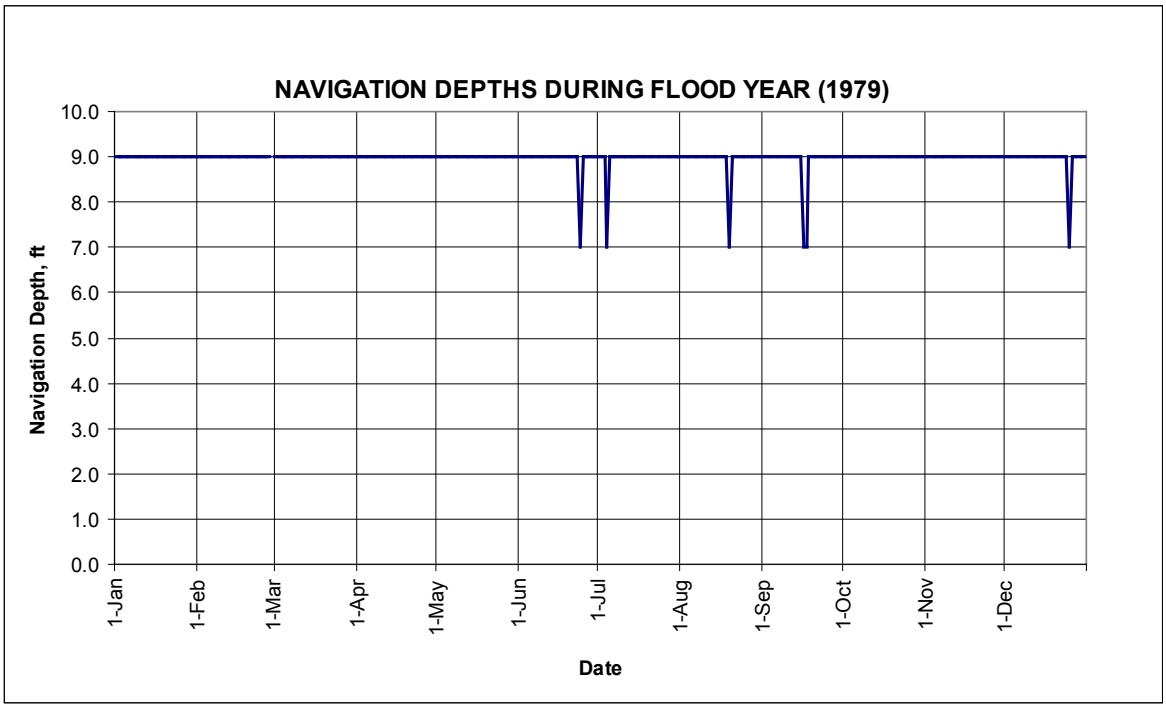


Figure 2.1-9. Navigation depths for a flood year (1979) on the Alabama River.

Figure 2.1-10 and Figure 2.1-11 represent the historical drought of record (2007). Normally, APC reservoirs immediately upstream of Montgomery, Alabama (Jordan and Bouldin Dams on the Coosa River and Thurlow Dam on the Tallapoosa River, hereafter referred to as JBT) provide a combined minimum release of 4,640 cfs (weekly average), historically to support navigation in the Alabama River along with other downstream benefits. For more discussion on the JBT minimum release requirement, see Section 2.1.1.1.4.13. In August 2007, under extreme drought conditions, APC reduced combined JBT releases by 10 percent (to 4,176 cfs) following an environmental analysis of the effects of flow reduction on downstream project functions and natural resources (USACE, Mobile District 2007). As extreme conditions continued into the fall of 2007, APC incrementally continued to reduce releases from the JBT projects until combined releases averaged as low as 2,000 cfs by November 2007 before beginning to gradually increase releases thereafter (USGS 2010a). As a result of these actions, the channel depth downstream of Claiborne Lock and Dam dropped to less than 4 ft in 2007.

Extreme high-flow conditions also limit availability of the project for commercial navigation, principally related to the ability to use the navigation locks at the three locks and dams on the Alabama River. Those conditions are temporary and far more short term (usually lasting no more than a few days) than low-water limitations resulting from extended periods of drought and low basin inflows. At Robert F. Henry Lock and Dam, use of the navigation lock is discontinued when the headwater above the dam reaches elevation 131.0 ft. That elevation equates to a flow of about 156,000 cfs, which occurs on average about once every 3 years (USACE, Mobile District 1999). At Millers Ferry Lock and Dam, use of the navigation lock is discontinued when the tailwater downstream of the dam reaches elevation 81.0 ft. That tailwater elevation equates to a flow of about 220,000 cfs, which occurs on average about once every 18 years (USACE, Mobile District 1991). At Claiborne Lock and Dam, use of the navigation lock is temporarily discontinued when the tailwater downstream of the dam reaches elevation 47.0 ft. That tailwater elevation equates to a flow of about 130,000 cfs, which occurs on average about once every 1.8 years (USACE, Mobile District 1993a). Those lock and dam projects are described in more detail in Sections 2.1.1.1.4.15 through 2.1.1.1.4.17.

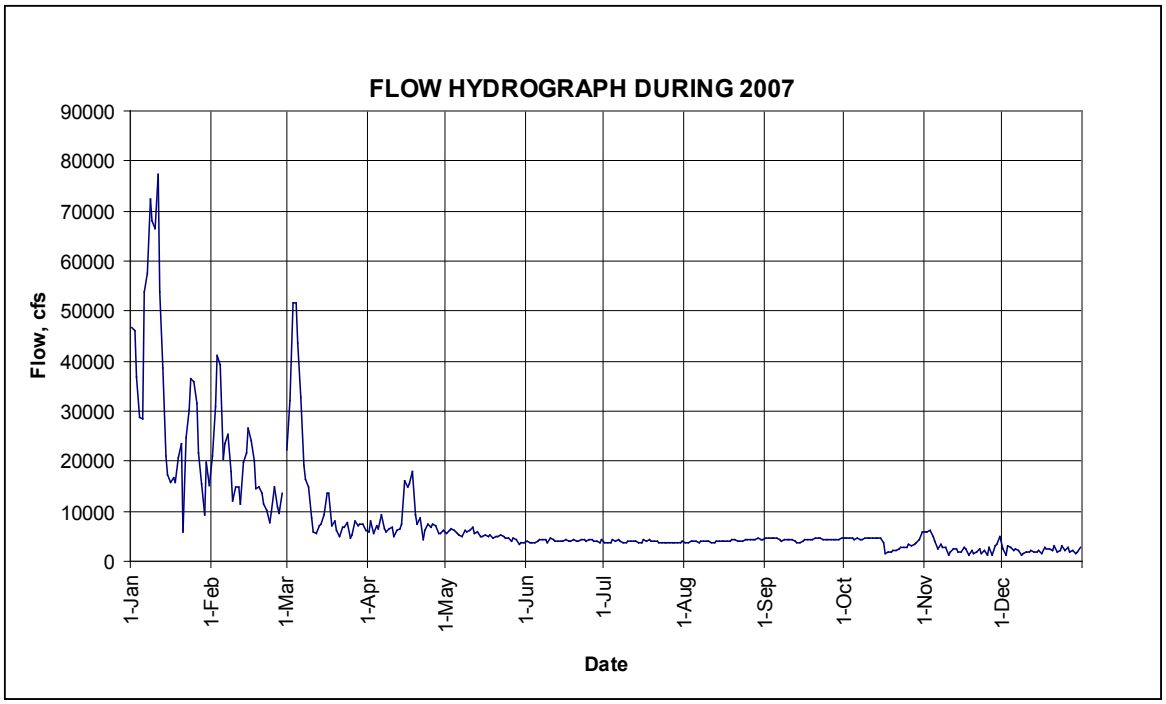


Figure 2.1-10. Flow hydrograph for a special case of low-flow (2007) on the Alabama River.

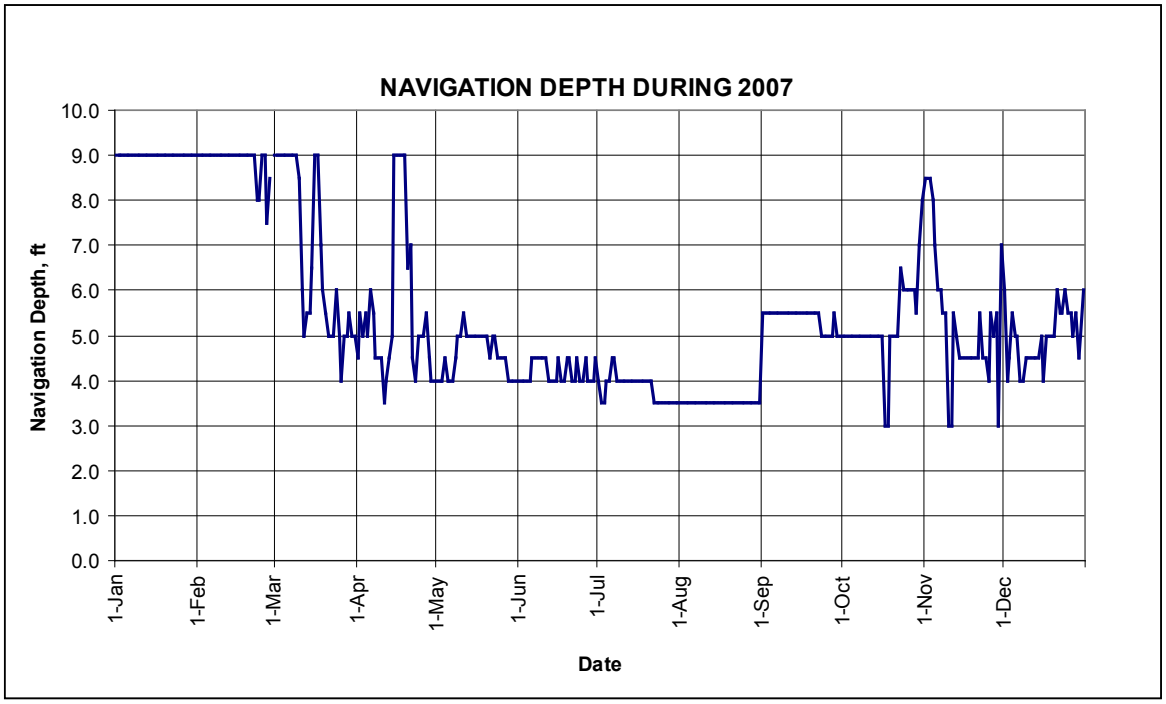


Figure 2.1-11. Navigation depths for low-flow conditions (2007) on the Alabama River.

2.1.1.1.4 Surface Water: Reservoirs

Modern dam construction in the ACT Basin dates from the middle to the latter part of the 1800s. Navigation locks and small dams provided sufficient depths for slack-water river traffic on the Coosa River in the early 1900s. Those dams are no longer in service. By 1930 two dams on the Coosa River and three on the Tallapoosa River were built to take advantage of the natural stream gradients for power production. During the middle 1900s, large, multipurpose reservoirs were built throughout the basin for hydropower, navigation, recreation, and water supply (USACE, Mobile District 1997). The last dam (R.L. Harris Lake on the Tallapoosa River) was completed in 1983.

There are 17 major dams in the ACT Basin (Jordan Dam and Bouldin Dam on the Coosa River share a common reservoir). Six dams are federally owned (USACE) and 11 are privately owned projects (by APC). Of the 17 dams, two are on the Coosawattee River, one on the Etowah River, seven on the Coosa River, four on the Tallapoosa River, and three on the Alabama River. The 17 projects and their key characteristics are listed in Table 2.1-4. One small low head dam on the Etowah River at Cartersville, Georgia, is not included in Table 2.1-4. Known as Thompson-Weinman Dam, it was built in the early 1900s and is about 3.5 miles downstream of Allatoona Dam. It has been abandoned and no longer serves a useful purpose. Other locally constructed small impoundments (principally for water supply and recreation) exist in the basin, but they are not on the mainstem rivers. The other impoundments are discussed in Section 2.1.1.1.4.17. Plans for future reservoirs in the basin are discussed in Section 2.1.1.2.5.1.6.

One of the principal focus areas for the proposed ACT WCM update is management of the conservation storage in the reservoirs to meet authorized project purposes. Conservation storage for the purpose of the ACT WCM update process is defined as the volume of reservoir storage available to meet authorized project purposes other than flood risk management (e.g., hydropower, water supply, recreation, etc.). Conservation storage is equivalent to the storage volume between the top of the inactive pool and the top of the conservation pool in each reservoir. Of the 16 major reservoirs in the ACT Basin (considering Jordan Dam and Lake and Bouldin Dam as one reservoir), Lake Martin on the Tallapoosa River has the greatest amount of storage, containing about 46 percent of the total conservation storage. Allatoona Lake, R.L. Harris Lake, Weiss Lake, and Carters Lake are the next four largest reservoirs in terms of storage (see Table 2.1-5 and Figure 2.1-12). Thurlow Lake is not included in Table 2.1-5 and Figure 2.1-12 because of its negligible storage capacity relative to the other projects. The relationship of conservation storage to inactive storage and flood storage is depicted in Figure 2.1-13. Each reservoir is discussed individually below. APC controls about 80 percent of the available conservation storage in the ACT Basin; federal projects (Robert F. Henry Lock and Dam, Millers Ferry Lock and Dam, Allatoona Lake, and Carters Lake) control about 20 percent. The two most upstream USACE reservoirs, Allatoona Lake and Carters Lake, account for about 17 percent of the total basin conservation storage. An overview will be provided for all the projects, but more emphasis will be placed on those projects owned and operated by USACE, which is the primary focus of the ACT water control manual update.

Most of the dams in the ACT Basin function to generate electricity by hydropower. Hydropower dams convert the force of falling water into electrical power. While it is not the primary source of energy in the United States, hydropower is still a very important source of electricity because it can be started quickly to provide for immediate needs.

Table 2.1-4.
Major projects on the mainstem rivers in the ACT Basin

Basin/river/project name	Owner/year completed	Drainage area (sq mi) [a]	Reservoir size (ac) [b]	Available conservation storage (ac-ft) [b]	Total capacity (MW)	Full (summer) pool elev. (ft) [b]
Coosa River Basin						
Coosawattee River		862				
Carters Dam and Lake	USACE/1974	374	3,275	141,402	600 [c]	1,074
Carters Reregulation Dam and Lake	USACE/1974	520	870	16,000	None	698
Etowah River		1,861				
Allatoona Dam and Lake	USACE/1949	1,122	11,862	284,580	82.2 [c]	840
Coosa River		10,156				
Weiss Dam and Lake	APC/1961	5,270	30,027	263,417	87.75 [d]	564
H. Neely Henry Dam and Lake	APC/1966	6,596	11,235	118,210	72.9 [d]	508
Logan Martin Dam and Lake	APC/1964	7,743	15,269	144,383	128.25 [d]	465
Lay Dam and Lake	APC/1914	9,053	11,795	92,352	177 [d]	396
Mitchell Dam and Lake	APC/1923	9,778	5,855	51,577	170 [d]	312
Jordan Dam and Lake [e]	APC/1929	10,102	5,890	19,057 [e]	100 [d]	252
Bouldin Dam [e]	APC/1967	10,102	734	---- [e]	225 [d]	252
Tallapoosa River Basin						
Tallapoosa River		4,687				
R.L. Harris Dam and Lake	APC/1982	1,454	10,660	207,317	135 [b]	793
Martin Dam and Lake Martin	APC/1927	2,984	39,210	1,202,340	182.5 [b]	491 [f]
Yates Dam and Lake	APC/1928	3,293	2,004	6,928	44.25 [b]	345 [f]
Thurlow Dam and Lake	APC/1930	3,308	570	None	81.35 [b]	289 [f]
Alabama River Basin						
Alabama River		22,739				
Robert F. Henry Lock and Dam and R.E. “Bob” Woodruff Lake	USACE/1972	16,233	13,500	36,450	82 [c]	126 [g]
Millers Ferry Lock and Dam and William “Bill” Dannelly Lake	USACE/1969	20,637	18,528	46,704	90 [c]	80.8 [g]
Claiborne Lock and Dam and Lake	USACE/1969	21,473	6,290	None	None	36 [g]

Notes:

a. Source: USGS HUC Units and stream gage data (Subregion 0315)

b. Source: USACE projects – verified by USACE (June 2014); APC projects – values verified by USACE coordination with APC via email (June 2014)

c. Declared Power Capacity is defined as the plant’s operational capacity declared on a weekly basis to the power marketing agency. The value may vary slightly from week to week depending on factors such as head and cooling capabilities; values shown are the nominal values reported

d. Source: FERC 2009

e. Jordan and Bouldin Dams both impound the same reservoir and share the same reservoir storage.

f. Subtract one (1) ft to convert from ft NGVD29 to Martin datum.

g. Represents the upper limit of normal operating range for these projects.

APC: Alabama Power Company; MW: Megawatts; NA: Not applicable.

Table 2.1-5.
ACT Basin conservation storage by project, expressed in acre-feet (ac-ft) and by percent of total conservation storage

Project	Conservation storage (ac-ft)	Percent of total conservation storage
Allatoona Lake*	284,580	10.8%
Carters Lake*	157,402	6.0%
Weiss Lake	263,417	10.0%
H. Neely Henry Lake	118,210	4.5%
Logan Martin Lake	144,383	5.5%
Lay Lake	92,352	3.5%
Mitchell Lake	51,577	1.9%
Jordan Dam and Lake (including Bouldin Dam)	19,057	0.7%
R.L. Harris Lake	207,317	7.9%
Lake Martin	1,202,340	45.7%
Yates Lake	6,928	0.3%
Robert F. Henry Lock and Dam and R.E. “Bob” Woodruff Lake*	36,450	1.4%
Millers Ferry Lock and Dam and William “Bill” Dannelly Lake*	46,704	1.8%
Total	2,630,717	100.0%

Note: * = federal (USACE) project. Carters Lake value combines conservation storage in Carter Lake and Carters Reregulation pool

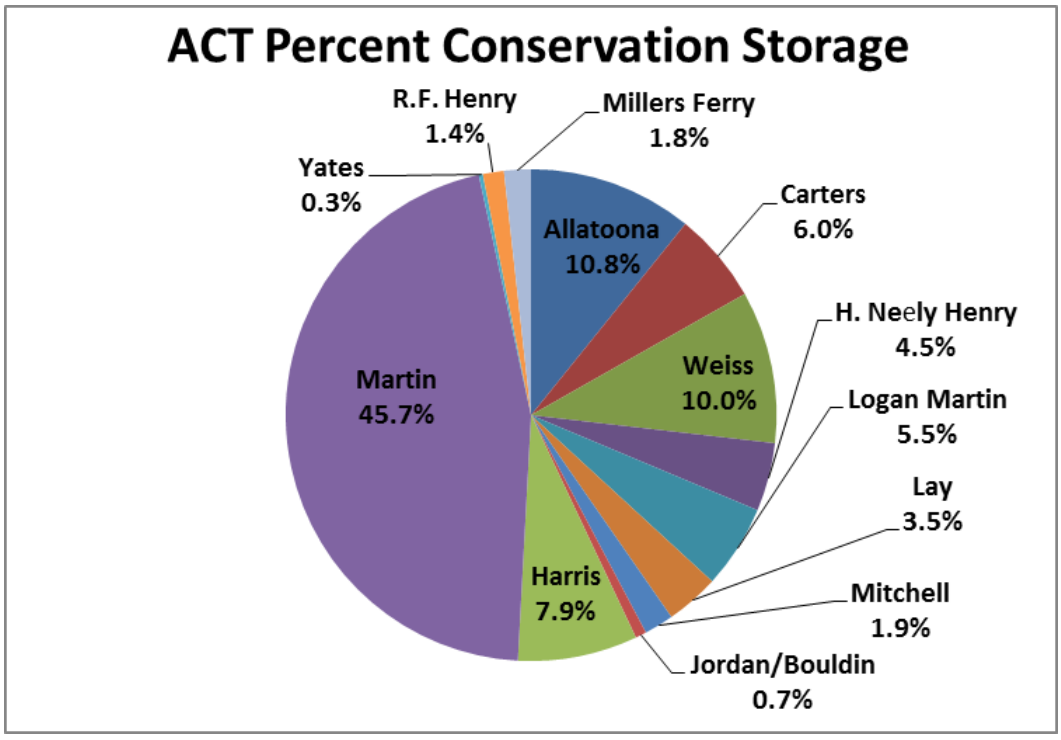


Figure 2.1-12. ACT Basin reservoir conservation storage (percent of total conservation storage by project).

Much of the hydropower generation is *peaking* power. The generators are turned on when there is the most, or *peak,* demand for power. Air conditioning and heating are the power uses that often cause the peak demand for power so the hydropower releases are usually made when temperatures are extreme. Peaking hydropower projects typically generate power during the peak electrical demand hours (generally from 2 to 8 hours per day) on the weekdays and then generally do not generate on the weekends. In contrast, the run-of-river hydropower projects in the ACT Basin typically generate power by passing the available inflows from upstream peaking projects. However, run-of-river projects do normally operate for a portion of the day, thus significantly influencing daily flows in the tailrace and downstream water courses. Unlike storage projects, run-of-river hydropower facilities do not follow a guide curve, nor do they fluctuate appreciably or redistribute flows seasonally.

This paragraph describes in simplified terms the general process by which reservoir release decisions are made. Storage reservoirs (not run-of-river reservoirs) are typically subdivided into separate storage levels, as shown in Figure 2.1-13. The lowest level is the top of the inactive pool. No reservoir releases are made when the pool level is below this level. Level 2 is usually associated with the top of the conservation pool.

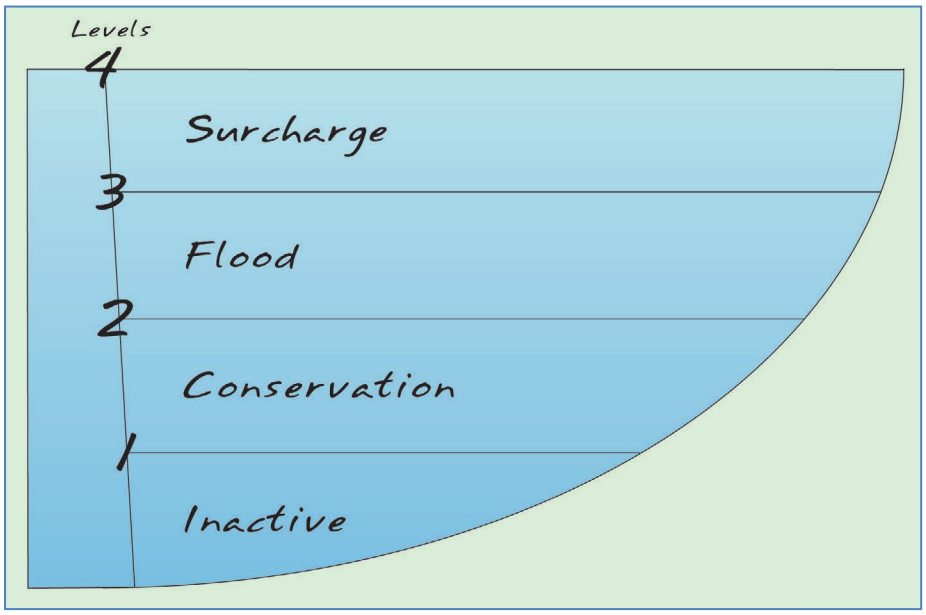


Figure 2.1-13. Schematic of reservoir storage (ACT Basin).

The conservation pool can be subdivided into multiple action zones, as illustrated for Allatoona Lake in Figure 2.1-21. Each action zone triggers a different operating schedule. Level 3 is the top of the flood risk management pool. Typically, the area between the top of conservation pool and top of the flood risk management pool is active flood storage. Water is stored in that area when it cannot be safely passed through the downstream channel system. Usually, the top of the flood risk management level is not the maximum level (USACE, Mobile District 1998b).

Typically, a reservoir has surcharge storage to accommodate water above the emergency spillway. In surcharge storage, the outflow is determined by the spillway capacity and cannot be controlled by the operators.

2.1.1.1.4.1 Carters Lake

The USACE Carters Lake and Carters Reregulation Dam on the Coosawattee River is a multipurpose project, completed in 1974. Authorized project purposes include flood risk management, hydropower,

navigation, water quality, water supply, fish and wildlife conservation, and recreation. Authorized project purposes, including both specific and general authorizations, are discussed in detail in Section 3.1.8. A general map depicting Carters Lake is provided in Figure 2.1-14. The Carters Lake project is a pumped-storage peaking facility. Water is released from Carters Lake, flows through the penstock, and generates power as it is discharged to the reregulation dam pool. USACE generates power at Carters Lake only a few hours each weekday, when demand for electricity is greatest. When demand for electricity is low, usually during the night or on weekends, two of the four generating units can be reversed to pump water back up from the reregulation pool to Carters Lake. Water is available again for hydropower generation in the next peak use period, and Carters Lake is maintained at its optimal power generation level. In addition to providing a lower pool to support pumped storage operations, the reregulation dam reregulates peaking flows from Carters Lake to provide more stable downstream flow conditions.

The Carters Lake project has a hydropower generating capacity of 600 MW, the largest capacity of any project in the ACT Basin (refer to Table 2.1-4) and one of the largest plants in SEPA's Georgia-Alabama-South Carolina system for marketing of hydropower generated by USACE projects. SEPA's mission and the marketing of hydropower from Corps projects in the region are discussed in more detail in Section 2.1.1.2.1.2.

Carters Lake has a total storage capacity of 472,756 ac-ft at elevation 1,099 ft. Of that, available conservation storage is 141,402 ac-ft, 89,191 ac-ft are reserved for flood risk management, and 242,163 ac-ft are inactive storage. The top of the conservation pool is at elevation 1,074 ft in the summer and 1,072 ft in the winter. The bottom of the conservation pool is elevation 1,022 ft. Carters Lake has a surface area of 3,275 acres (ac) at elevation 1,074 ft. The normal year-round operating range for the pool above the reregulation dam is elevation 674 to 698 ft. The Carters Reregulation Dam, which has 16,000 ac-ft of available conservation storage, provides a minimum continuous flow of 240 cfs to the Coosawattee River.

As expected with a peaking/pumped storage operation, both Carters Lake and the reregulation pool experience frequent elevation changes. Typically, water levels in Carters Lake vary no more than 1 to 2 ft per day. However, levels can rise more than that during flooding events as the lake captures and temporarily retains flood flows. The reregulation pool will routinely fluctuate by several feet (variable) daily as the pool receives peak hydropower discharges from Carters Lake and serves as the source for pumpback operations into Carters Lake during non-peak hours. The reregulation pool will likely reach both its normal maximum elevation of 698 ft and minimum elevation of 674 ft at least once each week because of the effects of hydropower generation and pumpback operations.

The Carters Lake guide curve is shown in Figure 2.1-15. Typical release patterns that can occur at Carters Lake over a one-week period under normal, wet, and dry conditions, respectively, are depicted in Figure 2.1-16, Figure 2.1-17, and Figure 2.1-18. Each figure presents data for Carters Lake inflows, pool elevation, and discharges to and from the downstream reregulation pool. The *normal conditions* hydrograph for Carters Lake shows weekday peaks in discharge for power generation, and recirculation flows from the reregulation lake back into the main reservoir. Those recirculation flows are indicated by negative flow values on the hydrograph. The peaks are for daily power generation when power demand is highest and power generation is most cost effective. Discharges cease on the weekends to allow the reservoir to recharge to ensure water is available for the following week's power generation. Recirculation from the reregulation lake continues on the weekends. Figure 2.1-17 below shows the *wet condition* for Carters Lake, which illustrates a higher discharge volume and recirculation volume from the normal condition. The higher discharge volumes are associated with having a higher pool elevation during this wet period as more is needed to be released. The *dry condition* for Carters Lake shows inflow near zero. Discharges are kept to a minimum only to meet power supply demands. The pool elevation fluctuates as discharge continues on weekdays, but ceases on the weekend.

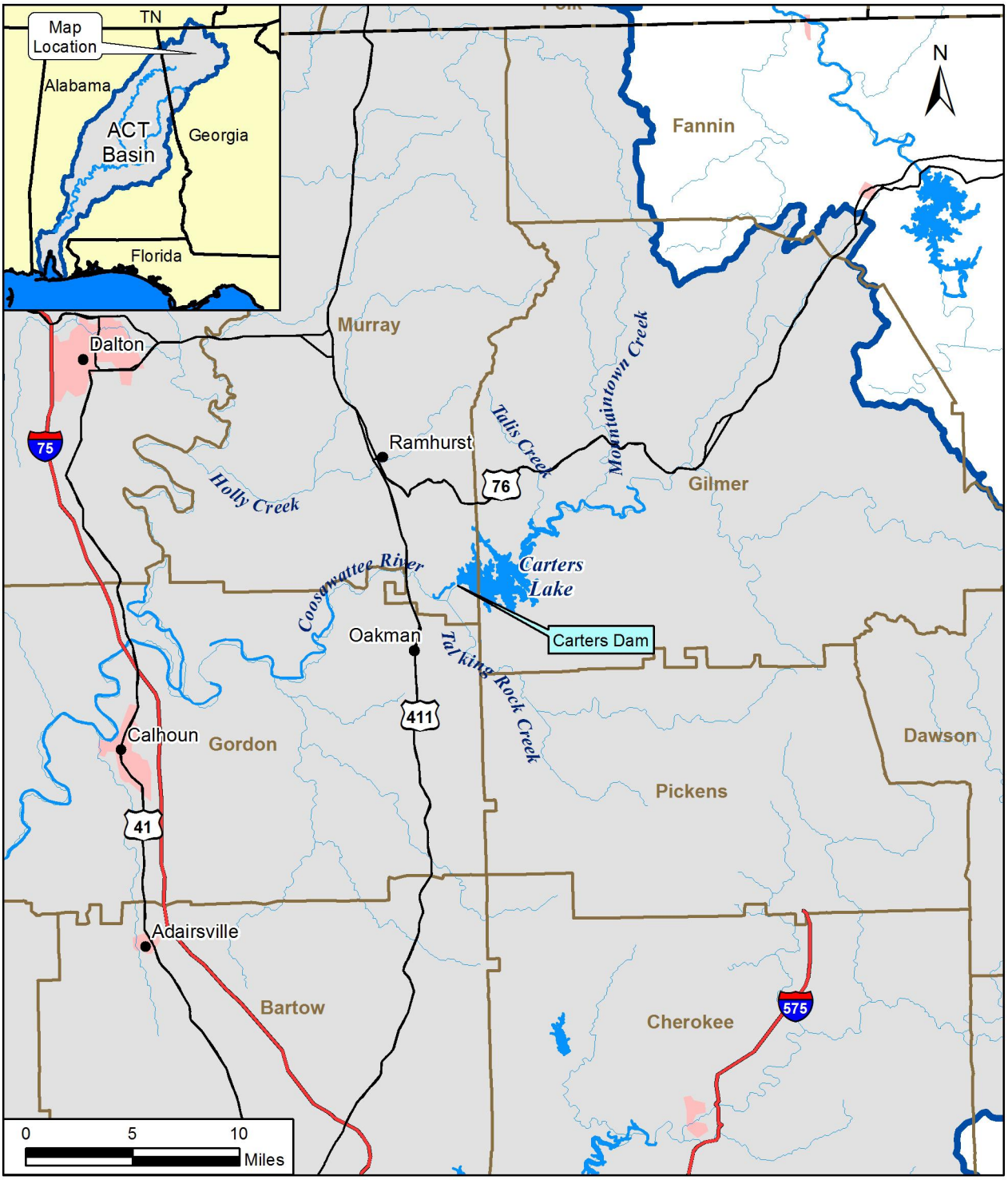

Map Location
TN
Alabama
ACT Basin
Georgia
Florida
N
Fannin
Murray
Dalton
Ramhurst
Talis Creek
Mountaintown Creek
Gilmer
Holly Creek
75
76
Coosawattee River
Carters Lake
Carters Dam
Oakman
Talking Rock Creek
411
Calhoun
Gordon
Dawson
Pickens
41
Adairsville
Bartow
Cherokee
575
0
5
10
Miles
LEGEND
ACT Basin Boundary
County Boundary
City
Urban Area
Interstate
U.S. Route
Surface Water
USACE Dam
Carters Lake

Figure 2.1-14

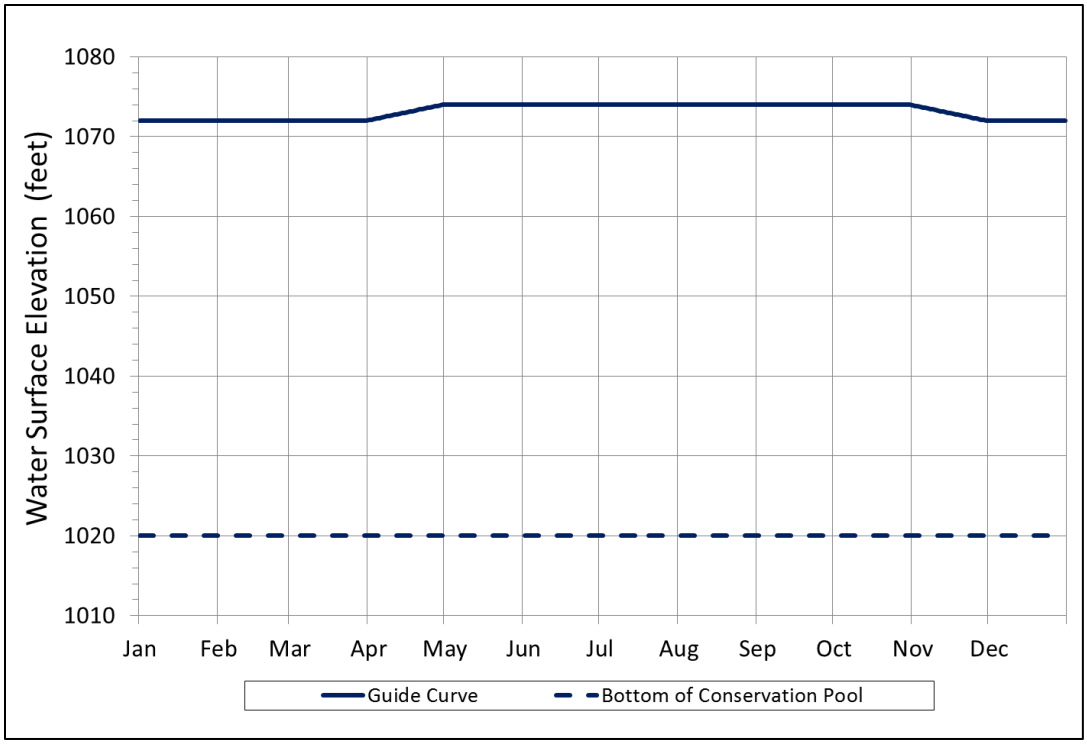


Figure 2.1-15. Carters Lake guide curve.

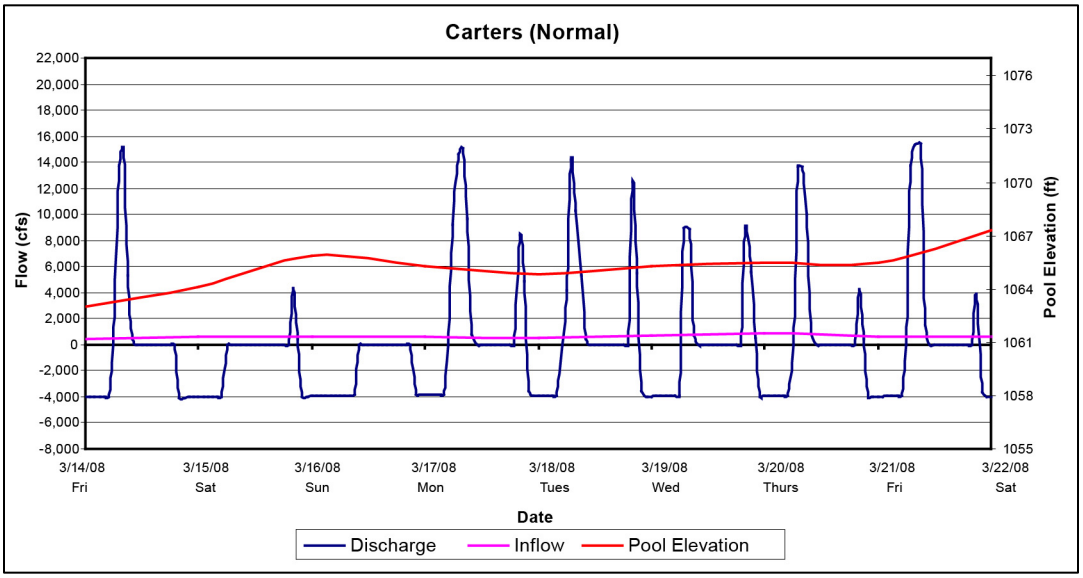


Figure 2.1-16. Carters Lake, typical release pattern, normal conditions.

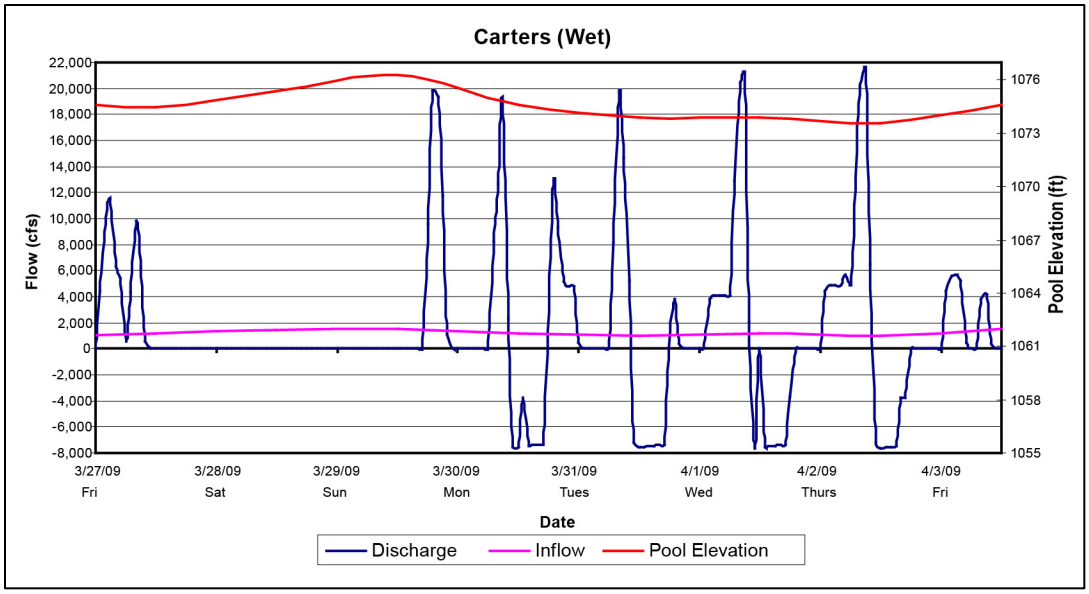


Figure 2.1-17. Carters Lake, typical release pattern, wet conditions.

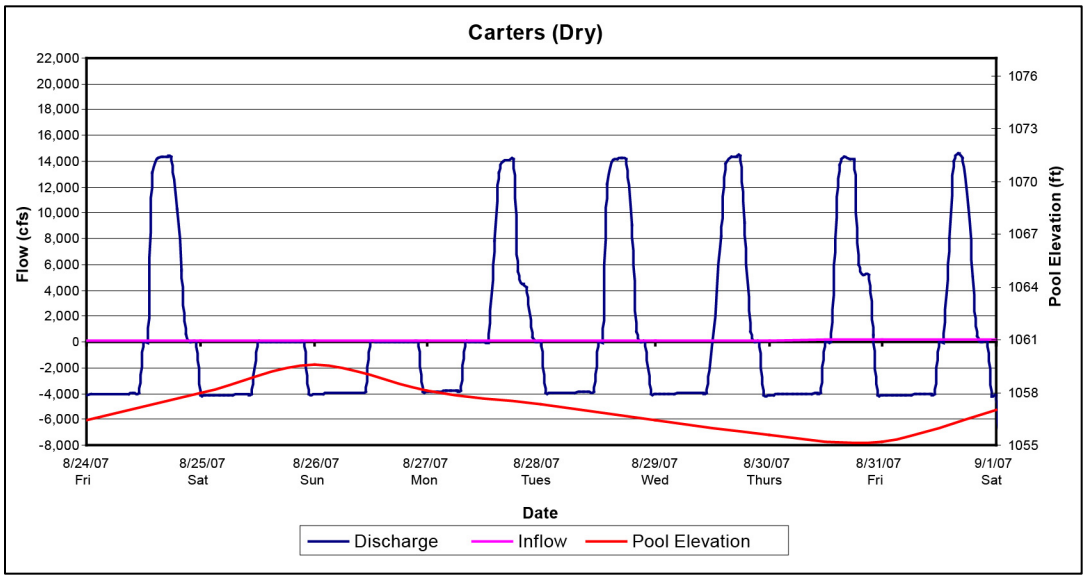


Figure 2.1-18. Carters Lake, typical release pattern, dry conditions.

As indicated earlier, a continuous minimum flow release of 240 cfs is required from the reregulation dam to the Coosawattee River. Mean monthly flows at the USGS gage 02382500 (Coosawattee River at Carters, Georgia) since completion of the Carters Lake project range from a low of 560 cfs in September to a high of 1,600 in March. Peak discharges in the Coosawattee River downstream of the Carters Lake project have been substantially reduced compared to pre-project conditions. Figure 2.1-19 depicts annual peak discharges for most years between 1897 and 2009. Since 1974 (completion of Carters Lake project), annual peak discharges have not exceeded 9,000 cfs, whereas numerous peak discharges occurred before the project that were between 10,000 and 30,000 cfs and as high as 46,000 cfs (1938) and 57,000 cfs (1951).

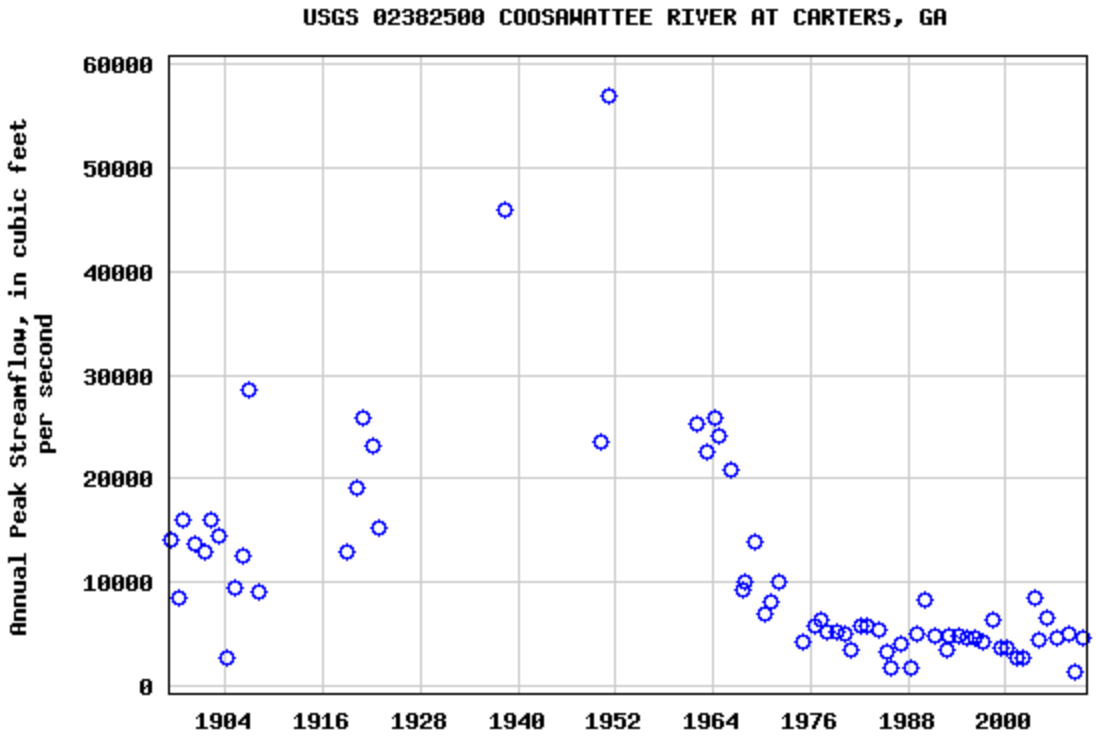


Figure 2.1-19. Coosawattee River, at Carters, Georgia (USGS 02382500), annual peak streamflow (1897–2009).

The presence of the reregulation pool and the nature of the pumpback operation at the Carters Lake project preclude the daily rapid rise and fall in stages downstream of the reregulation dam in the Coosawattee River that would normally be associated with peaking hydropower operations. Consequently, river stages downstream of the reregulation dam tend to be stable and prone to minimal deviation over a 24-hour period during normal operations, typically ranging up to 0.2 ft. As releases from the dam can be incrementally increased or decreased, particularly during high rainfall periods, stages in the Coosawattee River downstream of the reregulation dam can temporarily vary by several feet over a period of a few days.

Beginning shortly after the construction of the Carters Lake project, hydropower interests in the private sector began to pursue efforts to acquire a license from FERC to add non-USACE hydropower generation at the Carters Reregulation Dam. Energos Management, Inc., applied to FERC for a preliminary permit to pursue a non-USACE hydropower license at the Carters Reregulation Dam in November 1982 (FERC Project No. 6897) (FERC 2010a). After several years of effort to develop the proposed project, FERC accepted Energos Management's request to surrender its license for the project in April 1991. The licensee indicated that the project was not economically feasible at that time because of the low price it would receive for the power and the high interest rates for financing (FERC 2010b).

In June 1992, Fall Line Hydro Company, Inc., applied to FERC for a preliminary permit to pursue a hydropower license at the Carters Lake project. FERC granted the preliminary permit to Fall Line Hydro in November 1992 to evaluate the feasibility of a hydropower facility at the site (FERC Project No. 11301). In November 1995, Fall Line Hydro submitted an application for a FERC license for the project, and FERC subsequently granted a license (July 2001) to construct, operate and maintain a non-USACE hydropower facility at the Carters Lake project. Fall Line Hydro failed to construct the facility, and FERC terminated the license in January 2006. Shortly thereafter, Fall Line Hydro filed a new preliminary permit

application, reflecting essentially the same project plan as was proposed for its previously terminated project. In October 2006, Fall Line Hydro was granted a preliminary permit (FERC Project No. 12655). After only limited action by the applicant, Fall Line Hydro's preliminary permit expired on October 1, 2009 (FERC 2010c).

On October 1, 2009, Northbrook Carters Lake, LLC, applied to FERC for a preliminary permit to pursue a hydropower license at the Carters Lake project. FERC granted the preliminary permit on April 2, 2010 (FERC Project No. 13598) (FERC 2010c). On February 28, 2011 Northbrook Carters Lake submitted a petition to surrender the preliminary permit to FERC after preliminary analysis of the potential project. On March 2, 2011, FERC issued a notice of surrender of the preliminary permit (FERC 2013a). There are no known ongoing studies or related activities to pursue non-federal hydropower development at the Carters reregulation dam at this time.

2.1.1.1.4.2 Allatoona Lake

The USACE Allatoona Dam on the Etowah River creates the 11,862-ac Allatoona Lake. The project, completed in 1949, was built for flood risk management, regulation of stream flow for navigation, hydropower, and recreation. Other purposes of the project are water supply, water quality, and fish and wildlife conservation. Authorized project purposes, including both specific and general authorizations, are discussed in detail in Section 3.1.8. The City of Cartersville and CCMWA withdraw water from Allatoona Lake for water supply. Cobb County's Northwest Water Reclamation Facility also discharges into this lake. Withdrawals and return flows in the ACT system are discussed in more detail in Section 2.1.1.2.3. Allatoona Lake has a flood storage capacity of 302,576 ac-ft and a conservation storage capacity of 284,580 ac-ft. A general map of Allatoona Lake is provided as Figure 2.1-20.

A notable feature of the Allatoona Dam and Lake project is the Acworth sub-impoundment. The sub-impoundment, known as Lake Acworth, is located on the Proctor Creek arm of Allatoona Lake in the extreme northwest corner of Cobb County. Acworth was a small rural community prior to the construction of the Allatoona project. The economy of the area was based on agriculture and limited industrial development. As detailed planning and design for the Allatoona project was underway in the 1940's, local elected officials and business leaders recognized the potential economic and social benefits of Acworth's location on the shores of the lake. They also recognized that extreme seasonal fluctuations in Allatoona Lake levels due to planned project operations would cause the upper Proctor Creek arm of the reservoir to be a large mud flat during significant portions of the year and, thus, not suitable for recreational activities. These local leaders engaged USACE and congressional interests to address this concern, and their efforts resulted in the inclusion of the Lake Acworth sub-impoundment in the Allatoona project plan. The sub-impoundment dam was completed in July 1950, about one year after Allatoona Dam was completed and filling of the lake was initiated (GADNR-HPD 2005).

The 325-acre sub-impoundment directly supports the project purposes of recreation and conservation of fish and wildlife. Lake Acworth is shown on Plate 2-6 of the Allatoona Dam and Lake WCM in Appendix A of the EIS. The Acworth Dam facilities are owned and maintained by USACE. The sub-impoundment dam provides a non-fluctuating pool level generally at about elevation 848 feet NGVD29. The earth filled dam is 1,500 feet long with a 60-foot concrete spillway flanked on each side by concrete non-overflow sections 61 feet long. The ungated spillway has a crest elevation of 848 feet and is bridged in a single span by a road (GA Highway 92), which connects the city of Acworth with U.S. Highway 41. The dam has two 24-inch sluices, one at each end of the spillway, to allow for fluctuation of the upper pool during low flow for mosquito control and to drain the reservoir if needed. The Acworth sub-impoundment supports a variety of recreational activities. Lands around the sub-impoundment are leased to the Acworth Lake Authority and Cobb County Parks Department for public park purposes. The Acworth sub-impoundment is also discussed in the Allatoona Dam and Lake WCM in Appendix A of the EIS.

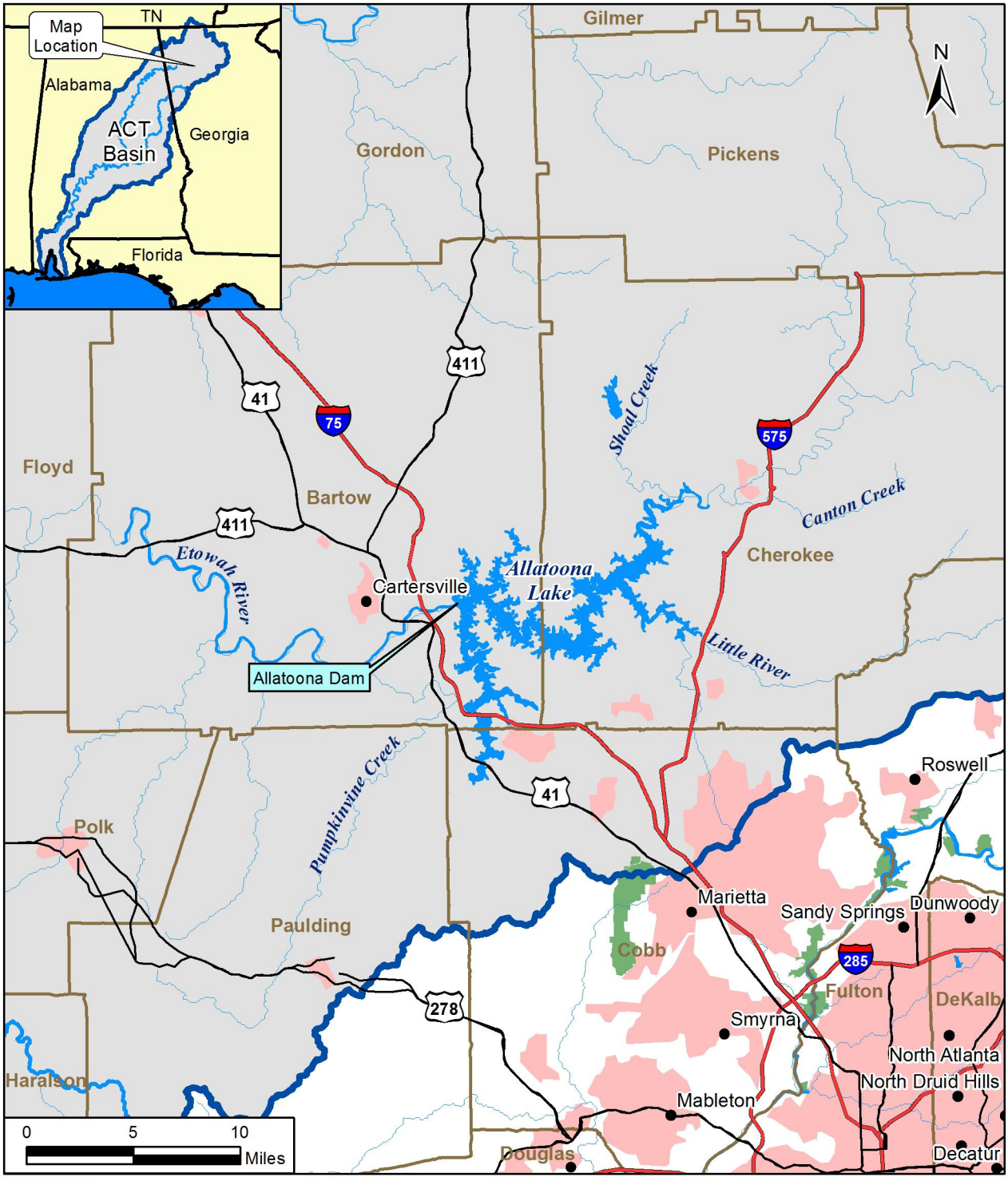

Map Location
TN
Alabama
ACT Basin
Georgia
Florida
N
Gilmer
Gordon
Pickens
Floyd
Bartow
Cherokee
Shoal Creek
Canton Creek
Etowah River
Allatoona Lake
Cartersville
Allatoona Dam
Little River
Pumpkinvine Creek
Polk
Paulding
Haralson
Douglas
Roswell
Marietta
Sandy Springs
Dunwoody
Cobb
Fulton
DeKalb
Smyrna
North Atlanta
North Druid Hills
Mableton
Decatur
41
75
575
411
278
285
0 5 10 Miles
LEGEND
ACT Basin Boundary
County Boundary
City
Urban Area
Interstate
U.S. Route
Surface Water
National Park Service Land
USACE Dam
Allatoona Lake

Figure 2.1-20

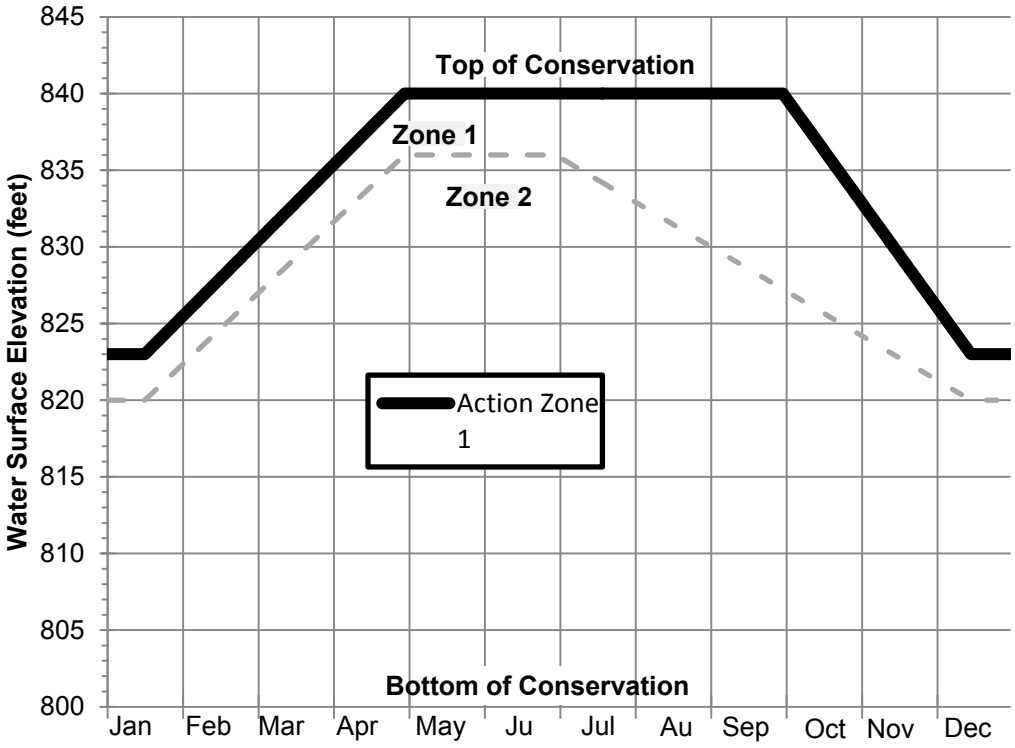
A minimum flow of about 240 cfs is continuously released through a service unit in Allatoona Dam, which generates power while providing a constant flow to the Etowah River downstream. Allatoona Dam operates in a peaking mode, generating power between 2 and 6 hours during normal operations each weekday. Weekend generation may occur if required to meet customer needs. The period of power generation is related to the stage of conservation pool drawdown. Generally, only the 240 cfs minimum flow is released on the weekends. The total generating capacity of the project is 82.2 MW.

Water levels in Allatoona Lake remain fairly stable during normal operating conditions. Lake levels vary only several inches except during high inflows to the basin and during flood storage drawdown in the winter, which reduces the pool from 840 ft to 823 ft. Flood flows that are captured in the reservoir are generally released slowly over the subsequent weeks, unless additional flood flows are anticipated. Power releases during the low-flow season augment flows at the APC's projects along the Coosa River. The hydropower releases also provide water for M&I needs in the Rome, Georgia, area and for navigation on the Alabama River downstream of Montgomery during the dry season.

Current project operations are governed by *action zones* that define general operating principles and parameters when lake level conditions are below the top of the conservation pool at any point during the year. The action zones for Allatoona Lake are shown in Figure 2.1-21. The line between zones is a guideline that does not dictate any mandatory, absolute change in outflow policy. Operating conditions for each zone are as follows (USACE, Mobile District 1993b):

- Zone 1—Normal conservation releases are made. Releases from this zone will generally be equivalent to between two and six hours of full powerhouse generation. Full consideration will be given to making hydropower releases to meet system hydropower requirements as well as other basin-wide considerations for storage use.
- Zone 2—More conservative water releases are made whenever the pool is in Zone 2. The objective will be to protect downstream water supply and water quality values and to protect dependable generation capacity of the power plant. Typically, minimum releases consisting of continuous release of about 240 cfs (small hydropower unit) plus from 0-2 hours of peaking power generation, as described in the current manual, will be made each weekday. However, additional short-term releases may be made for unusual or emergency situations.

Typical release patterns that can occur at Allatoona Lake over a one-week period under normal, wet, and dry conditions, respectively, are depicted in Figure 2.1-22, Figure 2.1-23, and Figure 2.1-24. Each figure presents data for inflows to Allatoona Lake, lake elevations, and discharges from the dam to the Etowah River. The *normal conditions* hydrograph for Allatoona Lake shows weekday peaks in discharge. The peaks are for daily power generation when power demand is highest and power generation is most cost effective. Discharges cease on the weekends to allow the reservoir to recharge to ensure water is available for the following week's power generation. In Figure 2.1-23 below for the *wet condition*, a 24-hour discharge is seen during the weekdays. The high volume of discharge is because of high inflows and a high pool elevation. A drop in pool elevation can be seen as discharge continues through the week. Low inflows and a low pool elevation can be seen in Figure 2.1-24 below for the *dry condition* at Allatoona Lake. Discharges are kept to a minimum and in short duration on weekdays only just to meet power demands.



Source: USACE, Mobile District 2010b

Figure 2.1-21. Allatoona Lake, action zones for project operation.

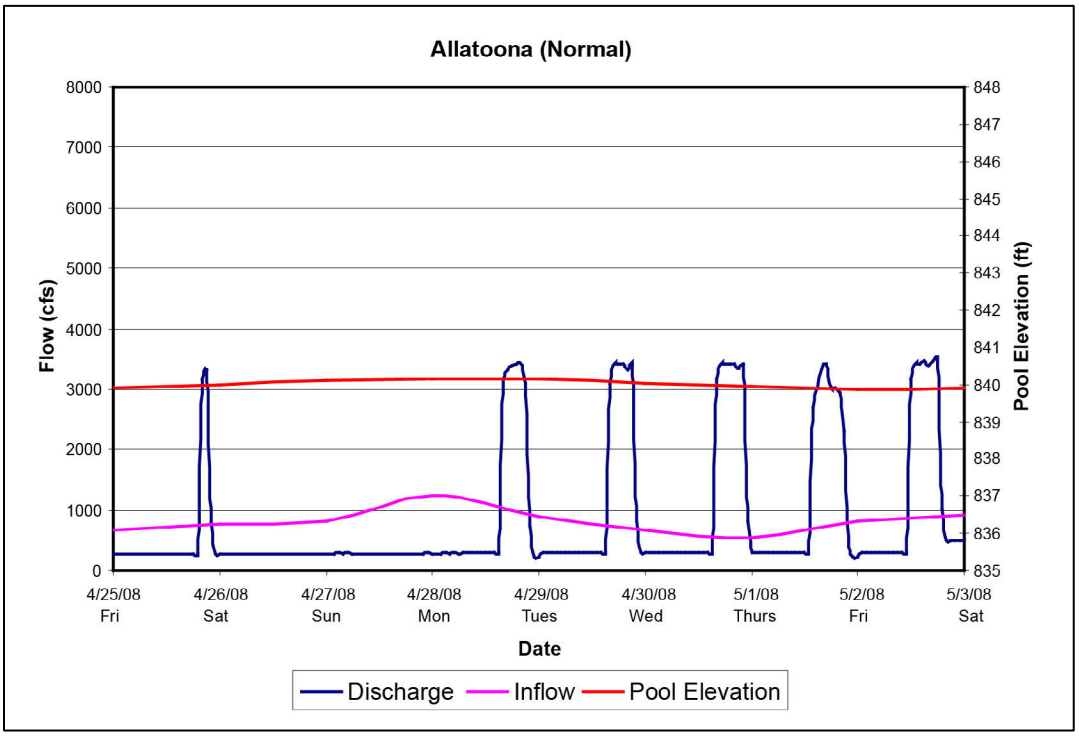


Figure 2.1-22. Allatoona Lake, typical release pattern, normal conditions.

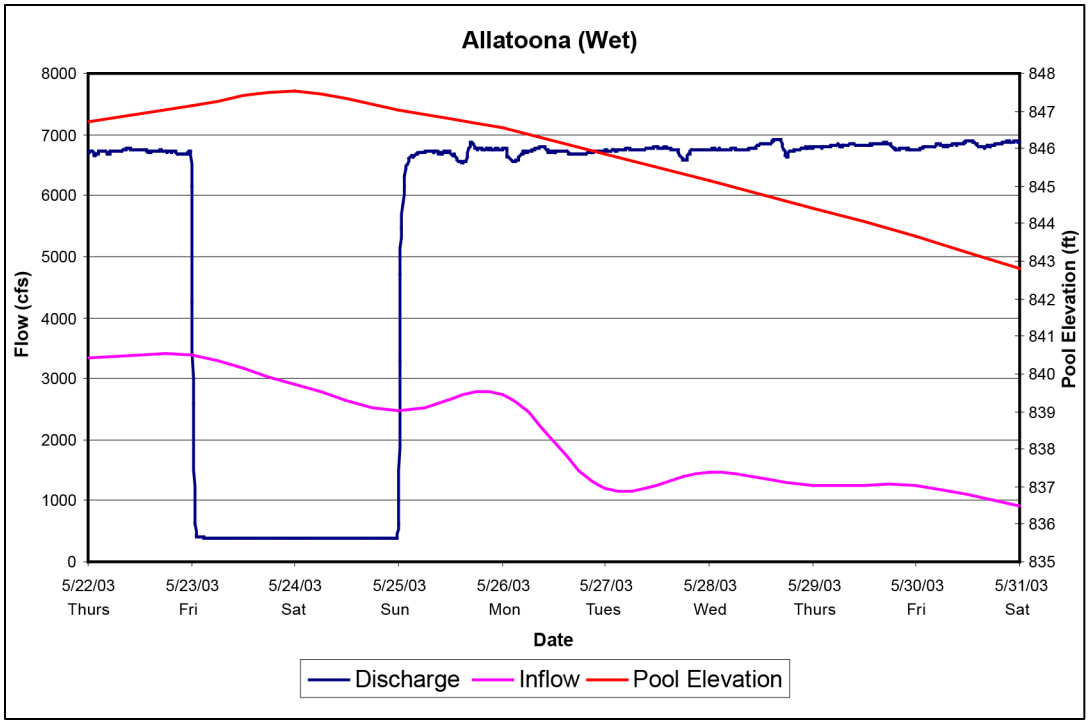


Figure 2.1-23. Allatoona Lake, typical release pattern, wet conditions.

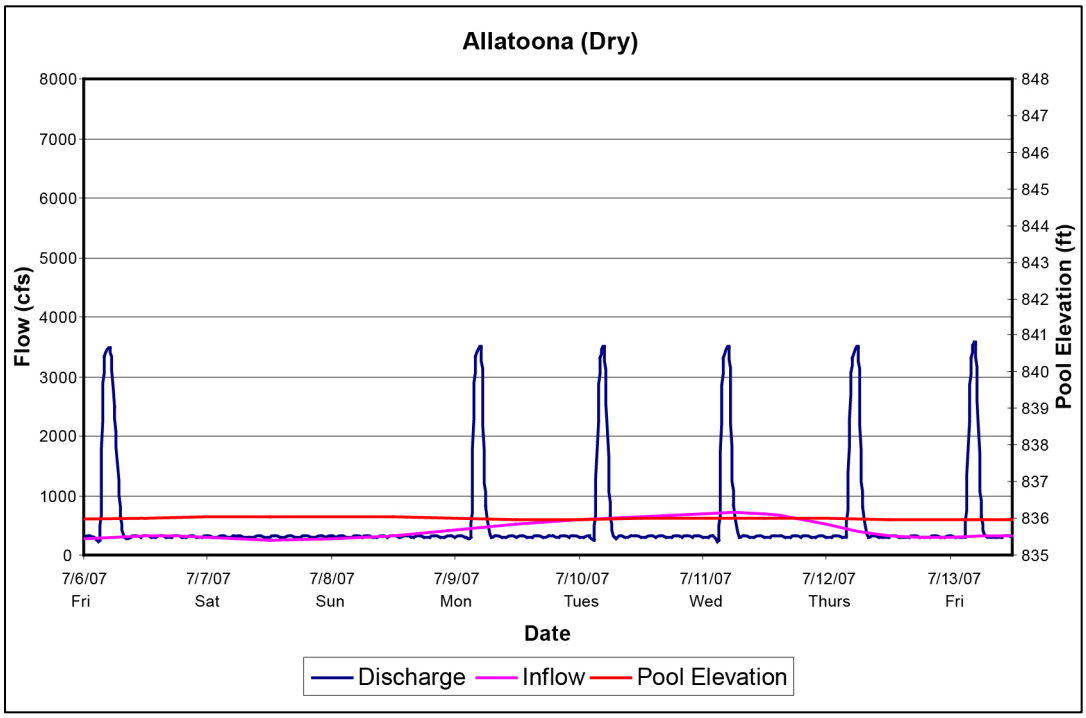


Figure 2.1-24. Allatoona Lake, typical release pattern, dry conditions.

Tailwater stages may vary significantly daily because of peaking hydropower operations at Allatoona Lake, characterized by a rapid rise in river stage immediately after generation is initiated and a rapid fall in stage as generation is ceased, generally from 2 to several hours later, depending on available basin inflows. Figure 2.1-25 depicts river stages immediately downstream of Allatoona Lake over a typical one-week period in late summer under normal conditions. River stages rise and fall by 2.5 to 3.0 ft before, during, and following peak hydropower generation. Except during high flow conditions when hydropower may be generated for more extended periods of time, this peaking power generation scenario with daily fluctuating stages downstream is repeated nearly every week day (not generally on weekends).

Peak discharges in the Etowah River downstream of Allatoona Lake have been substantially reduced compared to pre-project conditions. Figure 2.1-26 depicts peak discharges between 1920 and 2009. Since 1949 (completion of Allatoona Lake), annual peak discharges have not exceeded 10,500 cfs, except in 1964 when the peak discharge reached 22,600 cfs. Before Allatoona Lake, peak discharges were as high as 40,000 cfs in 1920 and 1946 and typically fell within the range of 11,000 to 28,000 cfs.

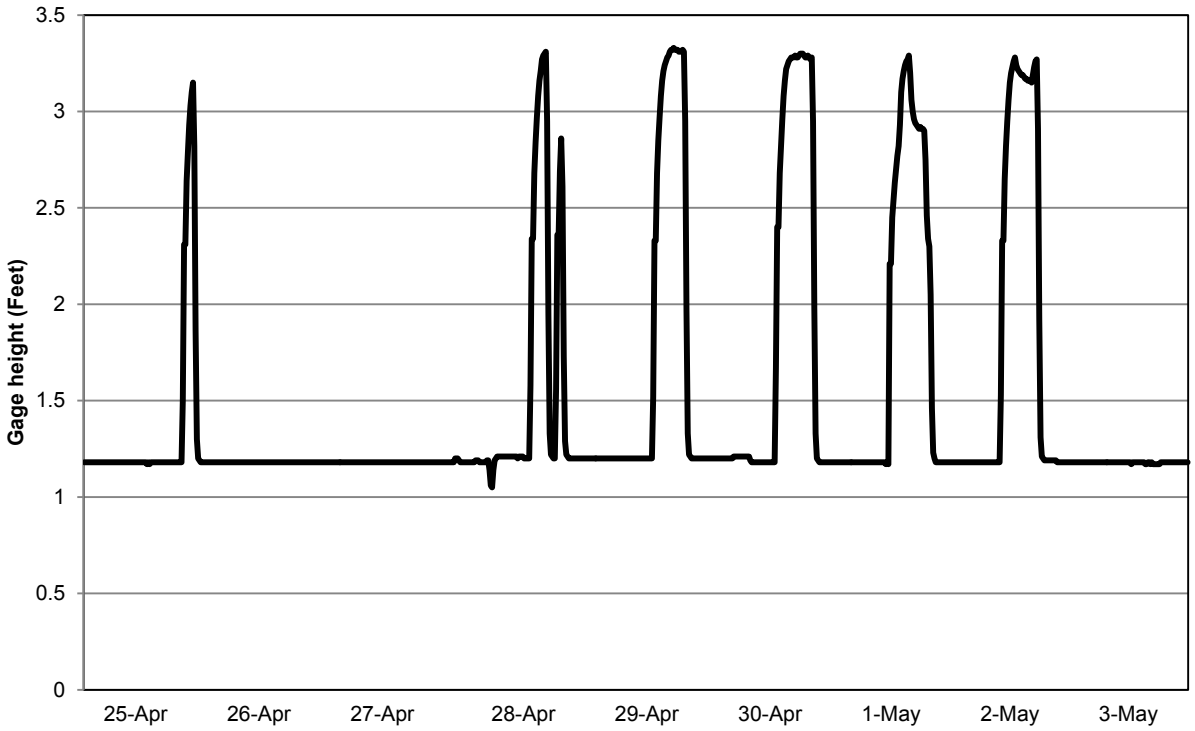


Figure 2.1-25. Etowah River at Allatoona Lake, above Cartersville, Georgia (USGS 02394000), tailrace gage height (2011).

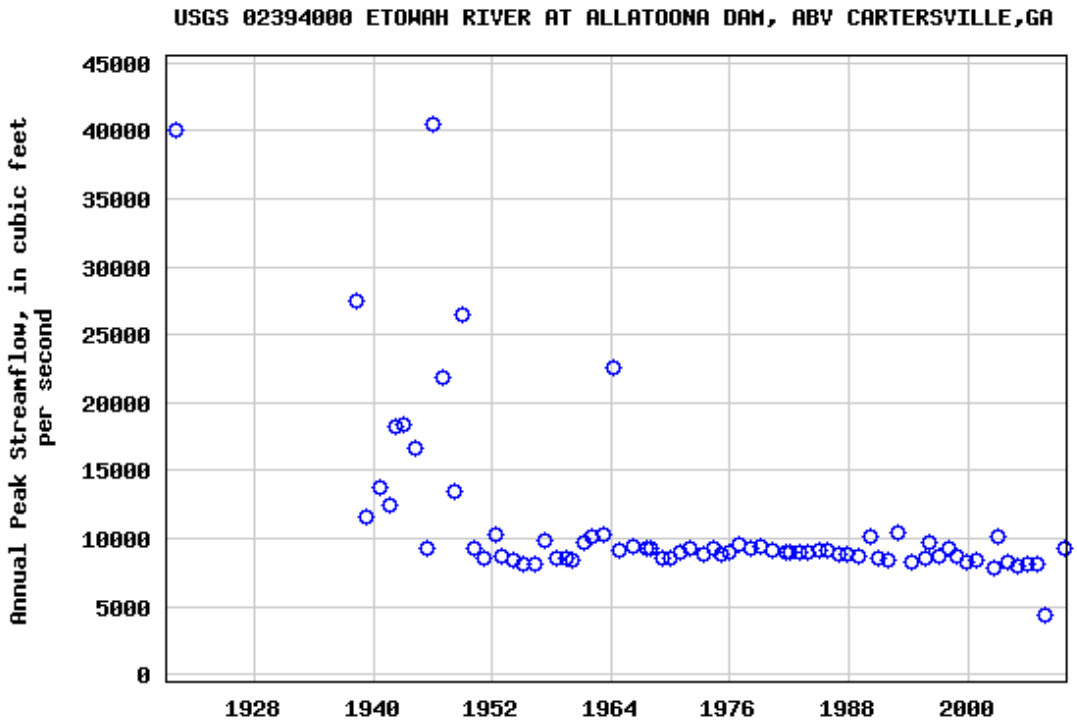


Figure 2.1-26. Etowah River, at Allatoona Lake, above Cartersville, Georgia (USGS 02394000), annual peak streamflow (1920–2009).

2.1.1.1.4.3 Weiss Lake

Weiss Lake is the most upstream of seven APC reservoirs on the Coosa River, in northeastern Alabama and northwestern Georgia. Weiss Lake has a surface area of 30,027 ac. The reservoir extends about 52 mi upstream from Weiss Dam, and about 11 mi of the reservoir are in Georgia. The reservoir has 447 mi of shoreline and a maximum depth of 62 ft and is relatively shallow with a depth of around 10 ft at normal pool elevation. A map of Weiss Lake is provided in Figure 2.1-27.

Weiss Lake is used for hydropower generation, flood risk management, navigation flow augmentation, maintenance of water quality, industrial and municipal water supply, irrigation withdrawals, recreation, and habitat for fish and wildlife conservation (FERC 2009). From May through the end of August, the reservoir is normally operated near full pool elevation of 564 ft during normal inflows and average system generating requirements. A drawdown of the reservoir begins in September and continues to the end of December when the level is lowered to elevation 558 ft. The reservoir begins refilling on January 1 and continues to refill until April 30, when full pool is normally reached. Available conservation storage is 263,417 ac-ft (USACE, Mobile District 2014a). Conservation storage is used for hydropower augmenting low inflow and seasonally for flood risk management capability for small flood events. The dedicated flood risk management pool for Weiss Lake is from 564 to 574 ft and provides 397,000 ac-ft of storage (FERC 2009).

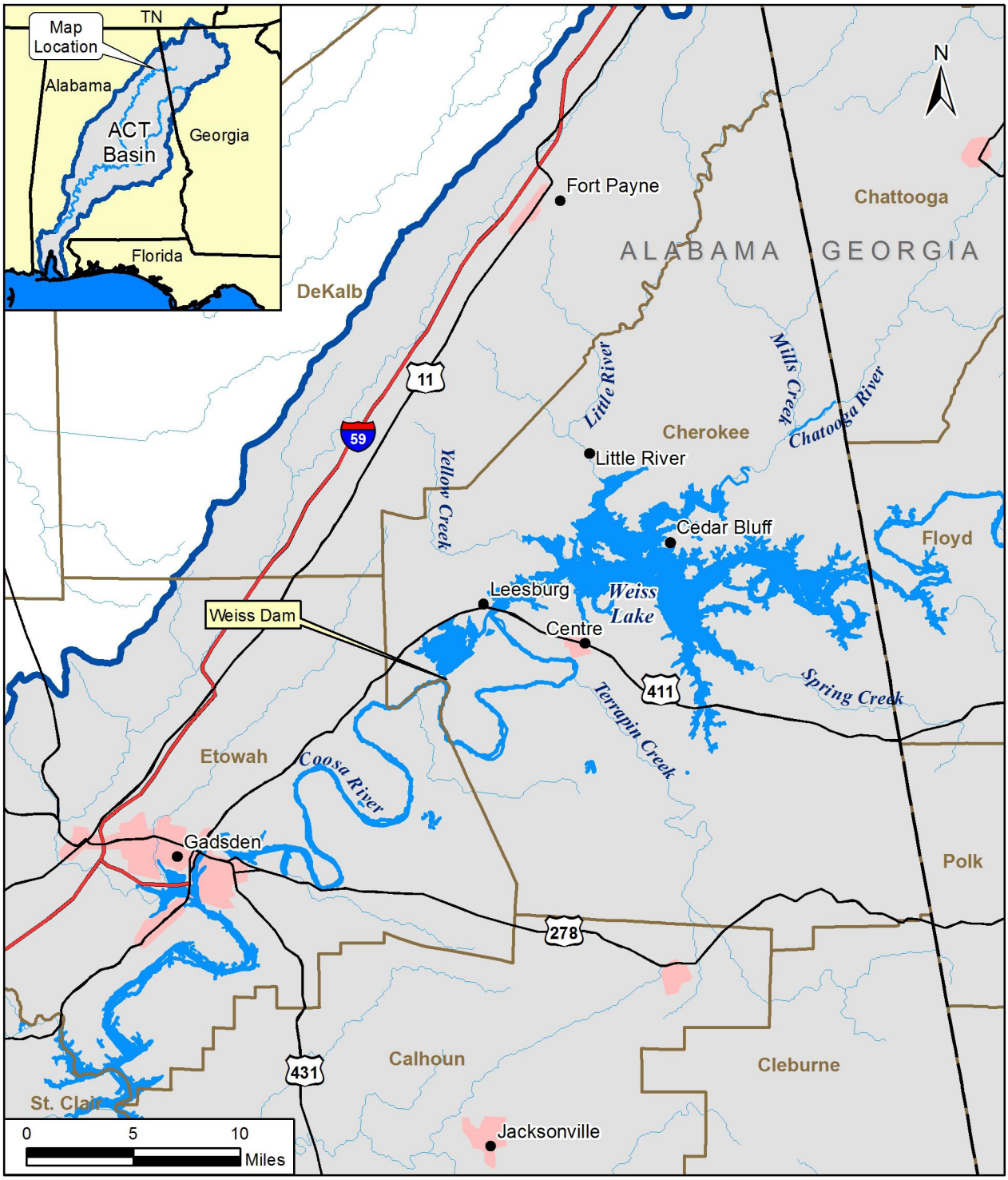

Map Location
TN
Alabama
ACT Basin
Georgia
Florida
N
Fort Payne
Chattooga
ALABAMA
GEORGIA
DeKalb
11
59
Little River
Mills Creek
Chatooga River
Cherokee
Little River
Yellow Creek
Cedar Bluff
Floyd
Leesburg
Weiss Lake
Weiss Dam
Centre
411
Spring Creek
Terrapin Creek
Etowah
Coosa River
Gadsden
Polk
278
Calhoun
Cleburne
431
St. Clair
Jacksonville
0
5
10
Miles
LEGEND
ACT Basin Boundary
County Boundary
City
Urban Area
Interstate
U.S. Route
Surface Water
Non-Federal Dam
Weiss Lake

Figure 2.1-27

APC normally operates the Weiss Lake development in a peaking mode with generation units kept in the spinning mode to allow for quick hydropower production when needed by the electrical grid. Typical operation for power generation ranges from 1 to 6 hours per day during the week with no generation on the weekend. The generating capacity of the project is 87.75 MW. A canal about 7,000 ft long carries water from the main reservoir to the forebay at the powerhouse. Discharges through the Weiss Lake powerhouse flow into a 1,300-ft-long, man-made tailrace canal to re-enter the Coosa River at the downstream end of the bypass reach. Discharges from the powerhouse tailrace enter the upper reaches of APC's downstream H. Neely Henry Lake, which has a normal full pool elevation of 508 ft (FERC 2009). The H. Neely Henry Lake pool inundates the Weiss Lake tailwater at the power plant. The dam's operation is coordinated with releases from H. Neely Henry Lake to keep the pool levels in balance and fairly stable (USACE, Mobile District 1997). A spillway is along the original river alignment and is used to pass flood waters in excess of the discharge capacity of the powerhouse, which is 24,650 cfs with all three units in operation. The Weiss Lake bypass reach, the original meandering river channel of the Coosa River downstream of the spillway, is about 20 mi long. Prior to the issuance of the new FERC license for operation of Weiss Dam and Lake in June 2013 (see discussion below), the project did not have a specific minimum flow requirement.

APC operates Weiss Lake, in coordination with its other hydropower projects on the Coosa River, for flood risk management in accordance with regulations prescribed by the Secretary of the Army which are published in Title 33 of the CFR Chapter II, Part 208, Section 208.65. The APC and USACE adopted a Memorandum of Understanding (MOU) in December 1965 concerning the operation of the Weiss Lake project, which, along with USACE 1965 WCM for the project, is used to implement the prescribed regulations. The purpose of the MOU and the associated WCM is to clarify the responsibilities of the two agencies with regard to operation of the project for flood risk management and other purposes and to provide for the orderly exchange of hydrologic data (USACE, Mobile District 1965). A draft revision to the manual was prepared in June 2004 but was not finalized (USACE, Mobile District 2004a).

Whenever the basin inflow causes the reservoir to rise above the guide curve elevation, the power plant is operated at full gate capacity around the clock until the reservoir recedes to the level of the guide curve. When the reservoir level is at elevation 564 ft, all inflow will be passed through the power plant until its discharge capacity is exceeded. Thereafter, as inflows and pool levels can increase, excess flows would be passed through the spillway in accordance with specific operational procedures until the pool levels recede to the guide curve elevation and within the discharge capacity of the powerhouse, as described in the WCM for the project.

As part of the FERC relicensing process for the Coosa River Project, APC proposed the following modifications to operations at Weiss Lake:

- Raise the winter guide curve by 3 ft from elevation 558 ft to 561 ft from December 1 through March 1. There would then be a constant rise in the Weiss Lake reservoir until the normal summer elevation of 564 ft is reached on May 1. The summer guide curve would be extended from August 31 to September 30 with the same summer elevation as operated. That proposal could have some adverse effects on the flood risk management function of the Weiss Lake project. USACE has not concurred with the APC proposal to FERC, and that proposal is not addressed in the current update to the ACT Basin Master Manual. Before implementing the proposed increases in winter pool elevations, additional analyses (and NEPA documentation) would be required to allow revisions to the ACT manual beyond those considered in this EIS. [NOTE: On June 20, 2013, following public review of the draft EIS for the ACT WCM update, FERC issued a new license for the APC projects on the Coosa River (No. 2146). The new license did not include the proposed modifications to winter pool levels at Weiss and Logan Martin lakes.]

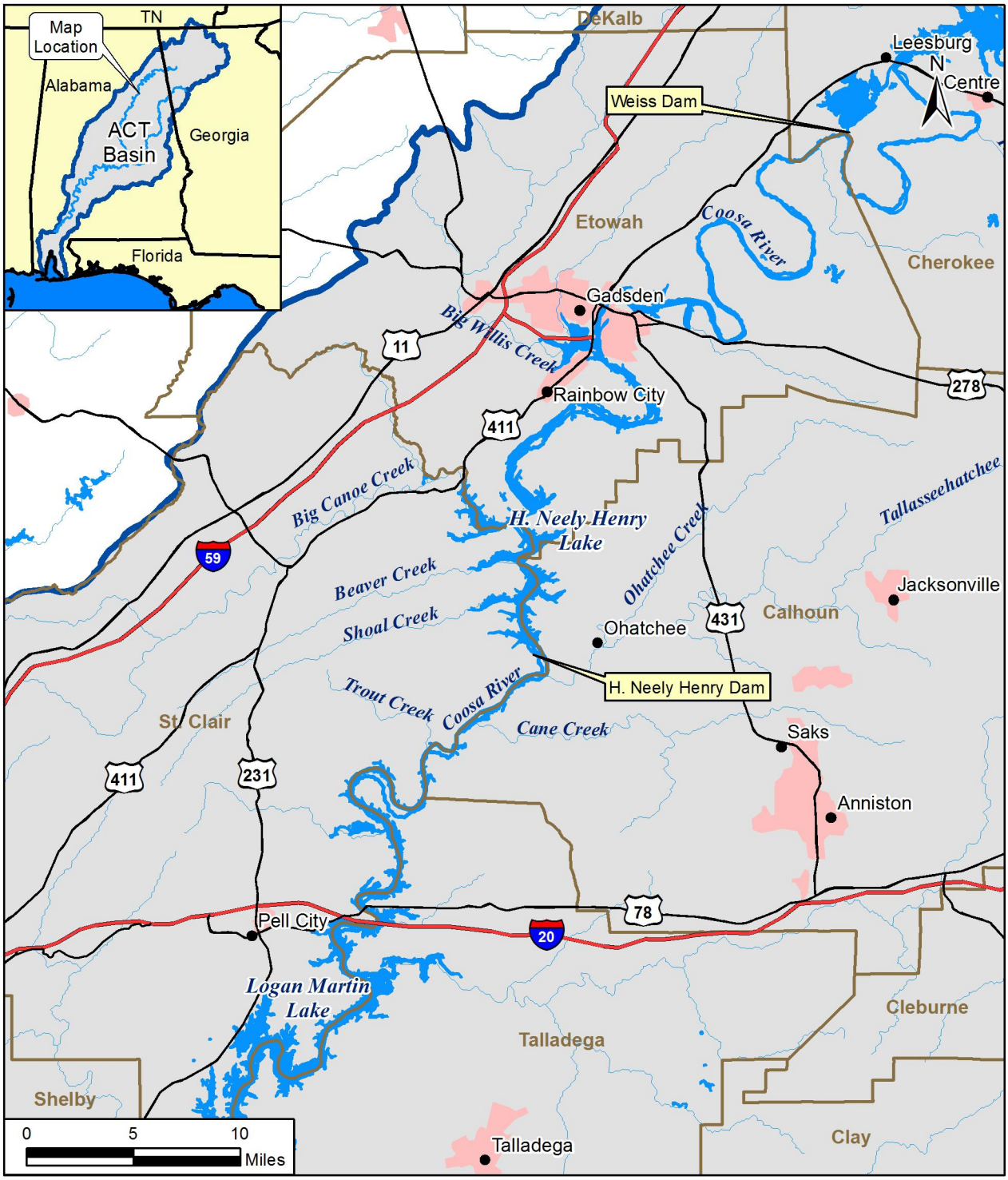
- Release a variable continuous minimum flow into the bypassed river reach downstream of the spillway at the Weiss Lake project to enhance aquatic habitat and water quality for aquatic organisms as part of a comprehensive adaptive management plan. The continuous minimum flow would range from 4 to 9 percent of the flows occurring at the upstream Mayo's Bar gage (USGS gage no. 02397000), depending on the month, with an adjustment of that flow twice per week according to the actual flow occurring at the Mayo's Bar gage. While the details of this proposal could change somewhat in the relicensing process, some plan for a continuous minimum flow below into the Weiss Lake bypassed reach is highly likely. The final plan is not likely to have a material affect the ACT Basin water control plan update. [NOTE: The new FERC license for continued operation of the APC projects on the Coosa River (No. 2146), issued on June 20, 2013, includes the variable continuous minimum flow requirement at the Weiss Lake project as described above.]

2.1.1.1.4.4 H. Neely Henry Lake

Releases from Weiss Lake enter the upper reaches of the H. Neely Henry Lake. H. Neely Henry Lake is a multipurpose project owned and operated by APC. H. Neely Henry Lake extends from the tailwater area of Weiss Lake 78 mi downstream to the H. Neely Henry Dam. The reservoir has 339 mi of shoreline and a maximum depth of 53 ft, but is relatively shallow with an average depth of 10.8 ft. A map of H. Neely Henry Lake is provided as Figure 2.1-28 (FERC 2009). The reservoir has a surface area of 11,235 ac and a total storage capacity of 120,853 ac-ft at the normal lake elevation of 508 ft. Available conservation storage is 118,210 ac-ft (USACE, Mobile District 2014a). Similar to Weiss Lake, H. Neely Henry Lake is used for hydropower generation, flood risk management, navigation flow augmentation, maintenance of water quality, industrial and municipal water supply, irrigation withdrawals, recreation, and habitat for fish and wildlife conservation (FERC 2009).

APC normally operates the H. Neely Henry Lake development in a peaking mode with a typical daily fluctuation of about 1.5 ft. The facility generally provides for several hours of generation each weekday, as power needs require, with no generation on the weekends. The generating capacity of the project is 72.9 MW. Discharges from the powerhouse enter the upper reaches of the Logan Martin Lake immediately downstream. Under existing guide curve conditions from May 1 through the end of September, the water level is kept at or near the normal maximum water level of elevation 508 ft. Beginning in October and continuing to the end of November, the water level is drawn down to APC and USACE interim-approved winter guide curve elevation 507 ft where it is kept until the end of March. The interim approval for the guide curve is discussed in more detail below. During April, the water level is raised to the summer elevation of 508 ft by April 30. Historically under low flow conditions, the reservoir level falls below the reservoir guide curve values. [NOTE: The interim-approved guide curve was incorporated into the new FERC license for continued operation of the APC Coosa River projects, which was issued on June 20, 2013. More information is provided below.]

APC operates the H. Neely Henry Lake, in coordination with its other hydropower projects on the Coosa River, for flood risk management in accordance with regulations prescribed by the Secretary of the Army, which are published in 33 CFR, Chapter II, Part 208, Section 208.65. APC and USACE adopted a MOU in January 1979 concerning the operation of the H. Neely Henry Lake project which, along with USACE 1979 WCM for the project, is used to implement the prescribed regulations. The purpose of the MOU and the associated WCM is to clarify the responsibilities of the two agencies with regard to operation of the project for flood risk management and other purposes and to provide for the orderly exchange of hydrologic data (USACE, Mobile District 1965). A draft revision to the manual was prepared in June 2004 but was not finalized (USACE, Mobile District 2004b).



H. Neely Henry Lake

Figure 2.1-28

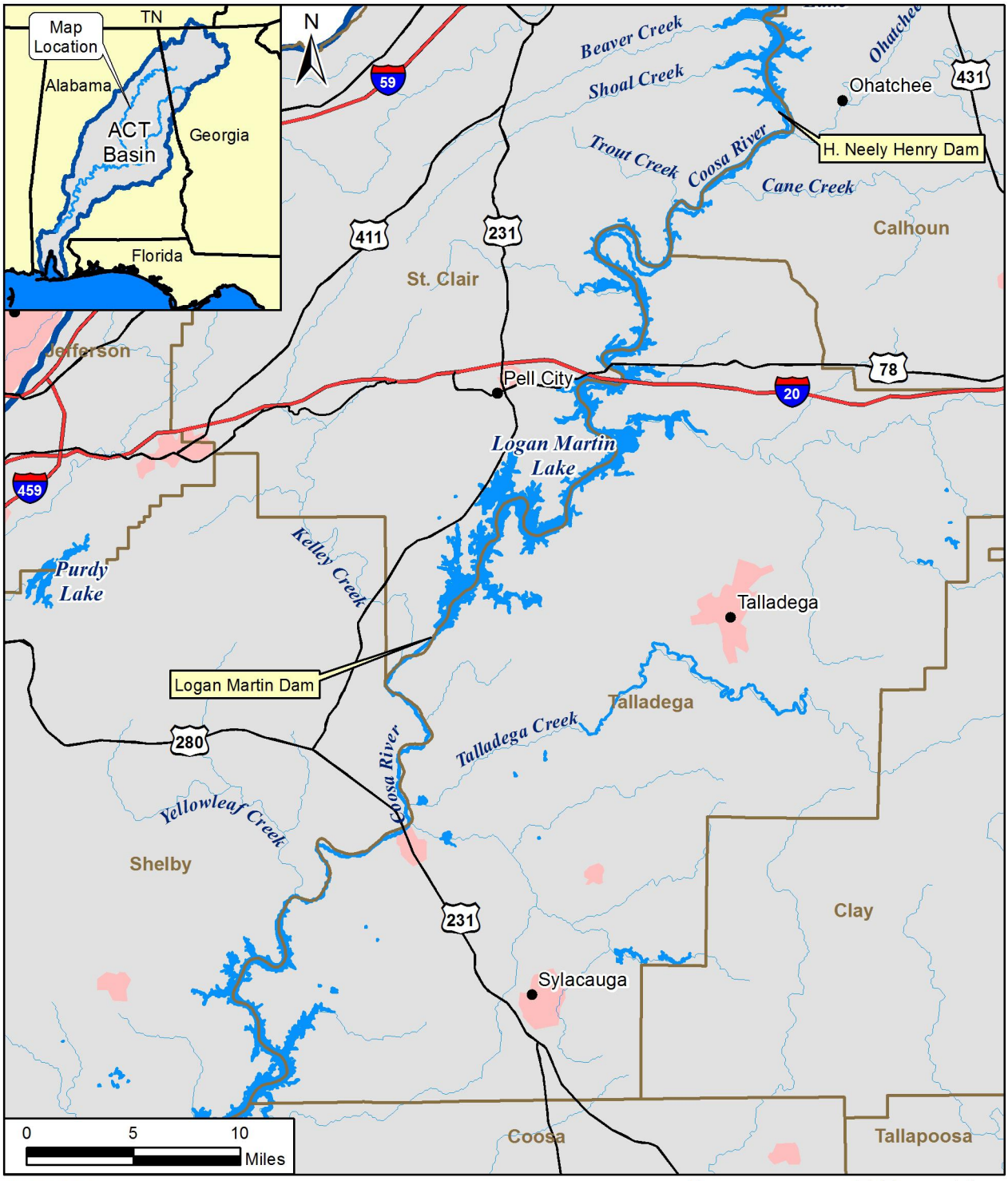
There is no dedicated flood risk management storage for this project. However, to limit flood damage to the City of Gadsden, about midway on the H. Neely Henry Lake, the reservoir is lowered in advance of an impending flood if given enough warning. The time to begin the drawdown, as well as the rate and level of drawdown, is determined by analysis of the USGS gage no. 02400500 Coosa River at Gadsden, Alabama, near the midpoint of the H. Neely Henry Lake. A series of trigger points at 0.5 ft increments between 508.0 and 511.0 ft correspond to the lowering (or raising) of the water at the dam in increments down to 502.5 ft (FERC 2009).

In June 1999, APC requested a temporary 3-year variance to H. Neely Henry Lake's guide curve to maintain higher water levels during the winter (i.e., increase the winter pool level by 2 ft from 505 to 507 ft). FERC issued an approval for the variance on February 26, 2001. On March 18, 2004, FERC issued an extension to operate on an interim basis using the variance pending a final decision on APC's relicensing application for its Coosa River projects. (The relicense application was filed with FERC by APC in July 2005; the licenses expired on July 31, 2007 and have been annually renewed until completion of the relicense process.) FERC and USACE prepared a joint Environmental Assessment addressing the effects of the proposed 2004 extension (FERC 2009). APC has proposed that the interim operating plan be included in the new FERC license, and USACE has concurred with that proposal. [NOTE: On June 20, 2013, following public review of the draft EIS for the ACT WCM update, FERC issued a new license for the APC projects on the Coosa River (No. 2146), which included the revised guide curve for H. Neely Henry Lake.]

APC has voluntarily established a drought curve for the H. Neely Henry Lake at elevation 505 ft from the beginning of December to the end of March, rising to elevation 507 ft at the beginning of June, and then falling back to elevation 505 ft by the beginning of December (FERC 2009). Background information on establishing drought curves (or Drought Contingency Curves) for selected APC projects in the ACT Basin is presented in Section 2.1.1.1.4.10 (Lake Martin). The drought curves are not part of the existing licensed conditions for APC projects; APC uses the drought curves voluntarily. They would be used to initiate basin-wide drought management procedures and as an interim drought management plan before the ACT Master Manual update and the Alabama Drought Management Plan are finalized. The drought curves serve as trigger points for operational measures to manage water resources during extreme droughts (FERC 2009). The drought curves were developed without direct USACE involvement or concurrence. USACE and APC are cooperating regarding the development of a drought plan for the overall ACT Basin as part of the update of the ACT Master WCM. The eventual outcome of that update might or might not affect the APC Drought Contingency Curves for the H. Neely Henry Lake or other APC projects in the basin.

2.1.1.1.4.5 Logan Martin Lake

Releases from H. Neely Henry Lake enter the upper reaches of Logan Martin Lake. Logan Martin Lake extends from the tailwater area of the H. Neely Henry Lake 48.5 mi downstream to the dam at Logan Martin Lake. The lake has 275 mi of shoreline and a maximum depth of 69 ft at the dam (FERC 2009). The lake has a surface area of 15,269 ac and a total storage capacity of 273,467 ac-ft at the top of the conservation pool. Available conservation storage is 144,383 ac-ft (USACE, Mobile District 2014a). Conservation storage is used for hydropower production, augmentation of low inflow, and seasonally for flood risk management capability. A map of Logan Martin Lake is provided as Figure 2.1-29 (FERC 2009). Uses for this reservoir are similar to that of H. Neely Henry Lake. However, Logan Martin Lake has more capacity to support operations, as may be needed. There is no dedicated flood storage in the reservoir. Generally, all inflow is passed through the project when the reservoir reaches the top of the conservation pool. Nonetheless, APC coordinates the operation of Logan Martin Lake with other projects on the Coosa River to minimize flooding. When inflow exceeds the power plant's capacity (32,700 cfs), the excess is released through the spillway.



Logan Martin Lake

Figure 2.1-29

APC normally operates the Logan Martin Lake in a peaking mode for several hours each weekday, depending on electrical power demand. Discharges from the Logan Martin Lake powerhouse enter the upper reaches of the Lay Lake immediately downstream from the Logan Martin Lake. The generating capacity of the project is 128.25 MW. From May 8 through the end of September, Logan Martin Lake is operated from the full pool elevation of 465.0 ft during normal inflows and system generating requirements. Beginning on October 1, the guide curve decreases to elevation 463.0 ft at the end of the month. Between November 1 and December 31, the water level drops to elevation 460 ft where it remains until March 30. On April 1, the water level begins rising toward the normal full pool elevation of 465.0 ft on May 8 (FERC 2009).

APC operates the Logan Martin Lake, in coordination with its other hydropower projects on the Coosa River, for flood risk management in accordance with regulations prescribed by the Secretary of the Army, which are published in 33 CFR, Chapter II, Part 208, Section 208.65. APC and USACE adopted a MOU in November 1967 concerning the operation of the Logan Martin Lake project which, along with USACE 1968 WCM for the project, is used to implement the prescribed regulations. The purpose of the MOU and the associated WCM is to clarify the responsibilities of the two agencies with regard to operation of the project for flood risk management and other purposes and to provide for the orderly exchange of hydrologic data (USACE, Mobile District 1968). A draft revision to the manual was prepared in June 2004 but was not finalized (USACE, Mobile District 2004c).

As part of the FERC relicensing process for the Coosa River Project, APC proposed to raise the winter pool at the Logan Martin Lake by 2 ft, from the existing winter elevation of 460 ft to 462 ft. From January 1 to April 14, the pool would be at 462 ft. Beginning on April 15, lake levels would gradually increase to the normal summer pool elevation of 465 ft on May 1. On October 1, the water elevation would begin to fall to the winter pool elevation (462 ft) by January 1 (FERC 2009). That proposal could have some adverse effects on the flood risk management function of the Logan Martin Lake project. USACE has not concurred with the APC proposal to FERC, and the proposal is not addressed in the current update to the ACT Basin Master Manual. Before implementing the proposed increase in the winter pool elevation, additional analyses (and NEPA documentation) would be required to allow revisions to the ACT manual beyond those considered in this EIS. [NOTE: The newly issued FERC license for continued operation of the APC Coosa River projects, dated June 20, 2013, did not include approval to raise the winter pool level at Logan Martin Lake.]

APC has voluntarily established a drought curve for the Logan Martin Lake project at elevation 458 ft from the beginning of December to the end of March and then rises to elevation 462 ft at the beginning of June and falls back to elevation 458 ft by the beginning of December (FERC 2009). Establishing drought curves (or Drought Contingency Curves) for selected APC projects in the ACT Basin is discussed in more detail in Sections 2.1.1.1.4.4 and 2.1.1.1.4.10. The drought curves were developed without direct USACE involvement or concurrence. USACE and APC cooperated regarding the development of an overall drought plan for the ACT Basin as part of the update of the ACT Master WCM. The outcome of the WCM update might or might not affect the voluntary APC Drought Contingency Curve for the Logan Martin Lake project.

2.1.1.1.4.6 Lay Lake

Discharges from the Logan Martin Lake enter directly into the upper reaches of Lay Lake, owned and operated by APC. Lay Lake extends from the tailwater area of the Logan Martin Lake 48 river mi downstream to the dam at Lay Lake. The 11,795-ac reservoir has about 289 mi of shoreline and a maximum depth of 88 ft (FERC 2009). A map of Lay Lake is provided as Figure 2.1-30. The project's primary purpose is hydropower production, but the reservoir also provides storage for water quality, water supply, and recreation. A major paper products company also releases treated wastewater into Lay Lake. The reservoir is typically maintained near the top of the conservation pool (396 ft), but can be drawn down a foot to meet high power demands. The power plant operates as necessary to keep the lake from

exceeding the top of the conservation pool. Generally, the project is operated in a run-of-river mode, releasing outflows that approximate reservoir inflows on a daily basis. The generating capacity of the Lay Lake project is 177 MW. Discharges from the powerhouse enter the upper reaches of the Mitchell Lake immediately downstream.

Although Lay Lake has no flood risk management storage, APC coordinates the operation with other projects on the Coosa River to minimize flooding. Lay Lake is also operated together with the Mitchell Lake and Jordan Dam and Lake to maintain downstream flow requirements on weekends, since the upper storage projects do not normally operate on weekends. Lay Lake contributes its run-of-river flows in meeting the downstream requirements at Jordan Dam and Lake.

2.1.1.1.4.7 Mitchell Lake

Discharges from the Lay Lake enter directly into the upper reaches of Mitchell Lake, owned and operated by APC. Mitchell Lake extends from the tailwater area of Lay Lake 14 river miles (RMs) downstream to the dam at Mitchell Lake. The 5,855-ac reservoir has 147 mi of shoreline and a maximum depth of 90 ft (FERC 2009). A map of Mitchell Lake is provided as Figure 2.1-30.

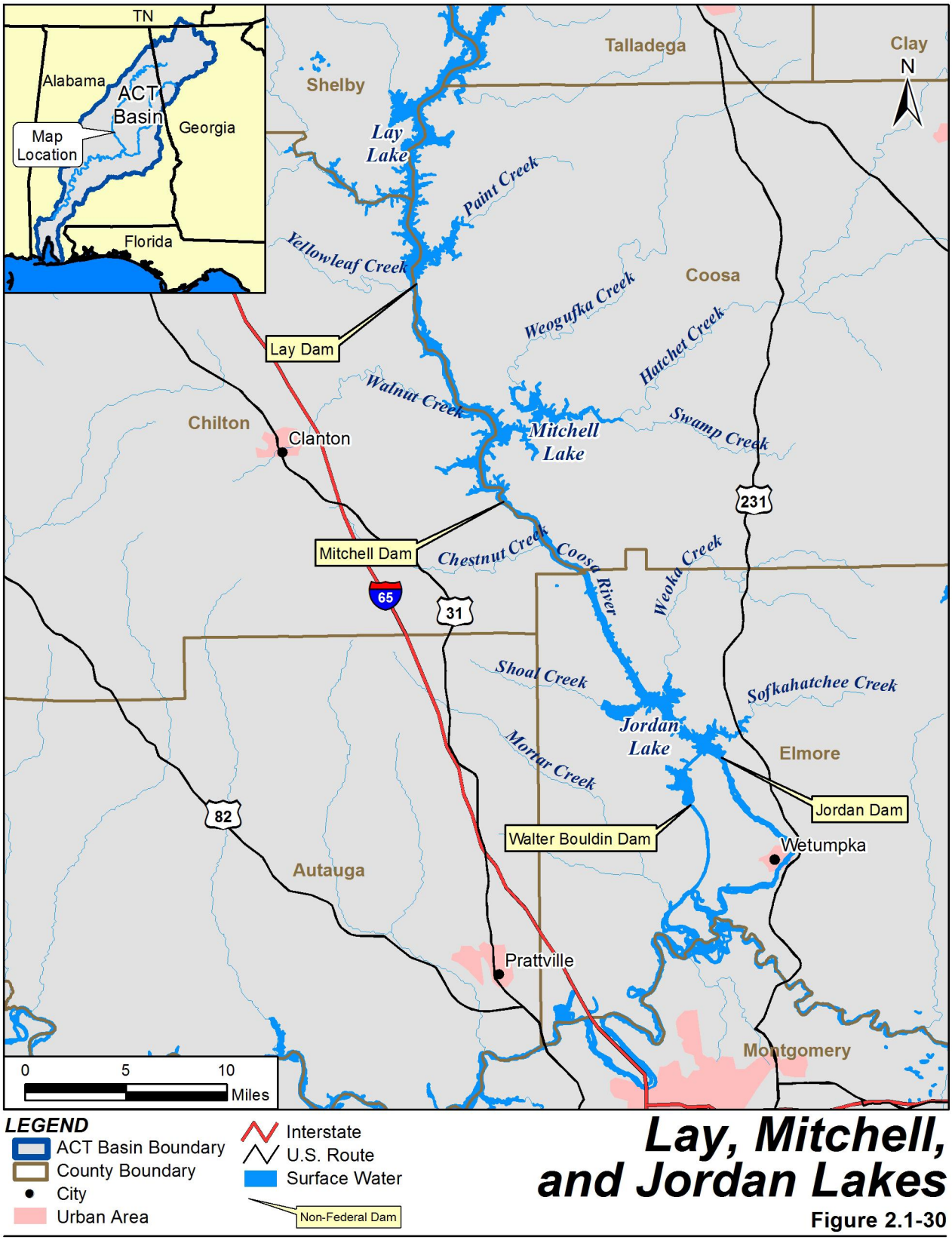
Mitchell Lake is operated by APC primarily for hydropower production. The project is operated in a run-of-river mode with a daily inflow basically equaling outflow. Discharges from the powerhouse enter the upper reaches of the Jordan Dam and Lake reservoir immediately downstream (FERC 2009). The reservoir also provides storage for water quality, water supply, and recreation. APC maintains the reservoir as close to the top of the conservation pool as possible (312 ft). If necessary, the reservoir can be drawn down 1 ft to meet power demands. The project has a generating capacity of 170 MW. There is no flood risk management storage at the Mitchell Lake project.

The Mitchell Lake is also operated together with Lay Lake and Jordan Dam and Lake to maintain downstream flow requirements on weekends, since the upper storage projects do not normally operate on weekends. Mitchell Lake contributes its run-of-river flows in meeting the downstream requirements at Jordan Dam and Lake.

2.1.1.1.4.8 Jordan Dam and Lake and Bouldin Dam

Discharges from Mitchell Lake enter directly into the upper reaches of Jordan Dam and Lake. Jordan Lake extends from the tailwater area of the Mitchell Lake development downstream 18 mi to Jordan Dam. The reservoir has 118 mi of shoreline and a maximum depth of 110 ft. Jordan Dam and Lake and Bouldin Dam are the most downstream APC facilities on the Coosa River. Jordan Lake is a 5,890-ac reservoir at its normal elevation of 252 ft. The Bouldin Dam is on a 3-mi-long forebay canal about one mile upstream from Jordan Dam and Lake. The Bouldin Dam tailrace canal is 5 mi long and discharges into the Coosa River downstream of Jordan Dam and Lake near the confluence of the Tallapoosa and Coosa rivers at Wetumpka. The Bouldin Dam forebay and intake canal have a surface area of 734 ac and a maximum depth of 52 ft. A map depicting the Jordan Dam and Lake and Bouldin Dam is provided as Figure 2.1-30 (FERC 2009).

Jordan Dam and Lake and Bouldin Dam provide for hydropower generation by APC. The Jordan Dam and Lake and Bouldin Dam projects have generating capacities of 100 MW and 225 MW, respectively. The projects are normally operated in a run-of-river mode, with daily inflow basically equaling outflow. Discharges from the projects enter the Coosa River near Montgomery, Alabama. Normal operations maintain a lake level near elevation 252 ft throughout the year, with no storage available for flood risk management. The lake level is frequently lowered by up to 1 ft to meet power or minimum flow demands (FERC 2009).



Lay, Mitchell, and Jordan Lakes

Figure 2.1-30

Lay Lake, Mitchell Lake, and Jordan Dam and Lake operate as necessary to maintain downstream flow requirements on weekends since the upper storage projects normally do not operate on weekends. Jordan Dam and Lake is the only APC project on the Coosa River that has a FERC mandatory minimum flow for ecological and recreational purposes. APC has operated the Jordan Dam and Lake under minimum flow requirements since the late 1960s. These requirements have been modified on several occasions, with the most recent modification implemented in July 2001. The current flow requirements are summarized as follows:

- April 1 through May 31: 4,000 cfs continuous flow from 12 p.m. to 6 a.m., and 8,000 cfs pulse flow from 6 a.m. to 12 p.m.;
- June 1 through June 15: reduce continuous 4,000 cfs flow at a rate of 66.7 cfs per day and reduce 8,000 cfs pulsing flow at a rate of 133.3 cfs per day;
- June 16 through June 30: continue to reduce continuous flow at a rate of 66.7 cfs per day, and eliminate pulse flow;
- July 1 through March 31: 2,000 cfs continuous flow at all times;
- Recreation flows, June 16 through October 31: flows to vary from 4,000 to 10,000 cfs, depending on weekend day, holiday, and time of day, but may be suspended because of insufficient inflow, lower reservoir levels at the upstream Weiss, H. Neely Henry, and Logan Martin lakes, or if releases would cause DO levels to fall below 4 milligrams per liter (mg/L) (FERC 2009).

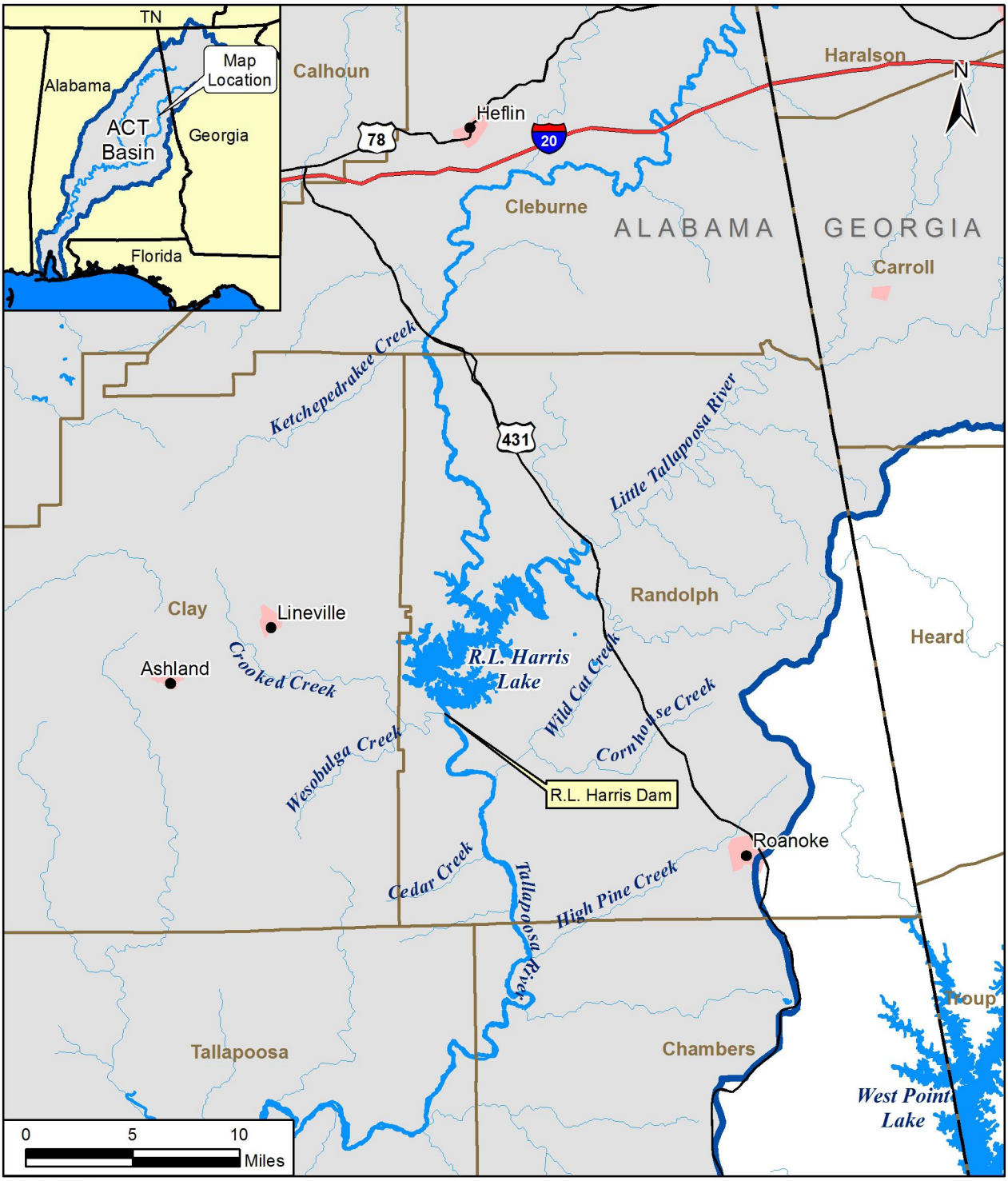
All flows in excess of the minimum flow requirement at Jordan Dam and Lake pass through a canal to Bouldin Dam. Flows greater than the penstock capacity at Bouldin Dam (30,000 cfs) are passed through the Jordan Dam turbines or spillway. Bouldin Dam has no minimum flow requirements and no spillway.

2.1.1.1.4.9 R.L. Harris Lake

The R.L. Harris Lake is an APC facility on the Tallapoosa River (Tallapoosa RM 139.1) in Randolph and Clay counties, Alabama. R.L. Harris Dam, completed in 1983, is the most upstream of a series of four APC dams on the Tallapoosa River. The two most upstream projects (R.L. Harris Lake and Lake Martin) are peaking hydropower facilities, and the two most downstream (Yates and Thurlow lakes) are run-of-river projects, passing inflow as it enters each reservoir. The R.L. Harris Dam and Lake provide for hydropower generation, flood risk management, recreation, and fish and wildlife conservation. The project provides for minimum continuous downstream releases for water quality and fish and wildlife conservation purposes. A map depicting the R.L. Harris Lake is provided as Figure 2.1-31.

The lake created by R.L. Harris Dam (also known as Lake Wedowee) extends for 29 mi up both the Tallapoosa and Little Tallapoosa rivers and is within Randolph and Clay counties. The reservoir summer level is elevation 793, which provides a total storage of 425,721 ac-ft and a surface area of about 10,660 ac. During the flood season the reservoir is normally maintained at elevation 785, which provides 100,108 ac-ft of storage for flood risk management operations (USACE, Mobile District 2003a). Available conservation storage for hydropower generation and other purposes is 207,317 ac-ft (USACE, Mobile District 2014a).

The project has 135 MW total generating capacity. The penstock capacity is 16,000 cfs. APC operates the R.L. Harris Dam in a peaking mode, generating power as demands dictate, typically on a Monday through Friday schedule. The power plant will be operated as needed to keep the lake from exceeding the guide curve (or top of conservation pool—summer elevation 793 ft, winter elevation 785 ft). When the reservoir is above the guide curve, releases are made in accordance with prescribed operating plans for flood risk management. The power plant can be used to meet any required releases or supplement the spillway releases as needed to satisfy the designated outflow requirements. R.L. Harris Dam is operated to maintain a continuous minimum flow of 45 cfs at the Wadley gage, which is about 15 mi downstream of the dam (USACE, Mobile District 2003a).



LEGEND

- ACT Basin Boundary
- County Boundary
- City
- Urban Area
- Interstate
- U.S. Route
- Surface Water
- Non-Federal Dam

R.L. Harris Lake

Figure 2.1-31

Operations for flood risk management are conducted in accordance with regulations prescribed by the Secretary of the Army and published in 33 CFR, Chapter II, Part 208, Section 208.65. Before beginning construction of the R.L. Harris Dam and Lake, APC and USACE adopted an MOU (dated September 27, 1972) concerning the project's operation. The purpose of the MOU was to clarify the responsibilities of the two agencies with regard to the operation of the project for flood risk management and other purposes and to provide direction for the orderly exchange of hydrologic data. Following completion of the R.L. Harris Dam and Lake, the operating instructions for flood risk management were adjusted, as reflected in a revised MOU (1990) and in the USACE WCM for R.L. Harris Lake (USACE, Mobile District 2003a).

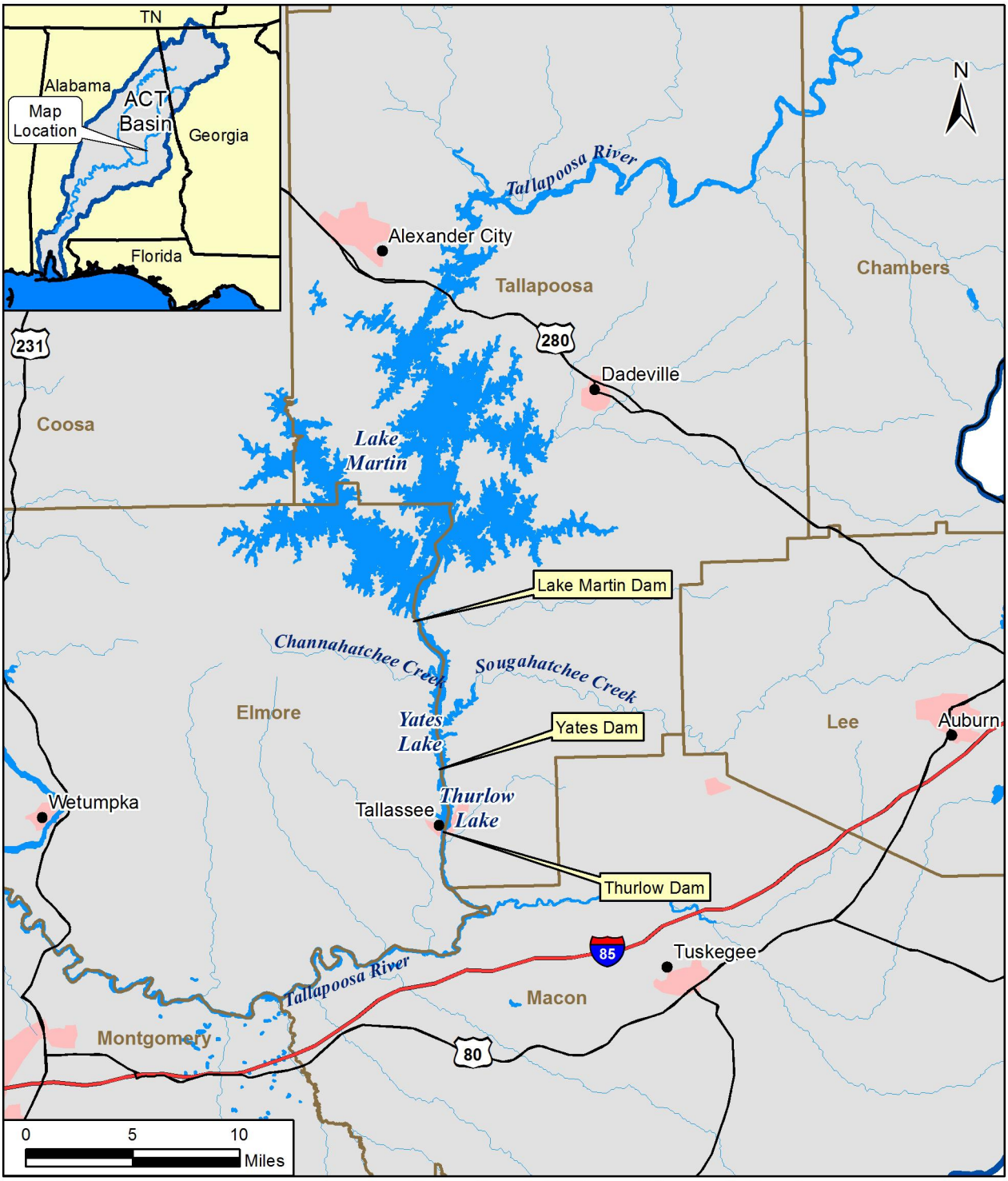
Beginning in 2003, USGS (Alabama Cooperative Fish and Wildlife Research Unit), USFWS, APC, Alabama Department of Conservation and Natural Resources (ADCNR), Alabama Rivers Alliance, and other stakeholder interests (local government, property owners, environmental organizations, and such) initiated efforts to develop a stakeholder-based approach to adaptive management, using a structured decision analysis. The reach downstream of R.L. Harris Dam was selected as the study site, and the management issues have focused on the effects of the hydropower operation on values associated with the Tallapoosa River, including ecosystem health, aquatic species populations, power production, economic development potential, reservoir user satisfaction, river landowner satisfaction, and river boater satisfaction (Irwin and Kennedy 2008). To develop that model, the stakeholder group addressed the following objectives (Kennedy et al. 2006):

1. Determine stakeholder values and objectives;
2. Develop models relating aquatic community (specifically, fish) responses to changes in habitat and flow regime;
3. Develop decision models for evaluating the impacts of current and alternative dam operating procedures on stakeholder valued outcomes; and
4. Develop explicit recommendations for alternative dam operating procedures that will produce the information for resolving key uncertainties about the effects of dam operation on the aquatic community.

Since the process was initiated, the stakeholder group has considered, tested, and monitored various operational adjustments. Monitoring and evaluation remains underway, and the stakeholder group continues to work collaboratively on effective dam operating strategies.

2.1.1.1.4.10 Lake Martin

Lake Martin is a 31-mi-long APC impoundment in Coosa, Elmore, and Tallapoosa counties, on the Tallapoosa River, near Dadeville, in east central Alabama. Lake Martin dam is approximately 60.6 mi upstream of the junction of the Tallapoosa and Coosa rivers, which forms the Alabama River. Lake Martin dam is 79.5 mi downstream of R.L Harris Lake. Lake Martin is depicted in Figure 2.1-32. The following paragraphs describing Lake Martin and its operation are summarized from the 2008 Pre-Application Document for FERC relicensing of the project (APC 2008). Note that the 2008 FERC pre-application document for relicensing refers to elevations at Lake Martin that are one foot higher in all cases than historically and currently published elevations for the project. Currently published elevations for Lake Martin are in Martin Datum, which is equivalent to 1 foot below mean sea level (Hathorn 2013a). The discussions below and in Section 6 of this document refer to Lake Martin elevations in Martin Datum. Elevation data are being updated by APC during the ongoing FERC relicensing process (Stover 2013).



Lake Martin, Yates Lake, and Thurlow Lake

Figure 2.1-32

The lake has 880 mi of shoreline and a surface area of 39,210 ac. Lake Martin is a multipurpose storage project. The lake has a total storage capacity of 1,628,303 ac-ft and available conservation storage of 1,202,340 ac-ft (USACE, Mobile District 2014a). The lake has a normal summer full pool elevation of 490 ft (Martin Datum) and has a mandatory drawdown of 10 ft in the winter months. The lake level fluctuates seasonally to provide the benefits the project was built to support, including hydropower, limited seasonal flood risk management when the reservoir is in drawdown condition, recreation, M&I water supply, water quality enhancement, aquatic flow maintenance, and navigation flow support. The normal tailwater elevation is 343 ft.

APC began construction of the project in 1923, and it was placed in service with three generating units in 1926. APC added a fourth generating unit in 1952. The project features include: a concrete gravity dam with an earth dike section, about 2,000 ft in length and a maximum height of 168 ft; a 720 ft-long, gated spillway section with 20 spillway gates; head works containing 12 intake gates and four steel penstocks; and a powerhouse, containing four vertical Francis turbines that power four generating units for a total installed capacity of 182.5 MW. The project's intake structures' inverts are 68 ft below normal full pool elevation.

Lake Martin is usually operated for peaking hydropower generation on Monday through Friday. During generation, the dam's four turbines release up to 17,900 cfs. There is no specific continuous minimum flow release requirement at Lake Martin. Hours of generation per day depend on reservoir inflow. Normally, the project operates for at least 8 hours daily on weekdays and 5 to 6 hours on Saturday, as needed. The project does not typically generate on Sunday. On average, Lake Martin generates about 40 percent of the electricity of APC's Tallapoosa River fleet of dams. In addition, Lake Martin contributes to the energy that is generated at Yates and Thurlow lakes because of its ability to store and release water that would otherwise be spilled. Because of Lake Martin's operational flexibility, it is able to store water during low electrical usage periods and then generate with the same water during periods of high electrical usage when production costs would normally be higher.

APC uses three different guide curves in its operations of Lake Martin—the *Flood Control Guide*, the *Operating Guide*, and the *Drought Contingency Curves.* Those curves are illustrated on Figure 2.1-33. Note that the terms are those defined and used by APC to describe the operation of its projects, and they can differ somewhat from the terminology associated with guidelines for operation of USACE reservoirs. APC's *Flood Control Guide* reflects the maximum elevation at which the lake is normally maintained in the interest of flood risk management. Beginning in January, the curve is at elevation 480 ft and remains constant until February 17th. On that date, the curve begins rising until it reaches 490 ft on April 28th. The curve remains at that elevation until August 30th when it begins to lower. The curve lowers 10 ft to elevation 480 ft by December 31st and remains constant until filling begins the next February. When the lake is below elevation 490 ft, APC has the ability to store floodwater to help manage high river flow events. After the peak flood flows have receded, APC lowers the elevation of Lake Martin to or below the *Flood Control Guide* elevation. When the inflow to and outflow from the lake cause the elevation to exceed the guide, the project is operated as follows:

1. When the lake is above the *Flood Control Guide* and between elevations 480 and 485, the turbines at Lake Martin dam will be operated to provide for a continuous outflow from Thurlow Lake of at least the equivalent of the hydraulic capacity of the turbines at Yates Lake, approximately 12,400 cfs.
2. When the lake is above the *Flood Control Guide* and between elevations 485 and 488, turbines at Lake Martin dam will be operated to provide for a continuous outflow from Thurlow Lake of at least the plant capacity at that dam of approximately 13,200 cfs.

3. When the lake is above the *Flood Control Guide* and above elevation 488, turbines at Lake Martin dam will be operated as in number 2 above. In addition, as required to avoid rising above elevation 490, the project will be operated to provide an outflow from Lake Martin dam at least equivalent to all turbine units available operating at full gate, and the spillway gates will be raised so that the reservoir will not exceed elevation 490, up to a discharge capacity of 133,000 cfs.

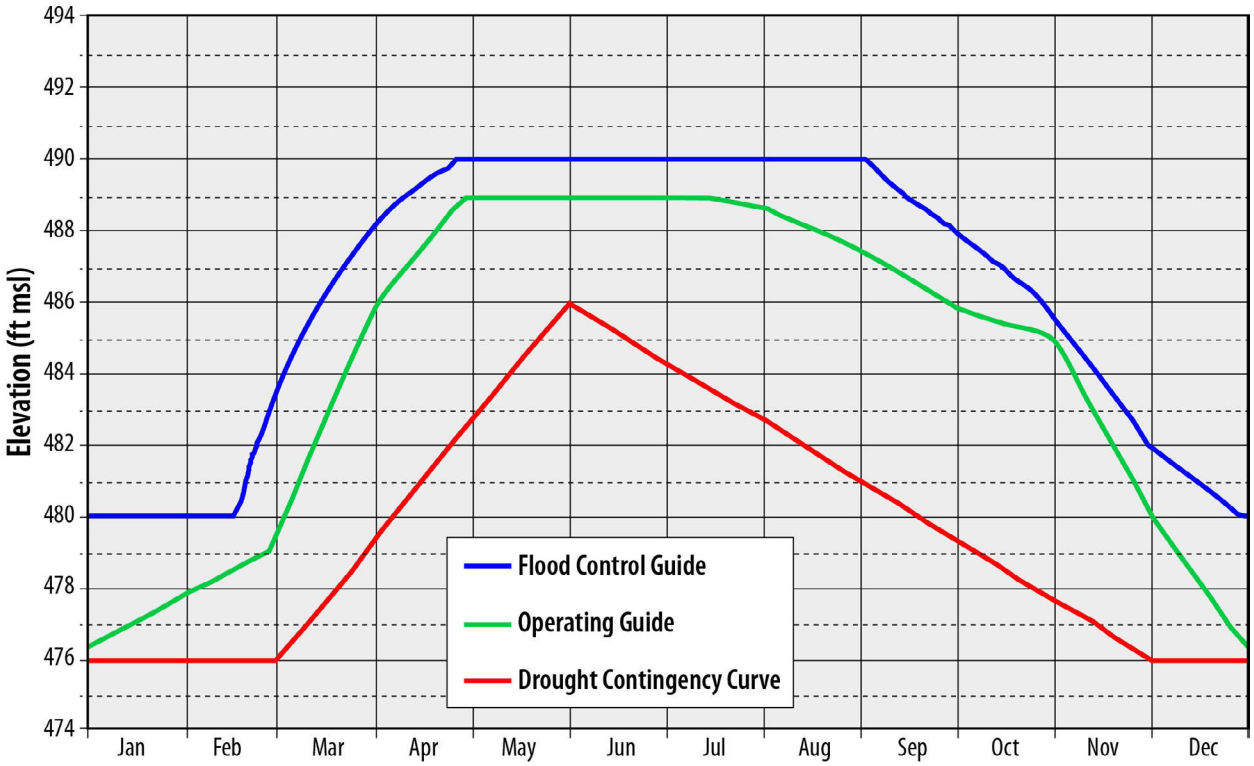


Figure 2.1-33. Lake Martin, Tallapoosa River, APC, guide curve (elevations are referenced to Martin Datum).

The middle curve reflected on Figure 2.1-33 is the APC *Operating Guide.* That curve was developed in the 1970s through discussions with homeowner and boat owner groups who desired a higher pool elevation with less seasonal fluctuation than had been experienced historically. Under the original FERC license for Lake Martin dam (1923), APC often operated the project in a manner that lowered the lake 20 or more feet below the elevation 490 ft. As part of the relicensing of the project during the 1970s, APC and stakeholders agreed that the normal project operation should maintain a higher pool elevation. The area between the *Flood Control Guide and the Operating Guide* represents the range in which APC will operate Lake Martin under normal conditions. APC attempts to maintain Lake Martin at or near the upper end of that operating range as often as possible. By operating the project at or near the *Flood Control Guide,* APC can optimize the project benefits and improve the likelihood that Lake Martin can refill to near full pool each summer. When the lake elevation drops below the *Operating Guide* for extended periods, APC begins to restrict discharges to those necessary to fulfill requirements that include critical electrical system needs, downstream flow augmentation for navigation, water quality, fish and wildlife conservation, and municipal/industrial water supply purposes until lake levels can recover.

The lower curve on Figure 2.1-33 is the APC *Drought Contingency Curve.* That curve provides an indication of impending hydrologic drought conditions. During the 1990s, APC developed *drought contingency curves* for Lake Martin dam and its other hydropower projects. The intent of the curve is to indicate when the project is considered to be under drought conditions. The Lake Martin *Drought Contingency Curve* does not directly trigger a change in operations. It is used as one of several factors in evaluating drought reservoir operations. The curve was developed to reflect drought operations that occurred in 1986 and in 1988. In the recent droughts of 2000 and 2007, reservoir operations did not change immediately when Lake Martin fell below the *Drought Contingency Curve,* but that occurrence was one of several factors used in planning reservoir operations in coordination with APC's other reservoirs and USACE' reservoirs in the ACT Basin during the past two droughts. USACE is cooperating with APC regarding the development of a drought plan for the overall ACT Basin as part of the update of USACE' Master WCM, which might or might not affect the APC *Drought Contingency Curve*.

FERC issued APC a 40-year license for the continued operation of the Lake Martin dam in May 1978. Because Lake Martin was operated on annual licenses issued by FERC for 5 years, during which FERC was evaluating the license application, the license will expire on June 8, 2013. Pending issuance of a new license, Lake Martin dam continues to operate in accordance with the provisions of the previous license. During the life of the previous license, FERC issued an Order Amending License in August 2003 approving turbine upgrades at the dam for Units 1, 2 and 3. Those upgrades were completed in February 2005.

APC filed a NOI and Pre-Application with FERC to initiate the relicensing process in June 2008. As part of the relicensing process, APC has expressed intent to evaluate the effects of a change in the winter guide curve on environmental, recreational, cultural, and socioeconomic resources, flood risk management and power generation based on stakeholder input requesting that this change be considered. Using modeling tools, APC will evaluate the possibility of raising the winter guide curve elevation of Lake Martin or extending the time that Lake Martin is at summer pool. APC will not propose any operational change that would adversely affect or require a change to the minimum release downstream of Thurlow Lake. USACE will participate in the FERC relicensing process for Lake Martin dam with respect to potential effects on the federal projects in the ACT Basin. A change in the winter guide curve for Lake Martin was not considered as part of the ACT WCM update process. [NOTE: The draft EIS for the FERC relicensing process for Lake Martin was circulated for public review on June 6, 2013. The draft EIS addresses an APC proposal to raise the winter pool at Lake Martin by three feet to elevation 483 ft (Martin Datum) and to extend the summer pool elevation of 490 ft (Martin Datum) from September 1 until October 15. As of August 2014, the final EIS and further action on the FERC license is pending.]

2.1.1.1.4.11 Yates Lake

Yates Lake, completed in 1928, is the third in a series of four APC projects on the Tallapoosa River. The project is at Tallapoosa RM 52.7, about 7.9 mi downstream of Lake Martin dam. Figure 2.1-32 depicts the location of Yates Lake. The primary purpose for the project is hydropower, but the reservoir also provides for water quality, water supply, and recreation. APC coordinates the Yates Lake operation with the other Tallapoosa River projects to minimize flooding. Releases from Lake Martin dam flow directly into the headwaters of Yates Lake. The lake has a surface area of 2,004 ac and a storage capacity of 53,908 ac-ft. Yates Lake has an open-crest spillway with an elevation of 345 ft. Flows in excess of turbine capacity flow over the spillway. The project has a 44.25-MW powerhouse with a hydraulic capacity of approximately 12,400 cfs (APC 2008).

APC operates Yates Lake together with the downstream Thurlow Lake to meet a 1,200-cfs minimum flow requirement at Thurlow Lake on weekends, because the upper two storage projects—R.L. Harris Lake and Lake Martin—do not normally operate on weekends.

2.1.1.1.4.12 Thurlow Lake

Thurlow Lake, completed in 1930, is the fourth, and most downstream, APC dam on the Tallapoosa River. The project is at Tallapoosa RM 49.7, about 3.0 mi downstream of Yates Lake. Figure 2.1-32 depicts the location of Thurlow Lake. As stated above, APC operates the Thurlow Lake together with the Yates Lake project to meet downstream flow requirements on weekends. Thurlow Lake's primary purpose is hydropower, but the reservoir also provides for water quality, water supply, and recreation. Thurlow Lake (commonly referred to as Lake Talisi) has no flood risk management storage. APC coordinates the Thurlow Lake operation with the other Tallapoosa River projects to minimize flooding. Thurlow Lake is by far the smallest of the four Tallapoosa River reservoirs. The surface area of the lake is 570 ac, and the total storage capacity is 17,976 ac-ft. APC typically operates the project at elevation 289 ft with little fluctuation. Generating capacity at the Thurlow Lake is 81.35 MW with a hydraulic capacity of approximately 13,200 cfs. Downstream of Thurlow Lake, the Tallapoosa River flows unimpeded for 49 mi to its confluence with the Coosa River (APC 2008).

APC operates the Yates and Thurlow lakes as run-of-river projects that take advantage of peaking releases from Lake Martin. Since 1991, APC has provided a continuous 1,200 cfs minimum release from Thurlow Lake powerhouse, other than in extreme drought conditions. On many occasions, releases from Lake Martin dam are necessary to allow the Thurlow Lake powerhouse to meet this requirement. Procedures are in the Yates and Thurlow lakes FERC license (FERC Project No. 2407) that reduce the release requirement at Thurlow Lake whenever inflows to the Yates and Thurlow lakes are abnormally low. Normal flows downstream of Thurlow Lake typically vary from 1,200 cfs to 17,900 cfs (APC 2008).

2.1.1.1.4.13 Flows at the Confluence of Coosa and Tallapoosa Rivers

Flow in the Alabama River is largely controlled by the APC impoundments on the Coosa and Tallapoosa rivers above Robert F. Henry Lock and Dam. These APC impoundments are Jordan and Bouldin Dams, both discharging into the Coosa River from Jordan Lake, and Thurlow Dam on the Tallapoosa River. Pursuant to articles in the FERC licenses for these impoundments, a minimum discharge must be released to support navigation on the Alabama River based on a 1972 agreement between the APC and USACE. Although this agreement is for navigation, the flow also provides conjunctive support for downstream water quality, hydropower generation, recreation, and fish and wildlife conservation. These flow requirements are discussed in more detail below.

Prior to 1941, Alabama Power was required by its FERC license to maintain a minimum flow of 6,000 cfs at Montgomery, Alabama, for the purpose of supporting navigation. In 1941, due to wartime priorities, the minimum flow was modified to 3,000 cfs. Under the current operations, APC's Jordan, Bouldin, and Thurlow (JBT) projects provide a minimum 7-day average flow of 4,640 cfs (32,480 day second feet[1] (dsf)/7-day). The 4,640 cfs was originally derived in 1972 by prorating the 7Q10 flow at the USGS Montgomery gage of 5,200 cfs using a drainage area ratio. The ratio was derived by dividing the portion of the basin controlled by APC Projects (13,465 square miles) by the drainage area at the Montgomery gage (15,100 square miles). The 7-day flow of 4,640 cfs was agreed upon by USACE and APC to be an adequate volume of flow from the APC projects (JBT) to meet the 7Q10 flow of 6,600 cfs at Claiborne Lock and Dam when combined with the intervening local inflows. Thus, 4,640 cfs became the minimum weekly releases from the APC's JBT projects. The 7-day minimum total is computed by adding the discharges from these three projects. In 1980, the agreement was modified to require a minimum volume of at least 8,000 dsf for any three-day period within the present 7-day 32,480 dsf requirement. The flow requirement changed for two major reasons. First, the construction of the Robert F. Henry Lock and Dam

[1] 1dsf = the volume of 1 cfs over a 24 hour period

caused backwater at the Montgomery gage, making it difficult to monitor the flow. Second, the critical area for navigation changed from Montgomery, Alabama to the section of the Alabama River below Claiborne Lock and Dam (Hathorn 2013).

Under extreme drought conditions, the minimum flow may be reduced, after consultation with USACE and concurrence from FERC. Reductions in JBT releases below 4,640 cfs (weekly average) occurred during extreme drought conditions in 2007. Those reductions are described in more detail in Section 2.1.1.1.3.4. Flows were also temporarily reduced below the weekly average target during drought conditions from September through early November 1986.

2.1.1.1.4.14 Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake

The R.E. "Bob" Woodruff Lake is created by the Robert F. Henry Lock and Dam, 281 mi upstream of Mobile Bay. This is the most upstream of three USACE projects on the Alabama River, also known as the Alabama River lakes. R.E. "Bob" Woodruff Lake extends from the Robert F. Henry Lock and Dam upstream to the Bouldin Dam. Montgomery, Alabama, is near the headwaters of the lake. The project purposes are hydropower, navigation, recreation, water quality, and fish and wildlife conservation. The lake is a popular recreation destination, receiving up to 2 million visitors annually. In addition to management of project lands for fish and wildlife conservation, consistent with other project purposes, USACE acquired 10,566 ac of land along the lake in Lowndes County in the 1990s as part of a comprehensive mitigation plan for effects of construction of the Tennessee-Tombigbee Waterway in Alabama and Mississippi (Day, personal communication 2010). The mitigation plan was authorized in the WRDA of 1986. The acquired lands are dedicated solely for intensive management for fish and wildlife mitigation. The property is on the left bank of the Alabama River, just upstream of the Robert F. Henry Lock and Dam, near Selma, Alabama. ADCNR manages the mitigation lands. ADCNR acquired additional contiguous lands with other funding sources and manages the entire 12,531-ac site as the Lowndes Wildlife Management Area.

R.E. "Bob" Woodruff Lake is 81.1 mi long and averages 1,300 ft wide. It has a surface area of 13,500 ac and a total storage capacity of 247,210 ac-ft (available conservation storage of 36,450 ac-ft) at a normal pool elevation of 126 ft. Lake levels are typically stable with minimal fluctuation, except for temporary periods during flood events when some increases will be observed. There is a 9-ft-deep by 200-ft-wide navigation channel over the entire length of the lake. USACE operates the project for navigation and hydropower generation. The facility has a generation capacity of 82 MW. The Robert F. Henry Lock and Dam is operated in tandem with the downstream Millers Ferry Lock and Dam to provide an average daily outflow of 6,600-cfs downstream of Claiborne Lock and Dam and Lake for navigation and waste assimilation needs on the Alabama River. This flow is a non-mandatory minimum flow target or guide, representing the 7Q10 flow level (6,600-cfs) at the downstream Claiborne Lock and Dam and Lake. That flow level cannot be met in all circumstances, particularly under extreme drought conditions. Sections 2.1.1.2.1.3 and 2.1.1.2.1.6 provide more detailed information on the 6,600-cfs flow target and actions USACE takes when basin inflows are insufficient to meet that target. Figure 2.1-34 is a vicinity map depicting Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake.

Typical release patterns that may occur at Robert F. Henry Lock and Dam over a one-week period under normal, wet, and dry conditions are depicted in Figure 2.1-35, Figure 2.1-36, and Figure 2.1-37, respectively. Each figure presents data for inflows above Robert F. Henry Lock and Dam, lake elevations, and discharges from the dam. Robert F. Henry Lock and Dam functions as a run-of-river project, meaning that the natural flow and elevation drop of a river are used to generate electricity on rivers with a consistent and steady flow. The *normal condition* in the figure below shows a relatively steady pool elevation and inflows.

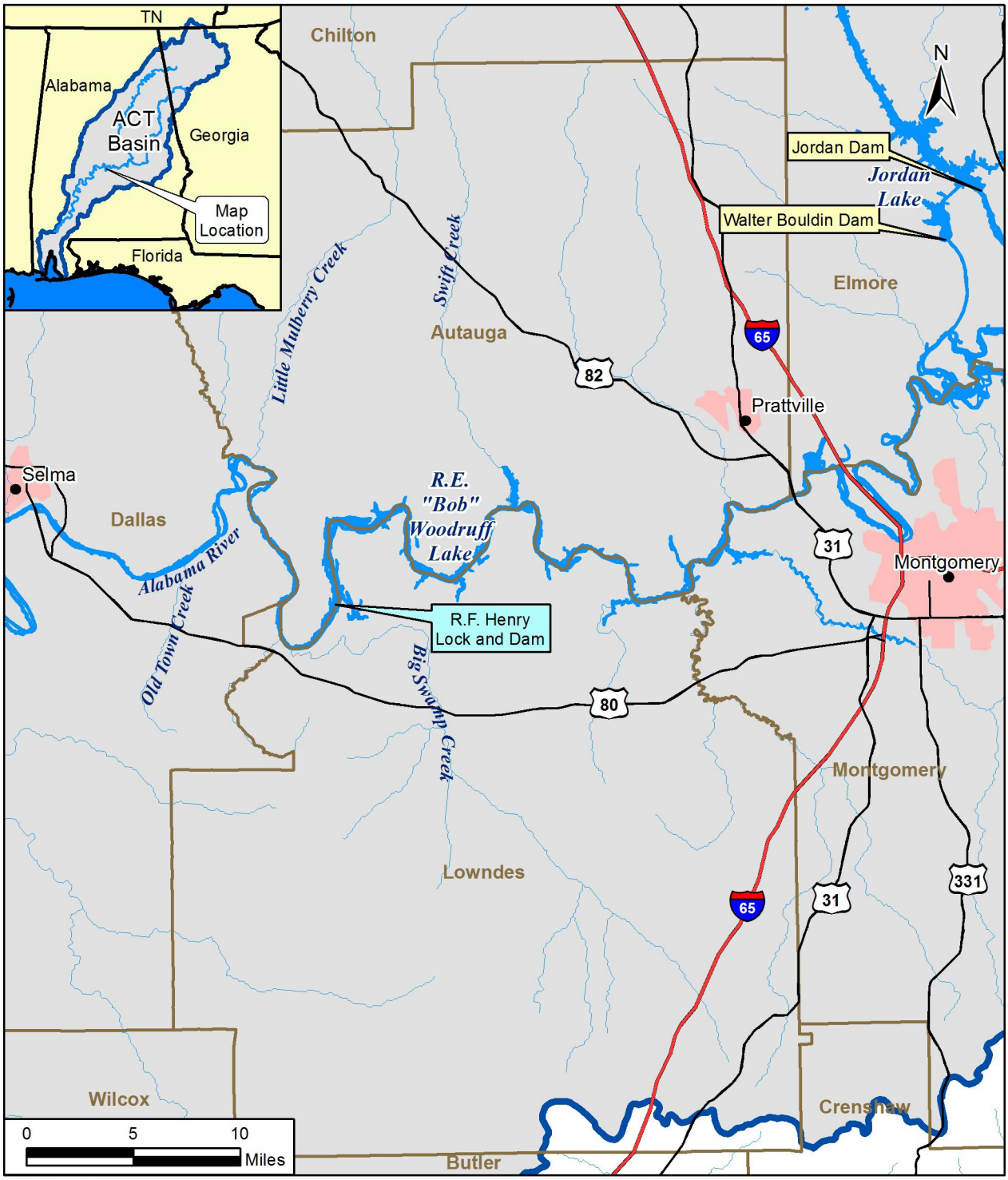

TN
Alabama
ACT Basin
Georgia
Florida
Map Location
Chilton
N
Jordan Dam
Jordan Lake
Walter Bouldin Dam
Elmore
Swift Creek
Little Mulberry Creek
Autauga
65
82
Prattville
Selma
Dallas
R.E. "Bob" Woodruff Lake
31
Montgomery
Alabama River
Old Town Creek
R.F. Henry Lock and Dam
Big Swamp Creek
80
Montgomery
Lowndes
331
65
31
Wilcox
Crenshaw
0
5
10
Miles
Butler
LEGEND
ACT Basin Boundary
County Boundary
City
Urban Area
Interstate
U.S. Route
Surface Water
USACE Dam
Non-Federal Dam
R.F. Henry Lock & Dam/
R.E. "Bob" Woodruff Lake

Figure 2.1-34

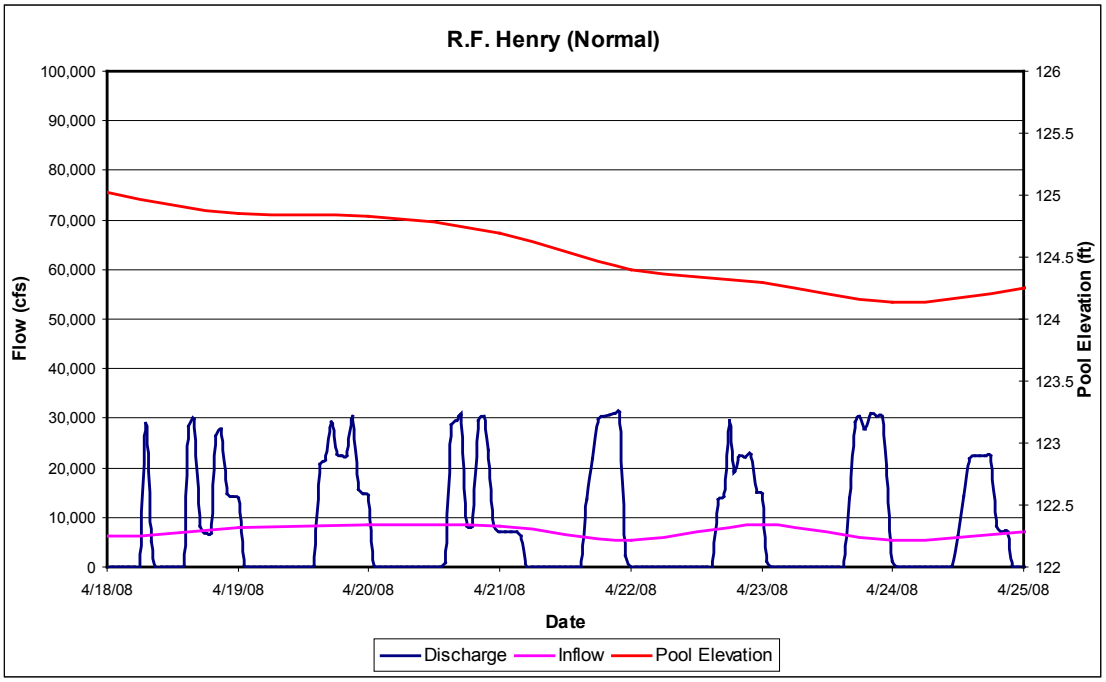


Figure 2.1-35. Robert F. Henry Lock and Dam, typical release pattern, normal conditions.

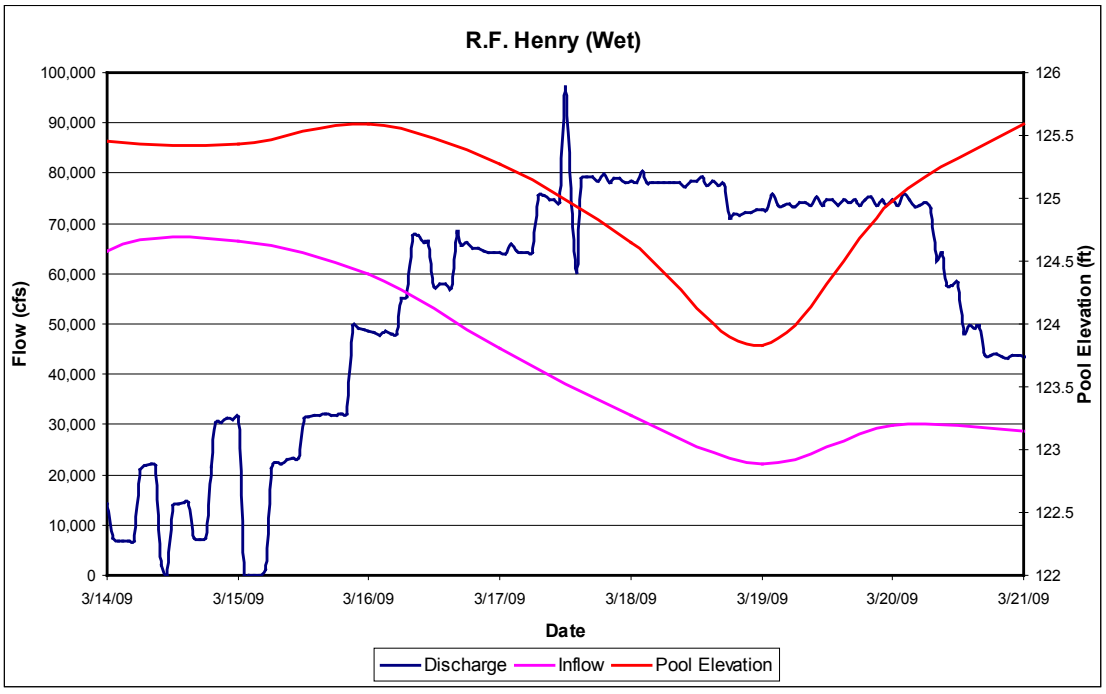


Figure 2.1-36. Robert F. Henry Lock and Dam, typical release pattern, wet conditions.

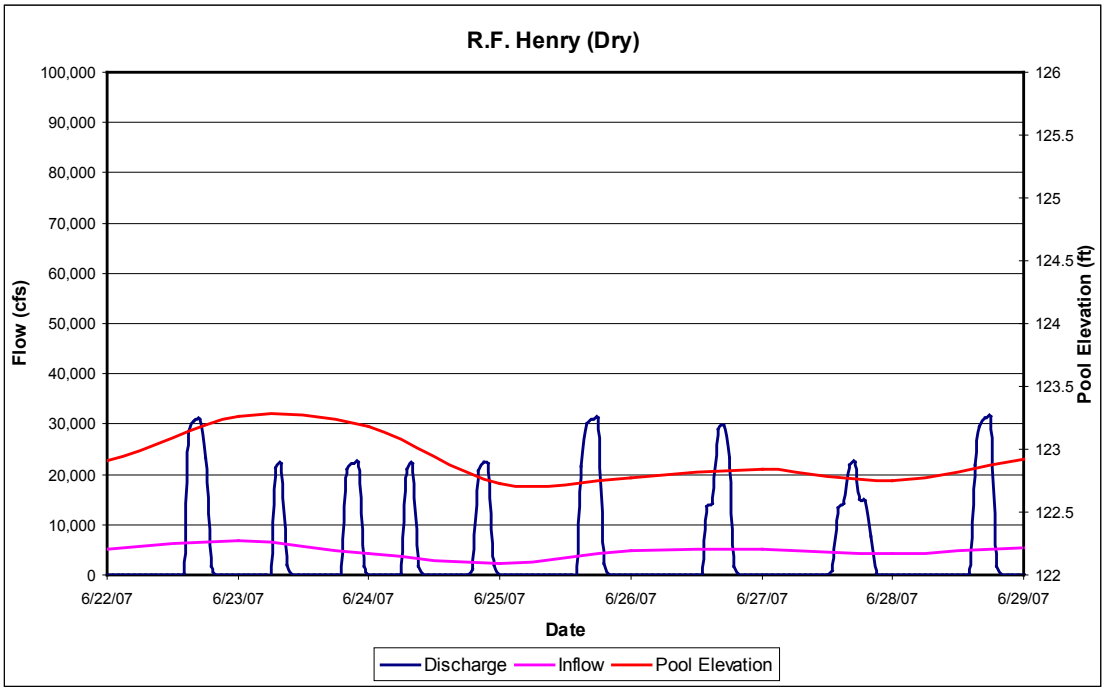


Figure 2.1-37. Robert F. Henry Lock and Dam, typical release pattern, dry conditions.

Water is released daily in various durations to match the inflows coming into the project. The *wet condition* for Robert F. Henry Lock and Dam displays a continuous discharge because of high inflows. A drop in pool elevation is seen after a large volume of water is released and inflows lessen. Low inflows and a low pool elevation can be seen in the figure above for the *dry condition* at Robert F. Henry Lock and Dam (Figure 2.1-37). Discharges are kept to a minimum and in short duration to match low inflows that come into the system under this condition.

Under normal and dryer conditions, hydropower generation at the Robert F. Henry Lock and Dam is not continuous. While operating as a run-of-river facility, generation may occur several hours a day, seven days per week, followed by hours of non-generation. Consequently, tailwater stages may vary significantly daily because of these peak hydropower operations, characterized by a rapid rise in river stage immediately after generation is initiated and a rapid fall in stage as generation is ceased. Figure 2.1-38 depicts river stages immediately downstream of Robert F. Henry Lock and Dam over a typical one-week period under normal conditions. River stages may rise and fall by as much as 5 to 7 ft during periods of hydropower generation. Except during higher flow conditions when hydropower may be generated for more extended periods of time, this pattern of power generation and fluctuating stages in the tailrace is routinely repeated daily.

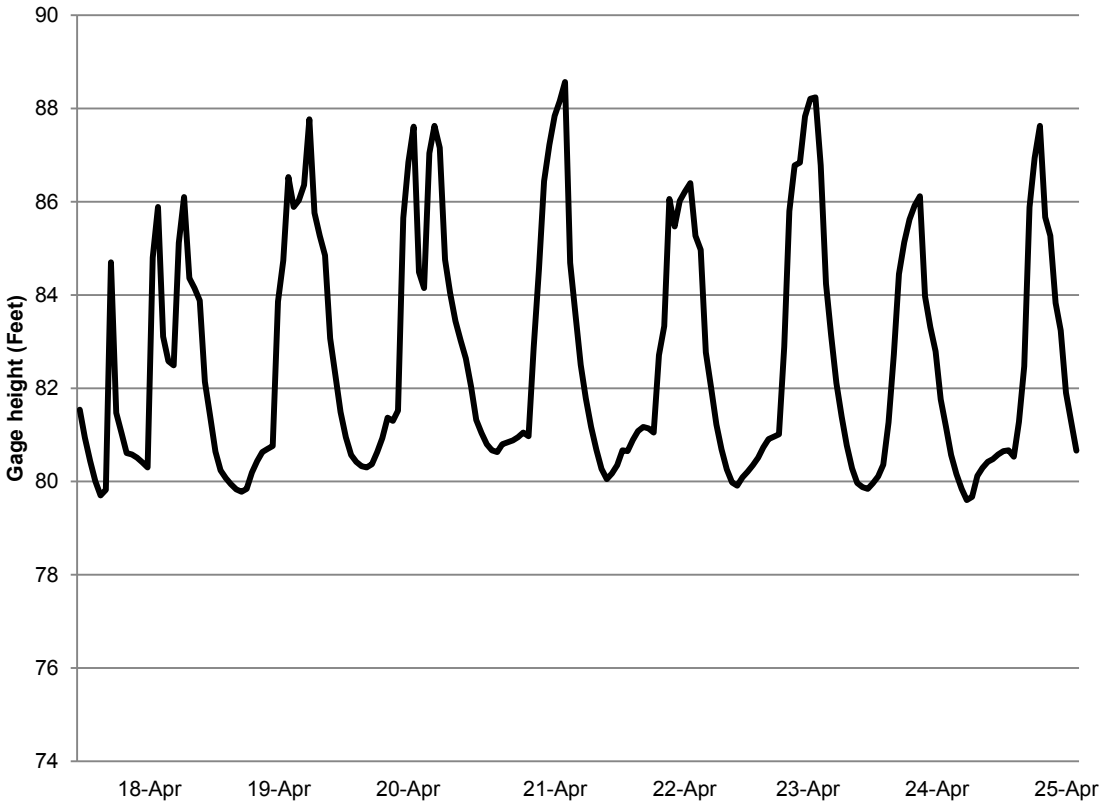
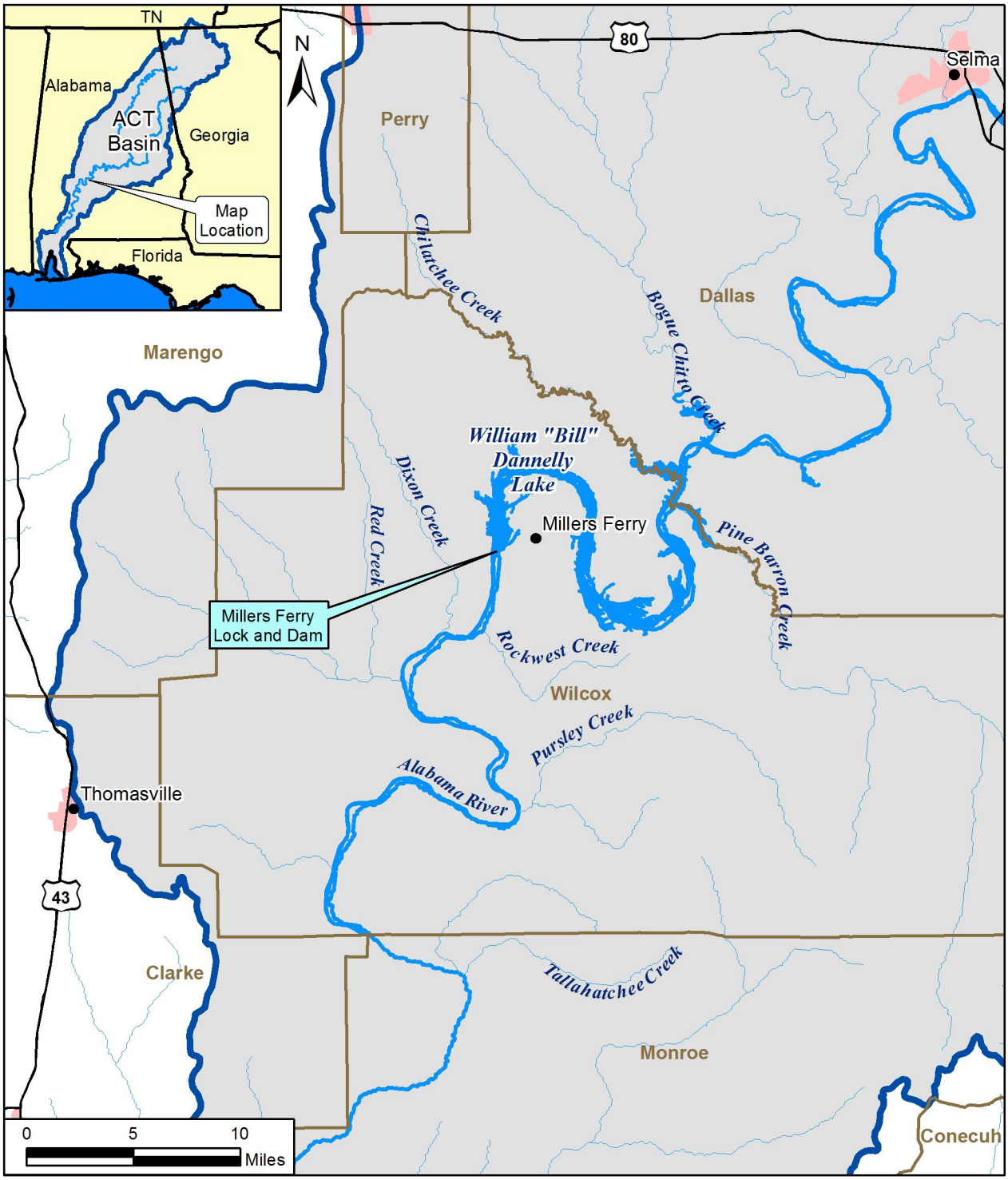


Figure 2.1-38. Alabama River downstream of Robert F. Henry Lock and Dam, near Selma, Alabama (USGS 02421351), tailrace gage height (2011).

2.1.1.1.4.15 Millers Ferry Lock and Dam and William "Bill" Dannelly Lake

The William "Bill" Dannelly Lake is created by the Millers Ferry Lock and Dam on the Alabama River, 178 mi upstream of Mobile Bay. William "Bill" Dannelly Lake is 103 mi long and averages almost 1,400 ft wide. The reservoir partially inundates several tributary streams. The Cahaba River flows into the upper reaches of William "Bill" Dannelly Lake. Figure 2.1-39 is a vicinity map depicting Millers Ferry Lock and Dam and William "Bill" Dannelly Lake.

William "Bill" Dannelly Lake has a total storage capacity of 346,254 ac-ft (available conservation storage of 46,704 ac-ft), at a normal pool elevation of 80.8 ft. It has a surface area of 18,528 ac. There is a 9-ft-deep by 200-ft-wide navigation channel extending the entire length of the reservoir. The facility is a multipurpose reservoir constructed by USACE for both navigation and hydropower. The hydropower generating capacity of the project is 90 MW. The reservoir also provides recreation, water quality, and fish and wildlife conservation benefits. In addition to management of project lands for fish and wildlife conservation, consistent with other project purposes, 1,703 ac of project lands are specifically designated for intensive management as part of a comprehensive mitigation plan for impacts from construction of the Tennessee-Tombigbee Waterway in Alabama and Mississippi (Lyon, personal communication 2010). The mitigation plan was authorized in the WRDA of 1986. A daily average minimum flow of 6,600 cfs is provided through Claiborne Lock and Dam for downstream navigation and assimilative flow needs on the Alabama River, as long as basin inflows are sufficient to do so.



Millers Ferry Lock & Dam/ William "Bill" Dannelly Lake

Figure 2.1-39

Lake levels remain fairly stable on a day-to-day basis, but rise slightly, up to 0.5 ft, in wet weather. The reservoir provides ample recreation opportunities.

Typical release patterns that can occur at Millers Ferry Lock and Dam over a one-week period under normal, wet, and dry conditions are depicted in Figure 2.1-40, Figure 2.1-41, and Figure 2.1-42, respectively. Each figure presents data for inflows above Millers Ferry Lock and Dam, lake elevations, and discharges from the dam. Millers Ferry Lock and Dam is operated as a run-of -river project. The *normal condition* depicted in the figure below shows relatively steady inflows. Water is released daily in various durations to match the inflows coming into the project. A clear run-of -river pattern is seen in the figure below for the *wet condition* at Millers Ferry Lock and Dam. The inflows are high for this period, and this leads to higher discharges. Inflows and discharge both increase and decrease together to keep a steady flow of water through the system. The associated pool elevation also follows the same pattern for this week period. A significant decrease in inflow can be seen in the *dry condition* hydrograph for Millers Ferry Lock and Dam. Discharges are kept to a minimum and in short duration to match to low inflows that are coming into the system.

Under normal and dryer conditions, hydropower generation at Millers Ferry Lock and Dam is not continuous. While operating as a run-of-river facility, generation can occur several hours a day, seven days a week, followed by hours of non-generation. Consequently, tailwater stages can vary significantly daily because of the peak hydropower operations, characterized by a rapid rise in river stage immediately after generation is initiated and a rapid fall in stage when generation is ceased. Figure 2.1-43 depicts river stages immediately downstream of Millers Ferry Lock and Dam over a typical one-week period under normal conditions. River stages can rise and fall by as much as 2.5 to 3.5 ft during periods of hydropower generation. Except during higher flow conditions when hydropower can be generated for more extended periods of time, that pattern of power generation and fluctuating stages in the tailrace is routinely repeated daily.

2.1.1.1.4.16 Claiborne Lock and Dam and Lake

Claiborne Lock and Dam is on the Alabama River about 118 mi upstream of Mobile Bay. The lake created by the dam is similar to a wide river, averaging about 800 ft wide, with a surface area of 6,290 ac. Claiborne Lake extends 60 mi upstream to the Millers Ferry Lock and Dam. Claiborne Lock and Dam and Lake are depicted on Figure 2.1-44. Total storage capacity in the lake is 102,480 ac-ft (negligible conservation storage) at a maximum operating pool elevation of 36 ft. The lake has a 9-ft-deep, 200-ft-wide navigation channel extending its entire length. The primary purpose of this project is navigation. There is no hydropower generating capability at the project. The lake also provides recreation, water quality, and fish and wildlife conservation benefits. In addition to management of project lands for fish and wildlife conservation, consistent with other project purposes, 2,567 ac of project lands are specifically designated for intensive management as part of a comprehensive mitigation plan for impacts from construction of the Tennessee-Tombigbee Waterway in Alabama and Mississippi (Lyon, personal communication 2010). The mitigation plan was authorized in the WRDA of 1986.

Claiborne Lake is the most natural and undeveloped of the three Alabama River lakes. The lake remains mostly within its original river banks and is surrounded by a rustic atmosphere. USACE is allowing the shoreline to revert to its natural state, providing important wildlife habitat. Recreation visitors number over one million annually (USACE, Mobile District 1998a).

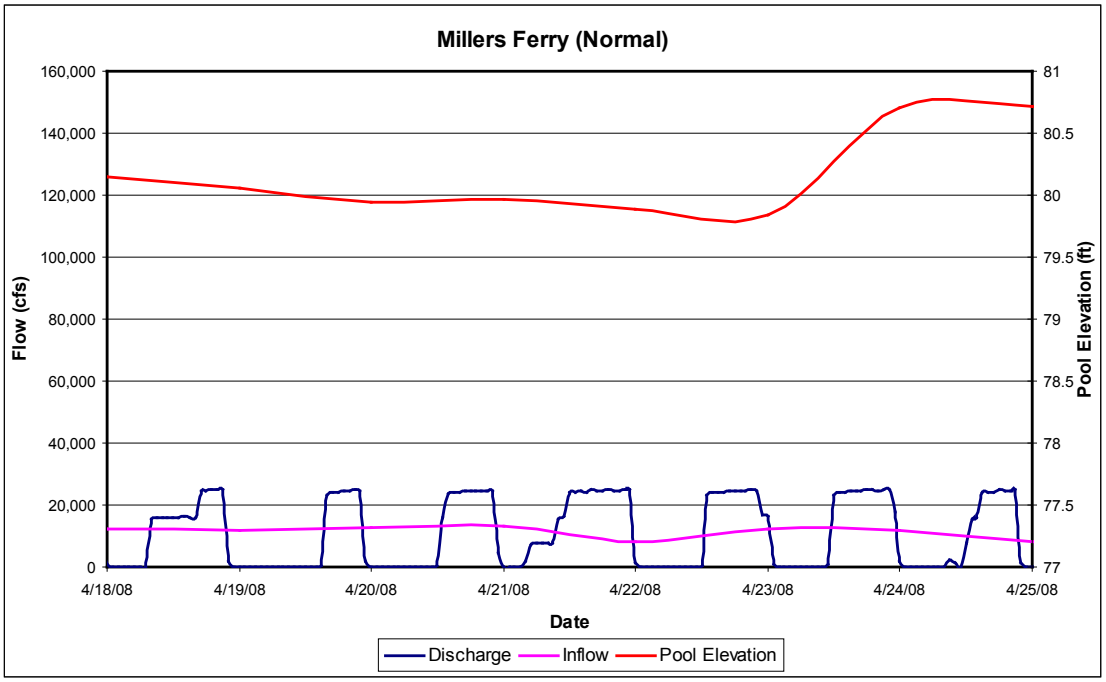


Figure 2.1-40. Millers Ferry Lock and Dam, typical release pattern, normal conditions.

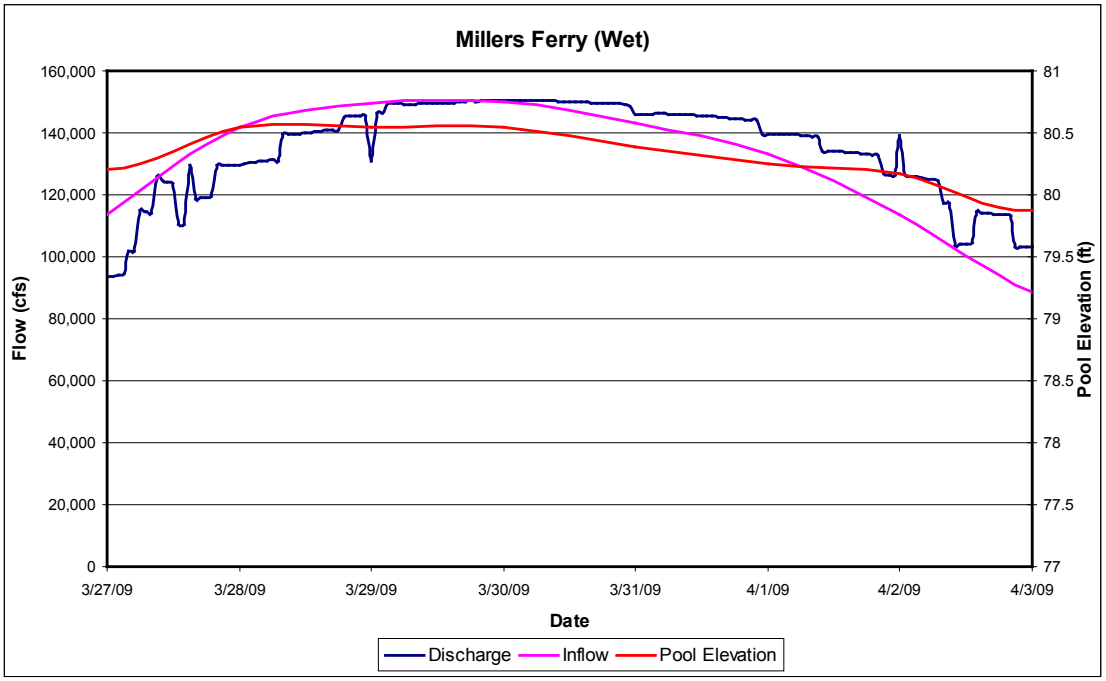


Figure 2.1-41. Millers Ferry Lock and Dam, typical release pattern, wet conditions.

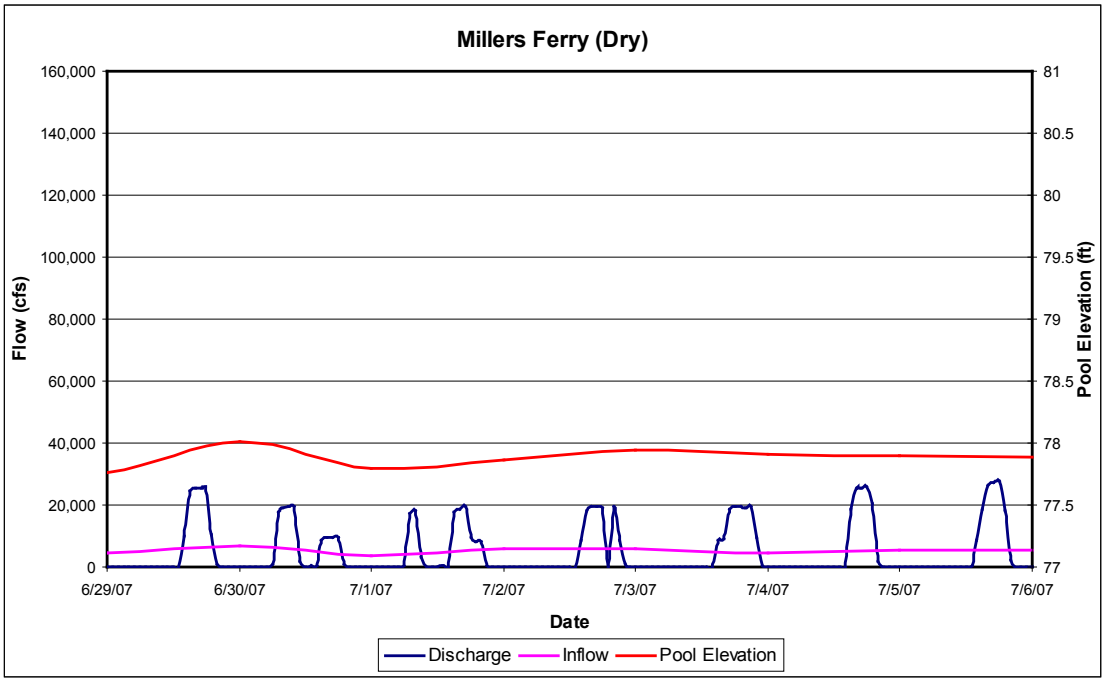


Figure 2.1-42. Millers Ferry Lock and Dam, typical release pattern, dry conditions.

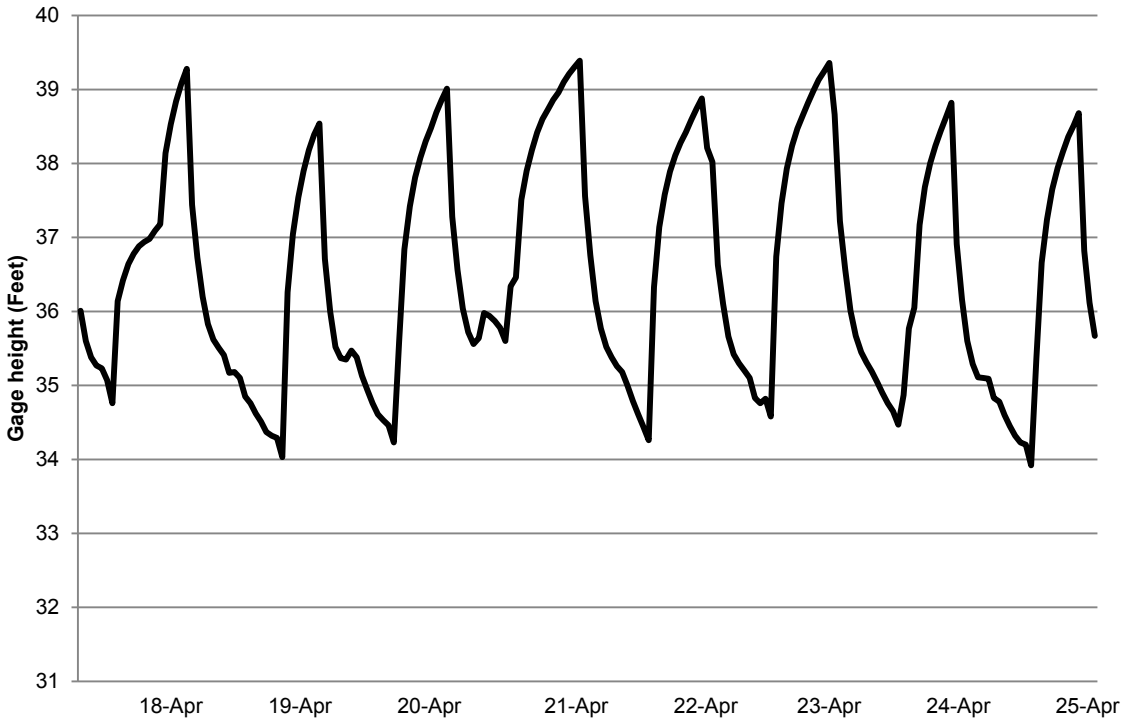
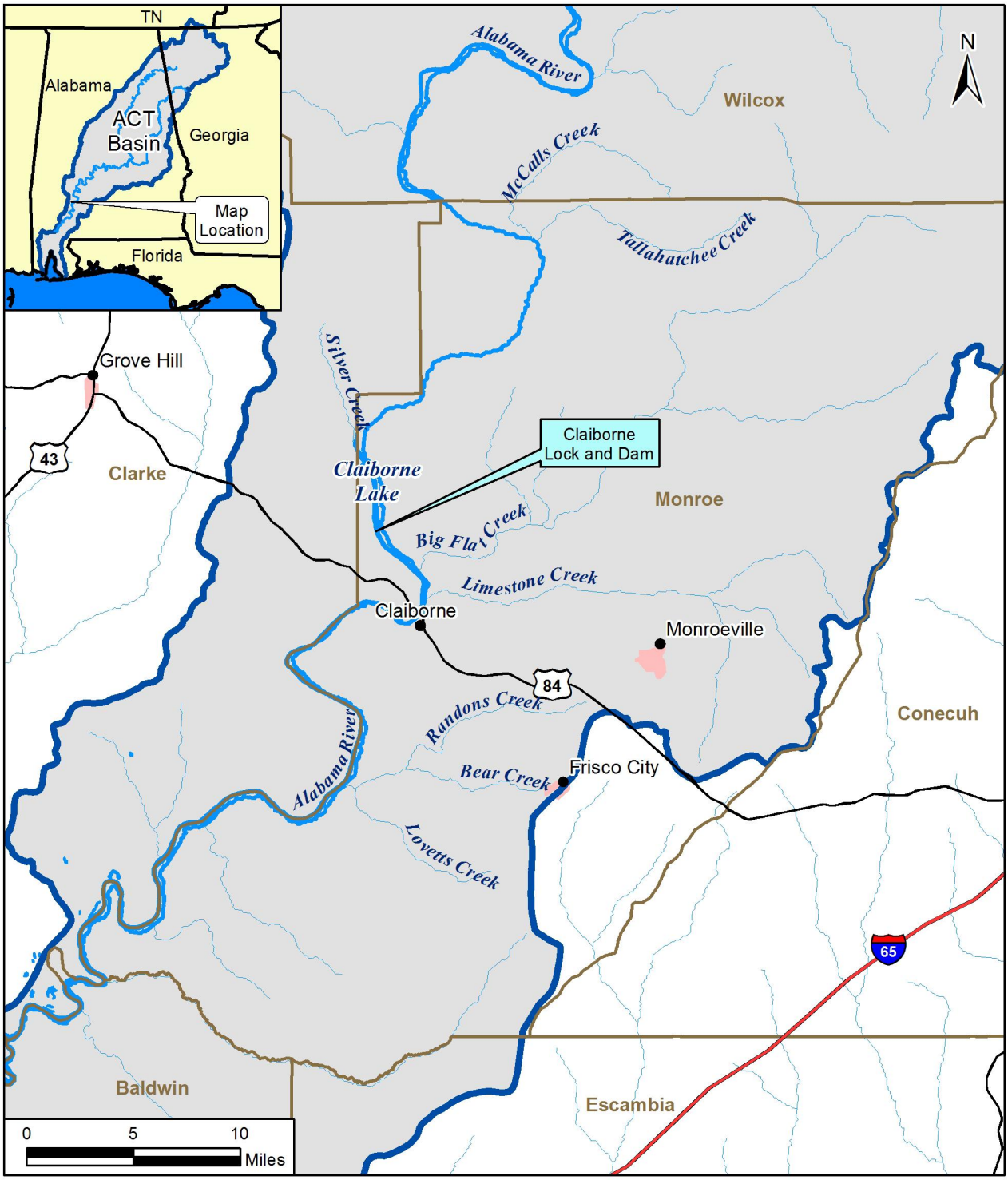


Figure 2.1-43. Alabama River downstream of Millers Ferry Lock and Dam (USGS 02427506), tailrace gage height (2011).



LEGEND

- ACT Basin Boundary
- County Boundary
- City
- Urban Area
- Interstate
- U.S. Route
- Surface Water
- USACE Dam

Claiborne Lock and Dam and Lake

Figure 2.1-44

Between May 1983 and February 1986, private sector hydropower interests initiated efforts to acquire a license from FERC to add non-federal hydropower generation at the Claiborne Lock and Dam. None of these interests were granted a preliminary permit by FERC to proceed with detailed investigations. In 1999, Universal Electric Power (UEP), Inc. applied for and received (July 1999) a preliminary permit from FERC to pursue non-federal hydropower development at Claiborne Lock and Dam (FERC Project No. 11629) (FERC 2010d). In July 2002, the preliminary permit expired, and UEP applied for a new preliminary permit from FERC on August 20, 2002. The permit was reissued under FERC Project No. 12351 (FERC 2013b). On June 9, 2003, UEP surrendered its preliminary permit for Claiborne Lock and Dam (P-12351) (FERC 2013c).

AMG Energy, LLC applied for and received (in June 2004) a preliminary permit from FERC to pursue studies for non-federal hydropower development at Claiborne Lock and Dam (Project No. 12485) FERC 2013d). AMG Energy completed feasibility studies and surrendered its preliminary permit in November 2006 (FERC 2013e). The Alabama River Newsprint Company (ARNC) subsequently received a FERC preliminary permit in November 2007 to study non-federal hydropower development at Claiborne Lock and Dam (FERC Project No. 12808) (FERC 2013f). Having completed its evaluation and determining that the project was not economically feasible, ARNC surrendered its preliminary permit in April 2009 (FERC 2013g).

In April 2010, Lock+Hydro Friends Fund XIX, LLC (HFF XIX) (a subsidiary of Hydro Green Energy, LLC) received a preliminary permit from FERC to study proposed non-federal hydropower development at Claiborne Lock and Dam (FERC Project No. 13519) (FERC 2013h). HFF XIX filed a Draft License Application with FERC for the Claiborne Hydroelectric Project in March 2013 (FERC 2013i), proposing to deploy two 11-MW hydropower turbines within a new powerhouse adjacent to the existing lock and dam and to construct associated intake and tailrace areas. The proposed project would include an inflatable rubber dam crest to be installed in the top of the existing overflow spillway at the lock and dam to increase the crest from elevation 33 feet to 36 feet. The inflatable rubber dam crest would be deflated when flows would be sufficiently large to overtop it. In December 2013, FERC issued a successive preliminary permit and granted priority to file a license application to Lock+HFF XIX (FERC 2013j). A Final License Application for the project is expected to be filed with FERC by HFF XIX by December 2015.

Downstream of Claiborne Lock and Dam, the Alabama River flows about 72 miles farther to its confluence with the Tombigbee River to form the Mobile River. This reach of the Alabama River has a federally authorized navigation channel, authorized at 9-ft deep by 200-ft wide. The navigation channel is sustained by a combination of flows from Claiborne Lock and Dam, maintenance dredging, and training works. One major industry, Alabama River Cellulose LLC (a Georgia Pacific subsidiary), operates on that reach of the Alabama River about 3.5 miles downstream of Claiborne Lock and Dam and draws its water supply directly from the river. Alabama River Cellulose LLC withdrawals are included in the discussion on ACT water withdrawals in Section 2.1.1.2.3.

2.1.1.1.4.17 Other Reservoirs in the ACT Basin

In 2002 USACE conducted a preliminary survey of existing reservoirs in the ACT Basin in Alabama and Georgia. The survey provided information on the number, location, and approximate size of the smaller reservoirs in the basin that are off the mainstem rivers (generally those other than federal or major power company reservoirs). The survey identified 280 reservoirs in Alabama and Georgia in the ACT Basin that are 20 ac or larger (USACE, Mobile District 2002). Those impoundments serve a variety of purposes, including water supply for livestock and irrigation; fish and wildlife conservation; recreation; M&I water supply; and other localized uses. Hundreds of other smaller ponds and impoundments are scattered across the ACT Basin.

In the ACT Basin in Alabama, the survey identified 170 reservoirs larger than 20 ac. The total surface area of the reservoirs is about 10,413 ac, an average reservoir size of about 61 ac. The survey identified 110 reservoirs in the ACT Basin in Georgia. The total surface area of the reservoirs is about 6,807 ac, an average reservoir size of about 62 ac (USACE, Mobile District 2002). The summary does not include the reservoirs on the mainstem rivers (Alabama, Coosa, Tallapoosa, Etowah, Oostanaula, and Coosawattee) that are otherwise specifically discussed in this document. This preliminary survey was considered to be detailed enough to provide a reasonably complete summary of the more noteworthy surface water impoundments in the ACT Basin and, when combined with the mainstem river reservoirs, the cumulative reservoir surface area within the ACT Basin.

One of the noteworthy non-mainstem reservoirs in the ACT Basin is Purdy Lake. Purdy Lake is a 990-ac reservoir at the headwaters of the Cahaba River, which was completed in 1964. It has a drainage area of about 43 sq mi. The lake's location is shown in Figure 2.1-29. The primary purpose of the lake is to provide water supply for Birmingham. The dam and reservoir are owned by the Birmingham Water Works Board. There are no facilities for hydropower generation at the project.

USACE issues permits under section 404 of the CWA and section 10 of the Rivers and Harbors Act of 1899 (as applicable) for reservoir projects. Table 2.1-6 summarizes permits (or pending permit actions) for proposed non-USACE reservoirs since 1988 in the ACT Basin (Johnson, personal communication 2010). Those reservoirs are in the upper Tallapoosa, upper Etowah, and Conasauga River basins in Georgia. They have generally been pursued for the primary purpose of water supply, but they might also serve other purposes, such as recreation. Those projects represent the substantial reservoir projects in the basin over the past 24 years with respect to reservoir size, yield, and costs. No similar reservoir projects have recently been pursued in portions of the ACT Basin in Alabama (House, personal communication 2010). Table 2.1-6 might not include all permit actions for impoundments across the ACT Basin because a number of other minor impoundments might have been constructed for local purposes between 1990 and 2010 that collectively do not rise to the level (size and scope) of those projects.

The Hickory Log Creek Dam and Reservoir is the newest locally constructed water supply reservoir in the ACT Basin, along the upper Etowah River upstream of Allatoona Lake. The dam and reservoir is a joint project by CCMWA and the city of Canton that will serve as an additional water supply source. The project began in 2004 and the reservoir was filled in 2010. The project is on Hickory Log Creek in Cherokee County, near the City of Canton, Georgia, and about 1.4 mi upstream of the creek's confluence with the Etowah River. The dam is approximately 950 ft wide and 180 ft high, making it one of largest dams in the state not built by USACE or the Georgia Power Company (CCMWA 2010). The dam impounds approximately 17,702 ac-ft of usable storage. It is an off-channel pumped-storage reservoir. The Hickory Log Creek project is permitted by Georgia Environmental Protection Division (EPD) for withdrawals up to 39 million gallons per day (mgd) from the Etowah River, to be shared by the city of Canton and CCMWA. In addition to the dam and reservoir, the project includes an intake and pump station, and a pipeline to transport water between the reservoir and the Etowah River. The total storage in Hickory Log Creek Reservoir is equivalent to about 6 percent of the conservation storage in Allatoona Lake (or about 1.4 feet of elevation at the summer guide curve elevation of 840 ft).

Table 2.1-6.
Non-USACE reservoir projects (permitted by USACE since 1990, or permit pending) in the ACT Basin not on the mainstem rivers

River Basin (Subbasin)	Stream	Project name	County	Yield (mgd)	Size (ac)	Status
Tallapoosa	Sharpe Creek	Sharpe Creek Reservoir	Carroll, GA	-- [a]	230	Permitted 1988 Constructed 1991
Coosa (Conasauga)	Conasauga River (off stream)	River Road Reservoir	Whitfield, GA	18	118	Permitted 1992 Constructed 1997
Coosa (Conasauga)	Haig Mill Creek	Lower Haig Mill Reservoir	Whitfield, GA	5	109	Permitted 1993 Constructed 1995
Coosa (Etowah)	Yellow Creek	Hollis Q. Lathem Reservoir	Cherokee/ Dawson, GA	-- [b]	334	Permitted 1994 Constructed 1999
Coosa (Etowah)	Hickory Log Creek	Hickory Log Creek Reservoir	Cherokee, GA	44	411	Permitted 2004 Constructed 2009
Coosa (Etowah)	Richland Creek	Richland Creek Reservoir	Paulding/ Bartow, GA	35	305	Permit Pending
Coosa (Etowah)	Russell Creek	Dawson County Water Supply Reservoir	Dawson, GA	11.5	137	Permit Pending
Tallapoosa	Indian Creek	Indian Creek Water Supply Reservoir	Carroll, GA	18	643	Permit Pending

Notes:

a. Sharpe Creek Reservoir releases support downstream water supply withdrawals, as needed, from the Little Tallapoosa River by the City of Carrollton, Georgia.

b. Lathem Reservoir is a drought contingency reservoir designed to work in conjunction with the Cherokee County Water and Sewer Authority's Etowah River water intake during periods of drought to support permitted withdrawals from the river up to 36 mgd (monthly average).

As proposed by CCMWA and city of Canton in the original 404 permit application to USACE, water would be pumped from the Etowah River to fill the reservoir during high-flow periods and released during low-flow periods to supplement Etowah River flows, enabling dependable water supply withdrawals from the existing city of Canton intake on the Etowah River just downstream of Hickory Log Creek and from CCMWA's existing intake in Allatoona Lake. The permit application was modified in 2003 to reflect that CCMWA would withdraw water from a new intake to be constructed on the Etowah River upstream of Allatoona Lake. (USACE Savannah District 2004). Subsequent to issuance of USACE permit in 2004, CCMWA has sought the agreement from USACE to credit CCMWA's water supply storage account at Allatoona Lake with additional flows that CCMWA proposes to release from Hickory Log Creek reservoir into the Etowah River, which flows into Allatoona Lake. In addition, the Governor of Georgia submitted a request in January 2013 for additional storage in Allatoona Lake to support increased water supply withdrawals by CCMWA from Allatoona Lake. USACE has not made any final decision regarding CCMWA's proposal regarding Hickory Log Creek Reservoir releases and withdrawals from Allatoona Lake, or Georgia's request for additional water supply storage. Those decisions may depend in part on information that has been developed through this water control manual update and EIS process, and in part on separate policy decisions that may be made by the Department of the Army. Therefore, it was not possible, during this water control manual update and EIS process, to predict with certainty how the Hickory Log Creek Reservoir will be operated in the future.

Because the Hickory Log Creek Reservoir has been constructed, USACE has incorporated this existing reservoir into its modeling and analysis for purposes of this water control manual update and EIS. USACE HEC-ResSim model reflects diversions from the Etowah River to refill the Hickory Log Creek Reservoir and releases from the reservoir during low-flow periods, as contemplated in the proposed operations as permitted by USACE. However, USACE has not included the proposed but never built

CCMWA intake on the Etowah River. CCMWA has made it clear through its requests and actions that it seeks to withdraw Hickory Log Creek Reservoir releases from Allatoona Lake as opposed to building an intake on the Etowah River. Refer to the updated HEC-ResSim modeling report (EIS Appendix C) for a more detailed description of how Hickory Log Creek reservoir was modeled.

Planning for future reservoir construction or existing reservoir expansion to meet longer range water supply needs in the ACT Basin in north Georgia is discussed in Section 2.1.1.2.5.1.6.

2.1.1.1.5 Groundwater

The major aquifer formations in the ACT Basin include the solution-conduit aquifers, crystalline rock aquifers, and the sand and gravel aquifers (Figure 2.1-45). Groundwater in the ACT Basin generally flows from northwest to southeast, with some variation in local flow. Near major stream channels, and in areas of major water withdrawals, the flow is vertically upward and downward, but is mainly perpendicular to the stream channel, which demonstrates good hydraulic connection between groundwater and surface water. Rivers and streams in the southern half of the basin are deeply incised into the underlying aquifers and can receive substantial amounts of groundwater.

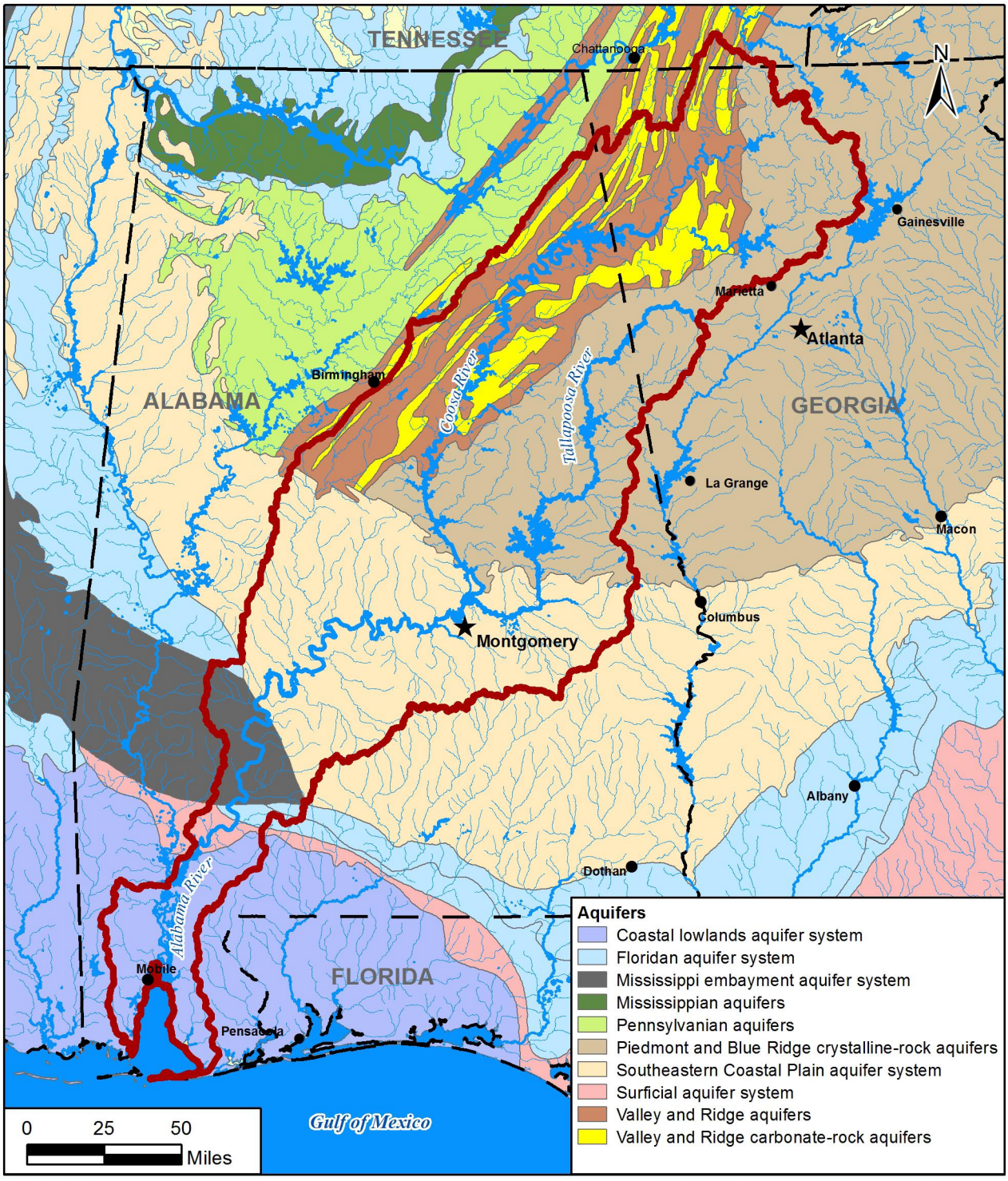
2.1.1.1.5.1 Valley and Ridge

Aquifers in the Valley and Ridge and Southwestern Appalachians are typically contained in sandstone, siltstone, and limestone. These aquifers are generally composed of deep, fractured bedrock and an overlying layer of chert. In the chert layer, groundwater flows through pore spaces, and porosity can range from 20 to 30 percent. Porosity in the rock portion of the aquifer is very low, and the groundwater flow is generally along secondary porosity routes, such as fractures and bedding planes. Groundwater storage is primarily in the overlying chert, and volume of water in the chert is controlled by its porosity and thickness. In addition to the large rock aquifers, sand and gravel deposits are found in the valley floor of the Coosa River and form small, local aquifers.

Well yield in the limestone and sandstone deposits is dependent on the interception of fractures and bedding plains in the aquifer. Wells that intercept several high yield fractures can produce several thousand gallons per minute, although most wells yield between 1 and 25 gallons per minute (Robinson et al. 1997). The water is suitable for municipal drinking water, but because of the typically low yield of wells it is not often used for municipal purposes. Extensive evaluations of the hydrogeology of the Valley and Ridge and Southwestern Appalachians can increase the likelihood of drilling a high yield well (Robinson et al. 1997). Wells in the sand and gravel aquifers in the valley floor of the Coosa River typically yield less than 10 gallons per minute.

2.1.1.1.5.2 Blue Ridge and Piedmont

The Blue Ridge and Piedmont are underlain by a metamorphic and igneous crystalline rock aquifer. The crystalline aquifer is overlain by a regolith of soils and saprolite of varying thicknesses, from 10 to 150 ft. The crystalline rocks have less than 2 percent primary porosity and little permeability. Most groundwater is stored in the saprolite, which has porosities of 20 to 30 percent. Water is transmitted from the saprolite to the crystalline bedrock via fractures that have formed in the rock from differential weathering at joints, faults, and quartz veins (Robinson et al. 1997). The volume of water stored in the saprolite is controlled by the porosity and thickness, while the volume of water stored in the bedrock is controlled by the degree of fracturing. The surface water drainage basins directly overlay the groundwater basins, and the two are interconnected (Robinson et al. 1997).



Major Aquifers

Figure 2.1-45

The crystalline rock aquifers are used for private water supplies and livestock watering. The groundwater supply in the crystalline aquifer is typically not sufficient to meet M&I supply demands (Robinson et al. 1997). Well yield is dependent on the number and type of intersections of crack and fractures in the bedrock. Wells typically yield 1-25 gallons per minute, but can range from 0 gallons per minute in wells with no fracture intersections to 700 gallons per minute in wells with primary fracture intersection (Robinson et al. 1997). Thorough evaluations of hydrogeologic settings can lead to an increased likelihood of developing ground-water resources, although recent studies have yielded mixed results.

2.1.1.1.5.3 Southeastern Plains Ecoregion Aquifer Systems

Aquifers in the Southeastern Plains ecoregion are composed of numerous self-confining to confining units. Water is stored in the porous-media aquifer in between the sand and gravel deposits. The wedge of unconsolidated to poorly consolidated material slowly dips toward the coast and increase in thickness to as much as 21,000 ft. Aquifers in the Coastal Plain are porous-media and solution-conduit aquifers, which are composed of carbonate rocks where water is stored in solution-enlarged fractures and bedding plains. The Southeastern Coastal Plain aquifer system is subdivided into five major aquifers. The aquifers are, from shallowest to deepest, the Lisbon aquifer, the Nanafalia-Clayton aquifer, the Ripley aquifer, the Eutaw aquifer, and the Tuscaloosa aquifer. The Floridan aquifer and Coastal lowland aquifer are also in the Southeastern Plains ecoregion. The recharge areas for the aquifers generally coincide with their areas of outcrop (Kidd et al. 1997).

The aquifers of the Southeastern Plains ecoregion aquifer system are difficult to distinguish from each other and are often mapped as one unit. The Lisbon Aquifer crops out at the fall line and is composed of sand and sandy limestone from the Eocene age. Yields are typically less than 100 gallons per minute and the aquifer is often used as a source for domestic wells. The Nanfalia-Clayton Aquifer has high yield that range from 75 to 900 gallons per minute. However, the water is mineralized in some locations and is not suitable for public or domestic drinking water. Wells yield range from 100 to 700 gallons per minute. The Ripley Aquifer is one of the most prominent aquifers in the Upper Cretaceous sediment. It is a major source of water in part of its outcrop area, supplying from 75 to 200 gallons per minute. The aquifer becomes thin and relatively impermeable toward the west of the ACT Basin and is not used as a source of water in those areas. The Eutaw and Tuscaloosa aquifer have been developed in conjunction for water supply. Both aquifers are used as sources of municipal water supply and yields range from 200 to 700 gallons per minute (Kidd et al. 1997).

The Floridan aquifer system is in the lower portion of the ACT and is composed of carbonate rocks that vary in thickness and transmissitivity. Water is stored in the secondary porosity zones, and wells that do not intercept the solution-enlarged fractures and bedding planes typically supply less than 10 gallons per minute of water. Most wells in the Floridan aquifer supply less than 50 gallons per minute, although some have ranged upwards to 175 gallons per minute. Sinkhole development is possible in areas with significant water-level declines because of groundwater withdrawal. The Floridan aquifer system is used for domestic water supplies (Kidd et al. 1997).

The Coastal lowlands aquifer system, at the very southern tip of the ACT Basin, is often used as a source for public water supplies. Well production in the sand and gravel beds ranges from 100 to 380 gallons per minutes. The aquifer is also used for domestic water supplies (Kidd et al. 1997).

2.1.1.2 Water Management and Use

2.1.1.2.1 Operation of USACE Projects

USACE regulations require developing a water control plan for each reservoir project and basin WCMs for the coordinated operation of multiple projects in a river basin. They also require that such manuals be updated or revised as necessary to conform with changing requirements from developments in the project area and downstream, improvements in technology, new legislation, and other relevant factors, provided that such revisions comply with existing federal regulations and established USACE policy. The water control plans for USACE reservoir projects in the ACT Basin need to be updated. The only approved *ACT Basin Reservoir Regulation Manual* is from December 1951. At that time, the only USACE reservoir that had been constructed in the ACT Basin was Allatoona Lake. Although separate water control plans for each USACE reservoir project in the ACT Basin have since been prepared, they too must all be updated.

Principal purposes for which the federal projects in the ACT Basin are operated consist of flood risk management, hydropower, navigation, fish and wildlife conservation, recreation, water supply, and water quality. Flood risk management, hydropower, and navigation were purposes specifically cited in the original authorizations of the ACT Basin projects. Functions such as recreation, water quality, and water supply, and fish and wildlife conservation are considered purposes under general legislation (Flood Control Act of 1944, P.L. 89-72, and P.L. 85-624). USACE policy states that legally authorized purposes recognized after project construction receive appropriate consideration when making water control decisions just as those for which costs have been allocated.

ACT Basin water control operations consider all project functions and account for the full range of hydrologic conditions, from flood to drought. Because actions taken at the upstream portion of the basin affect conditions downstream, the ACT projects (including APC projects) are operated as a system to the maximum extent possible rather than as a series of individual, independent projects. Balancing water control operations to meet each of those purposes varies between the individual projects and time of year. The projects' managers consider the often-competing purposes and conduct operations accordingly. When possible, they manage reservoir operations to complement and accommodate those purposes. For example, flood waters are evacuated to the greatest extent practicable through the powerhouse turbines to produce electricity. In addition to specific purposes for which the projects are operated, over the years a variety of activities (industrial and municipal water supply, in-stream recreation, water quality, and the like) have become dependent on the operational patterns of the projects.

Traditionally, the ACT projects had been operated such that hydropower requirements were controlled during the summer months when energy demands are high; navigation needs dominated during the fall, low-flow months. When rainfall causes water levels to rise excessively, flood-risk management operations override other project functions. During extreme drought conditions, water supply and water quality requirements have been the major operating concerns. That water management approach recognizes that extreme droughts can produce *either-or* situations under which project functions are nearly fully met or operations are directed primarily at meeting minimum water supply/water quality requirements, with other purposes relegated to a secondary, or restricted, function.

Project purposes and basic parameters guiding water management activities at each of USACE projects in the ACT Basin are discussed in Sections 2.1.1.1.4.1, 2.1.1.1.4.2, and 2.1.1.1.4.15 through 2.1.1.1.4.17. This section summarizes project operations and management objectives at USACE projects in the basin from the perspective of the authorized project purposes. Table 2.1-7 provides a summary of the operating project purposes for USACE projects in the ACT Basin.

Table 2.1-7.
Summary of project purposes for USACE reservoir projects in the ACT Basin

Operating purpose	Carters Lake	Allatoona Lake	Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake	Millers Ferry Lock and Dam and William "Bill" Dannelly Lake	Claiborne Lock and Dam and Lake
Flood risk management	X	X			
Hydropower	X	X	X	X	
Navigation	X	X	X	X	X
Recreation	X	X	X	X	X
Water supply	X	X			
Water quality	X	X	X	X	X
Fish and wildlife conservation	X	X	X	X	X

2.1.1.2.1.1 Flood Risk Management

Carters Lake provides flood risk management benefits to the rich farm lands along the Coosawattee and Oostanaula rivers. Peak flood stages are reduced as far downstream as Rome, Georgia, about 72 RMs downstream from the project (USACE, Mobile District 1979). Flood risk management operations at Allatoona Lake reduce peak stages of the Etowah River below the dam downstream to its confluence with the Oostanaula River at Rome. Releases of stored flood waters would not be made until the Rome stage falls below flood stage. Except for large floods as the March 1990 event, the Allatoona Lake flood storage can usually be evacuated in several weeks. Flood level reductions at Rome are primarily effected by operations at Allatoona Lake. Carters Lake usually provides for incidental flood stage reductions at Rome. Allatoona Lake controls about 28 percent of the total combined drainage area of the Etowah and Oostanaula rivers at Rome (4,010 sq mi), and Carters Lake controls about 9 percent of that area. The evacuation of flood storage at the Allatoona Lake and Carters Lake is coordinated so that the combined discharges will not cause or aggravate flooding at Rome. As a general rule, the Allatoona Lake flood inflows will be stored longer than the Carters Lake flood inflows because Allatoona Lake has a larger flood storage capacity and a shorter routing time to Rome. Flood operations at Allatoona Lake and Carters Lake also assist in the flood risk management operation at Weiss Lake on the Coosa River by reducing the inflows into that project during flood events. The extent to which Allatoona Lake can manage flood risk from a storm depends on the rainfall distribution and movement, storm centering, and flood characteristics. General area storms tend to be better managed because the local runoff downstream of Allatoona Lake will have flowed through Weiss Lake before the flood evacuation releases are required at Allatoona Lake (USACE, Mobile District 1993b).

The Robert F. Henry Lock and Dam, Millers Ferry Lock and Dam, and Claiborne Lock and Dam projects on the Alabama River are run-of-river projects and do not have dedicated storage capacity for flood risk management purposes. Those projects simply pass flood flows received from upstream projects and uncontrolled tributary streams, using the hydropower turbines, to the extent possible, and the spillways to pass flows.

2.1.1.2.1.2 Hydropower

Energy and capacity produced at USACE projects in the ACT Basin are marketed by SEPA, an agency of the U.S. Department of Energy (DOE), in accordance with the Flood Control Act of 1944. Power from Allatoona Lake on the Etowah River, Carters Lake on the Coosawattee River, and Robert F. Henry and Millers Ferry Lock and Dam projects on the Alabama River is marketed as part of a system of hydropower resources known as the Georgia-Alabama-South Carolina system. A system contract for those resources provides a portion of the power needs for several preference customers (cooperatives and municipals) throughout the southeast. The system also consists of the following projects: Hartwell, Richard B. Russell, and J. Strom Thurmond dams on the Savannah River and Buford, West Point, and Walter F. George dams on the Chattahoochee River.

Hydropower is a relatively small, but key, feature in meeting the power demands of the region. The importance of hydropower is that it is instantaneously available to meet extreme increases in power demand or to replace unexpected interruptions in thermoelectric generation. The 10 powerhouses in the Georgia-Alabama-South Carolina system have been operated most of the time as *peaking plants* in an integrated fashion to produce an aggregate hydropower supply for the system. As a result, power generation demands have been balanced between the projects weekly to enhance the long-term generating capability of the entire system. By integrating the projects' operation, the total utility and marketability of power produced for the entire system is greatly increased, and the adverse effects on the reservoirs are more balanced.

Droughts experienced over the basin in the past 20–30 years have revealed that, during extended low-flow periods, ACT projects' operation for hydropower production to meet the SEPA contract requests do not provide sufficient flexibility to adequately meet other authorized purposes. During such times, water taken from storage during the high-energy-demand months (June through September) would draw the pools down to such an extent that recreation would be affected in Allatoona Lake and Carters Lake and less storage would be available late in the year to meet other release requirements, such as for water quality or navigation. In such instances, hydropower production has been curtailed, as necessary, to balance the entire system operation.

Figure 2.1-21 depicts two zones in the conservation pool at Allatoona Lake. The zones are used to guide generation at the Allatoona Lake project toward meeting the overall system hydropower contract. When pool levels are in Zone 1, the project conditions are normal to wetter than normal. Most likely, other projects in the basin or in the federal hydropower system will similarly be normal to wetter than normal. Under those conditions, full consideration is given to meeting the power contract amounts developed by SEPA on balance with the other purposes of the project. Other operational considerations when the pool is in Zone 1 will be to balance the drawdown of Allatoona Lake with other lakes in the basin and other lakes in the hydropower system. Recreational impact levels (see Section 2.1.1.2.1.4 below) will be considered in making outflow decisions during the recreation season. Water quality and fish and wildlife conservation factors will also be given full consideration while in Zone 1 (USACE, Mobile District 1993b).

More conservative operations would be followed when pool levels are in Zone 2 at Allatoona Lake. A pool level in Zone 2 indicates dry or impending drought conditions. Careful, long-range analyses and projections of inflows, pool levels, and upstream and downstream water needs are made when pool levels fall into Zone 2. In Zone 2, the minimum generation to support dependable hydropower capacity would generally be run. If drought conditions become severe, Zone 2 would be reserved for emergency needs, either hydropower or downstream water supply, water quality, or other extreme needs. When projected conditions indicate a significant possibility of exhausting conservation storage, routine hydropower generation could be suspended and other conservative measures taken that would be appropriate to the drought severity. Continuous streamflow releases would be maintained to the extent possible throughout

any drought condition. The line demarcating Zones 1 and 2 is a guideline. When forecasts indicate that the pool level will be moving from one zone to another, USACE would make release decisions to bring about a smooth transition in outflow between the zones. The transition would typically occur over a one-ft pool elevation and within that transition zone (USACE, Mobile District 1993b).

Carters Lake and the downstream reregulation reservoir are operated under a *balance point method* for the pumped storage operation (USACE Mobile District 1979). When the pools are *balanced*, the actual inflows to the project are being released from the reregulation dam, and there is enough water in the reregulation pool above elevation 677 to allow the pumping units to restore the main reservoir to the top of the conservation pool elevation. That elevation varies from 1074 between May and September to 1,072 for the rest of the year. The normal, year-round operating range for the reregulation pool is 677 to 698. The 677 level assures enough water to permit a minimum flow of 240 cfs downstream for 3 days. The power customers have unrestrained use of the storage in the reregulation pool between 677 and 698 for generation and pumping, provided the main reservoir is at or below the top of the conservation pool level. The reregulation pool will likely reach both the maximum (698 ft) and the minimum level (677 ft) at least once during the course of the week. In addition, the power customers may request, daily, the use of the reregulation storage pool between elevations 696 and 698 for additional generation (USACE, Mobile District 1979).

At the Carters Lake project, generation during the weekdays normally occurs intermittently between 6 a.m. and 10 p.m. In general, little or no generation occurs during the weekend. Pumpback normally occurs between 10 p.m. and 6 a.m. during both the weekdays and weekends. Pumpback can also occur any time of the day when the power customers have excess energy and storage is available in the main pool (USACE, Mobile District 1979).

The Robert F. Henry and Millers Ferry Lock and Dam projects have relatively little conservation storage, are dependent on releases from the upstream impoundments, and consequently are operated essentially as run-of-river power plants. The outputs of the plants vary with changes in the inflow entering the Alabama River from the Coosa and Tallapoosa River projects and local tributary streams. Depending on flow, the plants are either continuously running (high flow) or peaking (low flow) on a 7-day basis. Power from the projects is marketed to provide a specific minimum capacity and weekly energy. When that obligation cannot be met, SEPA arranges for supplemental power from projects in the Georgia-Alabama-South Carolina system or purchase from other sources, or both.

2.1.1.2.1.3 Navigation

Allatoona Lake and Carters Lake, while originally authorized to support downstream navigation, are not regulated for navigation because they are distant from the navigation channel, and any releases for that purpose would be captured and reregulated by APC reservoirs downstream. Downstream navigation in the Alabama River benefits indirectly from the operation of the Allatoona Lake and Carters Lake projects for the other authorized purposes (USACE, HEC 1994).

Claiborne, William "Bill" Dannelly, and R.E. "Bob" Woodruff lakes are operated to maintain stable pool levels, coupled with the necessary channel maintenance dredging, to support sustained use of the authorized navigation channel. The navigation channel downstream of Claiborne Lock and Dam was initially designed for a 9-ft channel depth at a flow of approximately 8,500 cfs (or greater). As discussed in Section 2.1.1.1.4.13, APC operates its reservoirs on the Coosa and Tallapoosa rivers to provide JBT releases of at least 4,640 cfs (weekly average) near Montgomery, Alabama. Additional intervening flow or drawdown discharge from Robert F. Henry and Millers Ferry Lock and Dam projects must be used to provide a usable depth for navigation and, if those flow levels cannot be sustained, at least meet the 7Q10 flow of 6,600 cfs downstream of Claiborne Lock and Dam. However, the limited storage afforded in both

the Robert F. Henry and Millers Ferry Lock and Dam reservoirs (R.E. "Bob" Woodruff Lake and William "Bill" Dannelly Lake, respectively) can only help meet the 6,600 cfs level downstream of Claiborne Lock and Dam for a short period. As local inflows diminish or the storage is exhausted, a lesser amount would be released depending on the amount of local inflows (USACE, Mobile District 1974b). During low-flow periods, it is not always possible to provide the authorized 9-ft deep by 200-ft-wide channel dimensions, as discussed in more detail in Section 2.1.1.1.3.4.

2.1.1.2.1.4 Recreation

Allatoona Lake fluctuates significantly during the year, and the fluctuations can be even more extreme during periods of extremely dry weather. During peak recreation season, generally Memorial Day through Labor Day, USACE considers recreational needs at the Allatoona Lake project in making water management decisions. USACE has developed a series of threshold impact elevations that serves as a guide to understanding the recreational effects of water management decisions (USACE, Mobile District 1993). Those levels and definitions are as follows:

- Initial Impact Level–837. This is the elevation at which the recreational usage and recreation-related economy would begin to notice effects. Swimming areas would be reduced in size. Private docks would need adjusting, and some boating hazards can become evident in remote areas of the reservoir. Marina concessionaires would begin to need to move docks and water related business would decline.
- Recreation Impact Level–835. Recreation would be more severely affected at this level. All regular swimming areas will be exposed. Two boat ramps will be closed. Almost half of the private docks would be affected. Marina business would be severely reduced.
- Water Access Level–828. Recreation would be severely restricted. Only half of boat ramps would be usable. Private docks would be totally unusable. Hazards to navigation would be numerous. Marinas would have severe problems such as gas docks being grounded and some slips being unusable. There would be reduction in recreational business activity.

Carters Lake is designed to operate at a relatively stable pool level throughout the year under normal conditions (conservation pool level at elevation 1,074 ft during the summer and 1,072 ft during the winter). However, the pool level of the pool can drop significantly below those elevations under extremely dry conditions. In such cases, the use of water-related recreation facilities can be adversely affected. While these effects are considered in water management decisions at the project, the 1979 *Carters Lake Reservoir Regulation Manual* did not contain specific threshold impact elevations to guide water management decisions (USACE, Mobile District 1979). However, threshold impact levels were subsequently developed for the project. They are as follows:

- Initial Impact Level—1,068. The swim area would be reduced at Harris Branch Beach. No unmarked hazards to navigation would be expected at this level, and there would be no effects on the marina.
- Recreation Impact Level—1,060. Swim areas would be unusable because buoy lines could not be moved farther out. Harris Branch Beach would be closed. Boating and other water recreation activities would become increasingly hazardous because unmarked navigational hazards would begin to emerge. Two day-use boat ramp areas would be closed to the public.
- Water Access Level—1,055. Harris Branch Beach would be closed and swim areas remain unusable. Navigational hazards would become more prevalent. Boat slips at marinas would still be usable, but docks to the shoreline would be extremely sloped. Five boat ramp areas would be closed.

R.E. "Bob" Woodruff, William "Bill" Dannelly, and Claiborne lakes all have water-based recreation facilities. The lakes all have relatively stable pools except during flooding events. Water management activities for these run-of-river reservoirs are limited and have no measurable effect on recreational use.

The areas immediately downstream of dams typically have public access areas and are heavily used for recreation, principally fishing from the river banks or from boats. Public safety is an important consideration in the operation of USACE dams in the ACT Basin, especially for projects where peaking hydropower operations, when initiated, can rapidly increase flow and stage conditions in downstream areas.

In order to warn the public at the start of a hydropower release downstream at Allatoona Dam, a warning horn sounds when the operator initiates a generator start. An audio detector verifies the horn has sounded and allows the unit start-up sequence to continue. The horn will continue to sound for three minutes. The spillway at Allatoona Dam has a manually operated warning horn switch, located at gate No.1. The horn switch is activated by the operator opening the spillway gates. The horn will sound for three minutes. There is no audio detector for the spillway gates.

At Carters Dam, a warning horn sounds when an operator initiates a generator start. An audio detector verifies the horn has sounded and allows the unit start-up sequence to continue. The horn will continue to sound for three minutes. The reregulation dam does not have a downstream warning horn system because the routine releases are small and gradual. If there is a need for a large single gate change at the reregulation dam, the rangers would specifically notify individuals in the recreation area immediately downstream of the dam.

At R.F. Henry and Millers Ferry locks and dams, a warning horn is activated by the operator from the unit controls at the start of a hydropower release downstream. An audio detector verifies the horn has sounded and allows the unit start-up sequence to continue. The horn will continue to sound for two minutes before the unit starts. The Millers Ferry spillway has three horns that are initiated from the Millers Ferry/Jones Bluff Powerhouse SCADA system. The horns are activated by powerhouse operators before a gate is raised from its sill. The horns sound for two minutes, and are verified through audio detectors and electrical current detectors.

Since Claiborne Lock and Dam has continuous overflow of the spillway that gradually increases or decreases depending on flow conditions in the Alabama River, no specific warning system is in place at the project.

USACE Mobile District also uses the its public web site, http://water.sam.usace.army.mil, to share real-time, historical, and general information with the public about conditions at the projects as well as telephone auto-answer recorded messages at the projects. More information on public safety/public communication at USACE projects is available in the Master WCM and individual project manuals in Appendix A to the EIS.

More detailed information on specific recreation facilities at USACE lakes in the ACT basin is provided in Sections 2.4.1.3 (Land Use at ACT Basin Projects) and 2.6.1.6 (Socioeconomic Resources – Recreation). The ACT Master Manual and individual projects WCMs in Appendix A to the EIS also contain additional information and maps depicting recreational facilities at these projects.

2.1.1.2.1.5 Water Supply

The City of Chatsworth, Georgia, has a water supply storage agreement with USACE for 818 ac-ft of storage in Carters Lake. The City of Cartersville, Georgia, and CCMWA have water supply storage agreements with USACE for 6,371 ac-ft and 13,140 ac-ft of storage, respectively, in Allatoona Lake.

More discussion on the details associated with these water supply storage agreements is provided in Section 4.2.6

Minimum flows associated with USACE and APC projects in the ACT Basin [240 cfs from the Allatoona Lake and Carters Lake projects as well as target releases of 4,640 cfs from APC JBT projects near Montgomery, Alabama, and 6,600 cfs (7Q10 flow) downstream of Claiborne Lock and Dam and Lake] are generally associated with water quality, fish and wildlife conservation, and navigation needs in the system. However, the minimum flows also support water supply needs of users throughout the system.

2.1.1.2.1.6 Water Quality

Minimum flows of 240 cfs are released from both the Carters Lake and Allatoona Lake projects to maintain downstream water quality. The minimum continuous release from Allatoona Lake is accomplished by operating the small turbine-generator unit continuously. If the small unit is out of service, continuous releases can be made through the spillway or sluices. During long periods of only minimum flow release, some water from the large turbines will periodically be released to attain minimum flows to (1) keep the turbine-generators in good operating condition and (2) provide streamflow diversity for environmental purposes. In addition to the turbines releasing water for continuous minimum streamflow maintenance, releases can be made through the spillway or through sluices. Releases through the spillway, particularly during periods when the lake would be stratified, can be used to help maintain acceptable water quality conditions downstream (USACE, Mobile District 1993). Minimum flows for downstream water quality purposes are provided from the reregulation pool at Carters through the balanced approach for pumped storage hydropower operations as described in Section 2.1.1.2.1.2.

Flows from the Robert F. Henry and Millers Ferry Lock and Dam projects are used downstream to help provide the 7Q10 flow of 6,600 cfs downstream of Claiborne Lock and Dam and Lake. Several industries on the Alabama River have designed effluent discharges on the basis of that dilution flow. Whenever flows recede to that level, conditions are closely monitored so that adequate warning can be given if it is necessary to reduce the flows even further in response to extremely dry conditions. As projections indicate that drought conditions could intensify and that further flow reductions might be required, the existing WCMs for the Robert F. Henry and Millers Ferry Lock and Dam projects prescribe a process for notification of, and coordination with, state and federal agencies and affected industries along the river (USACE, Mobile District 1999; USACE, Mobile District 1991). Aside from the minimum flow target downstream of Claiborne Lock and Dam, no other water management activities occur at the Robert F. Henry and Millers Ferry Lock and Dam projects to specifically address water quality objectives.

2.1.1.2.1.7 Fish and Wildlife Conservation

Fish and wildlife conservation is an authorized purpose of the reservoirs in the ACT Basin in accordance with P.L. 85-64 (Fish and Wildlife Coordination Act of 1958). All USACE reservoirs in the ACT Basin support important fisheries and are operated accordingly, consistent with other project purposes. In addition to fishery management, such operations include aquatic plant control and waterfowl management activities. The various projects in the basin have specific operations for fish and wildlife conservation, which are described in the individual reservoir regulation manuals for the projects.

The USACE South Atlantic Division Regulation, SADR PDS-O-1 (May 31, 2010), *Lake Regulation and Coordination for Fish Management Purposes,* and Mobile District Draft Standard Operating Procedure (SOP) 1130-2-9 (February 2005), *Reservoir Regulation and Coordination for Fish Management Purposes,* were developed to address lake regulation and coordination for fish spawn management purposes. The draft District SOP was developed in response to an earlier version of the SADR (2001). The SADR and District SOP specifically apply to the Allatoona Lake project in the ACT Basin. They

identify principal fish spawning periods and provide general guidance for management of lake levels during the annual fish spawning period between March and May, primarily targeted at largemouth bass. The major goal of the operation is to not lower the lake level more than 6 inches in elevation during the reproduction period to prevent stranding or exposing fish eggs.

Minimum flow requirements of 240 cfs downstream of Allatoona Lake and Carters Lake projects for water quality purposes also support fish and wildlife conservation downstream of the projects, particularly during periods of extremely dry weather. APC's release target of 4,640 cfs from JBT projects near Montgomery, Alabama (at the headwaters of the R.E. "Bob" Woodruff Lake), while principally intended to support downstream navigation and water quality needs, also provides sustained flows for fish and wildlife conservation.

For each of the remaining USACE reservoirs in the ACT Basin (R.E. "Bob" Woodruff, William "Bill" Dannelly, and Claiborne lakes), USACE conducts routine natural resource management activities to improve fishery conditions. However, the lakes do not have specific water management procedures directed at fish and wildlife conservation except for seasonal operation of the locks for fish passage as described below. The impoundments support a healthy sport fishery. The pools are maintained at fairly constant levels, except during floods when high inflows cause reservoir levels to rise. The relatively stable pool during the spring spawning season is beneficial to the production of crappie, largemouth bass, Alabama (spotted) bass, shellcracker, warmouth, and sunfishes. However, because of the regulation of the project for navigation and hydropower, it might not be possible to maintain the optimum conditions for fish spawning that can be accomplished at other projects (USACE, Mobile District 1974b).

During each spring since 2009 (from February through May), USACE has operated the locks at Claiborne Lock and Dam and at Millers Ferry Lock and Dam to facilitate the upstream passage of migratory fishes. USACE has cooperated with the Nature Conservancy, the USFWS, Alabama Department of Conservation and Natural Resources, Auburn University and the Geological Survey of Alabama to develop a schedule to most effectively implement the operation. There are slight differences in the locking schedule each year, and alterations can occur depending on local hydrologic conditions and staffing schedules for the project site. The operation consists of opening the lower lock gate and allowing fish to enter. The lock is allowed to remain open for a period of 4 to 6 hours. The lock is then filled to the lake elevation, the upper gate is opened, and fish are allowed to enter and exit for the next 4 to 6 hours, after which the cycle is repeated. Vessel passage, maintenance, safety and other operational requirements continue unaffected by the fish passage schedule. Studies are ongoing to determine the success and most appropriate techniques to employ to provide maximum benefit to fish populations.

USACE implements routine wildlife conservation activities on project lands at each of the ACT projects, consistent with other operational activities. In addition, as discussed in Section 2.1.1.1.4.14, 10,566 ac have been acquired contiguous to project lands on "Bob" Woodruff Lake for purposes of fish and wildlife mitigation to address impacts associated with construction of the Tennessee-Tombigbee Waterway. Further, as discussed in Sections 2.1.1.1.4.15 and 2.1.1.1.4.16, about 1,703 ac of project lands on "Bill Dannelly Lake and 2,567 ac on Claiborne Lake have been designated and are intensively managed for wildlife mitigation for impacts resulting from construction of the Tennessee-Tombigbee Waterway.

2.1.1.2.1.8 Special Releases and Reservoir Operations

Occasionally, a temporary deviation from the normal regulation of a lake is needed to accommodate a special activity in the lake area or downstream. Construction accounts for a major portion of those incidents and includes utility stream crossings, bridge work, and improvements to recreation structures, tailrace surveying and major construction contracts. Special releases have also been made to help grounded barges downstream of Claiborne Lock and Dam.

Special releases are made to facilitate lake shore cleanup operations and recreational activities such as fishing tournaments. Special high-flow releases from the spillway have also been made to allow rapid water rescue training by emergency medical services personnel. Special operations have been made to facilitate search and rescue associated with drowning victims.

Variances at Allatoona Lake to allow early refilling to the summer pool have also been implemented. That has occurred during dry springs to capture limited rainfall to ensure refilling of the project summer pool levels.

Special operations and deviations are generally coordinated with the Mobile District Water Management Section in advance. The requests for release changes are usually for a few hours or days. Before a deviation is granted, the upstream watershed conditions, potential flood threat, conditions of downstream lakes, environmental factors, and water supply and hydropower needs are considered. To the extent that hydrologic conditions in the basin allow, water control regulation can assist with critical stakeholder needs throughout the basin, including water quality considerations. Processes for deviations from "normal" reservoir regulation, as defined in the ACT Master WCM and individual project WCMs are discussed in more detail in Paragraph 7-15 of the WCM documents, Any extended temporary deviation or long-term adjustment in reservoir operations would be approved by the USACE South Atlantic Division in accordance with established review and coordination procedures.

2.1.1.2.2 Coordination between USACE and APC Project Operations

FERC (2009) summarizes the history and key areas of collaboration regarding project operations on the Coosa River portion of the ACT Basin. Corps and APC have a long history on the Coosa River. APC completed construction of Lay Lake in 1914. APC received a 50-year license from the Federal Power Commission (the predecessor to FERC) for Mitchell Lake in 1921, and APC completed the project in 1923. APC received a 50-year license from the Federal Power Commission for the Jordan Dam and Lake in 1925, and completed construction in 1928. In 1925, APC conducted a study of the storage possibilities of the Coosa River upstream of the existing Lay Lake in regard to the development of five additional power dams. In 1928 APC prepared a report on complete *canalization* of the Coosa River. That report included the study of a power and navigation dam at the site of the existing Federal Lock 2 (identified as the Patlay site).

In 1934 USACE developed a general plan for the overall development of the Alabama-Coosa River system. That plan included a power and navigation dam on the Coosa River at the Patlay site previously studied by APC. Patlay (Lock 2) is about 1.5 mi upstream from the H. Neely Henry Lake.

Further studies were directed by Congress in resolutions adopted by the Committee on Rivers and Harbors, House of Representatives, on April 1, 1936, and April 28, 1936, and then by the Committee on Commerce, U.S. Senate, on January 18, 1939. In response to those resolutions, an interim report was submitted to Congress in October 1941. The report recommended development of the Alabama-Coosa River and tributaries for navigation, flood risk management, power generation, and other purposes in accordance with the plans proposed by the Chief of Engineers. The improvement, which was outlined in H.D. No. 414, included a dam with a powerhouse at the Patlay site.

On June 28, 1954, the 83rd Congress enacted P.L. 83-436, which suspended the authorization under the River and Harbor Act of March 2, 1945, insofar as it concerned federal development of the Coosa River for the generation of electric power. That was done to permit development of the river by private interests under a license to be issued by the Federal Power Commission (now FERC). The law stipulated that the license shall require provisions for flood risk management storage and for future navigation. It further stated that the projects must be operated for flood risk management and navigation in accordance with reasonable rules and regulations of the Secretary of the Army.

APC began commercial operations of the Weiss Lake, Logan Martin Lake, H. Neely Henry Lake, and Bouldin Dam in 1962, 1964, 1966, and 1967, respectively.

The relationship between APC and USACE in developing the Tallapoosa River Basin is closely linked as well. APC began construction on Lake Martin in 1923, and the project was placed in service in 1926. The Yates Lake downstream of Lake Martin was completed in 1928, and the Thurlow Lake downstream of Yates Lake was completed in 1930.

The U.S. government was authorized by the River and Harbor Act, approved March 2, 1945, (59 Stat. 10), to develop a site on the Tallapoosa River at Crooked Creek for flood risk management, hydropower and other purposes. The project was a part of the comprehensive plan for developing Alabama-Coosa River System as contained in H.D. No. 414, 77th Congress, 1st Session. Subsequently, Section 12 of P.L. 89-789 (80 Stat. 1405), approved November 7, 1966, suspended the authority for 2 years, with respect to hydropower, to permit development of the Tallapoosa River by private concerns.

APC on November 7, 1966, filed an application for a preliminary permit with the Federal Power Commission (now FERC) to study the Crooked Creek site for development. Subsequently, APC filed an application for a license for the proposed project on November 5, 1968. On December 28, 1973, the Federal Power Commission issued a license to APC for construction of the Crooked Creek Hydroelectric Project, No. 2628. APC requested a name change and on February 15, 1974, the project was renamed R.L. Harris Lake. The project was completed and placed into service in 1983.

USACE is responsible for the review and approval of the flood risk management plans, as reflected in WCMs for Weiss, H. Neely Henry, and Logan Martin lakes on the Coosa River, and R.L. Harris Lake on the Tallapoosa River, all of which are APC projects with flood storage. The latest USACE-approved WCMs for Weiss, H. Neely Henry, and Logan Martin lakes are dated 1965, 1979, and 1968, respectively, and the R.L. Harris Lake WCM is dated 2003. The purpose of the WCMs is to define the plan of operation at the reservoirs during the occurrence or threatened occurrence of damaging flood conditions at downstream stations, when such conditions can be alleviated or partially alleviated by the operation of the dam and power plant in the interest of flood risk management. The WCMs also define the plan of operation per USACE ER 33 CFR 208.11 *Use of Storage Allocated for Flood Control and Navigation at Non-Corps Projects.*

Along with the WCMs, USACE and APC developed a MOU for each applicable project to clarify the responsibilities of the two entities with regard to operation of the projects for flood risk management and other purposes and to provide for the orderly exchange of hydrologic data. The applicable MOU for each project will be updated upon completion and approval of the WCM update. USACE must approve any changes in the flood risk management operations of these projects.

2.1.1.2.3 Water Withdrawals, Consumptive Use, and Return Flows in the ACT Basin

2.1.1.2.3.1 Surface Water Withdrawals

2.1.1.2.3.1.1 Georgia

Table 2.1-8 provides a summary of permitted surface water withdrawals for M&I uses in the ACT Basin in Georgia (GAEPD 2009a). The surface water withdrawal permits are required by Georgia law for withdrawals in excess of 100,000 gallons per day (gpd), and they are issued by Georgia EPD. More detailed discussion on Georgia's water withdrawal permit program is provided in Section 2.1.1.2.5.1.1. The information in Table 2.1-8 is presented beginning with the permits in the most upstream counties in the Coosa River watershed working downstream, followed by those in the Tallapoosa River basin. The withdrawal limits for each permit are defined by two numbers (both expressed in mgd): (1) a maximum

daily limit (for any day) and (2) an average daily limit (based on a monthly average). The permitted withdrawal limits depicted in the table do not necessarily reflect actual quantities of water withdrawn by permit holders but they do define the maximum allowable amounts for each permit.

Table 2.1-8.
M&I surface water withdrawal permits in the ACT Basin (Georgia)

River basin	Permit holder	Permit number	County	Source water	Permit limit max day (mgd)	Permit limit monthly average (mgd)
Coosa River Basin (Georgia)—upstream counties to downstream counties						
Coosa	Dalton Utilities - Conasauga R	155-1404-01	Whitfield	Conasauga River	49.400	40.300
Coosa	Dalton Utilities - Mill Creek	155-1404-02	Whitfield	Mill Creek	13.200	7.500
Coosa	Dalton Utilities - Coahulla Cr	155-1404-03	Whitfield	Coahulla Creek	6.000	5.000
Coosa	Dalton Utilities - Freeman Springs	155-1404-04	Whitfield	Freeman Springs	2.000	1.500
Coosa	Dalton Utilities - River Road	155-1404-05	Whitfield	Conasauga River	35.000	18.000
Coosa	Chatsworth Water Works Commission	105-1405-01	Murray	Holly Creek	1.100	1.000
Coosa	Chatsworth Water Works Commission	105-1405-02	Murray	Eton Springs	1.800	1.800
Coosa	Chatsworth Water Works Commission	105-1409-01	Murray	Carters Lake	2.550	2.300
Coosa	Chatsworth, City of	105-1493-02	Murray	Coosawattee River	2.200	2.000
Coosa	Ellijay - Gilmer County W & S Authority	061-1407-01	Gilmer	Ellijay River	0.550	0.450
Coosa	Ellijay - Gilmer County W & S Authority	061-1408-01	Gilmer	Cartecay River	4.000	4.000
Coosa	Calhoun, City of	064-1411-03	Gordon	Big Spring	7.000	6.000
Coosa	Calhoun, City of	064-1412-01	Gordon	City Of Calhoun Spring	0.638	0.537
Coosa	Calhoun, City of	064-1492-02	Gordon	Oostanaula River	6.200	3.000
Coosa	Calhoun, City of	064-1493-01	Gordon	Coosawattee River	18.000	16.000
Coosa	Jasper, City of	112-1417-02	Pickens	Long Swamp Creek	1.000	1.000
Coosa	Bent Tree Community, Inc.	112-1417-03	Pickens	Chestnut Cove Creek	0.250	0.230
Coosa	Bent Tree Community, Inc.	112-1417-04	Pickens	Lake Tamarack	0.250	0.230
Coosa	Big Canoe Utilities Company, Inc.	112-1417-05	Pickens	Lake Petit	1.000	1.000
Coosa	Big Canoe Utilities Company, Inc.	112-1417-06	Pickens	Blackwell Creek	2.650	2.650
Coosa	Etowah Water & Sewer Authority	042-1415-01	Dawson	Etowah River	5.500	4.400
Coosa	Eagle Point Landfill LLC	058-1417-07	Forsyth	On-site sedimentation ponds	0.210	0.130
Coosa	Cherokee County Water & Sewerage Auth	028-1416-01	Cherokee	Etowah River	43.200	36.000

Table 2.1-8. (continued)

River basin	Permit holder	Permit number	County	Source water	Permit limit max day (mgd)	Permit limit monthly average (mgd)
Coosa River Basin (Georgia)—upstream counties to downstream counties						
Coosa	American Proteins, Inc.	028-1491-03	Cherokee	Etowah River	5.000	4.500
Coosa	Canton, City of	028-1491-04	Cherokee	Etowah River	23.000	18.700
Coosa	Canton, City of (Hickory Log Creek)	028-1491-05	Cherokee	Etowah River	39.000	39.000
Coosa	Bartow County Water Department	008-1411-02	Bartow	Bolivar Springs	0.800	0.800
Coosa	Adairsville, City of	008-1412-02	Bartow	Lewis Spring	5.100	4.100
Coosa	New Riverside Ochre Company, Inc.	008-1421-01	Bartow	Etowah River	5.000	5.000
Coosa	New Riverside Ochre Company, Inc.	008-1421-02	Bartow	Etowah River	6.000	6.000
Coosa	Emerson, City of	008-1422-02	Bartow	Moss Springs	0.630	0.500
Coosa	Gerdau AmeriSteel US, Inc. – Cartersville Steel Mill	008-1423-01	Bartow	Pettit Creek	2.000	1.500
Coosa	Cartersville, City of	008-1423-04	Bartow	Etowah River	26.420	23.000
Coosa	Georgia Power Co. - Plant Bowen	008-1491-01	Bartow	Etowah River	520.000	85.000
Coosa	Cartersville, City of	008-1491-06	Bartow	Allatoona Lake	21.420	18.000
Coosa	CCMWA	008-1491-05	Cobb	Allatoona Lake	86.000	78.000
Coosa	La Fayette, City of - Dry Creek	146-1401-01	Walker	Dry Creek	1.000	0.900
Coosa	La Fayette, City of - Big Spring	146-1401-02	Walker	Big Spring	1.650	1.310
Coosa	Mount Vernon Mills - Riegel Apparel Div.	027-1401-03	Chattooga	Trion Spring	9.900	6.600
Coosa	Summerville, City of	027-1402-02	Chattooga	Raccoon Creek	3.000	2.500
Coosa	Summerville, City of	027-1402-04	Chattooga	Lowe Spring	0.750	0.500
Coosa	Mohawk Industries, Inc.	027-1402-05	Chattooga	Chattooga R./ Raccoon Cr.	4.500	4.000
Coosa	Oglethorpe Power Corp.	057-1402-03	Floyd	Heath Creek	3,838.000	3,030.000
Coosa	Floyd County - Brighton Plant	057-1414-02	Floyd	Woodward Creek	0.800	0.700
Coosa	Cave Spring, City of	057-1428-06	Floyd	Cave Spring	1.500	1.300
Coosa	Floyd County	057-1428-08	Floyd	Old Mill Spring	4.000	3.500
Coosa	Berry Schools, The (Berry College)	057-1429-01	Floyd	Berry (Possum Trot) Reservoir	1.000	0.700
Coosa	TIN, Inc.	057-1490-01	Floyd	Coosa River	34.000	32.000
Coosa	Georgia Power Co. - Plant Hammond	057-1490-02	Floyd	Coosa River	655.000	655.000
Coosa	Rome, City of	057-1492-01	Floyd	Oostanaula & Etowah R	18.000	16.400
Coosa	Rockmart, City of	115-1425-01	Polk	Euharlee Creek	2.000	1.500
Coosa	Cedartown, City of	115-1428-04	Polk	Big Spring	3.000	2.600

Table 2.1-8. (continued)

River basin	Permit holder	Permit number	County	Source water	Permit limit max day (mgd)	Permit limit monthly average (mgd)
Coosa River Basin (Georgia)—upstream counties to downstream counties						
Coosa	Polk County Water Authority	115-1428-05	Polk	Aragon, Ammons, & Mulco Springs	1.600	1.100
Coosa	Polk County Water Authority	115-1428-07	Polk	Deaton Spring	4.000	4.000
Tallapoosa River Basin (Georgia)						
Tallapoosa	Haralson County Water Authority	071-1301-01	Haralson	Tallapoosa River	3.750	3.750
Tallapoosa	Bremen, City of	071-1301-02	Haralson	Beech Creek & Bremen Reservoir (Bush Creek)	0.800	0.580
Tallapoosa	Bowdon, City of - Indian	022-1302-01	Carroll	Indian Creek	0.400	0.360
Tallapoosa	Southwire Company	022-1302-02	Carroll	Buffalo Creek	2.000	1.000
Tallapoosa	Villa Rica, City of	022-1302-04	Carroll	Lake Paradise & Cowens Lake	1.500	1.500
Tallapoosa	Carrollton, City of	022-1302-05	Carroll	Little Tallapoosa River	12.000	12.000
Tallapoosa	Bowdon, City of - Lake Tysinger	022-1302-06	Carroll	Lake Tysinger	4.100	3.500

Source: GAEPD 2009a; GAEPD 2013

Fanning and Trent (2009) contains a comprehensive inventory of surface water use for Georgia in 2005. Table 2.1-9 summarizes specific M&I surface water withdrawals in the ACT Basin using data from that report. Surface water use in the ACT Basin in Georgia in 2005 totaled 788.98 mgd. That surface water use, summarized by water use category, is presented in Table 2.1-10. Overall, the most significant water use within the Georgia portion of the ACT Basin is for thermoelectric power generation (72.8 percent). Public water supply represents about 20 percent of the surface water withdrawals. According to the 2005 analysis, only about 3.5 percent of surface water use in the Georgia portion of the ACT Basin is used for irrigation and livestock.

Table 2.1-9.
M&I surface water withdrawals in the ACT Basin (Georgia)

Basin (subbasin)	Withdrawal by	County	Withdrawal (mgd)
Coosa River Basin (Georgia)			
Coosa (Conasauga)	Dalton Utilities	Whitfield	35.38
Coosa (Conasauga)	City of Chatsworth	Murray	1.26
Coosa (Coosawattee)	Ellijay-Gilmer County Water System	Gilmer	3.12
Coosa (Coosawattee)	City of Fairmount	Gordon	0.06
Coosa (Oostanaula)	City of Calhoun	Gordon	9.10
Coosa (Etowah)	Big Canoe Corporation	Pickens	0.48
Coosa (Etowah)	City of Jasper	Pickens	1.00
Coosa (Etowah)	Bent Tree Community	Pickens	0.07
Coosa (Etowah)	(Rubber)	Pickens	0.01
Coosa (Etowah)	Etowah Water and Sewer Authority	Dawson	1.50

Table 2.1-9. (continued)

Basin (subbasin)	Withdrawal by	County	Withdrawal (mgd)
Coosa River Basin (Georgia)			
Coosa (Etowah)	Town of Dawsonville	Dawson	0.10
Coosa (Etowah)	City of Canton	Cherokee	2.83
Coosa (Etowah)	Cherokee County Water System	Cherokee	15.81
Coosa (Etowah)	Gold Kist, Inc.	Cherokee	1.94
Coosa (Etowah)	City of Cartersville	Bartow	13.26
Coosa (Etowah)	New Riverside Ochre Company, Inc. (Chemicals)	Bartow	1.67
Coosa (Etowah)	Gerdau AmeriSteel US, Inc. – Cartersville Steel Mill (Primary metals)	Bartow	0.16
Coosa (Etowah)	Georgia Power Co – Plant Bowen	Bartow	38.92
Coosa (Etowah)	CCMWA	Bartow	44.42
Coosa (Upper Coosa)	City of Lafayette	Walker	1.20
Coosa (Upper Coosa)	City of Summerville	Chattooga	2.05
Coosa (Upper Coosa)	Mount Vernon Mills – Riegel Apparel Division (Textiles)	Chattooga	2.74
Coosa (Oostanaula)	(Domestic/Commercial)	Floyd	0.30
Coosa (Etowah / Oostanaula)	City of Rome	Floyd	9.98
Coosa (Upper Coosa)	Floyd County Water System	Floyd	2.57
Coosa (Upper Coosa)	Inland-Rome Inc. (Paper)	Floyd	25.74
Coosa (Upper Coosa)	Georgia Power Co - Plant Hammond	Floyd	535.00
Coosa (Upper Coosa)	Polk County Water Authority	Polk	2.22
Coosa (Etowah)	Vulcan Construction Materials	Polk	0.09
Tallapoosa River Basin (Georgia)			
Tallapoosa (Upper)	City of Bremen	Haralson	0.32
Tallapoosa (Upper)	Haralson County Water Authority	Haralson	2.05
Tallapoosa (Upper)	City of Bowdon	Carroll	0.75
Tallapoosa (Upper)	Southwire Company	Carroll	0.09
Tallapoosa (Upper)	City of Carrollton	Carroll	5.37
Tallapoosa (Upper)	City of Temple	Carroll	0.26
Tallapoosa (Upper)	City of Villa Rica	Carroll	0.58
Tallapoosa (Upper)	Carroll County Water System	Carroll	4.08

Table 2.1-10.
Surface water use—ACT Basin (Georgia, 2005)

Water use category	Quantity (mgd)	% of total
Total Use	788.98	100%
Public Supply	154.78	19.6%
Domestic and Commercial	0.30	0.0%
Industrial and Mining	32.49	4.1%
Irrigation	11.31	1.4%
Livestock	16.18	2.1%
Thermoelectric Power Generation	573.92	72.8%

On the basis of studies conducted by Dr. James E. Hook et al. (2009a, 2009b), estimates of surface water pumping rates for agricultural irrigation in the Coosa and Tallapoosa River basins (for year 2011) are presented in Table 2.1-11. In the tables, the *wet year* equals the wettest 25th percentile (1 in 4 years) and *dry year* equals the driest 25th percentile (1 in 4 years). The results of the studies are being used to characterize and quantify surface water withdrawals for agricultural irrigation associated with development of the Georgia Comprehensive Statewide Water Management Plan (SWP). Surface water withdrawals for agricultural irrigation in the Coosa and Tallapoosa River basins are relatively minor, ranging from a total of 2.76 mgd in a wet year to 9.96 mgd in a dry year. Approximately 75 percent of those agricultural surface water withdrawals occur in the Etowah River subbasin. Those estimates by Dr. James E. Hook et al. (2009a, 2009b) indicate that surface water withdrawals for agricultural irrigation in the Georgia portion of the ACT Basin might be smaller than the estimates presented in the 2005 Georgia water use report (Fanning and Trent 2009).

Table 2.1-11.
Coosa and Tallapoosa River basins, Georgia agricultural irrigation (surface water) annualized pumping rates in mgd (estimated for year 2011)

Basin/subbasin Hydrologic Unit Code (HUC)	Wet year	Median year	Dry year
Basin Total – Coosa River	2.76	6.06	9.96
Conasauga (03150101)	0.12	0.23	0.36
Coosawattee (03150102)	0.39	0.70	1.08
Oostanaula (03150103)	0.31	0.56	0.86
Etowah (03150104)	1.93	4.58	7.67
Upper Coosa (03150105)	0	0	0
Basin Total – Tallapoosa River	0	0	0
Upper Tallapoosa (03150108)	0	0	0

Source: Hook et al. 2009a, 2009b

2.1.1.2.3.1.2 Alabama

Hutson et al. (2009) contains a comprehensive inventory of surface water use for Alabama as of 2005. Table 2.1-12 summarizes specific M&I surface water withdrawals in the Alabama portion of the ACT Basin, based on data from that report. Surface water use in the ACT Basin in Alabama totaled 1,337.11 mgd. Table 2.1-13 provides a summary of surface water use, by water use category. Overall, the most significant water use within the Alabama portion of the ACT Basin is thermoelectric power generation (72 percent). Public water supply represents about 13 percent of surface water withdrawals. According to the analysis of 2005 information, less than 3 percent of surface water use in the Alabama portion of the ACT Basin is for irrigation and livestock.

Table 2.1-12.
M&I surface water withdrawals in the ACT Basin (Alabama)

Basin (subbasin)	Withdrawal by	County	Withdrawal (mgd)
Coosa River Basin (Alabama)			
Coosa (Upper)	Centre Water Works & Sewer Board	Cherokee	1.19
Coosa (Upper)	Piedmont Water Works & Sewer Board	Calhoun	0.93
Coosa (Middle)	Jacksonville Water Works & Sewer Board	Calhoun	1.34
Coosa (Middle)	Anniston Water Works & Sewer Board	Calhoun	0.08
Coosa (Middle)	Fort Payne Water Works Board	DeKalb	8.10
Coosa (Middle)	Goodyear Tire and Rubber Company	Etowah	9.87
Coosa (Middle)	Gadsden Water Works & Sewer Board	Etowah	14.86
Coosa (Middle)	Alabama Power Co – Gadsden Steam Plant	Etowah	142.68
Coosa (Middle)	SIC 32 – Unnamed Stone, Glass, Clay, and/or Concrete Products	St. Clair	3.49
Coosa (Middle)	Talladega/Shelby Water Treatment Plant	Talladega	6.44
Coosa (Middle)	Talladega County Water Department	Talladega	0.81
Coosa (Middle)	Talladega Water Works & Sewer Board	Talladega	1.62
Coosa (Middle)	Bowater Newsprint, Coosa Pines Operation	Talladega	52.47
Coosa (Lower)	Sylacauga Utilities Board	Talladega	3.25
Coosa (Lower)	SIC 22 – Unnamed Textile	Talladega	0.89
Coosa (Lower)	Goodwater Water Works & Sewer Board	Coosa	0.46
Coosa (Lower)	Alabama Power Co – E.C. Gaston Plant	Shelby	812.32
Coosa (Lower)	Clanton Waterworks & Sewer Board	Chilton	1.79
Coosa (Lower)	Five Star Water Supply	Elmore	5.46
Tallapoosa River Basin (Alabama)			
Tallapoosa (Upper)	Heflin Water Works	Cleburne	0.51
Tallapoosa (Upper)	Wedowee Gas, Water, and Sewer	Randolph	0.39
Tallapoosa (Middle)	Roanoke Utilities Board	Randolph	1.29
Tallapoosa (Middle)	Clay County Water Authority	Clay	1.87
Tallapoosa (Middle)	Lafayette	Chambers	0.53
Tallapoosa (Middle)	Central Elmore Water & Sewer Authority	Elmore	4.83
Tallapoosa (Middle)	Alexander City Water Department	Tallapoosa	10.57
Tallapoosa (Lower)	West Point Home, Inc	Lee	2.23
Tallapoosa (Lower)	Opelika Water Works Board	Lee	2.61
Tallapoosa (Lower)	Auburn Water Works Board	Lee	5.75
Tallapoosa (Lower)	Tallassee	Tallapoosa	1.98
Tallapoosa (Lower)	Tuskegee Utilities	Macon	2.71
Tallapoosa (Lower)	Montgomery Water Works & Sewer Board	Montgomery	25.17
Alabama River Basin			
Alabama (Upper)	Montgomery Water Works & Sewer Board	Montgomery	10.40
Alabama (Upper)	International Paper – Selma (formerly Hammermill)	Autauga	30.63
Alabama (Upper)	Southern Power Co – Plant E. B. Harris	Autauga	4.14
Alabama (Cahaba)	Birmingham Water Works & Sewer Board	Shelby	52.90
Alabama (Middle)	International Paper – Pine Hill	Wilcox	21.04
Alabama (Lower)	Alabama River Cellulose LLC	Monroe	54.61

Source: Hutson et al. 2009

Table 2.1-13.
Surface water use—ACT Basin (Alabama, 2005) (mgd)

ACT subbasin	HUC	Public supply	Industrial	Irrigation	Livestock	Thermo-electric	Total, by subbasin
Upper Coosa	03150105	2.12	0	3.10	0.40	0	5.62
Middle Coosa	03150106	33.24	65.83	7.91	0.87	142.68	250.53
Lower Coosa	03150107	10.96	0.89	5.10	0.35	812.32	829.62
Upper Tallapoosa	03150108	0.90	0	0.15	0.40	0	1.45
Middle Tallapoosa	03150109	19.09	0	0.52	0.32	0	19.93
Lower Tallapoosa	03150110	38.22	2.23	4.22	0.28	0	44.95
Upper Alabama	03150201	10.40	30.63	3.84	0.84	4.14	49.85
Cahaba	03150202	52.90	0	3.49	0.25	0	56.64
Middle Alabama	03150203	0	21.04	1.73	0.48	0	23.25
Lower Alabama	03150204	0	54.61	0.64	0.02	0	55.27
Total - By Use Category		167.83	175.23	30.70	4.21	959.14	1337.11

Source: Hutson et al. 2009

2.1.1.2.3.2 Groundwater Withdrawals

2.1.1.2.3.2.1 Georgia

In the Georgia portion of the Coosa River Basin, 25 M&I water users hold permits from the Georgia EPD to withdraw 27.20 mgd (on a monthly average). In the Tallapoosa River Basin in Georgia, two M&I water users hold permits to withdraw 2.93 mgd (on a monthly average) (GAEPD 2009b). The groundwater withdrawal permits are required by Georgia law for withdrawals in excess of 100,000 gpd, and they are issued by Georgia EPD.

Fanning and Trent (2009) provides estimates of groundwater withdrawals in the 19 Georgia counties that lie entirely or partly within ACT Basin. Those estimates indicate that about 64 mgd are withdrawn for a variety of beneficial uses. The breakdown of the withdrawals, by water use category, is as follows: public supply, 21 mgd (32 percent of total); domestic and commercial, 20.3 mgd (31 percent); industrial and mining, 20.5 mgd (31 percent); irrigation, 2.3 mgd (4 percent); livestock, 0.7 mgd (1 percent); thermoelectric power generation, 0 mgd. Overall, groundwater withdrawals represent less than 8 percent of total water withdrawals (surface and groundwater) in the Georgia portion of the ACT Basin.

Studies conducted by Dr. James E. Hook et al. (2009a, 2009b), developed estimates for groundwater water pumping rates (year 2011) in the Coosa and Tallapoosa River basins for agricultural irrigation that are presented in Table 2.1-14. In the tables, the wet year equals the wettest 25th percentile (1 in 4 years) and *dry year* equals the driest 25th percentile (1 in 4 years). The results of the studies are being used as to characterize and quantify groundwater withdrawals for agricultural irrigation associated with development of the Georgia SWP. Groundwater use for agriculture in these two river basins within Georgia is very minor and basically confined to the Etowah River subbasin.

Table 2.1-14.
Coosa and Tallapoosa river basins, Georgia agricultural irrigation (groundwater) annualized pumping rates in mgd (estimated for year 2011)

Basin/subbasin (HUC)	Wet year	Median year	Dry year
Basin Total – Coosa River	0.11	0.28	0.45
Conasauga (03150101)	0	0	0
Coosawattee (03150102)	0	0	0
Oostanaula (03150103)	0	0	0
Etowah (03150104)	0.11	0.28	0.45
Upper Coosa (03150105)	0	0	0
Basin Total – Tallapoosa River	0	0	0
Upper Tallapoosa (03150108)	0	0	0

2.1.1.2.3.2.2 Alabama

Table 2.1-15 provides a summary of the groundwater withdrawals within the ACT Basin in Alabama as of 2005 (Hutson et al. 2009). Total groundwater withdrawals in this area were reported to be 144.7 mgd. About 83 percent of those withdrawals were for public water supply, and only about 13 percent were for agricultural irrigation and livestock. Most of the groundwater withdrawals in the ACT Basin occur in three specific subbasins: (1) the Middle Coosa (28 percent), which coincides with several communities in the vicinity of Gadsden and Anniston, Alabama; (2) the Upper Alabama (33 percent), including the Montgomery, Alabama area and surrounding communities; and (3) the Cahaba River Basin (19 percent), including several communities between Montgomery and Birmingham, Alabama. Overall, groundwater withdrawals represent only about 10 percent of total water withdrawals (surface and groundwater) in the Alabama portion of the ACT Basin.

Table 2.1-15.
Groundwater use—ACT Basin (Alabama, 2005) (mgd)

ACT subbasin	HUC	Public supply	Industrial	Irrigation	Livestock	Thermo-electric	Total, by subbasin
Upper Coosa	03150105	2.02	0	0.15	0.32	0	2.49
Middle Coosa	03150106	35.20	2.14	2.14	0.69	0	40.17
Lower Coosa	03150107	4.21	0.86	0.50	0.25	0	5.82
Upper Tallapoosa	03150108	0	0.71	0.37	0.32	0	1.40
Middle Tallapoosa	03150109	0	0	0.12	0.24	0	0.36
Lower Tallapoosa	03150110	3.74	0.05	3.85	0.19	0	7.83
Upper Alabama	03150201	42.16	1.67	3.52	0.57	0	47.92
Cahaba	03150202	26.31	0.40	0.42	0.17	0	27.30
Middle Alabama	03150203	2.92	0	1.00	0.32	0	4.24
Lower Alabama	03150204	3.62	0.40	3.13	0.02	0	7.17
Total - By Use Category		120.18	6.23	15.20	3.09	0	144.70

Source: Hutson et al. 2009

2.1.1.2.3.3 Consumptive Water Use and Return Flows

Consumptive use is defined as the part of water withdrawn that is evaporated, transpired, incorporated into products or crops, consumed by humans or livestock, or otherwise removed from the immediate water environment (Hutson et al. 2004). Consumptive use also is referred to as *water consumed*.

Fanning and Trent (2009) summarized how much water is consumptively used for various categories of water use in the region (consumptive-use coefficients). Consumptive-use coefficients vary for each of the water-use categories. Because public supplies deliver water to domestic, commercial, industrial, and thermoelectric-power users, consumptive use is estimated for those use categories and not for public supply. For domestic water use, consumptive use is estimated at about 18 percent of the total use (Fanning and Trent 2009). The consumptive-use coefficient for commercial use was developed by the Georgia Water Use Program and supported by calculations using withdrawal and discharge data for some commercial users and estimated to be 18 percent (Fanning and Trent 2009). For industrial and mining use, consumptive-use coefficients were determined by industry type and type of mining activity. For example, the consumptive-use coefficient for the pulp and paper industry was estimated at 7 percent in 2005 and 13 percent for the textile industry. Irrigation and livestock water uses are considered to be 100 percent consumed; that is, all of the water withdrawn was evaporated or transpired, incorporated into crops, or consumed by livestock. Irrigation in the region uses sprinkler and micro-irrigation methods, which do not have the large non-consumptive amounts of water as do flood irrigation methods. Consumptive use is negligible for in-stream hydropower generation.

For thermoelectric power generation, the amount of consumptive water use, relative to the amount withdrawn, is primarily determined by the type of cooling system used at the power plant. *Once-through cooling* (also known as open-loop cooling) refers to systems in which water is withdrawn from a source, circulated through heat exchangers, and then returned to a surface-water body. *Recirculating cooling* (also known as closed-loop cooling) refers to systems in which water is withdrawn from a source, circulated through heat exchangers, cooled, and then recycled. Subsequent water withdrawals for a recirculating-cooling system are used to replace water lost to evaporation, blowdown, drift, and leakage. The percentage of consumptive use from generating units with once-through cooling ranged from zero to nearly 7 percent (median - 0.1 percent) compared to the percentage of consumptive use from generating units with recirculating cooling, which ranged from about 30 percent to 65 percent (median - 44 percent) (Hutson et al. 2009).

Table 2.1-16 below depicts the cooling system types and consumptive water use characteristics of the five thermoelectric power plants in the ACT Basin. The information in the table was compiled from Blalock (2010), DOE EIA (2010), Hutson et al. (2009), and USACE, Mobile District (2009).

Table 2.1-16.
Consumptive water use at thermoelectric power plants in the ACT Basin.

Plant name	Company	Location	River	Cooling system	Water quantity (2005) (mgd, average annual)		
					Withdrawn	Returned	Consumed
Bowen	GA Power	Bartow Co, GA	Etowah	Closed cycle	39.0	11.0	27.0
Hammond	GA Power	Floyd Co, GA	Coosa	Once-through	535.0	535.0	0.0
Gadsden	AL Power	Etowah Co, AL	Coosa	Once-through	142.7	142.2	0.5
Gaston	AL Power	Shelby Co, AL	Coosa	Once-through	814.2	813.1	1.1
Harris	Southern Power Co.	Autauga Co, AL	Alabama	Closed cycle	3.5	1.4	2.0

In 2005 total consumptive use across Georgia was estimated to be about 24 percent of total withdrawals (Fanning and Trent 2009). For those counties in northwest Georgia that lie entirely or partially within the ACT Basin, consumptive use (applying the above coefficients) was estimated to be approximately 117 mgd, or about 15 percent of total withdrawals. Surface water that is not *consumed* when used will be discharged (returned), with appropriate treatment, to the surface water system, which will generally be at

or near the point of withdrawal. Return flows to rivers and streams are governed by discharge permits under the CWA.

Water management models addressing reservoir and river operations for the ACT Basin account for all water withdrawals and return flows, including the effect of groundwater withdrawals and associated return flows to the surface water system. Actual withdrawal and return flow data are being used to evaluate existing conditions and to run alternative scenarios associated with the proposed update to the ACT WCM.

2.1.1.2.3.4 Interbasin Transfers

Interbasin transfers result when water is withdrawn from one basin and eventually discharged to another basin. This discussion on interbasin transfers is focused on surface water transfers. In the mid 1990s, interbasin transfers were investigated as part of the *ACT-ACF Comprehensive Study* (PMCL 1996). For the ACT Basin, surface water transfers out of the basin totaled 55 mgd (43 mgd to the ACF Basin and 12 mgd elsewhere). Transfers into the ACT Basin totaled 61 mgd (9 mgd from the ACF Basin and 52 mgd from elsewhere). Therefore, the investigation indicates that an overall net transfer of 6 mgd into the ACT Basin was occurring at the time.

Most of the interbasin transfers (both in numbers and volume) occur within the 15-county MNGWPD. The 2009 *Water Supply and Water Conservation Management Plan for the Metro Water District* (MNGWPD 2009) evaluates interbasin transfers in the district. The assessment (discussed in more detail in Section 2.1.1.2.5.1.8.2) indicates a net transfer of 14 mgd from the ACT Basin into the Chattahoochee (ACF) River Basin by Metro Water District counties, according to 2006 withdrawal and discharge data. MNGWPD (2009) also projects that 32 mgd would be transferred out of the ACT Basin into the Chattahoochee (ACF) Basin by Metro Water District counties by year 2035.

Tennessee Valley Authority (TVA 2007) indicates that a number of water supply utilities are on or near the Tennessee River basin boundary. Along those fringe areas (including the ACT Basin), water could be transferred into or out of the basin depending on water suppliers' local service territories. The net effect of water going out of the ACT Basin versus water coming into the ACT Basin from those transfers is minimal.

Fort Payne, Alabama (located in the ACT Basin), has a pipeline that transfers about 4 mgd from the Tennessee River system to meet local needs. Dalton, Georgia, in Whitfield County, was successful in contracting with a water utility on Chickamauga Reservoir to purchase up to 10 mgd, and additional purchases can be expected as the Dalton area continues to grow. Walker and Catoosa counties are already purchasing some water from a utility on the Tennessee River, and increased purchases are likely as the areas continue to grow (TVA 2007). Such uses result in net gains to water resources in the ACT Basin.

According to TVA (2007), additional interbasin transfers from the Tennessee River into the ACT Basin will likely be considered and evaluated as areas in the ACT Basin continue to grow and as water demands increase. Blount County and Birmingham, Alabama, a large metropolitan area on relatively small rivers, are outgrowing available water supplies. A portion of the Birmingham service area is in the ACT Basin (Cahaba River). The distance from Birmingham to Decatur or Guntersville on the Tennessee River is less than 80 mi, a reasonable piping distance by current standards. Water demand for the Atlanta metropolitan area will continue to grow; while in-state water resources might be sufficient for the near future, the Tennessee River is the nearest waterbody with enough volume to meet a major portion of Atlanta's future water demand. The entire northwest Georgia area above Atlanta is growing rapidly and exceeding the capacity of existing groundwater and surface water supplies. The likelihood of any future withdrawals from the Tennessee River to meet those needs is highly speculative; nonetheless, any such transfers in the future would represent net gains to water resources in the ACT Basin.

2.1.1.2.3.5 Historical Perspective on Water Use and Water Use Trends in the ACT Basin (1950–2005)

2.1.1.2.3.5.1 General Water Use Trends Since 1950

Kenny et al (2009) documented that between 1950 and 1980, there was a steady increase in water use in the United States. During that time, the expectation was that as population increased, water use would also increase proportionally. Contrary to expectation, reported water withdrawals declined in 1985 and have remained relatively stable since, in spite of a steady increase in U.S. population. Changes in technology, in state and federal laws, in economic factors, and increased awareness of the need for water conservation have resulted in more efficient use of the water from the nation's rivers, lakes, reservoirs, and aquifers. Estimates of water use for 2005 indicate that about 410 billion gallons (BG) per day were withdrawn for all uses in the United States. That total varied less than 3 percent since 1985 as withdrawals stabilized for the two largest uses—thermoelectric power and irrigation. Water use trends in the Southeast and in the ACT Basin have generally been consistent with those national trends, as reflected below.

2.1.1.2.3.5.2 Factors Influencing Water Use in the ACT Basin from the 1950s to the 1970s

When the implementation of federal water resource projects in the ACT Basin began in the 1950s, water use in the southeastern United States, including the ACT Basin, was generally consistent with the predominant socioeconomic pursuits and population distribution in the region. The region's favorable climate and generally good soil conditions were responsible for the continuing predominance of an agricultural economy. According to the 1950 census, the population of the ACT Basin was about 1.3 million. The population was predominately rural, with about 80 percent of the people living on farms or in small rural communities, fairly evenly distributed across the basin except for the sparsely populated area along the lower Alabama River. About 20 percent of the population resided in five larger urban centers: Rome, Georgia, and Gadsden, Anniston, Montgomery, and Selma, Alabama. After World War II, the area experienced slow net growth because of out-migration, and the overall population balance began to shift from the rural areas to the urban centers because of increased economic activity in the cities and industrialization of the Southeast (USACE, Mobile District 1951). Because the overall population was largely rural and widely distributed, most domestic water supply was provided by wells/springs, and municipal water systems supplied by surface water withdrawals and treatment plants were generally limited to the larger urban centers.

Corn and cotton were the principal agricultural products, followed by peanuts, potatoes, and beans. Cattle production was an important agricultural pursuit in the basin. In the 1950s, there were little or no groundwater or surface water withdrawals for crop irrigation. By the 1950s, almost all the mixed stands of hardwoods and pines in the upland areas of the basin and the hardwood stands in the lowlands had been stripped of their original growth, and the lands were either deforested or had second-growth trees. Longleaf pines dominated forest land in the southern portion of the basin, providing ample supply for the pulpwood and naval stores industries. Sand, gravel, coal, iron, marble, lime, and clay were mineral resources that were mined commercially in the basin (USACE, Mobile District 1951).

In the 1950s, industrialization in the basin was relatively new but developing rapidly into an important element of the regional economy. Industry was concentrated in the central and upper portions of the basin. The major industrial centers were Montgomery, Selma, Anniston, Gadsden, and Rome. Textile and apparel manufacturing, iron and steel production and fabrication, wood product processing, and chemical manufacturing were the major industrial pursuits. Textile industries were prominent across the region, with facilities in or near Alexander City, Montgomery, Opelika, Tallassee, and Talladega, Alabama, as well as Rome, Georgia. Steel and iron mills were in Gadsden and Anniston, Alabama. Manufacture of cut

stone, marble, building brick, and ceramic tile occurred across the central and upper portions of the basin. Tires were manufactured at a large facility in Gadsden, Alabama. Forest lands provided raw materials for saw mills, pulp and paper manufacturers, and naval stores plants. Chemical manufacturers produced fertilizers and cottonseed oil (USACE, Mobile District 1951).

Many of the industries required large quantities of water to support their manufacturing processes, predominately from surface water sources. Early economic development and industrialization was supported by hydropower generation in the basin. As urban population centers and industry expanded, demand for thermoelectric power generation also expanded in the region, dramatically increasing the demand for cooling water from surface water sources.

Through the 1960s and 1970s, the upper portion of the ACT Basin was significantly influenced by rapid suburban growth expanding west, northwest, and north of Atlanta and the emergence of the carpet industry in and around Dalton, Georgia. Both occurrences had major implications relative to population growth, land use change, and water resources (basin hydrology and water use) in the basin. Irrigation demands increased for lawns, parks, golf courses, and for emerging agricultural uses, such as sod farms in the Etowah River corridor.

2.1.1.2.3.5.3 Recent Water Use Trends (1980 to present)

Between 1980 and the present, the region has continued to experience rapid population growth, particularly the urban areas in the ACT Basin, including the northwest quadrant of the metropolitan Atlanta area. Additionally, acreage of irrigated agriculture has increased in the ACT Basin, although not as extensively as has been observed in the adjacent ACF Basin. Both factors would tend to indicate a continued upward trend in both surface water and groundwater withdrawal and use. However, a number of technological and economic factors have, in large part, offset increased water demands in the ACT Basin. Some of those factors are the following:

- Increased agricultural irrigation efficiencies.
- Improved cooling water technologies for thermoelectric power plants.
- Reduced water demands in the commercial-industrial water use category because of the changing economy of the region. The industrial sector of the economy in the region (which frequently requires significant quantities of water to support manufacturing processes) has significantly declined as business has shifted more to a service-based economy.
- Numerous water conservation/water efficiency technologies and programs instituted by the states and public water supply providers, particularly in northwest Georgia.

2.1.1.2.3.5.3.1 Georgia

Fanning and Trent (2009) evaluated water use trends in Georgia for the period 1980 through 2005. Statewide, total water use in 2005 (about 5,353 mgd) was about the same as in 1990 (5,471 mgd). Statewide public supply water use steadily increased from 1980 to 2000, corresponding to an increase in population (from 4,189,000 to 8,186,450) during the same period; however, water use leveled off and decreased slightly from 2000 to 2005. Commercial, domestic, and livestock uses remained about the same for the period of 1980 to 2005. Industrial water use fluctuated during the period of 1980 to 2005, mostly because of improved water efficiency, water recycling, and conservation measures at industrial plants and changes in the number and type of industrial facilities. Those statewide statistics are considered to be generally indicative of water use trends in the ACT Basin in Georgia.

Irrigation water use declined from 1980 to 1985 and again to 1990, increased from 1995 to 2000, and decreased markedly from 2000 to 2005. Estimated irrigation withdrawal was 30 percent lower in 2005 than in 2000 because of decreased irrigation demands resulting from the greater amount of rainfall in 2005, which relieved the prolonged drought that began in 1998 and continued through 2002. The total number of acres irrigated in the state increased by nearly 32 percent between 1995 and 2005.

Water for thermoelectric power generation has continued to be the largest of any off-stream use category in Georgia. Thermoelectric power withdrawal peaked in 1980, dropped sharply in 1985, and declined again in 1990 before increasing in 1995 and 2000. That rising trend was reversed in 2005 when thermoelectric power decreased by 24 percent from 2000 because of the decommissioning of three power plants and retrofitting cooling towers at several other plants. In the ACT Basin specifically, withdrawals at Georgia Power thermoelectric power plant Hammond have declined slightly between 2005 and 2009 (Blalock 2010) and have remained about the same at plant Bowen (USACE 2009).

2.1.1.2.3.5.3.2 Alabama

Pierce (1972) evaluated water use in Alabama in 1970. Mooty and Richardson (1998) evaluated water use in Alabama in 1995. Hutson et al. (2009) assessed water use in Alabama in 2005 and compared 2005 water use with 2000 levels. Those water use statistics are compared in Table 2.1-17. While the water use categories vary slightly in each analysis, they were grouped as necessary to make historical comparison as accurate as possible. Though there might be some variations in data compilation and improved reporting processes over time that can explain some of the anomalies, some clear water use trends can be gleaned from the summary. The statewide water use trends are generally consistent with those that would be expected in the Alabama portion of the ACT Basin, perhaps with the exception of the reported increased water withdrawals for thermoelectric power generation.

Table 2.1-17.
Water use trends—Alabama, 1970 to 2005 (in mgd)

	Year			
Water use category	**1970[c]**	**1995[c]**	**2000[c]**	**2005**
Total Use	6,700	7,100	9,900	9958
% Surface Water	96%	94%	96%	95%
% Groundwater	4%	6%	4%	5%
Thermoelectric Power	5,024	5,200	8190	8,274
Public Supply	466	813	834	802
Self-Supplied Industrial [a]	1,087	758	833	578
Rural Uses [b]	170	330	132	304

a. Self-supplied industrial includes mining and self-supplied commercial use

b. Rural use includes irrigation, livestock, aquaculture, and self-supplied residential

c. Reported total use might not exactly equal the sum of reported use for individual categories

While total water withdrawals increased by about 50 percent between 1970 and 2005, surface water use has consistently been about 95 percent of total water use (about 5 percent has been groundwater). The overall increase total water use is almost exclusively related to cooling water withdrawals associated with thermoelectric power generation, which is essentially a non-consumptive use. For the years analyzed, withdrawals for thermoelectric power production ranged from 73 to 83 percent of total withdrawals. Specifically, water withdrawals at APC's plants Gadsden and Gaston in the ACT Basin have remained about the same over the past 10 years (USACE 2009).

Water withdrawals for public supply increased by 74 percent between 1970 and 1995 (from 466 to 813 mgd) and remained at about the same level from 1995 to 2005. Self-supplied industrial water withdrawals declined by about 47 percent from 1970 to 2005. That decline is associated with both the improved efficiency of water use in the industrial/manufacturing sector of the economy, the overall decline in the industrial/manufacturing sector of the regional economy, which tended to use larger quantities of water in manufacturing processes, and improved metering and reporting (Hutson et al. 2009).

Water withdrawals for irrigation statewide have increased dramatically. Groundwater withdrawals for irrigation increased at a faster rate than surface water withdrawals, but overall irrigation remains a relatively small portion of total water use. Part of the increase in irrigation numbers was because of a more complete inventory of golf courses, nurseries, and sod farms. Total irrigated acreage from 2000 to 2005 increased about 94 percent from 70,010 ac to 135,800 ac, primarily as a result of the inclusion of more golf courses, nurseries, and sod farms (Hutson et al. 2009).

2.1.1.2.3.5.4 Per Capita Water Use

USGS water use data for Georgia indicate that public water supply per capita use averaged 185 gpd in 2000 (USGS 2004). USGS 2005 data indicate that per capita use in Georgia had declined to an average of 158 gpd (Fanning and Trent 2009). In Alabama, public water supply per capita use averaged 233 gpd in 2000 (USGS 2004) and likewise declined to 199 gpd in 2005 (Hutson et al. 2009). Per capita public water supply use is determined by dividing the total amount of water provided by public suppliers by the total population served. While those are statewide averages, per capita use in the Georgia and Alabama portions of the ACT Basin is likely to be similar. A USGS report estimated that per capita public water supply use in the adjacent ACF Basin in 1990 was about 173 gpd (Marella et al. 1993).

2.1.1.2.4 Critical Yield from USACE Reservoirs in the ACT Basin

Critical yield is defined as the maximum amount of water that can be consistently removed from a reservoir(s) through releases from the dam and/or withdrawals from the reservoir, during the most severe drought in the hydrologic period of record, exactly depleting the reservoir conservation storage once during the period of record. *Conservation storage* is the amount of water available in a reservoir to meet project purposes other than flood risk management.

In early 2010 USACE, Mobile District, developed updated critical yields for the federal projects in the ACT Basin (USACE, Mobile District 2010a), in response to the following language in the FY 2010 Energy & Water Development Appropriations Bill, 111th Congress, 1st Session:

> Alabama-Coosa-Tallapoosa [ACT], Apalachicola-Chattahoochee-Flint [ACF] rivers, Alabama, Florida, and Georgia—The Secretary of the Army, acting through the Chief of Engineers, is directed to provide an updated calculation of the critical yield of all federal projects in the ACF River Basin and an updated calculation of the critical yield of all federal projects in the ACT Basin within 120 days of enactment of this act.

Critical yield provides the basis from which water stored in a reservoir can be allocated to various project purposes. The conservation storage in a reservoir can be allocated to project purposes (including joint use and that which may be specifically allocated to and sold as water supply storage) on the basis of a percent of critical yield. A change in critical yield can result in modification of the allocations for a project purpose and/or an understanding that the risk of not being able to obtain the desired water flow has changed.

USACE reservoirs in the ACT Basin that were included in the 2010 analyses are Carters Lake and Allatoona Lake, because they hold the majority of water storage in the federal projects on the ACT

System. The Carters Lake project consists of two dams: the main dam (Carters Lake) and a small, downstream dam impounding discharges from the main dam for pump back purposes (Carters Reregulation Dam). Only the main dam was included in the critical yield evaluation. Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake, Millers Ferry Lock and Dam and William "Bill" Dannelly Lake, and Claiborne Lock and Dam and Lake are USACE reservoirs on the ACT System that were excluded from the critical yield analyses. These reservoirs were excluded from the analyses because they are *run-of-river* impoundments with little or no usable water storage and cannot significantly contribute to critical yield.

In this summary, critical yield is presented in terms of cfs. Critical yield can also be expressed in mgd or ac-ft per year (ac-ft/yr), reflecting the volume of water that can be removed from a reservoir per unit of time. Conversions for these various ways of expressing flow rate are as follows: 1 cfs = 0.6464 mgd = 722.7 ac-ft/yr.

2.1.1.2.4.1 How Critical Yield is Determined

2.1.1.2.4.1.1 Unimpaired Flow Data Set

The unimpaired flow data set is historically observed flows, adjusted for some of the human influence within river basins. Man-made changes in river basins influence water flow characteristics and are reflected in measured flow records. Determining critical yield requires removing identifiable and quantifiable man-made changes, such as M&I water withdrawals and returns, agricultural water use, and increased evaporation and runoff because of the construction of federal surface water reservoirs, from the observed flow measurements.

These quantities are used to extrapolate diversions, defined as the difference between water withdrawn and water returned to the system. Diversions are a net volume or quantity assumed to be permanently lost from the water system. The unimpaired flow data set is not a perfectly replicated flow data set representing conditions that would exist without the influence of human activities or a precise measure of natural flow conditions. Not all human influences, such as land use changes, can be accounted for, and many flow set adjustments are estimates based on assumptions, not direct measurements of the human influences. The unimpaired flow data set that served as a basis for the 2010 critical yield analysis for the ACT Basin included data for the period from 1939 through 2008. Subsequently, the unimpaired flow data set has been extended through 2011.

2.1.1.2.4.1.2 Droughts

Several drought periods were identified from the historic record and from previous yield analyses. Critical drought periods analyzed for the 2010 critical yield update included 1940–41; 1954–58; 1984–89; 1999–2003, and 2006–2008. Critical yield was computed for each drought period and the lowest value was selected as the critical yield for the 2010 update report.

2.1.1.2.4.1.3 Diversions

For purposes of the critical yield analysis, ACT system diversions include municipal, industrial and agricultural withdrawals and returns from the Etowah River and its tributaries upstream of Allatoona Lake and from the Coosawattee River above Carters Lake. Critical yield calculations were made without diversions and with diversions, so that the impact of river withdrawals on critical yield could be determined. Maximum river withdrawals in the ACT occurred in 2006 and are reflected in the critical yield calculation for each drought period.

2.1.1.2.4.1.4 Models

The USACE HEC-ResSim model was used to simulate reservoir operations. The HEC-ResSim model has a Firm Yield subroutine which calculates the largest, consistent release that can be reliably supplied during the flow record. The HEC-ResSim ACT yield models include a net precipitation-evaporation rate for each reservoir. Those rates are based on evaporation values developed for NOAA Technical Reports, monthly pan evaporation rates, and National Weather Service (NWS) rainfall reports. The net evaporation losses (evaporation minus precipitation) were computed in inches at the projects. The NOAA values were used because historic monthly evaporation data is not available at the projects. Historic monthly precipitation data was obtained from the NWS.

2.1.1.2.4.1.5 Method A (Without Diversions)

Method A assumed that there are no withdrawals from or returns to the lake and no withdrawals from or returns to the river as it flows between projects. This condition results in the maximum yield possible from the federal projects. Method A is depicted in Figure 2.1-46.

2.1.1.2.4.1.6 Method B (With Diversions)

Method B assumed net river withdrawals and returns are occurring; this method does not include withdrawals from USACE reservoirs. The results of Method B represent a conservative assessment of the critical yield available from federal projects managed by USACE. Method B used the most severe drought events documented during the hydrologic period of record (1939–2010) and the year of maximum river withdrawals on the ACT Basin (2006) to make the calculations. Method B is depicted in Figure 2.1-47.

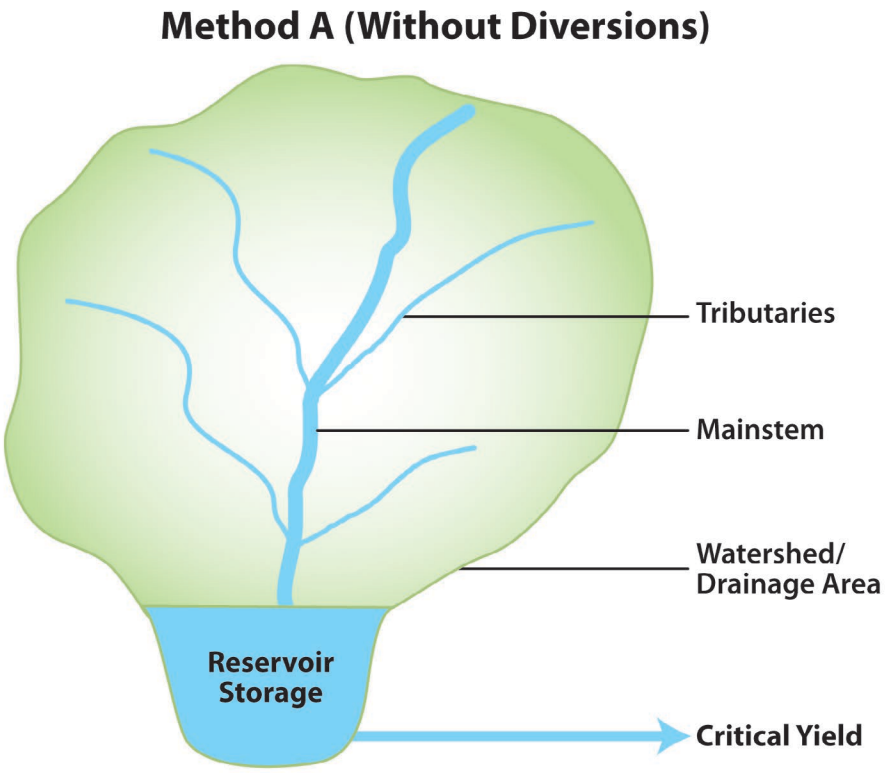


Figure 2.1-46. Critical yield method A.

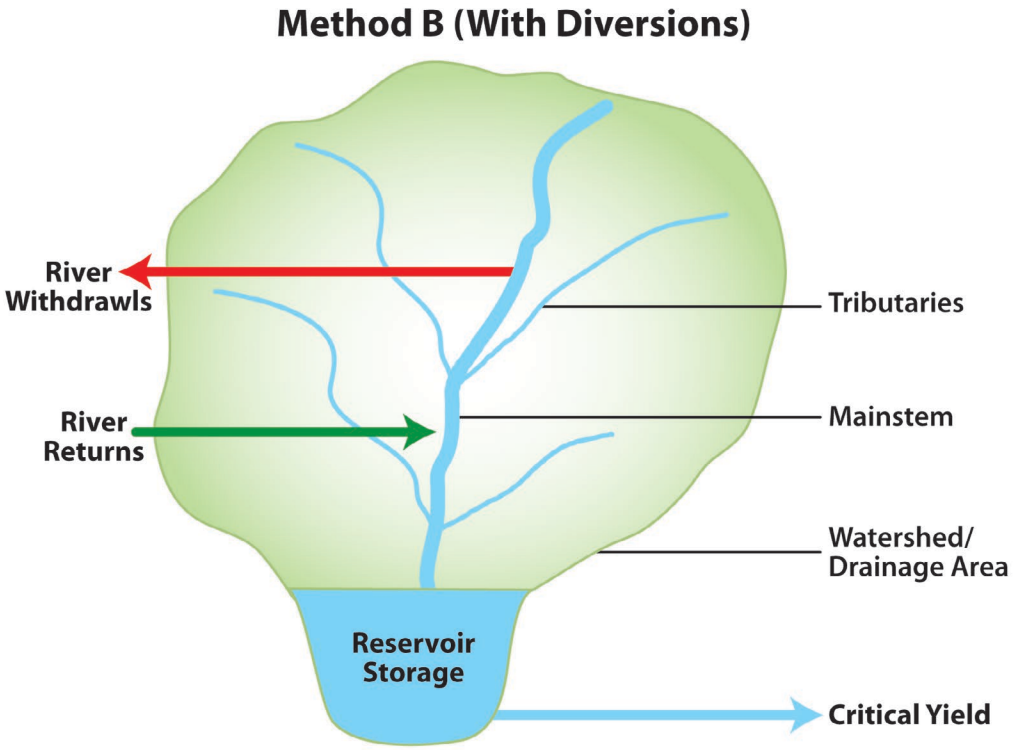


Figure 2.1-47. Critical yield method B.

2.1.1.2.4.2 Critical Yield Modeling Assumptions

The following assumptions were used in computing the 2010 critical yield update for the ACT System:

- The analysis did not consider the probability of the occurrence of drought(s) more severe than those in the period of record.
- The simulation model was operated only for critical yield. No other operating purposes were included. The critical yield represents the maximum flow that could be continuously provided to meet any, or all, demands (e.g., project purposes).
- Upstream users can consumptively divert water, precluding the availability of water yield to a downstream user. Maximizing the yield of the reservoir is consistent with current state-issued water withdrawal permits.
- Yield analysis is based on currently authorized conservation storage elevations.
- Projects are full at the beginning of the drought period simulation. The pool level at the beginning of a drought simulation is important because it is a variable that directly affects the quantity or volume of water available as critical yield.
- Under Model Methods A and B, none of the critical yield is returned to the system. Critical yield is permanently diverted from the system and assumed to be consumptively used. This methodology determines the conservative individual project yield.
- Existing area capacity curves as shown in the current WCMs were used.

Table 2.1-18 and Table 2.1-19 present the critical yield of each federal storage project on the ACT System and the critical drought period used in the calculations.

Table 2.1-18.
Method A—ACT project yield (without diversions)

Project	Critical yield (cfs)	Critical drought period
Allatoona Lake	729	May 2007 – April 2008
Carters Lake	390	May 2007 – April 2008

Table 2.1-19.
Method B—ACT project yield (with diversions)

Project	Critical yield (cfs)	Critical drought period	Critical yield reduction attributable to diversions
Allatoona Lake	693	May 2007 – April 2008	4.9%
Carters Lake	387	May 2007 – April 2008	0.8%

The impacts of the river withdrawals on the critical yield can be quantified by comparing the results from Method A (Without Diversions) and Method B (With Diversions). The 2006 river withdrawals had a measurable impact, reducing critical yield as much as 5 percent at Allatoona Lake but only 0.8 percent at Carters Lake.

2.1.1.2.5 Summary of Water Planning, Management, and Conservation Activities Pursued by State, Regional, and Local Interests in the ACT Basin

This section provides a general overview of water resource planning, management, and conservation activities by state, regional and local interests within Georgia and Alabama that have noteworthy implications for water resources in the ACT Basin and update of the ACT WCM. This section is not intended to provide in-depth detail on each of these activities or programs or to discuss every such activity within the ACT Basin by individual counties and municipalities, unless those efforts are part of one of the regional or state activities discussed below.

2.1.1.2.5.1 Georgia

2.1.1.2.5.1.1 Georgia Water Withdrawal Permit Program

Georgia laws, the Georgia Groundwater Use Act (O.C.G.A §§ 12-5-90 et seq.) and the Georgia Water Quality Control Act (O.C.G.A. § 12-5-31), require any water user who withdraws more than 100,000 gpd on a monthly average to obtain a withdrawal permit from Georgia EPD. Permit holders generally must report their withdrawals by month. The permits are issued free of charge, and the law does not transfer to the permit recipient any property right to the water or water permit upon issuance of the permit beyond the right to reasonable use of the water. The Georgia Water-Use Program collects the reported information under the withdrawal permit system and the drinking-water permit system and stores the data in the Georgia Water-Use Data System.

Since 1988 Georgia has required permits (from Georgia EPD) for those who pump water from either groundwater or surface waters of the state for agricultural uses. Land owners who pump groundwater or

whose tenants pump groundwater for agricultural uses, including irrigation, livestock watering, greenhouse watering, commercial fish production, and certain primary food processing operations like washing and cooling freshly picked vegetables might be required to have *Groundwater Withdrawal Permits*. The threshold is 100,000 gpd when use is averaged over any month. Surface water users are required to obtain *Surface Water Withdrawal* permits if the threshold pumping rate (100,000 gpd) and farm use conditions apply. All direct stream withdrawals must be permitted, and some will have low-flow limits for their use. Withdrawals from ponds may or may not require permits. Those that intercept intermittent or continually flowing streams that are considered waters of the state and ponds shared along property lines require permits. Ponds are also used to store groundwater. If a pond has no inflow except that pumped from a well, a groundwater permit is required for the well. If the pond intercepts runoff or stream flow and has water pumped in periodically from a well, a combined *Well-to-Pond Water Withdrawal Permit* is issued (Hook et al. 2009a, 2009b).

Before issuing a permit, Georgia EPD will evaluate the reasonableness of the use by applying the criteria listed in the statute, including the number of persons using the water source; the nature, severity, or duration of any impairment adversely affecting availability for other users; any injury to public health, safety or welfare; the kinds of activities proposed; the importance and necessity of the uses and the extent of any injury caused to other water uses; diversion from or reduction in flows in other watercourses or aquifers; prior investment in land; and other relevant factors. (O.C.G.A. § 12-5-31). M&I permits are issued for a term of 10 to 50 years, after which they must be renewed. Farm use permits are issued for an unlimited term, except in the Flint River Basin in which farm use permits issued after March 2006 have a term limit of 25 years (GAEPD 2006). M&I permits are issued for a specific quantity determined by reasonable use. Farm permits issued after 1991 also have defined quantities. Farm permits issued before 1991 are based on pump capacity as of July 1, 1988. M&I permits can be revoked by Georgia EPD for extended periods of nonuse. Farm permits cannot be revoked after an initial use, though farm permits can be revoked if water was never withdrawn.

2.1.1.2.5.1.2 Georgia Drought Management Plan

The 1998-2002 drought raised awareness in Georgia regarding drought impacts and interest in drought planning and management. The first *Georgia Drought Management Plan* was adopted by Georgia Department of Natural Resources (GADNR) Board in March 2003 (GAEPD 2003). The plan was developed using a collaborative approach involving stakeholders with an interest and expertise in water related matters. The stakeholders represented a geographical and political cross section of the state and a cross-section of business, industry, environmental, and water management. The Georgia General Assembly and the Board of Natural Resources have assigned the Director, Georgia EPD principal responsibilities for implementing the drought management plan. Numerous agencies and organizations are tasked in this plan with some level of water resource or water related management responsibilities. Georgia EPD and those agencies and organizations will coordinate closely and share information about their drought or water conservation concerns and solutions.

The pre-drought strategies contained in the plan are principally water conservation strategies. They are generally longer term actions, implemented before a drought, for the purpose of preparedness, mitigation, monitoring, and conservation. For example, during non-drought periods, municipal outdoor water use (other than specifically exempted activities) may occur only as follows: (a) for odd-numbered addresses, outdoor water use is allowed on Tuesdays, Thursdays and Sundays; (b) for even-numbered addresses, outdoor water use is allowed on Mondays, Wednesdays and Saturdays. As water conservation plans are developed by other agencies, regional development centers (RDCs), local governments, and water supply providers, they are to reflect the pre-drought strategies of the state plan (GAEPD 2003).

The state Climatologist's office and Georgia EPD routinely monitor and evaluate stream flows, lake levels, precipitation, groundwater levels, and other climatic indicators that are supplied by several cooperating entities, principally USACE, the USGS, and the National Drought Mitigation Center. These drought indicators reflect the health of the hydrologic system. Georgia is divided into nine climate divisions (regions), and each of the climate divisions has several indicators.

When the indicators in any one or more of the nine climate divisions dictate the possible need for a drought response declaration, The Georgia EPD Director will consult with a designated Drought Response Committee (with state, federal, and stakeholder representatives) to determine the potential severity of the drought condition(s), and the expected impacts. The Director, in consultation with the Committee, will make a determination of the appropriate level of response. Response guidance for each level of drought severity is provided by this plan, but particular drought conditions could require greater or lesser responses than those specified in the plan (GAEPD 2003).

During a declared drought, the Georgia EPD Director and, as appropriate, other members of the Drought Committee will notify the local RDCs, local governments, and water supply providers as to the appropriate action to be taken. Press releases will be prepared explaining the situation and state response requirements. The state climatologist and Georgia EPD will continue to monitor the drought indicators for changing conditions, and will act in response to those changing conditions. As drought conditions improve, a conservative approach is taken before the Director acts to decrease the drought level (GAEPD 2003).

As an example of drought response actions that can be triggered under the plan, Georgia Rules and Regulations, Chapter 391-3-30-.04 (GAEPD 2004a), specifically define those response actions required for outdoor water use under drought response levels of increasing severity:

391-3-30-.04 Outdoor Water Use Schedule during Declared Drought Response Levels

(1) The Director of the EPD is authorized to make drought declarations.

(2) During declared drought conditions, outdoor water use, other than activities exempted in 391-3-30-.05, shall occur only during scheduled hours on the scheduled days.

(3) *Declared Drought Response Level One* – Outdoor water use may occur on scheduled days within the hours of 12:00 midnight to 10:00 a.m. and 4:00 p.m. to 12:00 midnight.

(a) Scheduled days for odd-numbered addresses are Tuesdays, Thursdays, and Sundays.

(b) Scheduled days for even-numbered addresses are Mondays, Wednesdays, and Saturdays.

(c) Use of hydrants for any purpose other than firefighting, public health, safety, or flushing is prohibited.

(4) *Declared Drought Response Level Two* – Outdoor water use may occur on scheduled days within the hours of 12:00 midnight to 10:00 a.m.

(a) Scheduled days for odd-numbered addresses are Tuesdays, Thursdays and Sundays.

(b) Scheduled days for even-numbered addresses and golf course fairways are Mondays, Wednesdays and Saturdays.

(c) The following uses are prohibited:

1) Using hydrants for any purpose other than firefighting, public health, safety or flushing.

2) Washing hard surfaces, such as streets, gutters, sidewalks and driveways except when necessary for public health and safety.

(5) *Declared Drought Response Level Three* – Outdoor water use may occur on the scheduled day within the hours of 12:00 midnight to 10:00 a.m.

(a) The scheduled day for odd-numbered addresses is Sunday.

(b) The scheduled day for even-numbered addresses and golf course fairways is Saturday.

(c) The following uses are prohibited:

1) Using hydrants for any purpose other than firefighting, public health, safety or flushing.

2) Washing hard surfaces, such as streets, gutters, sidewalks, driveways, except when necessary for public health and safety.

3) Filling installed swimming pools except when necessary for health care or structural integrity.

4) Washing vehicles, such as cars, boats, trailers, motorbikes, airplanes, golf carts.

5) Washing buildings or structures except for immediate fire protection.

6) Non-commercial fund-raisers, such as car washes.

7) Using water for ornamental purposes, such as fountains, reflecting pools, and waterfalls except when necessary to support aquatic life.

(6) *Declared Drought Response Level Four* – No outdoor water use is allowed, other than for activities exempted in 391-3-30-.05, or as the Georgia EPD Director may order.

Exemptions for outdoor water restrictions in Chapter 391-3-30-.05 include: capture and re-use of cooling system condensate or storm water; re-use of gray water; landscape water uses with reclaimed wastewater; irrigation of personal gardens; specific and limited exceptions for newly installed landscapes; specific and limited exemptions for golf courses water use; and specific and limited exemptions for businesses whose operations are dependent on outdoor water use (GAEPD 2004a).

Most of the measures in the plan are short-term actions to reduce water demand during a drought, rather than long term demand management. The drought plan does not encompass measures to control long term water demand related to population growth, nor does it contain significant measures to manage the demand of the industrial and agricultural sectors. This is a limitation typical of state drought plans. The state is addressing these longer term issues through the development of the statewide water management plan and water conservation implementation plan (WCIP).

2.1.1.2.5.1.3 Georgia Statewide Water Management Plan

The 2004 Comprehensive Statewide Water Management Planning Act authorized the development of the SWP. The act establishes the following goal, "Georgia manages water resources in a sustainable manner to support the state's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens." Georgia EPD was charged with developing a draft of the plan, with oversight by the Water Council. Created by the act, the Water Council is a coordinating committee composed of the heads of eight state agencies with water related responsibilities, four legislators and two citizen members (GAEPD 2008a).

Between January 2006 and July 2007, Georgia EPD used an intensive public involvement process to develop the draft plan. As required by the act, the draft plan was submitted to the Water Council by July 1, 2008. Drawing on additional public review and comment, the Water Council revised the plan and submitted it to the Georgia General Assembly in January 2009. By the end of February 2009, the plan had been adopted by the General Assembly and signed by the Governor (Cowie and Davis 2009).

The SWP has three major components designed to address the goal for water management in Georgia: (1) Resource Assessments and Forecasting of Needs; (2) Tool Box of Water Management Practices; and, (3) Framework for Regional Water Planning.

The SWP makes provisions to conduct resource assessments and generate long-range forecasts. The resource assessments focus on water quantity and water quality. The water quantity resource assessment addresses the amount of water that is available to withdraw for beneficial use, while still supporting the ability of downstream users, or users from the same aquifer, to benefit from that water resource. The water quality resource assessment addresses, from a watershed perspective, at wastewater treatment levels that are required to protect water quality. In addition, statewide and regional population and economic forecasts will be translated in a consistent manner into water and wastewater demand forecasts over a 50-year planning horizon (Cowie and Davis 2009).

The SWP explicitly recognizes that regional variation means that different sets of water management practices will be better suited to different parts of the state. The *toolbox* of water management practices includes demand management practices; water return practices such as onsite sewage management (septic systems) and centralized wastewater treatment; and water supply management practices such as surface water storage, inter- and intra-basin transfers, and aquifer storage and recovery. Water conservation is highlighted as a priority practice for use across the state by all water use sectors. Water quality management practices, including stormwater and nonpoint source pollution management, are also part of the toolbox (Cowie and Davis 2009).

The SWP provides a framework for regional water planning. Through regional water planning, appropriate water management practices are selected and defined for implementation. Ten regional water planning councils were established in 2009 to develop and recommend regional Water Development and Conservation Plans (WDCPs) for adoption by Georgia EPD. The ten water planning regions are shown on Figure 2.1-48. The water planning regions are drawn along political (county) boundaries but they are generally aligned with the major river basins in the state. Each regional council consists of twenty-five members that represent the water users and the water related interests in each region. Council members are appointed by the Governor, Lieutenant Governor, and Speaker of the House.

WDCPs characterize the water needs for each region, as those needs relate to the needs of adjacent regions, and identify preferred water management practices to close any *gaps* between water capacities and water needs. The councils used the resource assessments and forecasts to develop recommended WDCPs in 2010 and 2011. Regional plans were submitted to the EPD for review in September 2011, revised as needed, and ultimately, adopted by the Georgia EPD Director in November 2011. In accordance with the 2004 act, water withdrawal permits and state loans for infrastructure projects must be consistent with the adopted regional plans. The SWP requires that each regional plan will be subject to review and revision/update every five years. (GADNR 2011).

Most of the ACT Basin in Georgia lies within the Coosa–North Georgia (CNG) water planning region under the SWP. The upper Tallapoosa River portion of the ACT Basin in Georgia lies within the Middle Chattahoochee water planning region under the SWP. The WDCPs for the CNG and Middle Chattahoochee regions were adopted by the Georgia EPD Director in November 2011. A small portion of the Coosa River basin (in Bartow, Cherokee, and parts of Paulding and Cobb counties) lies within the Metropolitan North Georgia Water Planning District (MNGWPD). The MNGWPD was created in 2001 and subsequently incorporated as a distinct region within the SWP. The first MNGWPD plan was completed in 2003 and has been updated every three years. More detailed information on MNGWPD programs is provided in Section 2.1.1.2.5.1.8.

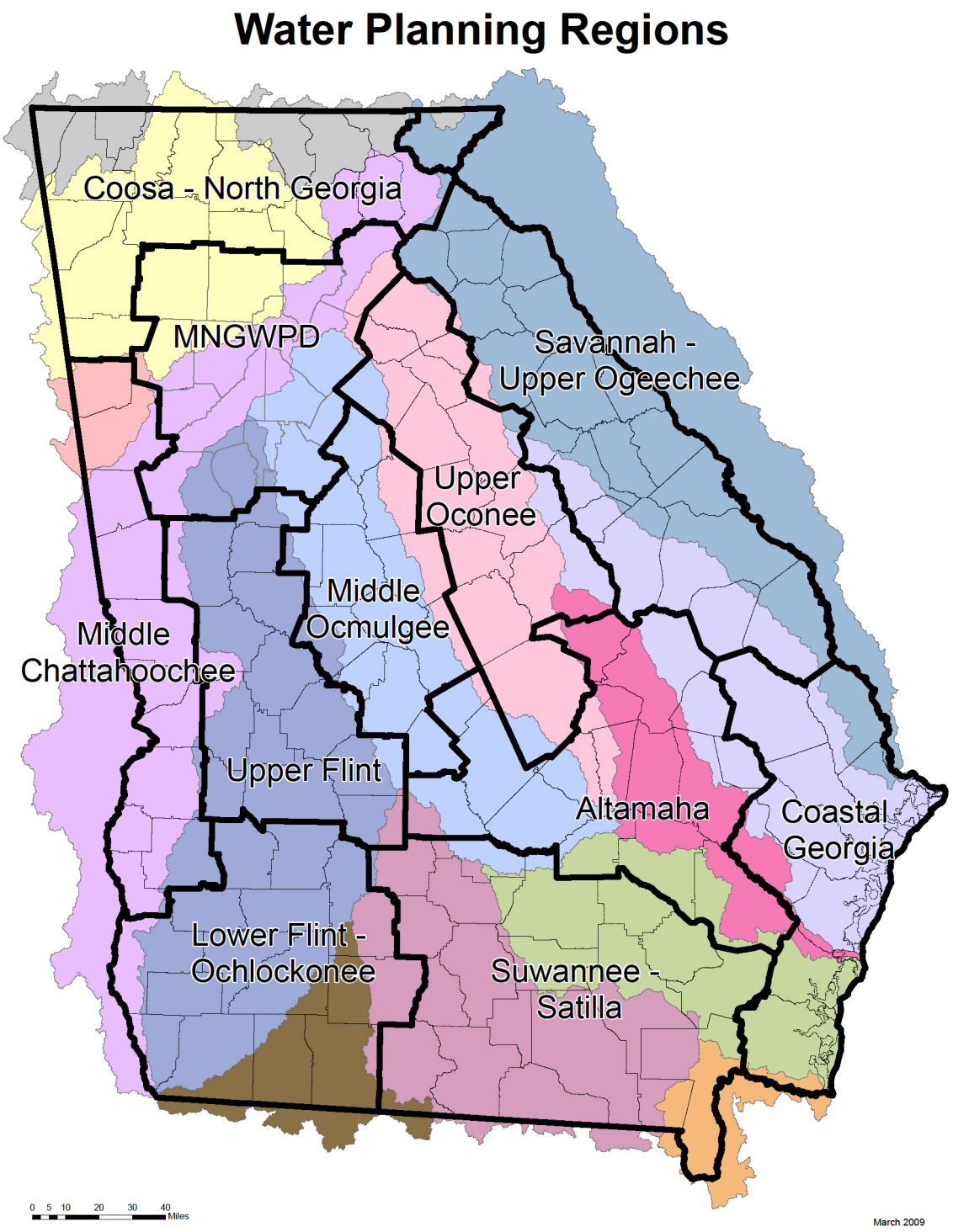


Figure 2.1-48. Georgia State Water Plan – Water Planning Regions

Key water resource issues addressed in the adopted CNG Regional WDCP are (GAEPD 2010b):

- Elevated nutrient loads in Allatoona Lake, Carters Lake and Weiss Lake
- Zones of low dissolved oxygen and high levels of bacteria in the Chattahoochee, Coosa and Tennessee river basins
- Gaps in surface water availability during drought conditions in the Coosa and Tennessee river basins
- More efficient use of water in the region
- Future water supply sources for the region

Key water resource issues being addressed in the adopted Middle Chattahoochee Regional WDCP include (GAEPD 2010d):

- Water supply and wastewater discharge demands of a rapidly growing region
- Coordination with the Lower Flint- Ochlockonee and Upper Flint Councils to address the USACE Revised Interim Operating Plan flow targets downstream of Woodruff Dam
- Balancing management of water supply needs and water quality with maintaining the region's economy
- Changes in the operation of Chattahoochee reservoirs to support higher lake levels and increased flow for water quality
- Other targeted water quality issues

Key water resource issues being addressed by the MNGWPD include (GAEPD 2010c):

- The Water Supply and Water Conservation Management Plan includes recommendations for an aggressive water demand/conservation program, reallocation of storage in Lake Lanier and Allatoona Lake for water supply, and construction of six new reservoirs (two of them within the ACT Basin – see section 2.1.1.2.5.1.8.4).
- The Wastewater Management Plan outlines a long-term implementation schedule for public wastewater treatment. It also provides for comprehensive wastewater planning to establish future sewer service areas and calls for more intensive management of privately owned septic systems.
- The Watershed Management Plan provides a comprehensive suite of local management measures intended to foster watershed protection, effective stormwater management, water quality improvement and the implementation of green infrastructure practices.

2.1.1.2.5.1.4 Georgia Water Conservation Implementation Plan

In May 2009 Georgia EPD published a comprehensive WCIP, designed to create a culture of conservation in the state and to guide Georgians toward more efficient use of the state's finite water resources (GAEPD 2009c). The WCIP is a product of the ongoing Georgia SWP process. The plan provides a multi-pronged strategy to achieve more efficient and sustainable water use through conservation (defined as beneficial reduction in water use, water waste, and water loss) and measures to promote more efficient use of water (maximizing benefit from each gallon used). The plan was developed in conjunction with representatives of state agencies, local government, and wide range of stakeholder interests.

The WCIP provides specific goals and benchmarks for Georgia's seven major water use sectors. The major water use sectors include agricultural irrigation; electric generation; golf courses; industrial and

commercial; landscapes; domestic and nonindustrial public uses; and state agencies. For each sector, the WCIP details water conservation goals, benchmarks, best practices and implementation actions designed to reduce water waste, water loss, and where necessary, water use.

The WCIP will be used to guide decisions related to water use and water management by

- Educating water users about water conservation practices and the goals they can accomplish
- Informing regional water plan preparation that will be overseen by regional water planning councils
- Helping water use sectors collectively improve water use efficiency
- Informing DNR rule-making regarding water conservation requirements in permitting

2.1.1.2.5.1.5 Conserve Water Georgia

Conserve Water Georgia (http://www.conservewatergeorgia.net/index.html) is a water conservation clearinghouse of Georgia EPD (GADNR 2009a). The focus of the clearinghouse is public information, education, and awareness. The site provides tips and tools for individuals, teachers and students, business and industry, and communities and local governments on conservation and water efficiency strategies.

Conserve Water Georgia promotes *waterSmart,* an education program designed to give Georgians information they need to successfully conserve water. Developed by CCMWA in 2000 for residents in its service area (http://www.watersmart.net/), Georgia EPD began using the *waterSmart* brand in communications and education activities in 2006 to help residents statewide understand how to maintain their landscapes while using less water. The state *waterSmart* program was piloted in six communities in 2007 (Albany, Augusta, Cobb County, Columbus, Dalton, and Macon) and went statewide through a partnership with University of Georgia Cooperative Extension in 2008.

Conserve Water Georgia promotes participation in the USEPA *WaterSense* program (http://www.epa.gov/watersense/). *WaterSense* can help consumers identify products and services that use less water while performing as well as or better than conventional models, thus saving natural resources, reducing their water consumption, and saving money. WaterSense is making it easy to find and select water-efficient products with a label backed by independent testing and certification. WaterSense also recognizes some professional service programs that meet WaterSense specifications by incorporating a strong water efficiency component.

2.1.1.2.5.1.6 Georgia Water Supply Act of 2008

In 2008, the General Assembly passed the Water Supply Act, which tasked the Georgia Environmental Finance Authority (GEFA) with responsibilities and powers related to water supply project development in the state. In particular, the act required that GEFA establish the Georgia Reservoir and Water Supply Fund and conduct a study on feasible sites for water supply reservoirs in the state. Additionally, the act authorized the water division at GEFA to assist, in coordination with EPD, local governments with the reservoir and water supply permitting process. The water division may also plan, design, acquire, construct, operate, manage and maintain new reservoirs on behalf of local governments. In tandem with the Georgia Fund (GEFA's state-funded loan program), the Georgia Reservoir and Water Supply Fund is available to provide loans to local governments for projects such as system interconnections, new and rehabilitated wells, reservoir modifications for water supply purposes, and the construction of new water supply reservoirs.

In response to one of its mandates under the Georgia Water Supply Act of 2008 (O.C.G.A. 12-5-470), the GEFA conducted an inventory and survey of feasible sites for multijurisdictional drinking water supply

reservoirs in Georgia. The effort also considered reservoirs under development or specifically proposed, existing reservoirs with potential expansion volumes, and possible reservoir locations extracted from prior studies. The report was intended to provide information and preliminary analysis that can support decisions by local governments and Regional Planning Councils on how best to augment local water supply. The report is summarized in the following paragraphs (GEFA 2008). The study should complement the analyses conducted under the SWP.

The analysis focused on the 78-county area in Georgia above the fall line because the need for drinking water supply reservoirs in Georgia is sharply divided by geology at the fall line. Below the fall line (81 counties), groundwater aquifers are the principal source of public water supply and large underground aquifers function as their own natural water supply storage reservoirs. Above the fall line, surface water is the principal source of public water supply and man-made reservoirs are essential for water supply storage.

The study acknowledged that reservoirs are only one tool to increase water supply. Of all options, reservoirs are the most costly, environmentally sensitive, and time-consuming. Local water providers are encouraged to first give consideration to conservation and efficiency in planning to meet future needs. Communities are to also examine interconnectivity to other systems as well as the potential for drilling wells.

According to the GEFA study (GEFA 2008), when a region or community determines that a reservoir is the best alternative, priority should be given to the expansion of existing ones, then to development of regional reservoirs, and finally to single-jurisdiction facilities. There might be opportunities to expand existing reservoirs and evaluate existing and proposed projects for their ability to serve multiple jurisdictions. The study also recommended that communities explore opportunities to build impoundments on smaller streams, supplemented by pumping from large streams, rather than proposing reservoirs on large streams.

The GEFA analysis (2008) found that 16 existing reservoirs in Georgia (one in the ACT Basin) have potential for increased water supply yield by raising the existing dam to provide more storage volume in combination with supplemental pumping from a nearby stream for reservoir filling. Sharpe Creek Reservoir in the Upper Tallapoosa River basin in Carroll County current has a *top of dam* volume of 1.63 BG. The volume of the proposed expansion would be approximately 1.1 BG. The total final volume would be 2.73 BG.

In the 2008 GEFA report, eight new water supply reservoirs were identified as either under development or specifically proposed within Georgia. One of those eight new reservoirs is under development (in the permitting process) in the ACT Basin, the proposed Richland Creek Reservoir is on Richland Creek in north Paulding County in the Etowah River watershed (Coosa River Basin). This site, identified as NWGP #25 in GEFA (2008), was associated with a water supply planning initiative by the Northwest Georgia Regional Water Resource Partnership. Subsequent to the 2008 GEFA report, specific proposals were developed for Russell Creek reservoir in Dawson County (Etowah River Basin) and Indian Creek reservoir in Carroll County (Little Tallapoosa River Basin). Section 404 permits are currently being sought from USACE for these projects. More information on all three of these proposed projects is presented in Section 2.1.1.1.4.17.

GEFA (2008) identified 114 possible additional water supply reservoir sites within Georgia from available prior studies and published reports. Of those sites, 55 are in the ACT Basin. Inclusion on that list, provided as Table 2.1-20 below, does not mean that reservoirs are actually proposed at each site. The list simply represents potential reservoir sites that could be considered for development in the future and may be indicative of where future water supply needs may exist. Note that Table 2.1-20 does not include specifically proposed water supply projects presented previously (i.e., Sharpe Creek, Richland Creek, Russell Creek, or Indian Creek) that are in detailed planning, permitting, design, or construction stages.

Table 2.1-20.
Possible future reservoir locations in ACT Basin based on review of prior studies and investigations (GEFA 2008)

Counties served	Name	Stream name	River basin
Murray	NWGP4	North Prong Sumac Creek	Coosa (Conasauga)
Murray	NWGP5	Conasauga River - Upper	Coosa (Conasauga)
Murray	NWGP6	Mill Creek	Coosa (Conasauga)
Murray	NWGP7	Holly Creek	Coosa (Conasauga)
Murray	NWGP8	Rock Creek	Coosa (Conasauga)
Gilmer	Cartecay River 01	Cartecay River	Coosa (Coosawattee)
Gilmer	Ellijay River 01	Ellijay River	Coosa (Coosawattee)
Gilmer	NWGP9	Barnes Creek	Coosa (Coosawattee)
Gilmer	NWGP10	Davis Creek	Coosa (Coosawattee)
Gilmer	NWGP11	East Mountaintown Creek	Coosa (Coosawattee)
Gilmer	NWGP12	Fightingtown Creek	Coosa (Coosawattee)
Gilmer	NWGP14	Talona Creek / Fausett Creek	Cossa (Coosawattee)
Pickens	Talking Rock Creek 02	Talking Rock Creek	Coosa (Coosawattee)
Pickens	Talking Rock Creek 13	Talking Rock Creek	Coosa (Coosawattee)
Pickens	NWGP15	Four Mile Creek	Coosa (Coosawattee)
Pickens	NWGP18	Pinhook Creek	Coosa (Coosawattee)
Pickens, Gordon, Bartow	NWGP19	Salacoa Creek	Coosa (Coosawattee)
Pickens, Gordon, Gilmer	NWGP30	Talking Rock Creek	Coosa (Coosawattee)
Pickens	NWGP16	Long Swamp Creek	Coosa (Etowah)
Pickens	NWGP17	Rock Creek	Coosa (Etowah)
Lumpkin	Pecks Mill Creek	Pecks Mill Creek	Coosa (Etowah)
Dawson	Etowah River 10	Etowah River	Coosa (Etowah)
Dawson	Gab Creek	Gab Creek	Coosa (Etowah)
Dawson	Shoal Creek- Option 2	Shoal Creek / Etowah River	Coosa (Etowah)
Dawson	Unnamed Tributary to Palmer Creek	Unnamed Tributary to Palmer Creek	Coosa (Etowah)
Forsyth	Etowah River 01	Etowah River	Coosa (Etowah)
Forsyth	Reservoir – Land Acquisition	ISD	Coosa (Etowah)
Fulton	Fulton County Etowah River Watershed Reservoir	ISD	Coosa (Etowah)
Cherokee	Boston Creek	Boston Creek	Coosa (Etowah)
Cherokee, Forsyth	Settingdown Creek	Settingdown Creek	Coosa (Etowah)
Cherokee	Sharp Mountain Creek	Sharp Mountain Creek	Coosa (Etowah)
Cherokee	Shoal Creek – Option 1	Shoal Creek	Coosa (Etowah)
Bartow	NWGP20	Stamp Creek	Coosa (Etowah)

Table 2.1-20. (continued)

Counties served	Name	Stream name	River basin
Bartow	NWGP29	Boston Creek	Coosa (Etowah)
Bartow	Pumpkinvine Creek 02	Pumpkinvine Creek	Coosa (Etowah)
Bartow	Raccoon Creek 08	Raccoon Creek	Coosa (Etowah)
Bartow, Paulding	Raccoon Creek 07	Raccoon Creek	Coosa (Etowah)
Bartow, Paulding, Cobb	Ward Creek	Ward Creek	Coosa (Etowah)
Chattooga, Floyd	NWGP22	Little Armuchee Creek	Coosa (Oostanaula)
Floyd, Walker	NWGP21	Johns Creek	Coosa (Oostanaula)
Floyd	NWGP24	Big Cedar Creek	Coosa (Upper Coosa)
Floyd, Polk	NWGP 23	Cedar Creek	Coosa (Upper Coosa)
Polk, Floyd	Big Cedar Creek	Big Cedar Creek	Coosa (Upper Coosa)
Walker	NWGP1	Allen Creek	Coosa (Upper Coosa)
Haralson	NWGP26	Little Creek	Tallapoosa
Haralson	NWGP27	Walker Creek	Tallapoosa
Haralson	NWGP28	Limestone Creek	Tallapoosa
Haralson	West Georgia / Tallapoosa River	Tallapoosa River	Tallapoosa
Haralson	West Georgia Beech Creek	Beech Creek / Tallapoosa River	Tallapoosa
Carroll	Little Tallapoosa River 19	Little Tallapoosa River	Tallapoosa
Carroll	Little Tallapoosa River 20	Little Tallapoosa River	Tallapoosa
Carroll	Lower Little Tallapoosa River 14	Lower Little Tallapoosa River	Tallapoosa
Carroll	Lower Little Tallapoosa River 19	Lower Little Tallapoosa River	Tallapoosa
Carroll	Whooping Creek Reservoir	Whooping Creek	Tallapoosa

ISD – Insufficient Data

With the completion of the SWP and associated regional WDCPs, more comprehensive data and analysis tools became available to guide future water supply planning.

In August 2012, the first loans under the Reservoir and Water Supply Fund were awarded. Those awards included a 40-year low interest loan to Paulding County in the amount of $29,100,000 for construction of the Richland Creek reservoir in northern Paulding County in the Etowah River basin (GEFA 2012).

2.1.1.2.5.1.7 Georgia Water Stewardship Act of 2010 and Water System Interconnection, Redundancy and Reliability Act of 2010

In light of significant water resource management challenges in Georgia, including rapid growth and droughts, the General Assembly enacted the Georgia Water Stewardship Act during the 2010 legislative session. Based on recommendations from the 2009 Governor's Water Contingency Task Force, the legislation began a process for developing new fresh water supply sources while also reaffirming "the imminent need to create a culture of water conservation in the state of Georgia."

The Act required the following specific actions by local governments, public water systems, and state agencies (UGA CAES 2011):

- Local Governments
  - By January 1, 2011, adopt or amend local ordinances to uniformly restrict outdoor water use for landscapes between 10 a.m. and 4 p.m. daily.
  - After July 1, 2012, enforcement of updated plumbing code specifying:
    - High-efficiency flow specification for plumbing fixtures, including toilets, urinals and showerheads.
    - Sub-meters installed in new multi-unit buildings, including residential, commercial and light industrial facilities.
    - High-efficiency cooling towers in new construction.
- Public Water Systems
  - Completion of annual water loss audits by systems serving 10,000 or more people by January 1, 2012, and by systems serving 3,000 or more people by January 1, 2013.
  - Submission of annual water loss audits to the GAEPD within 60 days of audit.
- State Agencies
  - Collaboration between those agencies that deal with water to enhance programs and incentives for voluntary water conservation.
  - Submit annual reports to the General Assembly summarizing programmatic changes implemented to encourage conservation and enhance water supplies.
  - Review and revise state water-related policies, procedures, regulations and programs by August 1, 2010.

Also in 2010, the General Assembly passed the Water System Interconnection, Redundancy and Reliability Act (Water Interconnection Act) to explore the potential of optimizing water supply through the interconnection of water systems. The primary objective of the Water Interconnection Act is to complete a thorough and detailed engineering study that develops an emergency water supply plan for all qualified water systems within the Metropolitan North Georgia Water Planning District. GEFA completed the plan, consistent with the Water Interconnection Act, in September 2011 (Governor's WSTF 2011).

2.1.1.2.5.1.8 MNGWPD (Metro Water District)

The Metro Water District was created by the Georgia General Assembly in 2001 (O.C.G.A. §12-5-572) to serve as the water planning organization for the greater metropolitan Atlanta area. The Metro Water District's purpose is to establish policy, create plans and promote intergovernmental coordination of water issues in the District from a regional perspective.

The Metro Water District includes 15 counties (Bartow, Cherokee, Clayton, Cobb, Coweta, DeKalb, Douglas, Fayette, Fulton, Forsyth, Gwinnett, Hall, Henry, Paulding, and Rockdale counties) as well as 92 municipalities partially or fully within those counties. The Metro Water District also has seven authorities that provide water, sewer or stormwater services. The Metro Water District's plans and policies work to protect water resources in the Chattahoochee, Coosa, Flint, Ocmulgee, Oconee and Tallapoosa River basins. The area represented by the Metro Water District includes a portion of the Coosa and Tallapoosa River basins in all, or parts, of the following counties: Bartow, Cherokee, Cobb, Fulton,

Forsyth, and Paulding. Overall, the Metro Water District covers a total area of 4,800 sq mi, with approximately 4.8 million residents (MNGWPD 2008). Refer to the map of MNGWPD boundaries and watershed map from MNGWPD Plan (Figure 2.1-49 and Figure 2.1-50).

With the adoption of the Georgia SWP by the Georgia General Assembly in 2008, the Metro Water District became one of ten regional water planning councils in the state. Accordingly, the work of the Metro Water District will continue within the integrated framework of statewide water resources planning.

The Metro Water District enabling legislation mandated the development of three long-term regional plans to address the water resources challenges:

- Water Supply and Water Conservation Management Plan
- Wastewater Management Plan
- Watershed Management Plan

Those three plans were developed concurrently and represent an integrated and holistic approach to water resources planning and management in the District (MNGWPD 2008).

The first plans were completed and adopted in 2003 and have been actively implemented by local jurisdictions in the Metro Water District. Updates to these plans were completed and published in May 2009 (MNGWPD 2009). The following paragraphs summarize the detailed strategies and recommendations for both effective water supply and water conservation as defined in the 2009 update to the Water Supply and Water Conservation Management Plan. It includes specific tasks and milestones for implementing these recommendations for local governments as well as regional and state agencies. The Metro Water District water resources plans are the result of a collaborative effort between the District's local jurisdictions, Georgia EPD, and numerous stakeholders.

2.1.1.2.5.1.9 Existing Water Supplies

The Metro Water District relies primarily on surface water from rivers and storage reservoirs as its main source of water supply. In fact, surface water provides over 99 percent of the water supply in the District. Groundwater use makes up less than 1 percent of the public water supplies for the Metro Water District, because of bedrock geology. For the foreseeable future, it is expected that the percentage of groundwater use will remain about constant. Groundwater supply sources remain viable as a potential source for small towns and as a supplemental source during critical periods. Within the Metro Water District, almost 888 average annual day-million gallons per day (aad-mgd) of permitted water supply (surface and groundwater) is available. The Coosa and Tallapoosa River basins account only for about 14.1 percent of the permitted available water supply in the Metro Water District. A summary of existing permitted monthly average available water supply by basin is presented in Table 2.1-21.

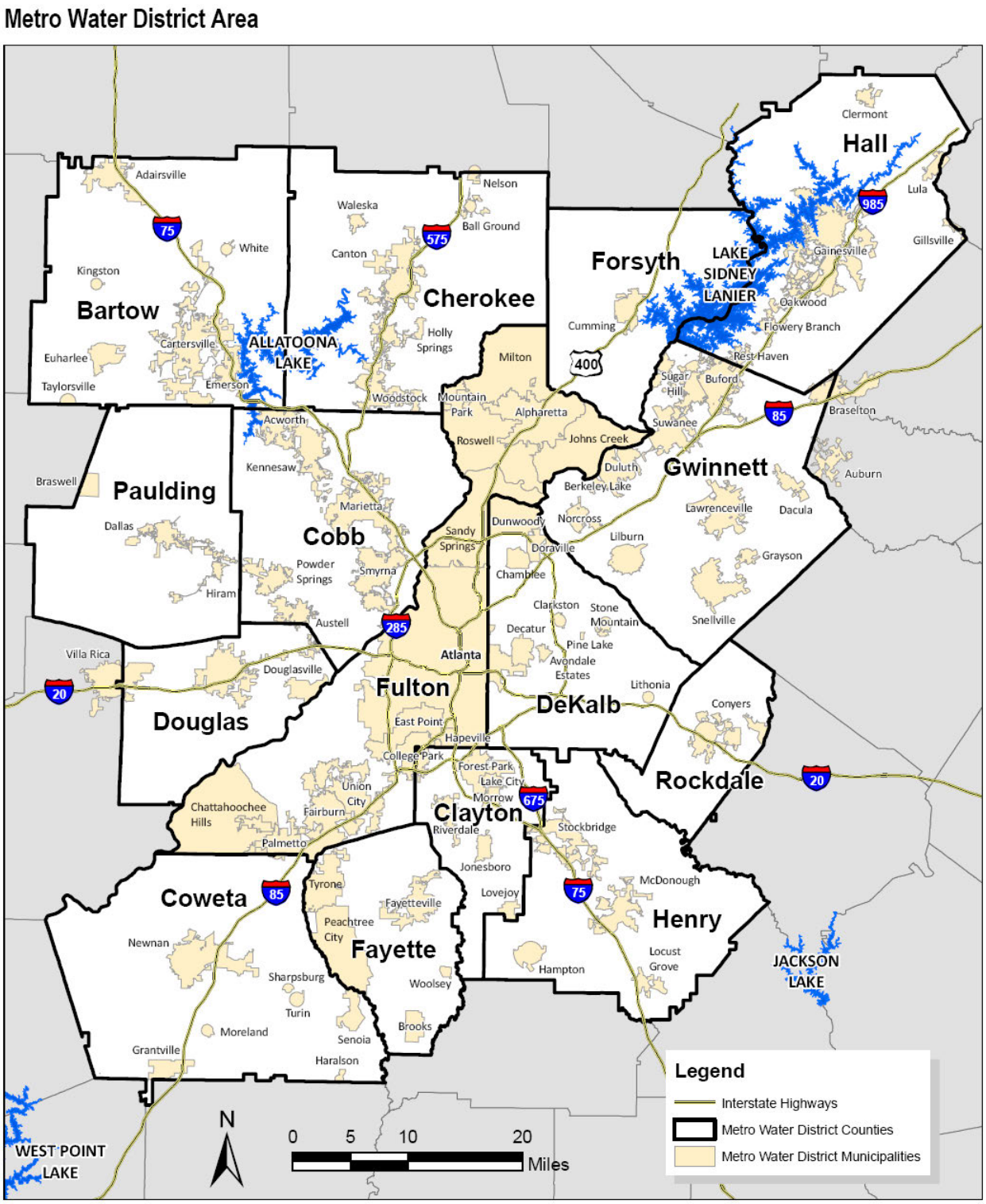


Figure 2.1-49. Metro Water District area.

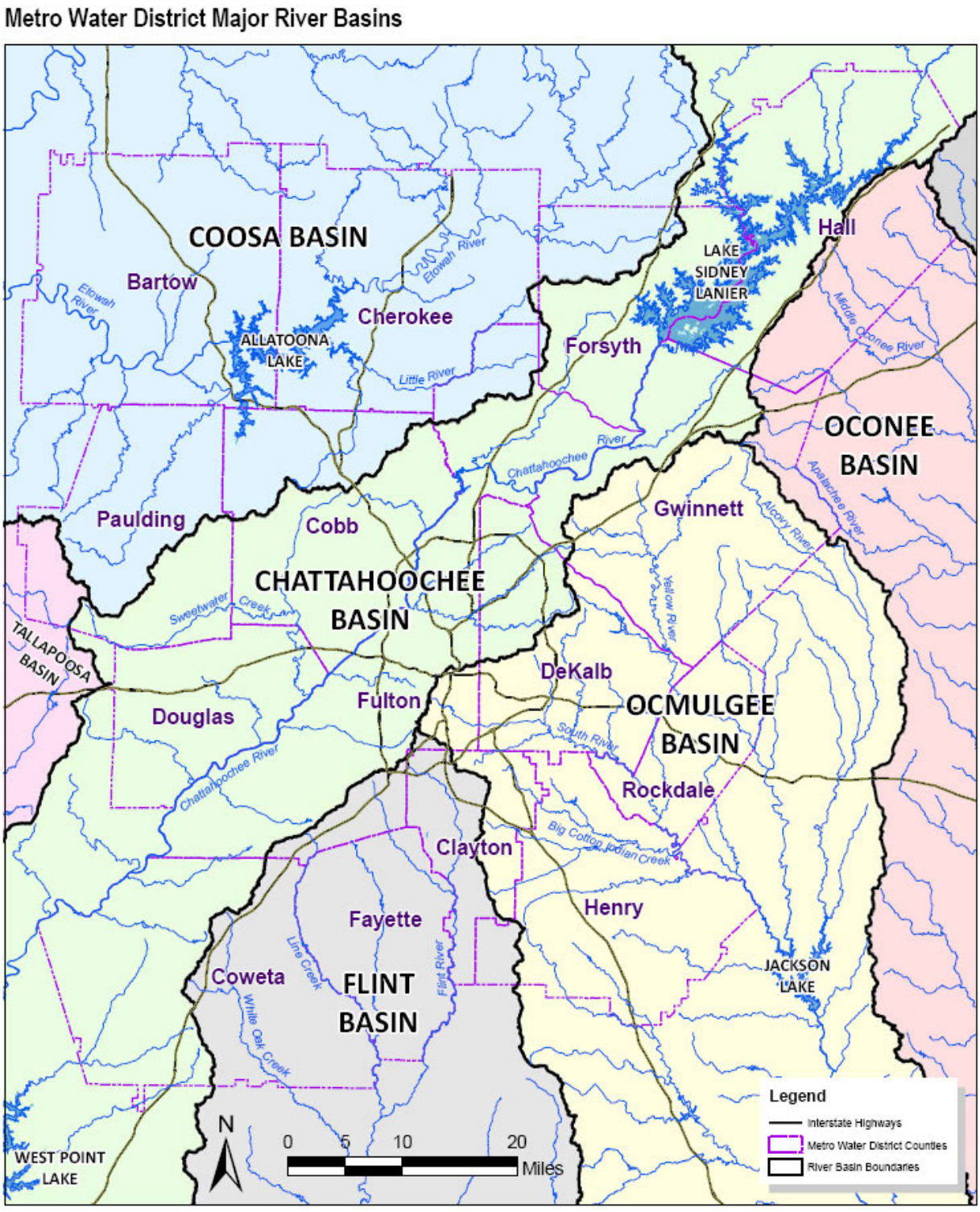


Figure 2.1-50. Metro Water District major river basins.

Table 2.1-21.
Metro water district percent permitted monthly average available water supply by basin

Source Basin	Percent Permitted Monthly Average Available Water Supply
Chattahoochee	72.6 %
Coosa	14.0 %
Flint	5.0 %
Ocmulgee	8.1 %
Oconee	0.2 %
Tallapoosa	0.1 %

2.1.1.2.5.1.9.1 Water Supply Interconnections

Water supply service and management throughout the Metro Water District is provided by over 50 individual water providers. Water management includes supply, treatment, distribution, interconnections, and the interaction of those infrastructure systems with the natural systems.

All 15 counties in the Metro Water District maintain interconnections with at least one other county for either routine or emergency water sale. Some of the interconnections originally served as a primary water supply source before the water system in the receiving county was adequately developed. The connections are now kept for emergency uses. Interconnections with other water systems provide a valuable means of increasing water system reliability.

2.1.1.2.5.1.9.2 Interbasin Transfers

Interbasin transfers of water and wastewater occur among municipalities, counties, and basins in the Metro Water District. Transfers among basins are particularly common within counties that straddle the ridges between two or more basins. Interbasin transfers are a key and necessary element in supplying water throughout the Metro Water District; there are water supply and wastewater transfers into and out of every basin. On the basis of 2006 actual withdrawals and discharges within the Metro Water District area, water supply withdrawals from the Coosa River Basin for use outside the basin (Chattahoochee) were 13 aad-mgd, while wastewater returns of 1 aad-mgd were generated inside the Coosa River Basin and discharged to the Chattahoochee River Basin. The current *net* interbasin transfer from the Coosa River Basin to the Chattahoochee River Basin (both water supply and wastewater returns) is estimated to be a loss of 14 aad-mgd (MNGWPD 2009).

MNGWPD (2009) estimates that water supply transfers in 2035 from the Coosa River basin to the Chattahoochee and Tallapoosa River basins would total 36 and 2 aad-mgd, respectively. Wastewater returns from the Chattahoochee River Basin to the Coosa River Basin in 2035 are estimated to be 4 aad-mgd. Therefore, the net transfer from the Coosa River Basin in 2035 is estimated to be 32 and 2 aad-mgd (from the Chattahoochee River Basin and Tallapoosa River Basin, respectively). Assuming a straight line rate of change, the net transfer from the Coosa River Basin in 2020 would be about 24 aad-mgd (to the Chattahoochee and Tallapoosa River basins).

2.1.1.2.5.1.9.3 Water Conservation Program

Water conservation is a critical element in meeting the water supply needs within the Metro Water District. When fully implemented, these water conservation measures will reduce the Metro Water District's water demand by the end of the planning period. Much progress related to water conservation has been achieved since the adoption of the 2003 Water Supply and Water Conservation Management Plan. The Metro Water District's plan has been instrumental in making water conservation a priority in north Georgia. The Metro Water District is the only major metropolitan area in the country with more than 100 jurisdictions that is implementing such a comprehensive long-term water conservation program that is required and enforced.

The planning process reflected in the 2009 update to the Metro Water District's Water Supply and Water Conservation Management Plan first considered water conservation/efficiency before investigating new or expanded sources. The water conservation program in the 2009 plan is the result of extensive analysis of the 2003 program, evaluation of new methods and measures, and stakeholder involvement. A list of 45 potential water conservation measures were identified and evaluated. Each potential conservation measure was ranked against three qualitative criteria: technology / market maturity, service area match, and customer acceptance / equity. The analysis detailed in the 2009 Plan update yielded a combination of measures that best met the ranking criteria and were determined to be cost effective. The water conservation measures in this Plan update include and go beyond the measures in the 2003 Plan. This update includes:

The 10 water conservation measures from the 2003 plan are:

- Conservation pricing
- Replace older, inefficient plumbing fixtures
- Pre-rinse spray valve retrofit education program
- Rain sensor shut-off switches on new irrigation systems
- Sub-meters in new multi-family buildings
- Assess and reduce water system leakage
- Conduct residential water audits
- Distribute low-flow retrofit kits to residential users
- Conduct commercial water audits
- Implement education and public awareness plan

Three of those ten water conservation measures were strengthened:

- Irrigation meter pricing at 200 percent of the first tier rate
- 1.28 gpf (gallons per flush) toilet rebate program only by 2014
- Minimum local education requirements and optional toolbox of examples is provided

Two new water conservation measures were added:

- Install 1.28 gpf toilets and low flow urinals in government buildings
- Require new car washes to recycle water

Tiered water conservation rates (where the more water used, the higher the price) have been put in place throughout the Metro Water District. By 2008 more than 99 percent of the population was subject to increasing block or tiered rates. All of the largest water systems have implemented programs to reduce system water loss. Toilet rebate programs are in place and ahead of schedule. In 2008, 24 water providers offered toilet rebates to eligible customers, either directly or as part of the Metro Water District's regional toilet rebate program.

The 2009 update to the Metro Water District plan projects a 20 percent reduction in per capita demand from 2001 to 2035 (see Figure 2.1-51). The starting point of 168 gallons per capita per day (gpcd) reflects billing data for 2001 collected for the 2003 plan. The 2006 data shows 151 gpcd, used in the plan update. The end point (135 gpcd) in 2035 reflects the benefit of the conservation program in the plan update.

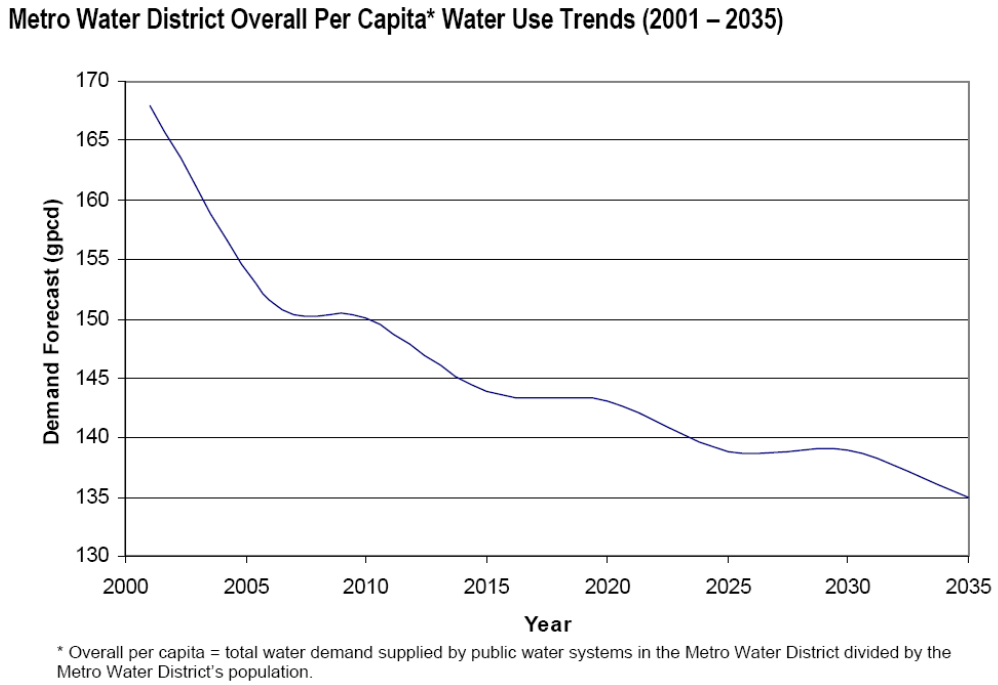


Figure 2.1-51. Metro Water District overall per capita water use trends (2001–2035).

2.1.1.2.5.1.9.4 Future Water Supply Demands and Sources

With implementation of the enhanced water conservation program, the projected water demand within the Metro Water District is estimated to be about 815 mgd by the year 2020 and 1,011 mgd by the year 2035 on an average annual daily demand basis. Figure 2.1-52 depicts present and projected future permitted water supplies and water demands, both with and without the enhanced water conservation measures. The current permitted surface water supply across the entire Metro Water District is 882 aad-mgd. Of that total, 148 aad-mgd comes from the Coosa River Basin and 1.5 aad-mgd comes from the Tallapoosa River Basin. According to Figure 2.1-52, that level of permitted supply would meet year 2020 demands (with enhanced conservation) through about year 2026. The Metro Water District has considered the benefits of the water conservation program (reduction in demand) before considering additional water supply sources.

To meet projected future water supply needs in the Metro Water District beyond 2026 through the 2035 planning period, additional water supply sources will be needed. The anticipated 2035 permitted surface water supply is 1,140 aad-mgd. Future water supply alternatives to meet 2035 demands within the Metro Water District include expanded use of existing water supply sources and reservoirs and construction of six additional water supply reservoirs, three of which are in the planning stages plus three others needed within the planning horizon. Table 2.1-22 presents information on the six proposed reservoirs within the Metro North District. Two of those reservoirs (Richland Creek Reservoir and Etowah Reservoirs) are within the ACT Basin.

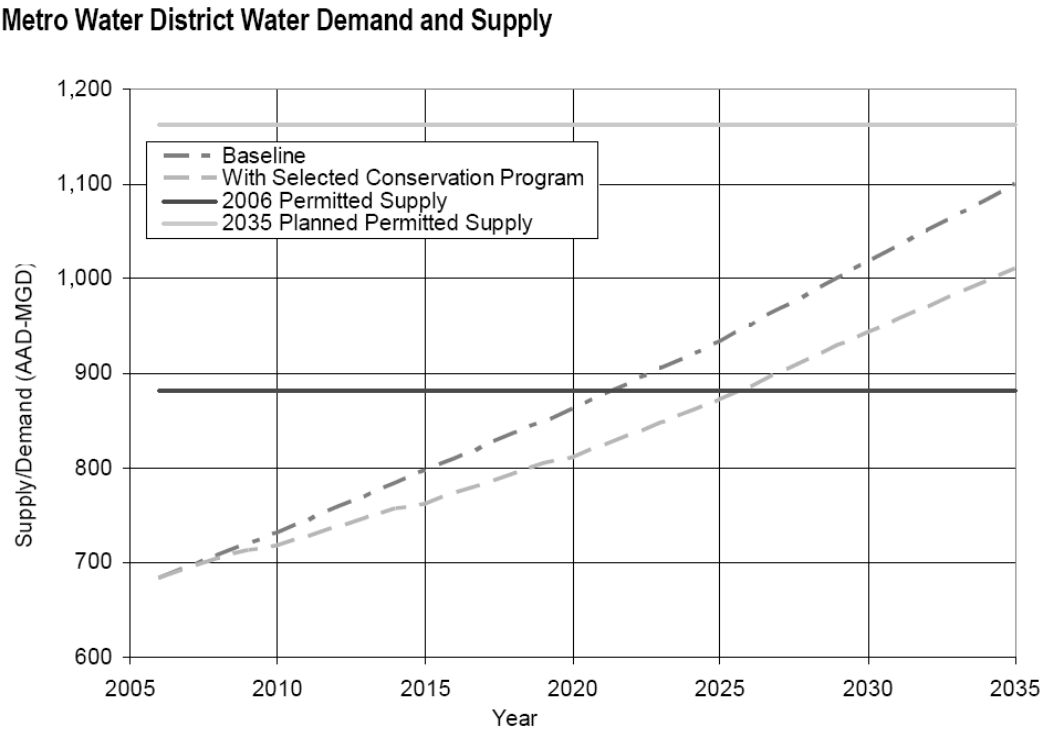


Figure 2.1-52. Metro Water District water demand and supply.

Table 2.1-22.
Planned water supply reservoirs in the Metro Water District

Reservoir	Owner/Operator Utilizing Resource	Basin	Estimated Size and Yield
Glades Reservoir	Hall County	Chattahoochee	The 733-acre reservoir with an estimated yield of 6.4 MGD will release water to Lake Lanier Currently in the permitting process.
Bear Creek Reservoir	Proposed South Fulton Water Authority	Chattahoochee	impoundment on Bear Creek, a tributary of the Chattahoochee River Estimated yield is 15 MGD.
Richland Creek Reservoir	Paulding County	Coosa	A 30-acre reservoir with an estimated yield of 35 MGD is in the permitting process on Richland Creek.
Etowah Reservoir	Fulton County	Coosa	A reservoir is being considered by Fulton County with a proposed 30 MGD yield.
Ocmulgee Reservoir	Henry County Water and Sewer Authority	Ocmulgee	A new reservoir is being considered in the Ocmulgee basin with a proposed 13 MGD yield.
Cedar Creek Reservoir	Gainesville-Hall County	Oconee	The Cedar Creek reservoir is expected to have a yield of 9 MGD and be supplemented with water from the North Oconee River.

2.1.1.2.5.1.9.5 Water Reuse

Several types of water reuse may be used in the Metro Water District to extend supplies or replace potential new water sources. The District plan outlines the different types of water reuse and discusses existing and future applications identified within the District to meet the 10 percent reuse planning standard identified by Georgia EPD.

Non-potable and indirect potable reuse are both practiced in the Metro Water District and are expected to sustain water supplies into the future. Indirect potable reuse is highly encouraged, where appropriate. Non-potable reuse is acceptable depending on each local community's consumptive use challenges, when it offsets an existing potable water supply.

The Metro Water District has assumed in its planning efforts that USACE reservoirs will continue to operate to meet water supply needs within the District consistent with the guidance about future yield expectations provided by Georgia EPD. After reviewing alternatives to the use of USACE reservoirs, *the Metro Water District has concluded that there are no alternatives to the Chattahoochee River and the Etowah River as major water supply sources for north Georgia.*

2.1.1.2.5.2 Alabama

2.1.1.2.5.2.1 Alabama Office of Water Resources (ALOWR)/Alabama Water Resource Commission

The Alabama Water Resources Act (Act Number 93-44, codified as Code of Alabama 1975, Article 9-10B-1, *et seq.*) legislatively established the ALOWR, a division of the Alabama Department of Economic and Community Affairs.

ALOWR plans, coordinates, develops, and manages Alabama's water resources, both ground and surface water in a manner that is in the best interest of Alabama. This includes recommending policies and legislation, conducting technical studies, implementing and participating in programs and projects, and actively representing Alabama's intrastate and interstate water resource interests (ALOWR 2010).

The Alabama Water Resources Commission provides oversight to the ALOWR and serves in an advisory capacity to the governor and presiding officers of the state House and Senate. The commission consists of 19 voting members selected by the governor, the lieutenant governor, and the speaker of the House of Representatives. Members serve 6-year, staggered terms. The Alabama Water Resources Act requires that commission membership include representatives from each congressional district and each major surface water region of Alabama. In addition to the geographic representation requirements, the membership must also represent a cross section of water user groups including rural and urban public water systems, nonpublic (industrial, manufacturing, and such), commercial navigation, conservation and the environment or water based recreation interests within Alabama (ALOWR 2010).

2.1.1.2.5.2.2 Alabama Drought Management Plan

Alabama has developed a Drought Management Plan (final draft), dated April 22, 2004 (ALOWR 2004). The plan is administered and coordinated by the ALOWR, working closely with numerous local, state, and federal agencies and other water resources professionals to pursue this statewide approach to drought planning and management. The following paragraphs provide a summary of the plan.

The purpose of the Alabama Drought Management Plan is to minimize the impact of drought, to develop identifying methodology, to develop action plans to be used during a drought and to reduce the risk of drought disasters. The plan outlines both long- and short-term measures to be used to mitigate the effects of drought and to respond to drought conditions. To accomplish those goals, the plan does the following:

- Defines a process to address drought and drought-related activities, such as monitoring, vulnerability assessment, mitigation, impact assessment, and response
- Identifies long- and short-term activities that can be implemented to reduce and prevent drought impacts

- Identifies local, state, federal, and private sector entities that are involved with state drought management and defines their responsibilities
- Acts as a catalyst for creation and implementation of local drought and response efforts

There is no way to prevent a drought from occurring; however, the effects of a drought can be reduced or even eliminated altogether. The impact of drought can be reduced by improving the overall forest health, which reduces the risk of drought-caused fires, improving and maintaining water systems, which will reduce pumping failures, establishing and implementing contingency plans (such as, predetermined water conservation measures), or by designating alternative emergency water sources.

The plan creates a statewide regional structure to identify the different areas affected by drought conditions, identify risks associated with drought conditions and identify ways to possibly avoid droughts and when drought emergencies cannot be avoided, identify ways to mitigate the impacts of droughts. The objectives are accomplished by developing drought triggers and indicators and by providing guidance on responses to drought conditions for the various sectors affected by droughts.

In the plan, the Alabama Drought Assessment and Planning Team (ADAPT) is established to serve in an advisory capacity to ALOWR and the Governor's Office, as needed, and to coordinate intergovernmental drought response and management in implementing all drought-related activities. ADAPT is composed of members from several Alabama agencies, the U.S. Department of Agriculture (USDA), the chairman of the Monitoring Advisory Committee (MAG), and chairman of the Drought Impact Group (DIG). The MAG provides technical support to ADAPT and is composed of representatives from federal, state, and local agencies and other water resources professionals. The DIG provides drought impact and mitigation support to ADAPT, is responsible for identifying drought effects on water users, and is representative of the following five drought impact sectors: agricultural affairs, domestic affairs, industrial affairs, recreational affairs, and environmental affairs. Each subgroup is composed of state, local, private, and nonprofit organizations and works on issues that encompass more than one drought sector.

The state is divided into nine regions. Drought indicators have been determined for each region. When the drought indicators begin to show the potential onset of drought conditions, the ALOWR, in coordination with ADAPT and MAG, declare appropriate drought stage determinations with increasing levels of severity (advisory, watch, warning, emergency) as the drought may deepen.

Upon the inception of a new or increased drought alert phase, the ADAPT is responsible for disseminating public information concerning all aspects of the drought. The initial action in responding to drought must be public education, providing information as to existing and potential conditions and water conservation measures necessary to meet the demand presented at each drought watch phase.

Drought triggers do not automatically invoke a required response from the various categories of water users. The triggers do prompt additional monitoring and notices to the water systems and public regarding the ongoing drought conditions. ALOWR in coordination with ADAPT notifies the local governments and water utilities as to severity of the drought and makes recommendations and provide guidance on the appropriate actions to be taken during the four stages of drought.

2.1.1.2.5.2.3 Alabama Water Use Reporting Program

The state of Alabama has a Water Use Reporting Program administered by ALOWR. All public water systems and those other individuals and organizations that have a capacity to withdraw 100,000 gpd or more are required to register with ALOWR and obtain a Certificate of Use (ALOWR 2010).

Each water user that meets the withdrawal threshold must submit an application form (called a "Declaration of Beneficial Use") and other required information. When ALOWR has reviewed the Declaration of Beneficial Use application and supporting documentation and determined it to be complete, ALOWR will issue a "Certificate of Use" that lists the name of the public water system, individual, or other organization as well as information concerning all registered surface and/or groundwater withdrawal points and pertinent withdrawal information. The certificate owner must annually report water usage information back to ALOWR. In accordance with the Alabama Administrative Code, Chapter 305-7-11, Certificates of Use are issued by ALOWR for periods of not less than five (5) years and not more than ten (10) years. A Certificate of Use can be suspended, revoked, terminated, or modified by the ALOWR if pertinent provisions of the Alabama Administrative Code or its implementing rules or if the specific terms and conditions in the certificate are violated (ADECA 2012).

2.1.1.2.5.2.4 Water Conservation Program

In addition to the Alabama Drought Management Plan, which specifically supports conservation efforts during periods of drought, the state actively encourages voluntary water conservation/ water efficiency initiatives on the ALOWR Web site (ALOWR 2010). The Web site promotes and maintains conservation tips on indoor and outdoor water use. The tips include links to assist (1) residential customers to investigate water saving opportunities in each area of the home; (2) agricultural interests to consider adapting conservation practices that are used on agricultural land across the country to conserve and improve natural resources for use on their land; and (3) municipal water planners with step-by-step approaches and conservation measures that can be used to develop and implement plans for water conservation. The web site also provides a sample Water Conservation Ordinance for use by municipal and county government officials.

2.1.1.2.5.2.5 Alabama Water Agencies Working Group

In August 2011, Governor Bentley called together four agencies of state government with water resource responsibilities to develop an overview of water issues and activities. The four agencies included: Alabama Department of Community Affairs, Office of Water Resources (ALOWR); Alabama Department of Conservation and Natural Resources (ADCNR); Alabama Department of Environmental Management (ADEM); and the Geological Survey of Alabama (GSA). The Governor decided in April 2012 to continue and expand this work by formalizing the Alabama Water Agencies Working Group (AWAWG). Soon thereafter, a fifth agency, the Alabama Department of Agriculture and Industries, was added to the AWAWG.

Governor Bentley directed the AWAWG to recommend an action plan and timeline for implementing a statewide water management plan by December 1, 2013. As part of the action plan process, AWAWG was tasked to establish a comprehensive database of Alabama's water resources and conduct meetings to gather input from stakeholders interested in water resource issues. The work of the AWAWG is coordinated by a chairman appointed by the Governor. Six subcommittees were created to help carry out the group's responsibilities and provide focus to the following specific topics: legal; database; stakeholders; legislation; reporting; and public information.

AWAWG prepared and submitted a report to the Governor on August 1, 2012 entitled *Water Management Issues in Alabama* (AWAWG 2012). The report represented an interim step in response to the Governor's directive. It identified and summarized a dozen key water issues for the state and associated policy options. The water and related issues identified included:

- Water Resources Management Plan
- Expanded Certificates of Use / Permitting

- Economic Development
- Surface Water and Groundwater Availability
- Drought Planning
- Water Conservation and Water Reuse
- Interbasin Transfers
- Instream Flows
- Interstate Coordination
- Water Resources Data
- Key Stakeholder Education and Outreach
- Public Education and Outreach

AWAWG reaffirmed the need for a statewide water management plan so that Alabama can address these issues responsibly and effectively. The August 2012 report was intended to provide a common base of information to assist various water agencies and others interested in water resource matters to take the first steps toward resolving policy issues and creating a comprehensive water management plan for Alabama.

The December 2013 report responding to the Governor's directive summarized actions taken by AWAWG through the August 2012 *Water Management Issues in Alabama* report and subsequent steps to develop and recommend a conceptual framework for a comprehensive state-wide water resource management plan. The recommendations were developed with substantial stakeholder participation. The conceptual framework included a vision statement, guiding principles, and an action plan addressing all twelve water resource issue areas identified in the August 2012 report. The recommended actions included proposed responsible agencies, estimated costs, relative priorities, and proposed timelines for implementation (AWAWG 2013).

2.1.1.3 Monitoring Water Quantity for Management

2.1.1.3.1 Surface Water

Several federal government agencies monitor water quantity in the ACT Basin. Extensive water quantity monitoring networks have been developed by the USGS as part of the Cooperative Water Program. Georgia EPD, Alabama Department of Environmental Management (ADEM) and the Alabama Department of Economics and Community Affairs provide support for continuous water quantity monitoring of surface water and groundwater. USACE monitors inflow and discharge at all USACE-managed reservoirs, along with pool elevation. All federal water quantity monitoring is available in real-time online. Both Georgia EPD and ADEM operate several additional water quantity monitoring networks in their state. Water quantity data is taken yearly and continuously depending on the station.

2.1.1.3.2 Groundwater

The USGS operates several monitoring networks in the ACT Basin. The largest network, the Active Groundwater Network, contains information that the USGS or its cooperators measure at least once every year. At four wells, measurements are recorded at 15- to 60-minute intervals using dataloggers that transmit the data to the USGS every 1 to 4 hours. Data collected within this network are used for statewide monitoring programs, drawdown monitoring, hydrologic research, and aquifer tests. The USGS Climate Response Network monitors the effects of droughts and climate variability on groundwater levels in two wells in the ACT Basin. Two wells are also part of the Long-Term Groundwater Data network, and measurements have been made at the wells at least once a year for at least the last two decades (USGS 2010b).

As part of the Cooperative Water Program in Georgia and Alabama, the USGS monitors groundwater levels in cooperation with Georgia EPD and ADEM, as well as several local municipalities. The wells are periodically observed and continuously monitored within the network of the state. Well inventory data are entered into the Ground-Water Site Inventory database.

The Geological Survey of Alabama monitors groundwater levels year-round at three well locations in the ACT Basin. The agency also samples water levels in an additional 450 wells in October (GSA 2010).

2.1.2 Water Quality Affected Environment

Trends in water quality since the CWA was passed show improvement. An unpublished study to evaluate trends in water quality data collected by ADEM from 1974 to 1998 indicates that overall total phosphorus, total suspended solids, and nitrate concentrations have improved (Elias and Dougherty 2009). In the September 1998 *Water Allocation for the Alabama-Coosa-Tallapoosa (ACT) River Basin, Alabama and Georgia, Draft Environmental Impact Statement* (USACE, Mobile District 1998a), the focus of regulatory agencies was on concerns similar to those of today—eutrophication in lakes and reservoirs, suspended sediment, and fecal coliform bacteria. However, the approach to regulation has evolved and continues to change. In the 1990s, environmental nonprofit organizations sued states and USEPA for not complying with the CWA. Since then, several total maximum daily loads (TMDLs) have been developed in the ACT Basin further regulating M&I wastewater facilities. Current regulatory efforts have also focused on nonpoint sources of pollution—agricultural activities, construction, and urban runoff.

The sections that follow describe water quality standards in the ACT Basin; waterbodies' ability to meet those standards; point sources of pollution; and efforts to quantify conditions, including monitoring efforts, models, tools, publications, and other studies. Since 1998 a great deal of work has been completed by the ADEM, Georgia EPD, and USEPA to quantify water quality conditions from both point and nonpoint sources along the mainstem of the ACT Basin and in tributaries. This document focuses on conditions in the mainstem of the ACT Basin.

2.1.2.1 Historic Water Quality

Water quality in the ACT Basin, specifically in Alabama, has historically been good. An 1888 account of water in Alabama declared that the state had "bold springs that never go dry,…streams of perennial flow, and…an abundance of water for all purposes," indicating that water quality was superb before the turn of the century (Smith and DeLand 1888). The need to protect the water quality in Alabama was first identified in 1927 by the Director of the Bureau of Sanitation in the Alabama Department of Health who was concerned about the impacts of the growing industrial sector on water quality. His stream pollution bill was never introduced in the state legislation, and it was not until 1939 that interest in water quality became widespread because of heavy publicity in newspapers and periodicals (State of Alabama 1949).

In 1945 a stream pollution abatement bill sponsored by sportsmen's associations was presented in the Alabama State Legislature. The bill was met with fierce opposition and did not pass, but an industrial waste survey was commissioned in 1946 by the Bureau of Sanitation to document sources of pollution in Alabama. The survey concluded that the large streams and rivers were relatively clean, but some small streams were heavily polluted because of industrial and municipal waste. After the survey, a stream pollution prevention bill was introduced to the legislation in 1947 and passed, creating the Water Improvement Commission. The commission immediately began conducting extensive pollution surveys of Alabama's waterways (State of Alabama 1949).

According to the 1940 census, the Coosa River Basin had a population of 308,662 and had major urban, agricultural, and industrial areas. During that time, a total of 37 industrial and municipal outfalls were in the basin, of which 14 sewage outfalls received no treatment, 14 received primary treatment, and 9 received secondary treatment. Overall, the Coosa River and its tributaries had good water quality in 1948. However, the areas directly downstream of sewage outfalls had elevated fecal coliform levels, depressed DO concentrations, and elevated biochemical oxygen demand (BOD) concentrations. Sampling points in the Coosa River had DO concentrations that ranged from 5.1 mg/L to 7.8 mg/L and BOD concentrations that ranged from 0.5 mg/L to 3.0 mg/L. Fecal coliform population ranged from 1.2 to 2600 colonies per milliliter. Tributaries downstream of sewerage outfalls were not always capable of assimilating the pollution, and DO was recorded as low as 0.0 mg/L, BOD over 48.0 mg/L, and fecal coliform as high as 1,100,000 colonies per milliliter (State of Alabama 1949).

The Tallapoosa River Basin had a population of 180,024 during the 1940 census survey. A total of 28 industrial and municipal waste discharge locations were in the basin in 1948, 12 with no treatment, 13 with primary treatment, and 3 with secondary treatment. On the Tallapoosa River, DO ranged from 6.7 mg/L to 8.0 mg/L, BOD ranged from 0.5 mg/L to 2.2 mg/L, and fecal coliform from 5.2 to 510 colonies per milliliter. Overall, the Tallapoosa River and its tributaries were in relatively good sanitary conditions in 1948, but streams with sewer and municipal outfalls had poor water quality. The smaller tributaries did not have enough flow to dilute the raw sewage, and during low flows, sewer discharges on smaller tributaries had the potential to make up the entire stream flow. The 1949 Water Improvement Commission study indicates that adequate treatment works and improved efficiency of the sewage plants would adequately improve water quality (State of Alabama 1949).

The Cahaba River flows into the Alabama River, and its basin had a population of 93,448 in 1940. Several abandoned and active coal mines and 10 municipal sewer outfalls were in the basin in 1948. The BOD concentrations ranged from 0.8 mg/L to 2.1 mg/L, DO from 5.4 mg/L to 9.2 mg/L, and fecal coliform from 2.9 to 160 colonies per milliliter. The 1949 Water Advisory Commission study concluded that all streams in the basin were able to satisfactorily handle the pollutant loads and the basin was in excellent sanitary condition (State of Alabama 1949).

A population of 280,528 lived in the Alabama River basin in 1940. In 1948 there were 15 industrial and municipal sewer outfalls in the basin, 10 of which received no treatment and 5 of which received primary treatment. On the Alabama River, DO ranged from 6.5 mg/L to 7.0 mg/L, BOD ranged from 0.7 mg/L, 1.8 mg/L, and fecal coliform ranged from 4.0 to 500 colonies per milliliter. The 1949 Water Advisory Commission determined that watershed was able to handle all sanitary loads adequately, with the exception of two tributaries, and that the basin had overall good water quality (State of Alabama 1949).

In 1961, the Alabama Legislature called on Georgia to eliminate silt from activities in the Etowah River basin causing a hazard to fish in Weiss Lake (Pollution from Etowah 1961). Earlier that year sampling in the Etowah River measured sediment loads at 10 times average conditions, 360 mg/L (Rome businessmen 1961). Shortly after activities in the watershed were identified as impairing water quality, the State began hearings to establish water quality standards in Georgia (Water pollution hearing 1967). Thirty years later rivers in the upper ACT Basin indicated only having moderate pollution problems according to a USEPA study (Pollution rating 1997).

In 2000 water quality data in the Cahaba River Basin from 1970 through 2000 was reviewed. The analysis determined that water quality in the basin, which provides drinking water for Birmingham, was overall good. Water quality over the three decades was occasionally reduced in some streams because of isolated events, such as illicit discharges, and small contamination sites, such as landfills. Recently, urban runoff and construction has affected water quality near Birmingham, resulting in increased sediment and fecal coliform in streams (Pitt 2000).

Fish killings have historically occurred in Alabama, and kills have typically been isolated instances. They have been caused by illegal discharges into rivers in the ACT Basin and because of low flows (OSU 1972). Widespread use of pesticides on agricultural and residential land in the late 1900s led to continued and current Polychlorinated Biphenyls (PCB) and dichlorodiphenyltrichloroethane (DDT) contamination in sediment and fish tissue, and consumption warnings have been issued for fish since the late 1980s (USGS 2004). Recent increases in urbanization have caused decreases in fish diversity and abundance.

2.1.2.2 Existing Reservoir Quality

Water quality conditions in the main bodies of reservoirs are typically better than in the shallower arms of the reservoirs formed by tributary streams. Inflows to tributary streams are typically nutrient and sediment-rich. Sediment and phosphorus concentrations are also highest in the upper reaches of reservoirs and decrease toward the main pool as velocity is lowered and sediment is removed from suspension.

In shallower reservoirs, such as the Alabama River lakes, mixing from currents and wind prevents strong stratification and the formation of a hypolimnion layer. In deeper reservoirs, thermal and dissolved oxygen stratification generally occurs in the summer and early fall months. The following paragraphs describe the annual temperature and dissolved oxygen dynamics in the deeper reservoirs in the ACT Basin, including Allatoona Lake and Carters Lake.

During the colder winter months, the water in deep reservoirs, like Allatoona Lake and Carters Lake, is generally cold, relatively clear, and the same temperature from the top to the bottom. Water on the top and bottom of these reservoirs has similar densities. Wind action keeps these lakes well-mixed, resulting in adequate dissolved oxygen levels throughout the water column. During winter, water temperature and oxygen concentrations do not limit fish movement in the lake. Lake water, which is released through the hydropower units from near the bottom of the lake below the dam, is cold and relatively clear.

During spring and early summer, the lake warms and stratifies into three distinct layers: a surface layer called the epilimnion, a bottom layer called the hypolimnion, and a layer between the two called the metalimnion (or thermocline).

The warm, upper layer is fairly uniform in temperature and varies from 15 to 30 feet thick throughout the summer. It is well oxygenated from wind action and photosynthesis.

The hypolimnion, the cold (45 to 55 °F) bottom layer, becomes isolated and no longer mixes with the warm, oxygenated epilimnion. Oxygen is not produced in the hypolimnion because the cold, deep layer does not receive sunlight and is devoid of phytoplankton production. Early in the lake stratification process, the hypolimnion still contains some oxygen but declines through the summer as biological and chemical processes consume oxygen. By summer's end, the lake is strongly stratified. The epilimnion is warm and well oxygenated. Water temperature and oxygen concentrations in the thermocline are both lower but still often provide acceptable habitat for cool-water fish species. In the hypolimnion, the water is cold and low in oxygen (less than 3 mg/l). As oxygen levels fall, some metals and sulfides in the lake sediments become soluble. They dissolve in the water and can be released downstream, entering the river. The river water becomes re-aerated rapidly as it flows downstream, thus releasing the metals and sulfides that have become soluble.

In the fall, the lake begins to lose heat, and the process of destratification begins. The warm water of the epilimnion cools and becomes deeper and denser. As the epilimnion’s density approaches the density of the hypolimnion, mixing of the layers occurs and the stratification is broken. This event is called *lake turnover*, and generally occurs around November – December each year. After mixing, no layers exist, and the entire lake has a relatively uniform temperature and oxygen levels.

2.1.2.2.1 APC Reservoirs

APC operates the Weiss Lake, H. Neely Henry Lake, Logan Martin Lake, Lay Lake, Mitchell Lake, and Jordan Dam and Lake in the ACT Basin. The reservoirs are shallow in depth and do not experience thermoelectric stratification, although DO can still become depressed in lower portions of the reservoir (APC 2009a). During the late summer, DO levels are often less than 4 mg/L in the deeper portions of the reservoirs, when APC releases water for hydropower generation. The DO levels in the reservoir tailwaters have occasionally violated DO water quality criteria, and violations have typically occurred less than 7 percent of the time (APC 2009a).

The six APC project reservoirs form a continuous slackwater system on the Coosa River, which prevents reaeration in the reservoir tailwaters, with the exception of the Weiss Lake tailwater. Aeration systems are in place on several of the reservoir dams (Jordan, Lay, Logan Martin, and Mitchell), and APC plans to install aeration measures on the Weiss and H. Neely Henry lakes. The installation, along with continued and improved operation of the aeration systems should ensure that DO standards are met in the tailwaters of the APC reservoirs (APC 2009a).

Additionally, five of the six APC reservoirs have been listed on the Alabama 303(d) list from PCB contamination, nutrient and organic enrichments, and pH and DO violations. TMDLs were completed in 2008 for Logan Martin, H. Neely Henry, Lay, Mitchell, and Weiss lakes to address the pH, nutrient, and organic enrichment violations. High levels of nutrient concentrations are flowing into the reservoirs from tributaries and upstream sources. The excess nutrients have led to eutrophication in the lakes.

2.1.2.2.2 Carters Lake

The 2010 draft Integrated 305(b) and 303(d) lists two segments of Carters Lake as impaired for chlorophyll *a*. A TMDL is being developed to address the nutrient issues. Carters Lake does experience some thermoelectric stratification, and DO levels are reduced in the hyplomnetic zone during late summer. The reregulation pool downstream of the main lake serves as a buffer to improve water quality and flow condition downstream of the dam (GAEPD 2010a; USACE, Mobile District 1973).

2.1.2.2.3 Allatoona Lake

The mid lake and dam forebay portions of Allatoona Lake meet all designated water use criteria. Both the Etowah River and Little River Embayment sections of Allatoona Lake are listed on the 2010 draft Integrated 305(b) and 303(d) list because of chlorophyll *a* impairment. The chlorophyll *a* draft TMDL was completed in 2009, and a fecal coliform TMDL was completed in 2004. The reservoir is transitioning from mesotrophic to eutrophic because of the influx of phosphorus nutrients. Phosphorus has increased in the reservoir and its tributaries because of increases in urban lands and broiler and beef cattle production. DO in the tailwaters of Allatoona Lake drops below 4 mg/L during the summer and through early fall, and can reach as low 1 mg/L in the tailwaters (GAEPD 2010a).

2.1.2.2.4 Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake

Robert F. Henry Lock and Dam was supporting its designated uses according to the 2010 draft 303(d) list. Tributaries draining municipal, industrial, or agricultural areas can have poor water quality. DO levels in the lake are low during the summer, but the levels are still adequate to support diverse fish populations. USACE operates a continuous water quality monitor station downstream of the dam that records DO, pH, conductivity, and temperature (ADEM 2010a; USACE, Mobile District 1999).

2.1.2.2.5 Millers Ferry Lock and Dam and William "Bill" Dannelly Lake

Millers Ferry Lock and Dam was supporting its designated uses according to the 2010 draft 303(d) list. Water quality in the tailwater of Millers Ferry Lock and Dam is good, although DO levels are low during the summer months when the power plant is in operation. USACE collects water quality data downstream of the dam (ADEM 2010a).

2.1.2.2.6 Claiborne Lock and Dam and Lake

Claiborne Lock and Dam and Lake is listed in the 2010 draft Integrated 303(d) lists for metals and organic enrichments. The nutrient enrichment has been caused by industrial and municipal discharges and runoff from agricultural areas. USACE monitors water quality, including DO concentrations, in the tailwater of the reservoir (ADEM 2010a; USACE, Mobile District 1974b).

2.1.2.3 Surface Water Quality

2.1.2.3.1 Water Quality Standards

Title 33 of the U.S.C., Navigation and Navigable Waters, Chapter 26, Subchapter III, section 1313, paragraph (3)(A), requires that states adopt water quality standards. The standards are reviewed through public involvement. Both the standards and any later changes must be approved by USEPA. Table 2.1-23 and Table 2.1-24 present the water quality standards for Alabama and Georgia. States designate uses, such as public water supply and recreation, for their waterbodies. Relevant water quality standards are then applied on the basis of a waterbody's designated use(s). Figure 2.1-53 illustrates the designated use(s) of mainstem waterbodies in the ACT Basin.

A February 2000 *Environmental Assessment for Major Rehabilitation of the Lake Allatoona Powerhouse* (USACE 2000), identified low DO in the tailrace of the dam during periods of no power generation. The proposed action did not cause impairment to DO, but USACE used the EA to describe plans for future features that will minimize seasonal DO violations. APC has proposed operating aeration systems at the Logan Martin Lake, Lay Lake, Mitchell Lake, and Jordan Dam and Lake projects to ensure compliance with its water quality certification (FERC 2009). In certain cases, site-specific criteria are identified for waterbodies. Table 2.1-25 provides the site-specific criteria for mainstem lakes in the ACT Basin.

Most states, including Alabama and Georgia, do not have water quality standards for nutrients, namely BOD, total phosphorus (or components), and total nitrogen (or components) in rivers. In lakes, site-specific criteria apply to chlorophyll *a*, which is commonly used as an indicator of nutrients in waterbodies. In 2002 USEPA recommended nutrient criteria for waterbodies on the basis of their ecoregion (USEPA 2008); Alabama and Georgia have not yet adopted those standards.

In a 2008 TMDL for Weiss Lake site-specific criteria were set for growing season median total phosphorus to be protective of water quality standards for chlorophyll *a*. Alabama has established a growing season average 20 µg/L chlorophyll *a* criteria at two locations in Weiss Lake. Through coordination between USEPA, Alabama, and Georgia, allowable growing season concentrations of total phosphorus were established for Alabama and the Coosa and Chattooga rivers in Georgia. The allowable load into Weiss Lake from the Coosa River was calculated to allow a growing season median concentration of 60 µg/L (or 0.06 mg/L) of total phosphorus (USEPA Region 4 2008). According to a draft review of Georgia's assimilative capacity, from 2001 through 2007 the Coosa River exceeded its growing season median concentration for total phosphorus (GAEPD 2010e).

In addition to the parameters presented in Table 2.1-23 through Table 2.1-25, both Alabama and Georgia have water quality standards for metals and other toxic substances that are based on human use and consumption rates. More information relevant to water quality standards for metals and other toxic substances are in *ADEM Administrative Code,* R. 335-6 (ADEM 2008a) and Administrative Rule 391-3-6-.03: Water Use Classifications and Water Quality Standards (GAEPD 2008b).

Table 2.1-23.
Alabama water quality standards

Designated use	E. *coli* bacteria	DO	pH	Temperature
Outstanding Alabama Water	< 126 colonies/100 mL as geometric mean in non-coastal waters > 235 colonies/100 mL as maximum in non-coastal waters < 35 colonies/100 mL as geometric mean in coastal waters > 104 colonies/100 mL as maximum in coastal waters	> 5.5 mg/L at all times Not <4 mg/L under extreme conditions from natural causes	Between 6.0 and 8.5 for all Between 6.5 and 8.5 for saltwater and estuarine waters	< 90 °F (32 °C) < 86 °F [a] (30 °C)
Public Water Supply	< 548 colonies/100 mL as geometric mean, no more than 2,507 colonies/100 mL in any given sample in non-coastal waters > 275 colonies/100 mL as maximum in coastal waters Jun–Sep incidental water contact and recreation < 126 colonies/100 mL, no more than 487 colonies/100 mL in any given sample in non-coastal waters Jun–Sep incidental water contact and recreation < 35 colonies/100 mL, no more than 158 colonies/100 mL in any given sample in coastal waters	> 5 mg/L at all times Not < 4 mg/L under extreme conditions from natural causes	Between 6.0 and 8.5	< 90 °F (32 °C) < 86 °F [a] (30 °C)
Swimming and Other Whole Body Water-Contact Sports	< 126 colonies/100 mL as geometric mean in non-coastal waters > 235 colonies/100 mL as maximum in non-coastal waters < 35 colonies/100 mL as geometric mean in coastal waters > 104 colonies/100 mL as maximum in coastal waters	> 5 mg/L at all times Not < 4 mg/L under extreme conditions from natural causes	Between 6.0 and 8.5 for all Between 6.5 and 8.5 for saltwater and estuarine waters	< 90 °F (32 °C) < 86 °F [a] (30 °C)

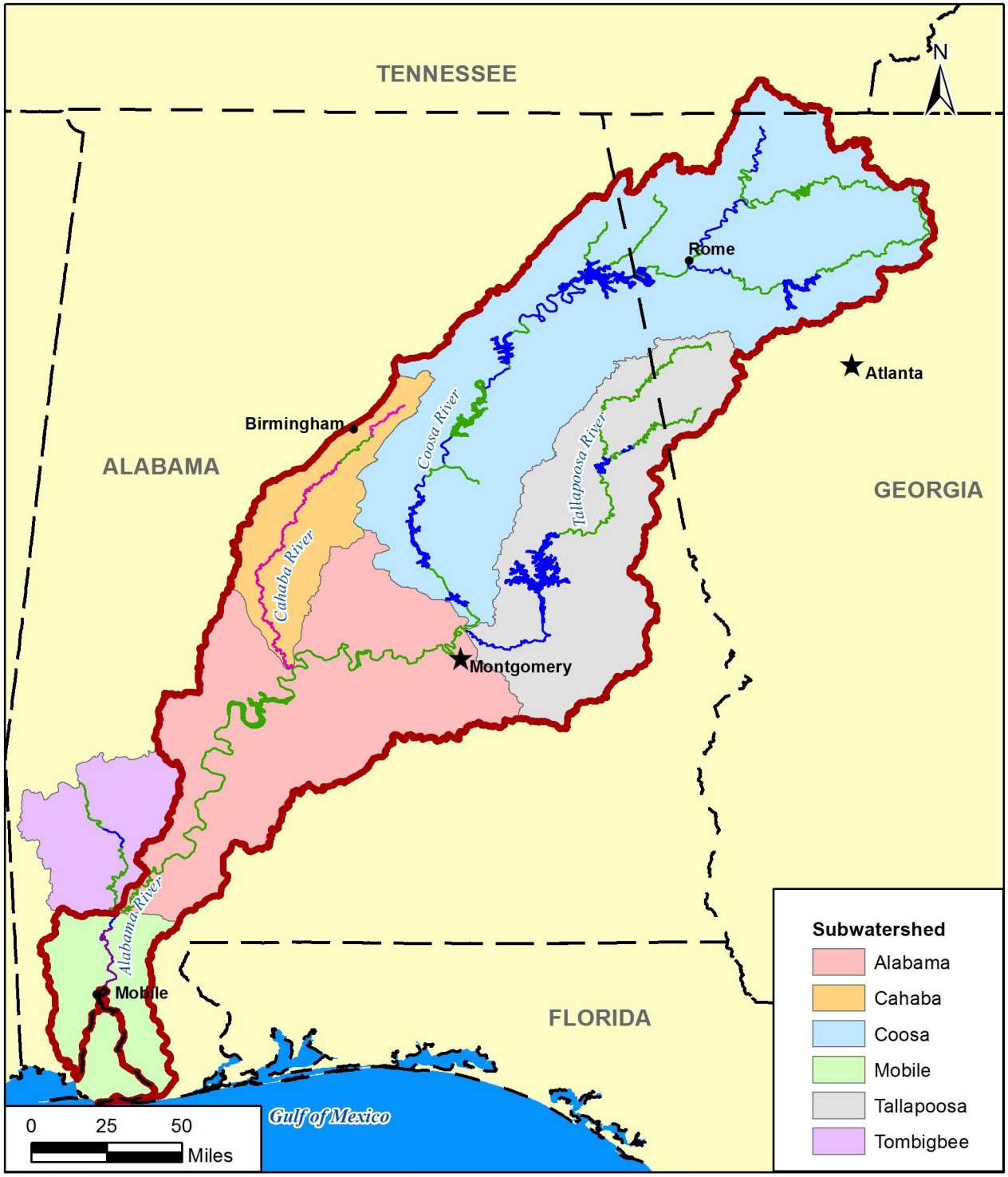
Designated use	E. *coli* bacteria	DO	pH	Temperature
Shellfish Harvesting	< 126 colonies/100 mL as geometric mean in non-coastal waters > 235 colonies/100 mL as maximum in non-coastal waters < 35 colonies/100 mL as geometric mean in coastal waters > 104 colonies/100 mL as maximum in coastal waters	> 5 mg/L at all times Not < 4 mg/L under extreme conditions from natural causes	Between 6.5 and 8.5	< 90 °F (32 °C) < 86 °F [a] (30 °C)
Fish and Wildlife	< 548 colonies/100 mL as geometric mean, no more than 2,507 colonies/100 mL in any given sample in non-coastal waters > 275 colonies/100 mL as maximum in coastal waters Jun–Sep incidental water contact and recreation < 126 colonies/100 mL, no more than 487 colonies/100 mL in any given sample in non-coastal waters Jun–Sep incidental water contact and recreation < 35 colonies/100 mL, no more than 158 colonies/100 mL in any given sample in coastal waters	> 5 mg/L at all times Not < 4 mg/L under extreme conditions from natural causes	Between 6.0 and 8.5 for all Between 6.5 and 8.5 for saltwater and estuarine waters	< 90 °F (32 °C) < 86 °F [a] (30 °C)
Limited Warmwater Fishery	< 548 colonies/100 mL as geometric mean, no more than 2,507 colonies/100 mL in any given sample in non-coastal waters > 275 colonies/100 mL as maximum in coastal waters	> 3 mg/L at all times	Between 6.0 and 8.5 for all Between 6.5 and 8.5 for saltwater and estuarine waters	< 90 °F (32 °C) < 86 °F [a] (30 °C)
Agricultural and Industrial Water Supply	< 700 colonies/100 mL as geometric mean, no more than 3,200 colonies/100 mL in any given sample in non-coastal waters No more than 500 colonies/100 mL in any given sample in coastal waters	> 3 mg/L at all times	Between 6.0 and 8.5 for all Between 6.5 and 8.5 for saltwater and estuarine waters	< 90 °F (32 °C)

Note: °F = degrees Fahrenheit; °C = degrees Celsius.

a. The maximum temperature in streams, lakes, and reservoirs in the Tennessee and Cahaba River basins, and for that portion of the Tallapoosa River Basin from the tailrace of Thurlow Lake at Tallassee downstream to the junction of the Coosa and Tallapoosa rivers, which ADCNR classified as supporting smallmouth bass, sauger, or walleye, may not exceed 86 °F (°C).

Table 2.1-24.
Georgia water quality standards

Designated use	Fecal coliform bacteria	DO	pH	Temperature
Drinking Water Supply (not treated drinking water)	May–Oct < 200 colonies/100 mL as geometric mean Nov–Apr < 4,000 colonies/100 mL (instantaneous max)	> 5 mg/L daily average No less than 4 mg/L at all times Trout streams 6.0 mg/L daily average, no less than 5.0 mg/L at all times	Between 6.0 and 8.5	< 90 °F (32 °C)
Recreation	Coastal waters: 100 colonies/100 mL Other: 200 colonies/100 mL	> 5 mg/L daily average No less than 4 mg/L at all times Trout streams 6.0 mg/L daily average, no less than 5.0 mg/L at all times	Between 6.0 and 8.5	< 90 °F (32 °C)
Fishing	May–Oct < 500 colonies/100 mL as geometric mean Nov–Apr < 4,000 colonies/100 mL (instantaneous max)	> 5 mg/L daily average No less than 4 mg/L at all times Trout streams 6.0 mg/L daily average, no less than 5.0 mg/L at all times	Between 6.0 and 8.5	< 90 °F (32 °C)
Coastal Fishing	May–Oct < 500 colonies/100 mL as geometric mean Nov–Apr <4,000 colonies/100 mL (instantaneous max)	Site-specific	Between 6.0 and 8.5	< 90 °F (32 °C)
Wild River	No alteration of natural water quality	No alteration of natural water quality	No alteration of natural WQ	No alteration of natural water quality



LEGEND

ACT Basin Boundary

Water Classification

Drinking Water, Public Water Supply

Limited Warmwater Fishery

Outstanding Alabama Waters

Recreation, Swimming, Fishing & Wildlife

Alabama, Cahaba, Coosa, and Tallapoosa Rivers, Designated Use Classifications

Figure 2.1-53

Table 2.1-25.
Mainstem lakes site-specific standards

State	Basin	Waterbody name	Chlorophyll *a*	Other
Alabama	Alabama	Claiborne Lake	Growing season average[a] < 15 µg/L at compliance point	
Alabama	Alabama	William "Bill" Dannelly Lake	Growing season average[a] < 17 µg/L at compliance point	
Alabama	Alabama	R.E. "Bob" Woodruff Lake	In development	
Alabama	Coosa	Jordan Lake	Growing season average[a] < 14 µg/L at compliance point	
Alabama	Coosa	Mitchell Lake	Growing season average[a] Upper Reservoir compliance point < 16 µg/L Forebay compliance point < 14 µg/L	
Alabama	Coosa	Lay Lake	Growing season average[a] < 17 µg/L[c] at compliance points	
Alabama	Coosa	Logan Martin Lake	Growing season average[a] < 17 µg/L[c] at compliance points	
Alabama	Coosa	H. Neely Henry Lake	Growing season average[a] < 18 µg/L[c] at compliance points	
Alabama	Coosa	Weiss Lake	Growing season average[a] < 20 µg/L at compliance point	
Alabama	Tallapoosa	Thurlow Lake	Growing season average[a] < 5 µg/L at compliance point	
Alabama	Tallapoosa	Yates Lake	Growing season average[a] < 5 µg/L at compliance point	
Alabama	Tallapoosa	Lake Martin	Growing season average[a] < 5 µg/L at compliance points	
Alabama	Tallapoosa	R.L. Harris Lake	Growing season average[a] Forebay compliance point < 10 µg/L or < 12 µg/L if measured immediately upstream of the Tallapoosa River – Little Tallapoosa River confluence	
Georgia	Coosa	Allatoona Lake	Growing season average[a] Upstream from the Dam and Mid-Lake downstream from Kellogg Creek < 10 µg/L Allatoona Creek upstream from I-75 < 12 µg/L Little River upstream from Hwy 205 < 15 µg/L Etowah River upstream from Sweetwater Creek < 14 µg/L	pH: 6.0–9.5 Total nitrogen: < 4 mg/L Phosphorus: 1.3 lb/ac-ft volume/year
Georgia	Coosa	Carters Lake	Growing season average[a] Upstream from Woodring Branch < 5 µg/L At Coosawattee River embayment mouth < 10 µg/L	pH: 6.0-9.5 Total nitrogen: <4 mg/L Phosphorus: 0.46 lb/ac-ft volume/year

µg/L = micrograms per liter, lb/ac-ft = pounds per acre per ft

a. Growing season is April through October.

b. ADEM is updating site specific standards.

2.1.2.3.2 Impaired Waters and TMDLs

Waterbodies that do not meet water quality standards based on their designated use(s) are identified by states as impaired under CWA section 305(b) and by USEPA under CWA section 303(d). Figure 2.1-54 shows the waterbodies in the ACT Basin identified as impaired on the 2008 section 303(d) list.

A number of impairments on the mainstem in the ACT Basin have been addressed by developing TMDLs. The following mainstem waterbodies with federal projects remain on the list of impaired waterbodies:

- Alabama River from McCalls Creek to Claiborne Lake for mercury from atmospheric deposition
- Alabama River from McCalls Creek to Bear Creek for mercury from atmospheric deposition
- Coosa River (Lay Lake) from Lay Lake to Southern Railroad Bridge for priority organics (PCBs) from contaminated sediments
- Coosa River (Lay Lake) from Southern Railroad Bridge to RM 89 for priority organics (PCBs) from contaminated sediments
- Coosa River (Lay Lake) from RM 89 to Logan Martin Lake for priority organics (PCBs) from contaminated sediments
- Coosa River (Logan Martin Lake) from Logan Martin Lake to Broken Arrow Creek for priority organics (PCBs) from contaminated sediments
- Coosa River (Logan Martin Lake) from Broken Arrow Creek to Trout Creek for priority organics (PCBs) from contaminated sediments
- Coosa River (Logan Martin Lake) from Trout Creek to H. Neely Henry Lake for priority organics (PCBs) from contaminated sediments
- Coosa River (H. Neely Henry Lake) from Big Wills Creek to City of Gadsden, Alabama water supply intake for priority organics (PCBs) from contaminated sediments
- Coosa River (H. Neely Henry Lake) from City of Gadsden, Alabama to Weiss Lake powerhouse water supply intake for priority organics (PCBs) from contaminated sediments
- Coosa River from the state line to Beach Creek in Georgia for PCBs, DO, and temperature
- Coosa River from Beach Creek to Rome, Georgia for PCBs and fecal coliform bacteria
- Etowah River from Sharp Mountain Creek to Allatoona Lake for fecal coliform bacteria
- Etowah River from the confluence with the Coosa River to Hwy 411 for PCBs and fecal coliform bacteria
- Etowah River from Hwy 411 to Euharlee Creek for PCBs and fecal coliform bacteria
- Etowah River from the Richland Creek to Allatoona Lake for PCBs and fecal coliform bacteria
- Allatoona Creek arm of Allatoona Lake for chlorophyll a
- Etowah River arm of Allatoona Lake for chlorophyll a
- Conasauga River from the confluence with the Oostanaula River to Hwy 286 for PCBs and fecal coliform bacteria
- Oostanaula River from Conasauga/Coosawattee to Oothkalooga Creek for fecal coliform bacteria
- Coosawattee River from Salacoa Creek to Oostanaula River for PCBs
- Coosawattee River embayment of Carters Lake for chlorophyll a
- Carters Lake upstream Woodring Branch to mid-lake for chlorophyll a
- Tallapoosa River in Georgia for fecal coliform bacteria

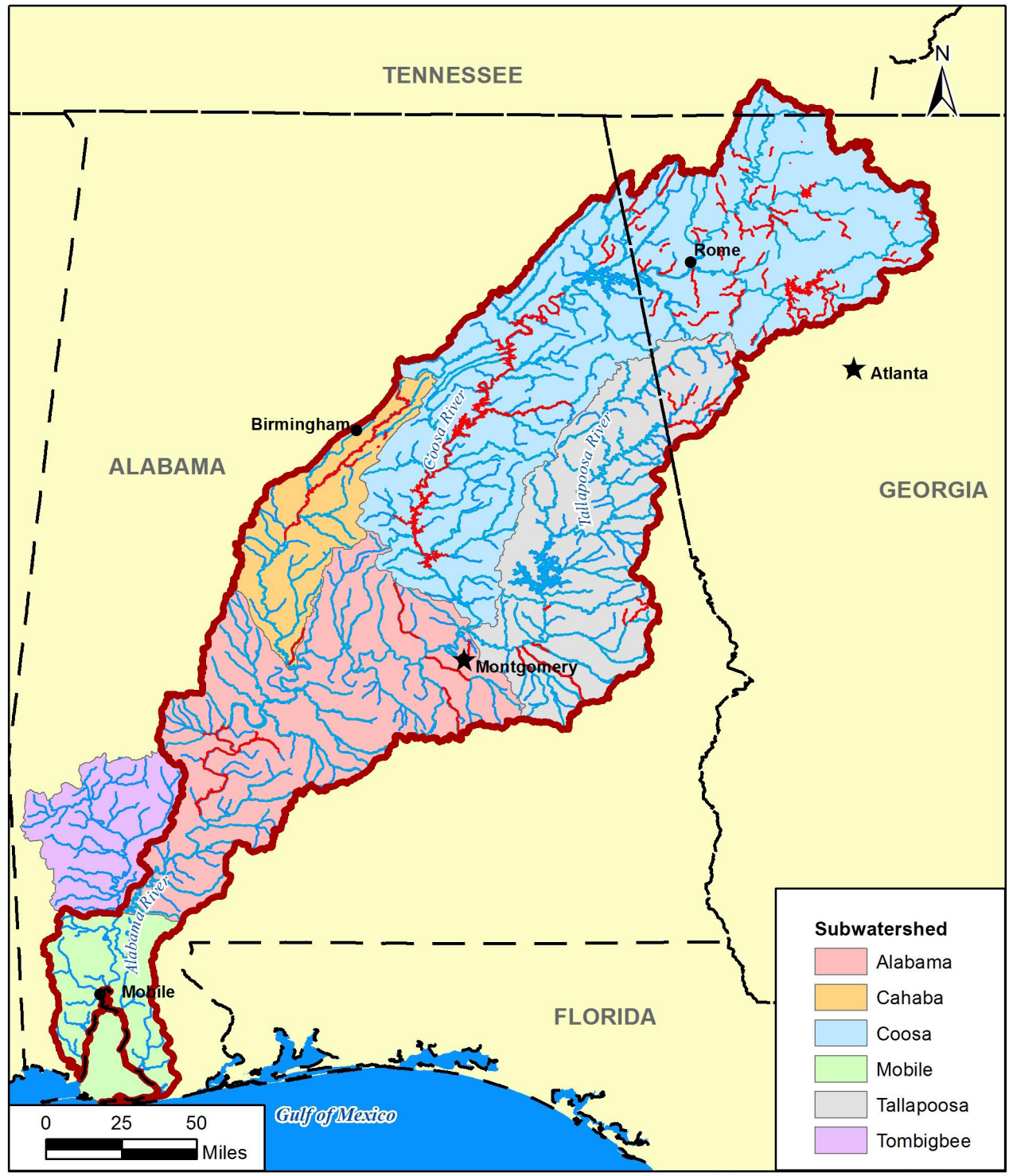

TENNESSEE
N
Rome
Atlanta
Birmingham
ALABAMA
GEORGIA
Coosa River
Tallapoosa River
Montgomery
Alabama River
Mobile
FLORIDA
Gulf of Mexico
0 25 50
Miles
Subwatershed
Alabama
Cahaba
Coosa
Mobile
Tallapoosa
Tombigbee
LEGEND
ACT Basin Boundary
303(d) Listed Waters
Alabama, Coosa, Tallapoosa Rivers
2008 Impaired Waterbodies

Figure 2.1-54

In Georgia, 56 stream segments (49 in the Coosa River Basin and 7 in the Tallapoosa River Basin [GAEPD 2009d, 2009e, 2009f]) that are tributaries to mainstem waterbodies are identified as biologically impaired from sedimentation. A detailed description of the sources and stressors to biological resources in the ACT Basin is presented in Section 2.5.

TMDLs are developed for waterbodies to identify sources of impairment, the necessary reductions to sources, and methods to implement the reductions. Historically, TMDLs in both Alabama and Georgia have been driven by lawsuits brought by environmental nonprofit organizations. Finalized TMDLs for the mainstem and major tributaries of the ACT Basin are listed in Table 2.1-26. Nutrient cycling in the reservoirs of the ACT Basin can be dependent on point and nonpoint sources, reservoir turnover rates, and water releases from dams. DO levels and temperatures in the tailwaters of dams can also be influenced by upstream releases. These are factors considered in the development of TMDLs to ensure that standards are being met. States and USEPA have used dynamic models in the development of TMDLs to ensure that these systems are adequately represented.

ADEM and USEPA are developing methods to ensure that legacy pollutants (PCBs) and metals (mercury) will be adequately addressed. ADEM has identified a target date—2017—for development of these TMDLs. The PCBs are contained in contaminated soils that, if disturbed, might cause a threat to human health from consumption of contaminated fish. Primary sources of PCB contamination in the ACT Basin are thought to be related to the General Electric manufacturing plant in Rome, Georgia, which closed in 1997, and to the Solutia (Monsanto) facility in Anniston, Alabama. Mercury buildup in fish tissue has been linked to atmospheric deposition and is often a regional concern. The Alabama Department of Public Health has issued fish consumption advisories for several reaches of the ACT Basin, including portions of the Weiss, H. Neely Henry, Logan Martin, and Lay lakes. The Georgia Wildlife Resources Division is responsible for reporting fish advisories and presents advisories throughout the state. Advisories in the Georgia portion of the ACT Basin include portions of Allatoona Lake, the Coosa River, and the Tallapoosa River (GAWRD 2009).

Georgia EPD and USEPA have developed a number of TMDLs for legacy pollutants (PCBs) and metals (mercury) as presented in Table 2.1-26. The TMDLs were developed on the basis of human health criteria. Regulations in the 1970s stopped the use of PCBs. Sampling since the 1970s in Georgia indicates a 90 percent reduction in fish tissue concentrations of PCBs (GAEPD 2009e). The primary source of mercury in the basin is atmospheric deposition. TMDLs finalized by Georgia EPD and USEPA for mercury assign loads to protect public health, particularly with respect to the consumption of fish (GAEPD 2004b).

In 2008 ADEM finalized a number of TMDLs for nutrients in mainstem waterbodies. The TMDLs presented in Table 2.1-26 identified a need for reduction in total phosphorus in watershed loading and from point sources to achieve the reservoir chlorophyll a standards, described in Section 2.1.2, Water Quality. The nutrient enrichment TMDLs developed along the Coosa River from Weiss Lake downstream to Mitchell Lake are dependent on loadings released from Weiss Lake and subsequent upstream reservoirs.

In April 2009 Georgia EPD posted a nutrient TMDL for Allatoona Lake (GAEPD 2009g). It was the first TMDL in the ACT Basin that identified the need for reductions in total nitrogen and phosphorus to achieve the reservoir chlorophyll a standards, described in Section 2.1.2.1.1, Water Quality Standards. Most of the listed waters in Georgia, where TMDLs have not been completed, have high levels of fecal coliform or impaired fish and macroinvertebrate communities. The three major tributaries of the Coosa River in Georgia have commercial fishing bans and fish consumption guidance because of PCBs.

Table 2.1-26.
TMDLs finalized in the ACT Basin

Waterbody	Pollutant of concern	Percent reduction	TMDL completed
Coosa and Tallapoosa River Basin, Georgia – Tributary to Buck, Baxter, Stamp, Shoal, Rowland Springs, Lavender, Kellogg, Cox, and Chappel creeks, Conasauga River and Chastain Branch	Fecal coliform	Based on land use from 0 to 100%	1998
Coosa and Tallapoosa River Basin, Georgia	Sediment	Various (12) from 46 to 97% sediment	2004
Coosa River Basin, Georgia	Sediment (impacting biota)	Various from 0 to 95% sediment	January 2009
Coosa River Basin, Georgia	Fecal coliform	Various (29) from 9 to 90%	January 2009
		Various (48) from 0 to 94%	2004
Talking Rock Creek, Spring Creek, and Etowah River	Mercury	0% recognizing that the allowable load can be maintained without reducing the current loads received by the stream	2004
Little River Embayment, Georgia	Chlorophyll (phased)	70% total phosphorus	2004
Allatoona Lake, Georgia – Tanyard Creek, Little River Embayment, and Cherokee/Cobb/Bartow	PCBs	0% recognizing that there are no point and nonpoint source loadings, and concentrations are because of historic activities	1998
Allatoona Lake, Georgia	Nutrients	Etowah River Arm = 16% total nitrogen, 20% total phosphorus	Draft April 2009
		Allatoona Creek Arm = 39% total nitrogen, 40% total phosphorus	
Coosa River, Georgia	DO	Thermoelectric reduction at Plant Hammond on the Coosa River	2004
Coosa River, Georgia	PCBs	34 segments; reductions expected to be achieved through corrective action of historical activities and stormwater controls, including site remediation and best management practices.	2009
Weiss Lake, Georgia	Nutrients	30% total phosphorus	2004, 2008
H. Neely Henry Lake, Alabama	Nutrients, organic enrichment (OE)/DO, pH	30% total phosphorus	2008
Logan Martin Lake, Alabama	Nutrients, OE/DO	30% total phosphorus	2008
Buxahatchee Creek, Alabama	Nutrients	95% total phosphorus	2009
Lay Lake, Alabama	Nutrients, OE/DO	30% total phosphorus	2008
Mitchell Lake, Alabama	Nutrients	30% total phosphorus	2008
Tallapoosa River Basin	Sediment (impacting biota)	Various from 0 to 26% sediment	January 2009
Tallapoosa River Basin	Fecal coliform	Various (6) from 8 to 76%	January 2009
		Various (4) from 17 to 82%	2004

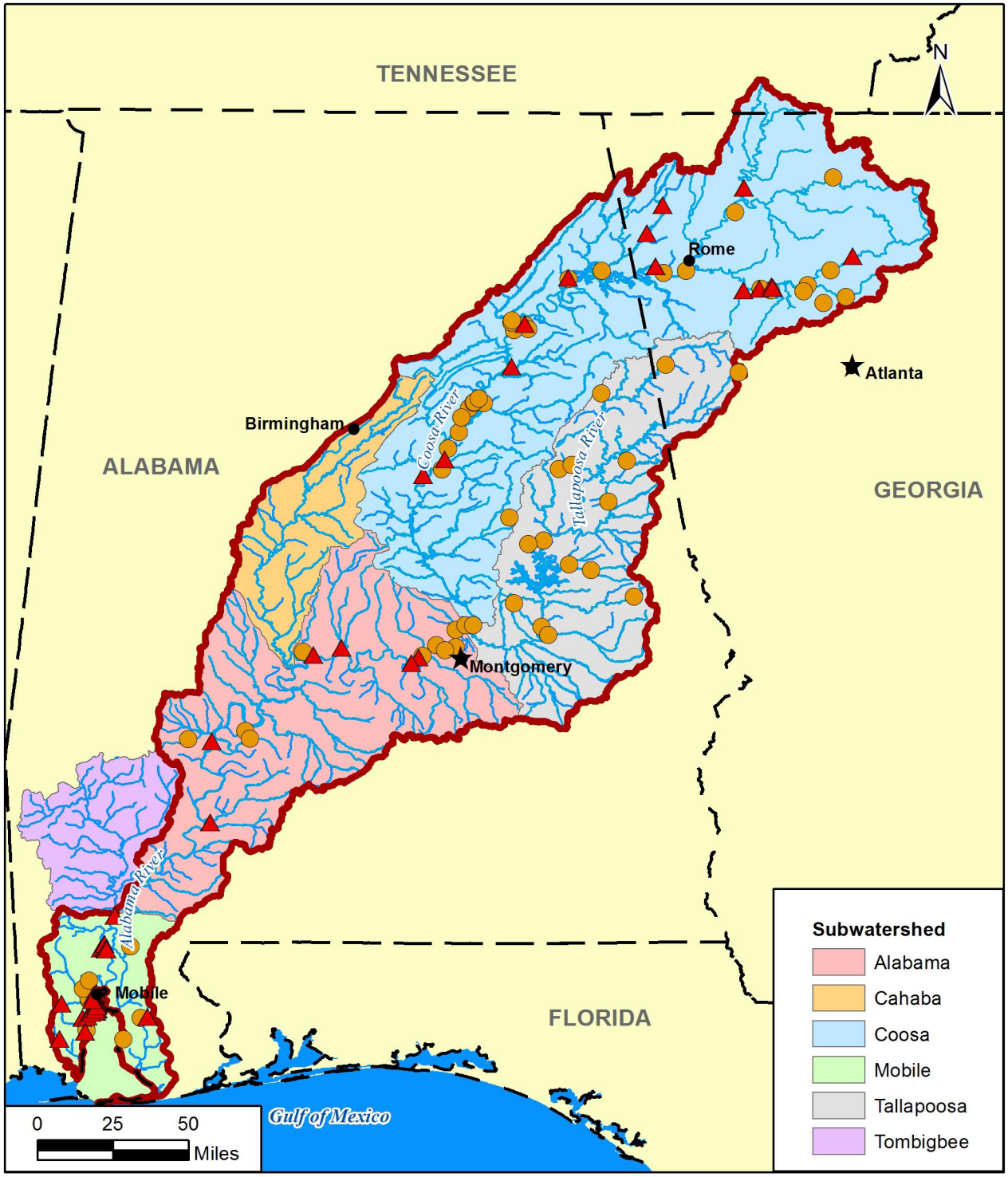
Table 2.1-26. (continued)

Waterbody	Pollutant of concern	Percent reduction	TMDL completed
Buffalo Creek, Georgia	**Copper**	**Phased implementation with reductions expected to be achieved through corrective action of historical activities and stormwater controls, including site remediation and best management practices.**	**2004**
Saugahatchee Creek Embayment (Yates Lake) and Pepperell Branch, Alabama	Nutrients and OE/DO	0% CBOD5 and total phosphorus 50% to stormwater and nonpoint sources, and nearly 90% reductions to wastewater treatment facilities	2008
Cahaba River, Alabama[a]	Nutrients	81% total phosphorus to wasteload allocations	2006
		65% total phosphorus to municipal separate storm sewer system (MS4) wasteload allocations	
Alabama River, Alabama	OE/DO	Millers Ferry Lock and Dam Discharge 57% CBODu	2005
		International Paper Company (Then Weyerhaeuser Pine Hill Mill) 67% instantaneous oxygen demand (IOD)	
Mobile Bay, Alabama	DO	NA	Delisting 2006

2.1.2.3.3 Point Sources

Point source permitting has historically identified pipe discharges from M&I sources. In the late 1990s, the National Pollutant Discharge Elimination System (NPDES) began to enforce its stormwater program by regulating stormwater discharges from MS4s, construction activities, and industrial activities. The program has changed the traditional definition of *point source*. The change allows regulators more authority over pollutants, ultimately resulting in improved water quality. Major M&I dischargers regulated under the NPDES program and discharging to the mainstem of the ACT Basin are listed in Table 2.1-27 and illustrated in Figure 2.1-55. Major point sources are defined as those that discharge more than 1 mgd of wastewater to surface waters.

Those facilities are required to submit discharge monitoring reports to ADEM and Georgia EPD to ensure compliance with their NPDES permits. The limits expressed in NPDES permits are determined by states by developing wasteload allocations. Wasteload allocations are developed to ensure facilities meet the in-stream water quality standards, as described in Section 2.1.2.1.1, Water Quality Standards. Standard methods are used to develop wasteload allocations for individual dischargers when the facilities request new permits or changes to their existing permits. Table 2.1-27 identifies the current permit limits for facilities that discharge to the mainstem of the ACT Basin.



M&I Point Source Discharges to Mainstem of Alabama, Coosa, and Tallapoosa Rivers

Figure 2.1-55

Table 2.1-27.
ACT Basin NPDES permit inputs for water quality modeling

Permit #	Facility	Stream	Design flow (mgd)	DO (mg/L)	BOD_5 (mg/L)	ON (mg/L)	NH_3 (mg/L)	NO_3/NO_2 (mg/L)	Total P = PO_4 (mg/L)	Longitude	Latitude
Carters Lake and Watershed											
GA0021369	Ellijay Water Pollution Control Plant (WPCP)	Coosawatee River	2.5	5	30	2	17.4	10	0.7	-84.491124	34.676657
GA0024091	Cartersville WPCP	Etowah River	15	seasonal	30	2	10	10	0.7	-84.838563	34.142755
GA0030333	Calhoun WPCP	Oostanaula River	16	5	20	2	5	10	0.7	-84.962785	34.509666
GA0032492	City of Chatsworth (Holly Creek) WPCP	--	3	seasonal	10	2	seasonal	10	Reported	-84.45515	34.45294
GA0046035	City of Adairsville - North (Oothkalooga Creek)	--	1	seasonal	seasonal	2	seasonal	10	0.7	-84.56244	34.23264
Allatoona Lake and Upper Etowah Watershed											
GA0038555	Cherokee County Fitzgerald Creek WPCP	Allatoona Lake	5	6	5	2	1.5	10	0.7	-84.613063	34.158788
GA0024988	Cobb County Noonday Creek WPCP	Noonday Creek	12	5	10	2	2	10	0.7	-84.537955	34.073474
GA0025674	Canton WPCP	Etowah River	1.89	5	30	2	17.4	10	0.7	-84.503799	34.230460
GA0033251	Fulton County Little River WPCP	Little River	1	5	8.5	2	1.7	10	0.7	-84.429466	34.103682
GA0046451	Cherokee County Rose Creek	Allatoona Lake	6	5	6.7	2	1.3	10	0.7	-84.613063	34.158788
GA0046761	Cobb County Northwest WPCP	Pipeline to Allatoona Lake	8	5	5	2	0.9	10	0.7	-84.633947	34.130739
Weiss Lake and Watershed											
GA0001104	TIN Inc./DBA Temple-Inland	Coosa River	NA	2	5,076 lb/d	2	5	10	0.7	-85.346049	34.249916
GA0001449	Georgia Power Company - Plant Bowen	Etowah River	85	5	30	2	5	10	0.7	-84.922935	34.134575
GA0026042	City of Rockmart WPCP (Euharlee Creek)	--	3	5	30	2	4.7	10	0.7	-85.03029	34.00424
GA0001104	Inland Paperboard	--	NA	5	13396, 10528, 5076a lb/d	2	5	10	0.7	-85.20466	35.05014

Table 2.1-27. (continued)

Permit #	Facility	Stream	Design flow (mgd)	DO (mg/L)	BOD_5 (mg/L)	ON (mg/L)	NH_3 (mg/L)	NO_3/NO_2 (mg/L)	Total P = PO_4 (mg/L)	Longitude	Latitude
GA0001457	Georgia Power Company - Plant Hammond	Coosa River	655	5	NA	2	5	10	0.7	-85.345402	34.250375
GA0024104	Mohawk Carpets	Chattooga River	--	3	400 lb/d	2	5	10	0.7	-85.387268	34.409452
GA0024112	Rome WPCP	Coosa River	18	2	30	2	17.4	10	0.7	-85.196768	34.229163
GA0024341	Rome - Coosa WPCP	Coosa River	2	2	30	2	17.4	10	0.7	-85.306346	34.217468
GA0024074	Cedartown WPCP (Cedar Creek)	--	3.5	seasonal	seasonal	2	seasonal	10	0.7	-85.1617	34.01222
GA0025607	Trion WPCP	Chattooga River	5	5	26/ 29	2	10.5 / 15.5	10	0.7	-85.30146097	34.540166
GA0025704	Summerville WPCP	Chattooga River	2	5	25/ 38	2	15-Oct	10	0.7	-85.3446279	34.459163
H. Neely Henry Lake and Watershed											
AL0022659	Gadsden East WWTP	--	6.18	3	25	10	20	8	2	-85.972388	33.967222
AL0053201	Gadsden West WWTP	Coosa River	11.32	3	20	10	20	8	2	-86.035813	33.990311
AL0057657	Attalla Lagoon	--	1.93	3	25	10	20	8	2	-86.070620	34.011950
AL0002119	Tyson Foods	--	1.60	3	16	10	4	8	15	-85.582000	33.581400
AL0001007	Goodyear Tire and Rubber	Nowlin Branch	10.00	5	10	2	5	10	0.7	-86.574630	34.355780
Logan Martin Lake and Watershed											
AL0054356	Lincoln South WWTP	Coosa River	2.50	3	10	10	1	10	37	-86.171386	33.591711
AL0045993	Pell City Dye Creek WWTP	Coosa River	4.75b	3	15	10	3	10	2	-86.241111	33.568056
AL0031534	National Cement Company of Alabama	Beaver Creek	See Permit	5	10	2	5	10	0.7	-86.143100	33.481000
AL0058408	Oxford Water Works and Sewage Board	Choccolocco Creek	4.9	6	seasonal	2	seasonal	10	0.7	-85.545600	33.344900
AL0022586	Jacksonville Water Works and Sewer Board	Williams Branch	3.5	6	25 / 37.5	2	seasonal	10	0.7	-85.455060	33.485000

Table 2.1-27. (continued)

Permit #	Facility	Stream	Design flow (mgd)	DO (mg/L)	BOD_5 (mg/L)	ON (mg/L)	NH_3 (mg/L)	NO_3/NO_2 (mg/L)	Total P = PO_4 (mg/L)	Longitude	Latitude
Lay Lake and Watershed											
AL0072451	Shelby County Public Works	Coosa River	--	5	10	2	5	10	0.7	-86.342500	33.373889
AL0003158	Kimberley-Clark Corporation	Coosa River	--	5	10	2	5	10	0.7	-86.359300	33.321700
AL0003140	APCO Gaston PLT intake	--	907.0	5	10	2	5	10	0.7	-85.582000	33.581400
AL0003140	APCO Gaston PLT cooling outfall	--	863.0	5	10	2	5	10	0.7	-86.274550	31.144280
AL0003140	APCO Gaston PLT ash pond out fall	--	25.0	5	10	5	1	5	0.5	-86.274550	31.144280
AL0003158	Bowater Alabama Inc. intake	--	77.0	5	10	2	5	10	0.7	-86.213350	33.191820
AL0003158	Bowater Alabama Inc. cooling	--	16.0	5	10	2	5	10	0.7	-86.213350	33.191820
AL0003158	Bowater Alabama Inc. process	--	27.0	3	25,561 ppd	5	2	5	1.2	-86.213350	33.191820
Jordan Dam and Lake											
--	--	--	--	--	--	--	--	--	--	--	--
Tallapoosa River											
GA0020982	Tallapoosa WPCP	Tallapoosa River	1	5	30	2	10	10	0.7	-85.295507	33.776652
GA0027162	Villa Rica - Tallapoosa West WPCP	Little Tallapoosa River	--	6	30	2	3	10	0.7	-84.944952	33.738263
AL0020486	Tallassee Lagoon	Tallapoosa River	1.4	5	25/NAc	2	5	10	0.7	-85.891910	32.515210
AL0048763	Tuskegee North WWTP	Tallapoosa River	2	5	25	2	20/ NA	10	0.7	-85.860971	32.476277
AL0025984	Tuskegee South WWTP (Calebee Creek)	--	1.25	7	3/10	0.1/0.8	0.25/2	10	0.7	-85.464910	34.285110
AL0020141	Ashland WWTP (Horsetrough Creek)	--	1.07	6	13/25	2/4.1	2/4.1	10	0.7	-85.483640	33.162700
AL0050245	Auburn Northside WWTP (Sougahatchee Creek)	--	1.6	6	9/13	2	2/3.5	10	0.7	-85.323950	32.373830

Table 2.1-27. (continued)

Permit #	Facility	Stream	Design flow (mgd)	DO (mg/L)	BOD_5 (mg/L)	ON (mg/L)	NH_3 (mg/L)	NO_3/NO_2 (mg/L)	Total P = PO_4 (mg/L)	Longitude	Latitude
AL0050245[d]	Auburn Northside WWTP (Sougahatchee Creek)	--	3	6	5/7	1/1.8	1/1.8	10	1.2d	-85.323950	32.373830
AL0050237	H.C. Morgan WPCF (Parkerson Mill Creek)	--	9	6	18/25	3/4	3/4	10	0.7	-85.302790	32.321000
AL0062839	Lafayette Mill Creek WWTP	--	1	7	6/10	2	0.85/1.7	10	0.7	-85.260800	32.542200
AL0021156	Alexander City Coley Creek WWTP	--	1.95	6	6/ NA	2/ 2.0	1/ NA	10	0.7	-85.552530	32.554770
AL0048861	Alexander City Sugar Creek WWTP (Sugar Creek – Inactive)	--	8.5	5	23	2	1.3/2.1	10	0.7	-85.570500	32.540500
AL0048861	Alexander City Sugar Creek WWTP (Lake Martin – Active)	--	8.5	5	23	2	1.3/2.1	10	0.7	-85.570500	32.540500
AL0050130	Opelika Westside WWTP (Sougahatchee Creek)	Sougahatchee Creek	4	6	10/15	2	1.1	10	0.25d	-85.448950	32.660450
AL0054631	Clanton Waterworks and Sewer Board	Walnut Creek	2.25	6	10/15	2	2/3	10	0.7	-86.275100	32.251200
R.E. "Bob" Woodruff Lake and Watershed											
AL0064025	Wetumka City of Water Works Sewer Bd	Coosa River	4.5	5	25	2	10	10	0.7	-86.220900	32.522700
AL0049921	Millbrook WWTP	Coosa River	2.3	5	25	2	10	10	0.7	-86.304440	32.501110
AL0003018	International Paper Company (Riverdale)	Alabama River	28.6	5	100.77	2	5	10	0.7	-86.854940	32.416251
AL0003115	International Paper Company (Prattville)	Alabama River	25.21	5	82.54	2	5	10	0.7	-86.485000	32.367800
AL0054704	General Electric WWTP	Alabama River	3.01	5	30.83	2	5	10	0.7	-86.519155	32.340632

Table 2.1-27. (continued)

Permit #	Facility	Stream	Design flow (mgd)	DO (mg/L)	BOD_5 (mg/L)	ON (mg/L)	NH_3 (mg/L)	NO_3/NO_2 (mg/L)	Total P = PO_4 (mg/L)	Longitude	Latitude
R.E. "Bob" Woodruff Lake and Watershed											
There are no major point sources discharging directly to William "Bill" Dannelly Lake.											
Alabama River											
AL0027723	Prattville Pine Creek WWTP	Alabama River	3	5	25	10/20	10/20	10	0.7	-86.400040	32.427122
AL0022225	Econchate WWTP[g]	Alabama River	21	2	25	10/20	10/20	10	0.7	-86.304681	32.417536
AL0022241	Towassa WWTP[g]	Alabama River	3	2	25	10/20	10/20	10	0.7	-86.356638	32.401687
AL0027863	Catoma Creek WWTP[g]	Alabama River	35	2	25	10/20	10/20	10	0.7	-86.466112	32.375465
AL0002674	Macmillan Bloedel Packing, Inc. (International Paper – Pine Hill)	Alabama River	19.4	5	67.82/ 38.69/ 49.18f	2	5	10	0.7	-87.478980	31.966070
AL0025968	Alabama River Pulp Company, Inc.	Alabama River	58.4	5	96.38	2	5	10	0.7	-87.486810	31.574310
AL0022578	Selma Valley Creek WWTP	Alabama River	6	5	25	2	20	10	0.7	-87.039980	32.395820
	= not permitted values but assumed for modeling purposes										

NA = Not available

WWTP = wastewater treatment plant

a. Loads are December–April, November and May, and June–October

b. Request to increase.

c. Summer/winter

d. Growing season (April–October) permitted values

e. William "Bill" Dannelly Lake watershed includes the Cahaba River. Information on point sources in the Cahaba River is available in the TMDL (ADEM 2007).

f. Winter/summer/spring–Fall

g. This facility was grouped under the Montgomery Water Work and Sanitary Sewer Board in the HEC-5Q Model.

1. Note: At the time this document was prepared, an assumption was made that only the major point sources would be needed for water quality modeling. This assumption was made in light of the time frame for future analysis and the large number of point sources with NPDES permits in the basin. This section will be updated in the future to make it consistent with the information used in the water quality modeling for the EIS. Personal communication with Jim Greenfield of USEPA indicated that permitted values for major point sources should be adequate for this water quality modeling effort.

2. Note: If the numbers appear with a slash (i.e., 30/45) the first number is the average and the second is the max. For DO they are all the minimum. For TP, if there is only one number, it is the average.

As previously described, regulations are changing to quantify stormwater runoff under the NPDES stormwater program for MS4s, construction activities, and industrial activities. The NPDES stormwater program was implemented in two phases on the basis of population. In 1990 cities and certain counties with more than 100,000 residents were defined under the Phase I program. In 1999, Phase II established regulations for smaller cities. The details of the regulatory requirements are provided on USEPA's *NPDES Stormwater Basic Information* Web page (USEPA 2009a).

Regulations for construction activities require construction sites with more than 1 ac of disturbed area to obtain an NPDES permit and implement best management practices to prevent erosion of the disturbed areas. Regulations for industrial facilities require an NPDES permit for activities where pollutants may be transported to storm sewers or surface water. MS4s include both municipal stormwater conveyance systems and, in some cases, roadways. Areas identified under the Phase I program are covered by individual NPDES permits (Table 2.1-28). In Alabama, Phase II communities and roadway MS4s are also covered under individual permits, but in Georgia Phase II communities are covered under a general permit, as shown in Table 2.1-29. All of these sources have been identified as major stressors on aquatic resources causing impairment to surface waters. The regulations are decreasing the amount of pollutants entering storm sewers and surface waters, but enforcement is limited.

2.1.2.3.4 Nonpoint Sources

Nonpoint sources of pollution are those generally associated with and quantified by land use activities in watersheds. Water quality concerns from nonpoint sources are usually related to fecal coliform bacteria, metals, nutrients (including BOD, nitrogen, and phosphorus), pesticides, and suspended solids from overland and in-stream erosion. The sources of the pollutants are associated with runoff from areas and activities not regulated by the NPDES program. These activities are usually associated with agricultural, forested, and urban land use activities.

Historically, agricultural lands have been a major source of sediment to waterbodies. However, there has been a decrease in the amount of land farmed in the ACT Basin over the last century. In portions of the basin in Georgia, a 57 percent reduction of farmland has occurred since 1950 (GAEPD 2009c). A decrease in soil erosion has been associated with the reduction in land farmed.

Table 2.1-28.
Phase I MS4s in the ACT Basin

NPDES permit	Permitted area
GAS000300	Forsyth County, Georgia
GAS000117	Fulton County, Georgia
GAS000125	Marietta, Georgia
GAS000108	Cobb County, Georgia
GAS000121	Kennesaw, Georgia
GAS000101	Acworth, Georgia
ALS000001	Jefferson, St. Clair, and Shelby counties, Alabama
ALS000003	Shelby County, Alabama
ALS000004	Montgomery, Alabama
ALS000002	Mobile and Baldwin counties, Alabama

Source: ADEM 2010a; GAEPD 2008c, 2008d; Smith, personal communication 2009

Table 2.1-29.
Phase II MS4s in the ACT Basin

NPDES permit	Permitted area
GAG6100000	Bartow County, Georgia
GAG6100000	Cherokee County, Georgia
GAG6100000	Canton (Cherokee Co.), Georgia
GAG6100000	Holly Springs, Georgia
GAG6100000	Woodstock (Cherokee Co.), Georgia
GAG6100000	Mountain Park, Georgia
GAG6100000	Catoosa County, Georgia
GAG6100000	Whitfield County, Georgia
GAG6100000	Dalton (Whitfield Co.), Georgia
GAG6100000	Walker County, Georgia
GAG6100000	Floyd County, Georgia
GAG6100000	Rome (Floyd Co.), Georgia
GAG6100000	Paulding County, Georgia
GAG6100000	Dallas (Paulding County), Georgia
ALR040009	Etowah County, Alabama
ALR040004	Calhoun County, Alabama
ALR040012	Smith Station, Alabama
ALR040018	Opelika, Alabama
ALR040003	Auburn, Alabama
ALR040030	Auburn University
ALR040015	Montgomery County, Alabama
ALR040035	Maxwell Air Force Base
ALR040003	Alabama Department of Transportation (Calhoun, Elmore, Etowah, Lee, Montgomery, and Talladega counties)

Source: ADEM 2010a; GAEPD 2008e; Smith, personal communication 2009

Urban activities in the ACT Basin, however, fall under both nonpoint and point sources as MS4 areas. Characterizing urban activities as point sources rather than nonpoint sources of pollution has allowed for improved regulatory authority over surface overland runoff from parking lots, as well as improved education on land use management to decrease pollutants (such as fertilizers and pesticides) entering surface waterbodies. Regulation and enforcement of best management practices on construction sites have also decreased the amount of overland erosion and siltation and, thereby, the amount of solids entering surface waterbodies.

Pollutant loads from agricultural, forested, and urban land use activities have been quantified when developing TMDLs in the basin. The extensive work done by a number of agencies can be consulted to quantify loads from land use activities in the ACT Basin. The variability in concentrations of a pollutant can be accounted for through understanding current and historical land use activities, and the properties of soils and local geology.

2.1.2.4 Groundwater Quality

The groundwater resources of the ACT Basin come from five major aquifer systems in the southeastern United States. The northeastern portion of the basin is dominated by the Piedmont and Blue Ridge aquifers; the western portion of the basin is dominated by the Valley and Ridge and Appalachian Plateau aquifers; and the southern portion of the basin is dominated by the Southeastern Coastal Plain Aquifer System (USGS 2009f). Water, a solvent, dissolves minerals from the rocks with which it comes into contact. The most common dissolved mineral substances are sodium, calcium, magnesium, potassium, chloride, bicarbonate, and sulfate. The groundwater quality from the various aquifers differs depending on the geology of the area and the depth of the aquifer from which water is withdrawn. For this reason, each aquifer is briefly discussed separately below.

The quality of water from the Piedmont and Blue Ridge aquifers is suitable for drinking and other uses practically everywhere. The concentrations of dissolved constituents—except fluoride, iron, manganese, and sulfate in some locations—seldom exceed state and federal drinking water standards. Some deep-yielding wells may contain large concentrations of dissolved ions, but those concentrations can be attributed to withdrawing water from a mineralized zone. Some locations could encounter large dissolved iron concentrations from iron-fixing bacteria. Oxidation and filtration can usually alleviate high iron and manganese concentrations and make the water potable. Rarely, radioactive minerals are found in concentrations high enough to create water-quality problems (USGS 2009g).

The quality of water in the Valley and Ridge aquifers is variable, but in general it is satisfactory for municipal supplies. Most water in the upper parts of the aquifer is not greatly mineralized and is suitable for most uses without treatment. Iron can be a constituent of concern; in some places it exceeds the drinking water standard of 300 µg/L. In localized zones the water also contains large sulfate concentrations. There are two dominant rock formations present in the aquifer, and each gives different dominant dissolved minerals. The pre-Pennsylvanian formation, from which the most water is obtained, has higher concentrations of magnesium from the presence of dolomite. The Pottsville Formation, a minor component of the overall volume of water, has higher concentrations of sodium and potassium from the presence of feldspar and mica (USGS 2009h).

The quality of water in the Appalachian Plateaus aquifers is variable, but most of the water is suitable for most uses. In places concentrations of sulfate and iron are too objectionable for the water to be considered potable. Large concentrations of hydrogen sulfide, derived from sulfate, can impart a *rotten-egg* odor to the water. Large concentrations of iron can stain plumbing fixtures. The quality of the water generally deteriorates with depth as it becomes more mineralized. In places, the dissolved solids concentrations at depths of 300 ft or more are as large as 1,000 mg/L, and the water is on the borderline of being considered potable. Chloride concentrations are usually less than 250 mg/L, but they vary from rock formation to rock formation (USGS 2009i).

Water in all the regional aquifers of the Southeastern Coastal Plain aquifer system undergoes similar chemical changes as it moves from outcrop areas down the hydraulic gradient into deeper, confined parts of the aquifers. Dissolved solids, iron, and chloride are generally low in recharge areas, but an increase occurs as the water moves down-gradient and dissolves more minerals. Dissolved solids and chloride concentrations both relate in large part to the degree to which freshwater has flushed salt water, entrapped during deposition of the sediments, from the aquifers. In recharge areas, the groundwater is a calcium bicarbonate type. As water moves deeper into the aquifer, it becomes a sodium bicarbonate type. Finally, in the deeper parts of the aquifer, the water becomes a sodium chloride type. Water in the recharge areas is generally potable and can be used for multiple uses. Water in the lower and southern portions of the aquifer may be usable and potable, but its dominant ions are sodium and chloride (USGS 2009j).

2.1.2.5 Water Quality Monitoring

Water quality in the ACT Basin is monitored by a number of federal, state, and local agencies as well as by industries for compliance with standards. Table 2.1-30 summarizes water quality conditions along the mainstem rivers in the ACT Basin using data collected by ADEM, GAEPD, EPA (Water Resource Data Base), USGS, and USACE as part of their monitoring efforts. The states use their monitoring data to make decisions about violations of water quality standards. These data were used to develop the HEC-5Q water quality model of the ACT Basin.

Table 2.1-30.
Summary of monitoring data collected by Alabama and Georgia from 2001 through 2008 in mainstem rivers of the ACT Basin

	BOD_5U (mg/L)	Oxygen (mg/L)	NH_3-N (mg/L)	NO_3-N (mg/L)	PO_4-P (mg/L)	TSS (mg/L)	Temp. (C)	Chlorophyll *a* (µg/L)
Coosawattee River at Carters								
No. of Samples	61	53	47	47	49	55	53	10
Avg	1.54	8.94	0.04	0.14	0.03	8.06	20.00	7.56
Min	0.40	7.09	0.02	0.05	0.02	3.00	5.80	3.60
Max	5.14	12.80	0.15	0.25	0.09	19.00	24.77	16.40
Median	1.30	8.61	0.03	0.13	0.02	7.50	21.75	4.10
Period cover by data	*Jan 2006 – Oct 2006*							*Jun 2005 – Oct 2005*
Coosawattee River at Calhoun								
No. of Samples	69	92	62	63	64	63	94	15
Avg	1.57	8.70	0.04	0.26	0.04	19.66	17.94	4.88
Min	0.50	5.42	0.01	0.13	0.02	4.00	4.90	2.60
Max	5.37	12.60	0.22	0.43	0.15	66.00	25.47	11.50
Median	1.52	8.20	0.03	0.26	0.03	15.00	19.92	4.20
Period covered by data	*Jan 2001 – Oct 2006*							*Jun 2005 – Oct 2006*
Etowah River at Allatoona Lake								
No. of Samples	0	56	56	56	49	56	56	56
Avg	NA	8.44	0.15	0.27	0.04	5.49	37.96	11.63
Min	NA	6.75	0.03	0.03	0.04	3.00	16.65	4.51
Max	NA	10.70	6.02	1.08	0.23	14.12	88.44	22.98
Median	NA	8.36	0.03	0.25	0.04	5.00	27.69	11.09
Period covered by data	*Apr 2000 – Oct 2007*							
Etowah River at Euharlee								
No. of Samples	101	162	86	99	97	96	162	31
Avg	1.58	9.08	0.07	0.54	0.09	23.17	16.72	6.94
Min	0.34	5.90	0.01	0.11	0.02	1.00	4.90	0.60
Max	3.59	13.77	0.23	1.18	0.55	480.00	28.00	115.00
Median	2.00	8.87	0.05	0.50	0.06	7.00	16.70	2.10
Period covered by data	*Jan 2000 – Aug 2008*							*Jun 2005 – Oct 2006*

Table 2.1-30. (continued)

	BOD_5U (mg/L)	Oxygen (mg/L)	NH_3-N (mg/L)	NO_3-N (mg/L)	PO_4-P (mg/L)	TSS (mg/L)	Temp. (C)	Chlorophyll *a* (µg/L)
Etowah River at Canton								
No. of Samples	91	156	76	89	87	59	156	24
Avg	1.40	9.20	0.05	0.26	0.05	34.96	15.74	4.40
Min	0.10	5.80	0.01	0.05	0.02	1.00	2.46	1.30
Max	3.92	13.50	0.28	0.88	0.72	675.00	27.17	17.90
Median	1.40	8.95	0.03	0.25	0.02	8.00	15.60	2.20
Period covered by data	*Jan 2000 – Jun 2008*					*Jan 2000 – Dec 2007*	*Jan 2000 – Jun 2008*	*Feb – Dec 2006*
Oostanaula River at Resaca								
No. of Samples	69	100	62	63	63	62	102	15
Avg	1.64	8.28	0.04	0.30	0.08	24.94	18.32	8.01
Min	0.20	4.62	0.01	0.04	0.02	2.00	3.90	1.90
Max	5.31	12.75	0.12	0.60	0.26	95.00	26.69	37.00
Median	1.66	7.76	0.03	0.29	0.07	21.50	19.90	4.70
Period covered by data	*Jan 2001 – Oct 2006*							*Jun – Oct 2005*
Coosa River near Rome								
No. of Samples	0	595	0	0	0	0	3292	545
Avg	NA	8.94	NA	NA	NA	NA	17.37	6.04
Min	NA	5.40	NA	NA	NA	NA	4.00	1.48
Max	NA	12.40	NA	NA	NA	NA	29.00	31.80
Median	NA	8.70	NA	NA	NA	NA	18.00	4.28
Period covered by data	*NA*	*Mar 2005 – Dec 2006*	*NA*	*NA*	*NA*	*NA*	*Jan 2000 – Nov 2009*	*Mar 2005 – Sep 2006*
Coosa River at State Line								
No. of Samples	130	3106	110	122	123	123	3352	678
Avg	2.00	8.82	0.04	0.40	0.10	17.68	19.82	7.04
Min	0.57	3.80	0.01	0.05	0.02	3.00	6.00	1.71
Max	9.00	15.30	0.18	0.61	0.50	229.09	34.00	36.20
Median	2.00	8.70	0.03	0.41	0.10	14.00	20.00	4.85
Period covered by data	*Jan 2000 – Aug 2008*							*Jun 2005 – Sep 2006*
Coosa River at Weiss								
No. of Samples	0	118	118	118	118	0	118	118
Avg	NA	8.31	0.03	0.24	0.09	NA	23.67	19.67
Min	NA	4.04	0.02	0.00	0.00	NA	8.63	0.10
Max	NA	12.17	0.15	0.63	0.29	NA	33.42	51.40
Median	NA	8.30	0.02	0.22	0.08	NA	24.41	19.80
Period covered by data	*Apr 2002 – Nov 2008*							

Table 2.1-30. (continued)

	BOD_5U (mg/L)	Oxygen (mg/L)	NH_3-N (mg/L)	NO_3-N (mg/L)	PO_4-P (mg/L)	TSS (mg/L)	Temp. (C)	Chlorophyll *a* (µg/L)
Coosa River at H.N. Henry								
No. of Samples	0	27	27	27	27	0	27	27
Avg	NA	8.07	0.02	0.06	0.06	NA	27.12	27.15
Min	NA	4.13	0.02	0.00	0.00	NA	20.43	2.14
Max	NA	12.93	0.07	0.66	0.14	NA	32.40	40.58
Median	NA	7.66	0.02	0.01	0.06	NA	27.99	26.70
Period covered by data	*Aug 2002 – Oct 2008*							
Coosa River at Logan Martin								
No. of Samples	0	38	39	39	39	0	38	39
Avg	NA	8.33	0.02	0.04	0.06	NA	27.09	20.22
Min	NA	5.26	0.02	0.00	0.00	NA	17.85	0.80
Max	NA	12.39	0.06	0.18	0.09	NA	32.56	34.89
Median	NA	8.04	0.02	0.01	0.06	NA	28.06	19.76
Period covered by data	*Apr 2002 – Nov 2005*							
Coosa River at Lay								
No. of Samples	0	51	51	51	51	0	51	51
Avg	NA	8.46	0.03	0.09	0.05	NA	28.08	18.48
Min	NA	5.12	0.01	0.00	0.00	NA	17.84	0.36
Max	NA	12.96	0.17	0.60	0.10	NA	33.40	35.78
Median	NA	8.26	0.02	0.02	0.05	NA	28.80	17.89
Period covered by data	*Aug 2002 – Oct 2008*							
Coosa River at Mitchell								
No. of Samples	0	53	53	53	53	0	53	53
Avg	NA	8.70	0.02	0.05	0.05	NA	27.20	18.01
Min	NA	4.56	0.02	0.00	0.00	NA	20.02	0.71
Max	NA	12.22	0.07	0.25	0.09	NA	33.66	60.18
Median	NA	8.78	0.02	0.02	0.06	NA	27.73	16.55
Period covered by data	*Aug 2002 – Oct 2008*							
Coosa River at Jordan								
No. of Samples	0	30	30	30	30	0	30	30
Avg	NA	8.66	0.02	0.05	0.04	NA	27.21	14.32
Min	NA	3.55	0.02	0.00	0.00	NA	19.45	2.67
Max	NA	13.47	0.13	0.24	0.08	NA	32.37	24.03
Median	NA	8.65	0.02	0.02	0.04	NA	27.99	14.15
Period covered by data	*Aug 2002 – Oct 2008*							

Table 2.1-30. (continued)

	BOD_5U (mg/L)	Oxygen (mg/L)	NH_3-N (mg/L)	NO_3-N (mg/L)	PO_4-P (mg/L)	TSS (mg/L)	Temp. (C)	Chlorophyll *a* (µg/L)
Tallapoosa River at Harris Lake								
No. of Samples	0	101	101	101	101	0	101	101
Avg	NA	8.54	0.03	0.07	0.04	NA	25.87	12.12
Min	NA	4.14	0.02	0.00	0.00	NA	19.29	2.14
Max	NA	12.06	0.26	0.31	0.09	NA	31.53	67.80
Median	NA	8.42	0.02	0.05	0.03	NA	26.20	8.90
Period covered by data	*Apr 2002 – Oct 2008*							
Tallapoosa River at Lake Martin								
No. of Samples	0	129	129	129	129	0	129	129
Avg	NA	8.18	0.02	0.05	0.04	NA	26.68	4.48
Min	NA	6.28	0.02	0.00	0.00	NA	18.92	0.53
Max	NA	10.72	0.14	0.35	0.10	NA	32.55	13.62
Median	NA	8.12	0.02	0.03	0.03	NA	26.99	3.47
Period covered by data	*Apr 2002 – Oct 2008*							
Tallapoosa River at Yates								
No. of Samples	0	23	23	23	23	0	23	23
Avg	NA	8.32	0.04	0.13	0.03	NA	24.28	4.94
Min	NA	6.44	0.02	0.01	0.01	NA	17.94	1.00
Max	NA	10.26	0.19	0.21	0.07	NA	30.69	18.69
Median	NA	8.24	0.02	0.12	0.03	NA	24.15	3.74
Period covered by data	*Apr 2002 – Oct 2008*							
Tallapoosa River at Thurlow								
No. of Samples	0	23	23	22	23	0	23	23
Avg	NA	8.18	0.03	0.14	0.03	NA	22.76	2.82
Min	NA	6.60	0.02	0.00	0.00	NA	18.00	0.80
Max	NA	11.27	0.15	0.22	0.06	NA	29.30	5.97
Median	NA	7.98	0.02	0.14	0.02	NA	22.86	2.40
Period covered by data	*Apr 2002 – Oct 2008*							
Alabama River at R.F. Henry								
No. of Samples	0	50	50	50	50	0	50	50
Avg	NA	8.53	0.02	0.13	0.04	NA	27.15	16.09
Min	NA	5.40	0.02	0.00	0.00	NA	18.76	3.56
Max	NA	11.77	0.16	0.33	0.08	NA	33.40	33.11
Median	NA	8.51	0.02	0.11	0.04	NA	28.53	15.49
Period covered by data	*Aug 2002 – Oct 2008*							

2.1.2.5.1 Federal Agencies

USACE conducts water quality monitoring at federal projects. More detailed descriptions of those water quality monitoring activities are provided in the project WCMs. Historically, data have been collected throughout the ACT Basin [including Allatoona Lake, Carters Lake, Claiborne Lock and Dam and Lake, Millers Ferry Lock and Dam and William "Bill" Dannelly Lake, and Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake (Jones Bluff)] for special studies. As part of the *Environmental Assessment for Major Rehabilitation of the Lake Allatoona Powerhouse* (USACE 2000), USACE collected DO in the tailrace of the Allatoona Lake. The action being proposed did not affect DO levels, but concentrations below water quality standards were noted when power was not being generated. The assessment recommended aeration options for the future that would decrease the impact of operations on DO.

In 2007 USACE also conducted a special study downstream of Millers Ferry Lock and Dam in coordination with International Paper (now Macmillan Bloedel Packing, Inc.). Special releases were made from Millers Ferry Lock and Dam and longitudinal DO was monitored at points downstream of the spillway (RM 133.5) to Steins Island (RM 91.1). Under current conditions, DO along the reach often falls below the state DO standard. USACE made special releases of flow during periods of low DO to determine if increased releases would increase downstream DO. The results of the study found that DO was improved from Millers Ferry Dam downstream to about 10 miles south of the Weyerhaeuser Mill when water was passed through the spillway at Millers Ferry Dam.

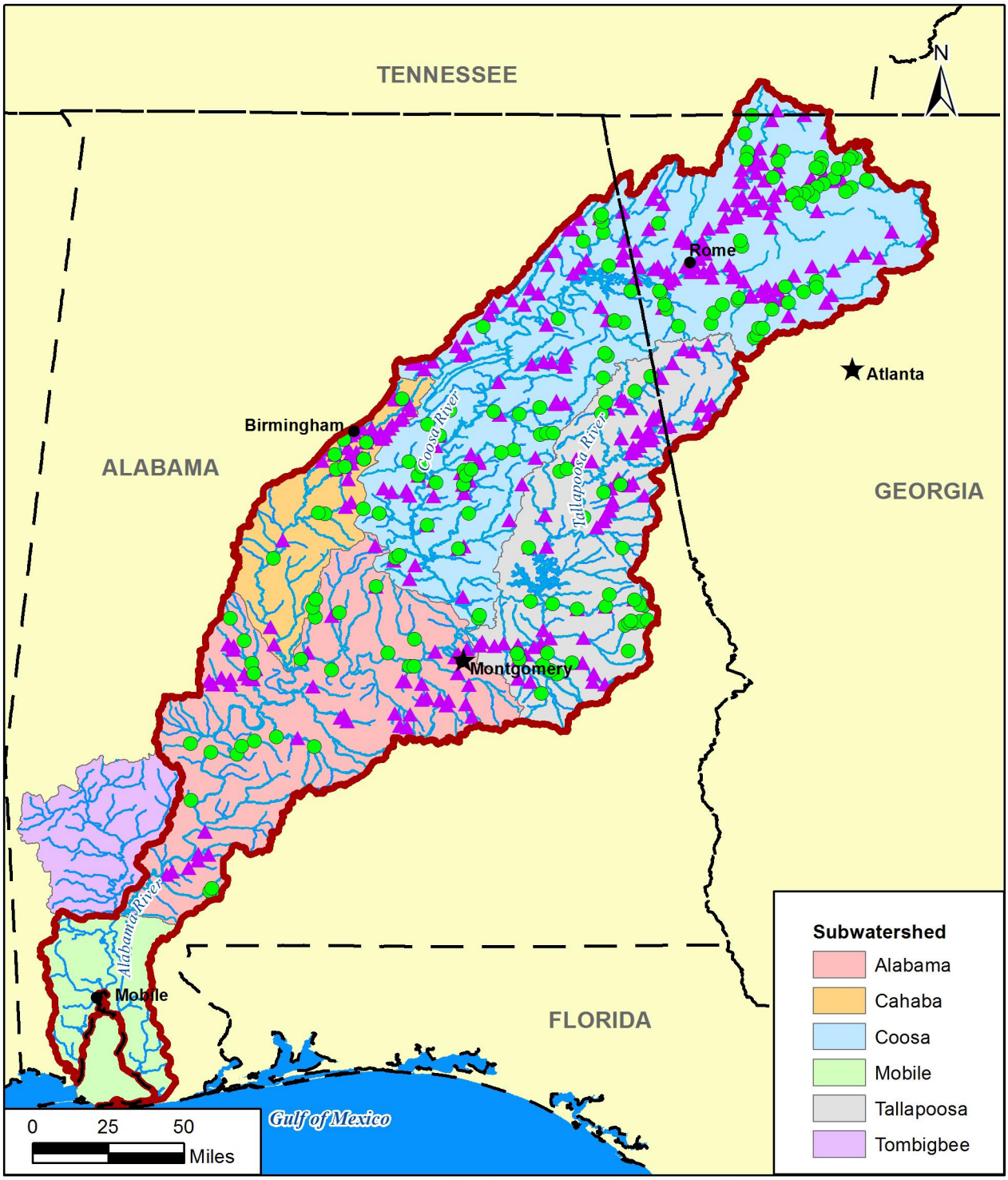
Since 1998 other federal agencies have focused their monitoring efforts on understanding the relationships between water quality and biological resources. In addition to monitoring conducted by the USGS with USEPA, USFWS is monitoring water quality in the ACT Basin. Figure 2.1-56 illustrates the water quality monitoring stations, by state and federal agencies, in the ACT Basin.

USGS collects water quality data throughout the ACT Basin. It usually coordinates its monitoring with local or state sponsors. In Alabama, 114 USGS water quality monitoring stations are in the ACT Basin. Of those 114 stations, 5 have real-time reporting of DO, temperature, and specific conductivity. In Georgia, Georgia EPD has sponsored 119 monitoring stations in the ACT Basin to collect data for use in developing TMDLs.

The Mobile River Basin, which includes the ACT Basin, was monitored as part of USGS's National Water Quality Assessment. In 2004 the USGS published the results of its monitoring effort for the Mobile River Basin. The study concludes that the major influences on stream quality were increased urban development and population density and runoff from urban and agricultural areas (Atkins 2004).

USEPA began conducting national surveys in 2005, which ended in 2009. The surveys collected data in lakes and rivers throughout the country, including the ACT Basin. The monitoring data include water chemistry in the water column and sediments, benthic macroinvertebrates, fish, zooplankton, and plankton.

USFWS has identified a need to monitor water quality, including temperature, pH, hardness, turbidity, oxygen content, and other chemical characteristics in the ACT Basin to ensure the normal behavior, growth, and viability of all life stages for mussels (USFWS 2010a).



LEGEND

- ACT Basin Boundary
- State Water Quality Stations
- Federal Water Quality Stations

Alabama, Coosa, Tallapoosa Rivers Federal and State Water Quality Monitoring Stations

Figure 2.1-56

2.1.2.5.2 Monitoring by State Agencies

A number of state agencies collect water quality data. In Alabama and Georgia, ADEM and Georgia EPD have refined their monitoring of water quality to concentrate efforts on basins in a rotating methodology. Alabama has a number of different water quality sampling programs, which focus on reservoir monitoring, trend monitoring, and specialty studies that address needs identified by ADEM for TMDL development and wasteload allocations. Georgia has a similar water quality monitoring program in the ACT Basin. Figure 2.1-56 illustrates the water quality monitoring stations of ADEM and Georgia EPD in the ACT Basin. Other agencies collect water quality data for specialty studies and to support biological sampling efforts.

2.1.2.5.3 Monitoring by Local Agencies

Throughout the ACT Basin, local agencies collect water quality samples to meet regulatory requirements for NPDES permits and to make management decisions. Given the size of the basin and the amount and scope of the data collected by state and federal agencies, those monitoring efforts are not detailed in this report.

2.1.2.5.4 Monitoring by Commercial and Industrial Organizations

Like local agencies, commercial and industrial organizations in the ACT Basin collect water quality samples to meet regulatory requirements for NPDES permits and to make management decisions. These monitoring efforts are not detailed in this report, but they are detailed in a number of TMDLs developed for the ACT Basin.

APC was issued a section 401 water quality certification on July 1, 2005 (letter from J. McIndoe, Chief, Water Division, ADEM, Montgomery, Alabama, July 1, 2005) for the Coosa River Projects including Weiss Lake, H. Neely Henry Lake, Logan Martin Lake, Lay Lake, Mitchell Lake, and Jordan Dam and Lake. The conditions of the certification include a water quality monitoring plan to collect DO and temperature data in project tailwaters during the summer months for 3 years after licensing. These monitoring data will be used to ensure compliance with the 4-mg/L DO standard in accordance with the section 401 water quality certification (FERC 2009).

2.1.2.5.5 Monitoring by Nonprofit and Volunteer Organizations

Nonprofit and volunteer organizations are very active in water quality monitoring throughout the ACT Basin. Those efforts are supported by ADEM through the Clean Water Partnership and by Georgia EPD through the Adopt-a-Stream program.

Other programs in Alabama include Alabama Water Watch (AWW) and Alabama Rivers Alliance. AWW organizes 250 volunteer monitoring groups throughout the state. In the ACT Basin, more than 100 volunteer monitoring groups are collecting data. Their data collection efforts have historically focused on field measurements for fecal coliform, temperature, DO, and Secchi depths (turbidity) in reservoirs. Recently, AWW has established several continuous monitoring stations to increase the understanding of water quality conditions throughout Alabama.

In Georgia volunteer monitoring efforts are also coordinated through localized Riverkeepers and the Georgia Water Coalition. In the ACT Basin, the Coosa River Basin Initiative, or Upper Coosa Riverkeeper, uses volunteers to monitor water quality in the Upper Coosa River and Oostanaula River watersheds (CRBI 2009).

2.1.2.6 Additional Studies

Various federal, state, and local agencies, universities, and nonprofit organizations have developed basin management plans and conducted specialty studies that describe watershed conditions, including sources and stressors affecting water quality in the ACT Basin. Section 2.1.1.2.5 describes efforts in the basin that include water quantity planning. The subsections to follow present studies focused on quantifying water quality in the ACT Basin.

2.1.2.6.1 Allatoona Lake/Upper Etowah Watershed Assessment (unpublished)

The Allatoona Lake/Upper Etowah River (LA/UE) Watershed Partnership is a partnership of municipalities in the watershed that formed to develop a watershed assessment, a watershed monitoring plan, and a watershed protection plan. At the onset of that effort, USACE helped develop a multiyear monitoring study and coordination among stakeholders. The USGS has also been contracted to monitor flows and water quality in the basin. The watershed assessment characterizes water quality and habitat conditions in the upper Etowah watershed. Growth in the watershed is inevitable. Consequently, the economic and environmental sustainability of the region is directly linked to protecting and preserving the water resources. Several counties in the LA/UE watershed rank in the top 10 in the state for population growth. With increased commercial and residential development, more drinking water and wastewater capacity will be needed. Increased growth brings the potential for increasing the amount of impervious area, nutrient applications, and stormwater runoff. Urbanization has historically produced stressors such as high-energy (peak) flows that cause in-stream bank erosion in the headwaters and silt deposits in the lower reaches. Bank erosion causes a loss of habitat, and the resulting siltation blankets existing habitat downstream, limiting the capacity of aquatic life—fish and benthic macroinvertebrates (e.g., aquatic insects, snails, worms)—to survive and reproduce. The increased sediment loads also contribute negatively in Allatoona Lake by silting in embayments and part of the lake. In the future, these problems must be evaluated and addressed to create a sustainable environment.

The monitoring plan, approved by Georgia EPD and USEPA, includes water quantity, water quality, and ecological conditions in the watershed. It is intended (1) to be comprehensive; (2) to help address multi-jurisdictional watershed management objectives; (3) to focus on ecological conditions at multiple spatial scales, in response to the 1972 CWA's emphasis on biological integrity; and (4) to help meet Georgia's requirements for watershed management plans. The set of objectives developed by the LA/UE Watershed Partnership required an approach that incorporates sites selected on the basis of expected problems or issues (targeted), as well as sites from which data could be aggregated for assessments at broader spatial scales (probability-based). Constituents sampled included selected laboratory and field chemistry, various aspects of flow and physical habitat quality, benthic macroinvertebrates, and fish. From 2005 through 2010, these data were gathered from approximately 400 locations throughout the upper basin. Implementation of the program required training, tracking of data quality characteristics, and performing analyses focused on the objectives.

2.1.2.6.2 Water Quality Screening Assessments

ADEM's Field Operations Division publishes reports each year to summarize data collected during basin water quality monitoring. ADEM's published water quality studies for the ACT Basin are in Table 2.1-31.

The Cahaba River and Sougahatchee Creek are major tributaries in the ACT Basin where attention has been focused to improve water quality conditions. Impairments in the watersheds have been attributed to increased urban activities and municipal discharges. Various state and local agencies have conducted intensive monitoring efforts in these watersheds. Most recently, in 2007 ADEM conducted an intensive fecal coliform study for the Save Our Saugahatchee watershed group in the Auburn and Opelika area

(ADEM 2007, 2008b). The Geological Survey of Alabama also conducts water quality monitoring throughout the state, including several studies on the Cahaba River.

Table 2.1-31.
ADEM's published water quality studies in ACT Basin

Year study completed	Title	Field office
2004	Surface Water Quality Screening Assessment of Southeast Alabama River Basins - 2004 Part II: Rivers, Reservoirs, and Tributaries	Montgomery
2004	Surface Water Quality Screening Assessment of the Southeast Alabama River Basins Part 1: Wadeable Rivers and Streams	Montgomery
2002	Cahaba Black Warrior River Basins	Montgomery
2000	Intensive Water Quality Survey of Coosa, Tallapoosa, and Alabama River Basin Reservoirs, 2000	Montgomery
2000	Surface Water Quality Screening Assessment of the Alabama River Basin, 2000	Montgomery
2000	Surface Water Quality Screening Assessment of the Tallapoosa River Basin, 2000	Montgomery
2000	Surface Water Quality Screening Assessment of the Coosa River Basin, 2000	Montgomery
1998	Monitoring of Watersheds Associated with Alabama State Parks Utilizing Chemical, Physical and Biological Assessments	Montgomery
1998	Water Quality Assessment: Cahaba River (Birmingham Riverview WWTP), 1998	Montgomery
1997	Intensive Water Quality Survey of Coosa and Tallapoosa River Reservoirs, 1997	Montgomery

Source: ADEM 2010b

2.1.2.6.3 Alabama Clean Water Partnership (ALCWP)

The ALCWP has developed watershed management plans for the ACT Basin on the basis of sources and stressors to water quality. Implementation of those plans is dependent on funding sources. Some projects identified in the plans have been implemented.

Alabama River Basin Watershed Management Plan, June 2005. Stakeholders in the Alabama River watershed provided local knowledge that was used to support data from local, state, and federal agencies in identifying stressors to water quality. Ultimately, goals were identified to reduce pollutants, protect high-quality habitats, educate stakeholders, and implement projects to reduce pollutants then reassess conditions in the watershed. Activities where pollution reduction was needed were agricultural activities, forestry activities, aquaculture operations, roads and construction, urban and residential sources, and mining activities (ALCWP 2005).

Upper Coosa Basin Watershed Management Plan, July 2004. The plan established goals and objectives to improve watershed health and developed strategies through partnerships in the watershed to achieve the plan objectives. The process included an inventory of water quality conditions in the basin and identification of stressors and sources. The plan had 12 objectives, including reducing pollution from agricultural activities, forestry activities, construction, and other land disturbance activities; urban sources; domestic on-site sewage disposal systems; and water-related recreational activities. Other objectives included developing a comprehensive plan for Cherokee County and incorporated cities to support future development and ensure stormwater management, protect groundwater resources, promote best management practices for wetlands and other critical habitat areas, inventory and monitor water quality, and increase citizen awareness of watershed protection.

Middle Coosa Watershed Management Plan, August 2003. This plan is similar to the plan developed for the Upper Coosa Watershed. Twelve similar objectives are identified to "improve, protect, and maintain the beneficial uses and water quality standards of the Middle Coosa River through a basin-wide public/private partnership" (ALCWP 2009).

Lower Coosa River Basin Management Plan, May 2005. The plan was presented as three documents to make information more accessible to stakeholders in the basin. It inventories physical and structural features of the basin, discusses water quality, and describes an improvement program.

Tallapoosa River Basin Management Plan, March 2005. This plan took a three-step approach that included stakeholder input to assess conditions in the watershed, evaluate management options and strategies, and prepare a plan to adopt the strategies. The overarching goal is to maintain the Tallapoosa River Basin's status of having the highest quality water in Alabama. The growth of Montgomery and Auburn-Opelika, the western fringes of the Atlanta metropolitan area in Cleburne and Randolph counties, and Elmore County is a concern for stakeholders in the watershed.

Cahaba River Basin Management Plan, 2002. The stakeholders involved in the Cahaba River Cleanwater Partnership used a comparative risk assessment method to prioritize problems and develop strategies to improve environmental conditions in the watershed. The process revealed that water quality impacts throughout the basin are most likely associated with three major stressor or pollutant categories: (1) sediment, (2) nutrients, and (3) toxic substances/pathogens. The stressors are significant in the context of the human ecology of the watershed in that their presence can result in limitations of desired uses and, in some cases, the loss of desired uses of watershed streams. The plan outlined a road map to focus efforts in the watershed to improve ecological health.

2.1.2.6.4 Georgia State Water Planning

As described in Section 2.1.1.2.5.1.3, the Georgia SWP has three major components: (1) Resource Assessments and Forecasting of Needs; (2) Tool Box of Water Management Practices; and, (3) Framework for Regional Water Planning. Those efforts focus on both water quantity and water quality. The water quality resource assessment addresses the assimilative capacity of the ACT Basin in Georgia. Two key issues for the Coosa-North Georgia Regional Council are related to water quality. Those issues are elevated nutrients in Allatoona Lake, Carters Lake, and Weiss Lake and zones of low DO and high bacteria in the Coosa River (GAEPD 2010b). As described in the *Review Draft Assimilative Capacity Assessment* (GAEPD 2010e), the Coosa River at the Georgia-Alabama border has exceeded the available DO and total phosphorus assimilative capacity.

2.1.2.6.5 Other Studies and Reports

Several other water quality studies of the ACT Basin have been conducted and documented. Table 2.1-32 identifies some of the water quality studies of the ACT Basin published since 1998. Not included in the table, are countless watershed assessments and TMDL implementation plans conducted by regional and local agencies.

The Northwest Georgia Regional Water Resources Partnership is a similar partnership to the LA/UE funded by the Northwest Georgia Regional Commission. The Northwest Georgia Regional Water Resources Partnership includes permit holders, local governments, and other stakeholders in the Coosa, Oostanaula, Coosawattee, and Etowah (downstream of Allatoona Lake) watersheds that formed to develop a source water assessment and a watershed protection plan. The documents identify and assess potential pollution sources near public drinking water intakes (NWGRC 2011).

Table 2.1-32.
Documented water quality studies in the ACT Basin

Author(s)	Title	Publication	Year
Nanette Nelson, Andrew Keeler	Water Quality Trading in Georgia: Addressing Two Potential Impediments to Success	Proceedings of the 2005 Georgia Water Resources Conference	2005
Norman E. Peters, Stephen J. Kandell	Evaluation of Stream Water Quality in Atlanta, Georgia, and the Surrounding Region (USA)	Impacts of Urban Growth on Surface Water and Groundwater Quality (Proceedings of IUGG 99 Symposium HSS, Birmingham, July 1999	1999
Byron Freeman, Seth Wenger, Sarah McClung, and Carrie Straight	Etowah River Basin Stressors Analysis	Unpublished Prepared for the USFWS	2002
M.J. Paul, D.S. Leigh and C.P. Lo	Urbanization in the Etowah River Basin: Effects on Stream Temperature and Chemistry	Proceedings of the 2001 Georgia Water Resources Conference	2001
J. Joshua Romies, C. Rhett Jackson, David E. Radcliffe, L. Mark Risse, and John Bryant	Estimating Phosphorus Loads in Streams Draining Poultry-Pasture Operations in the Upper Etowah River Basin, Georgia	Abstract from the 2008 USDA-CSREES National Water Conference	2008
J.B. Atkins	Water Quality in the Mobile River Basin, Alabama, Georgia, Mississippi, and Tennessee, 1999–2001	USGS, book published by DIANE Publishing, ISBN 0607964057, 9780607964059	2004
Martin, Teddy D. and Hollabaugh, Curtis L.	Effect of Rainfall on Water Quality Parameters: A Study of Correlations Between Rainfall and Water Quality Parameters	The Geological Society of America, 2002 Denver Annual Meeting	2002
McWilliams, JL, Schultz, BS, Hollabaugh, CL	The Little Tallapoosa River and the Drought of 1999–2000: Modification of Water Quality Parameters	Geological Society of America, Programs with Abstracts 33 (no.2, March 2001): A-68	2001
Schoonover, J. S., B. G. Lockaby, and B. Helms.	Effects of Watershed Land Use on Perennial Streams of West Georgia, USA. 1: Influence of urban development on stream hydrology	Journal of Environmental Quality 35: 2123–2131	2006
Schoonover, J. S. and B. G. Lockaby.	Land Cover Impacts on Stream Nutrients and Fecal Coliform in the Lower Piedmont of West Georgia.	Journal of Hydrology 331(3-4):371–382	2006
Schoonover, J., B. G. Lockaby, and S. Pan.	Changes in Chemical and Physical Properties of Stream Water across an Urban-Rural Gradient in Western Georgia.	Urban Ecosystems 8(1):107–124	2005
Robert Pitt	Water Quality Conditions in the Cahaba River and Likely Pollutant Sources	University of Alabama at Birmingham	2000

Through funding from ADEM, the Top of Alabama Regional Council of Governments has conducted several assessments in the Upper Coosa Watershed. The Little River Canyon National Preserve attracts more than 350,000 visitors each year (TARCG 2008). The Little River is a tributary to Weiss Lake. The importance of the resource to tourism drives the necessity to analyze the effects of growth on water quality and have a strategy to protect the watershed.

2.1.2.7 Modeling and Tools

2.1.2.7.1 Quantity Modeling

As mentioned earlier, the HEC-ResSim model is being used to simulate flow operations in the ACT Basin. HEC-ResSim is a state-of-the-art tool for simulating flow operations in managed systems. It was developed by USACE' HEC to help engineers and planners perform water resources studies in predicting the behavior of reservoirs and to help reservoir operators plan releases in real-time during day-to-day and emergency operations. *Release Candidate 3, Build 42* of the HEC-ResSim model Version 3.1 was used for the ACT period of record simulation.

HEC-ResSim has a graphical user interface designed to follow Windows® software development standards. The model's interface can be learned without extensive tutorials. Familiar data entry features make model development easy, and localized *mini plots* graph the data entered in most tables so that errors can be seen and corrected quickly. A variety of default plots and reports, along with tools to create customized plots and reports, facilitate output analysis.

HEC-ResSim provides a realistic view of the physical river/reservoir system using a map-based schematic. The program's user interface allows the user to draw the network schematic as a stick figure or as an overlay on one or more geo-referenced maps of the watershed. HEC-ResSim represents a system of reservoirs as a network composed of four types of physical elements: junctions, routing reaches, diversions, and reservoirs. By combining these elements, the HEC-ResSim modeler is able to build a network capable of representing anything from a single reservoir on a single stream to a highly developed and interconnected system like that of the ACT Basin. A reservoir is the most complex element of the reservoir network and is composed of a pool and a dam. HEC-ResSim assumes that the pool is level (i.e., it has no routing behavior), and its hydraulic behavior is completely defined by an elevation-storage-area table. The real complexity of HEC-ResSim's reservoir network begins with the dam.

Most reservoirs are constructed for one or more of the following purposes: flood risk management, hydropower generation, navigation, water supply, recreation, water quality, and fish and wildlife conservation. These purposes typically define the goals and constraints that describe the reservoir's release objectives. Other factors that might influence these objectives include time of year, hydrologic conditions, current pool elevation (or zone), and simultaneous operations by other reservoirs in a system. HEC-ResSim uses an original rule-based description of the operational goals and constraints that reservoir operators must consider when making release decisions.

The model calibration and validation of the HEC-ResSim model are presented in HEC's report in Appendix C.

2.1.2.7.2 Quality Modeling

USACE HEC developed HEC-5Q to provide an analytic tool for evaluating the water quality response. The model is linked with the HEC-ResSim model through an input of flows by reach. For this study, the enhanced HEC-5Q developed for the Columbia River Basin was generalized and improved to meet the requirements of the ACT Basin. Longitudinally segmented reservoirs were layered so that the vertical distribution of phytoplankton, DO, and other parameters could be represented. A branching of longitudinally segmented reservoirs was added as an option; it included variable water surface elevations based on backwater computations. A graphical user interface was also added to facilitate displaying and interpreting model results.

The model calibration and validation of HEC-5Q model is presented in HEC's report in Appendix D.

A number of other government and private agencies manage water resources in the ACT Basin. These agencies have developed models and tools to answer specific water quality related questions throughout the basin. Table 2.1-33 lists the water quality models and tools developed by state and federal agencies for mainstem waterbodies in the ACT Basin. Beyond the models and tools listed in Table 2.1-33, Alabama and Georgia regularly develop site-specific models and tools. Specifically, they develop wasteload allocations for individual dischargers when point source M&I dischargers request permits or permit renewals. Those efforts have historically focused on individual permittees. The models and tools presented in Table 2.1-33 have been developed to establish water quality conditions inclusive of nonpoint sources of pollution and to make basin-wide water quality management decisions.

Georgia EPD is developing watershed, in-stream, and reservoir water quality models for Allatoona Lake and Carters Lake to support TMDL development; additional watershed and in-stream models are being developed in the ACT Basin as part of the Georgia SWP (GAEPD 2009h). Those tools will be used to develop TMDLs and to make management decisions.

Table 2.1-33.
Available water quality models and tools from federal and state agencies

Waterbody	Agency	Purpose of project	Type of model or tool	Completed
ACT Basin-wide	USACE	Operations analysis	HEC-5Q—One-dimensional water quality model	Ongoing
ACT Basin-wide	NOAA	Land use change impacts on sediment and submerged aquatic vegetation in Mobile Bay, Alabama	Load Simulation Program C++ (LSPC)—Watershed	Ongoing
Allatoona Lake, Georgia	Georgia EPD	TMDL	LPSC—Watershed, Environmental Fluid Dynamic Code (EFDC)—three-dimensional hydrodynamic, and Water Quality Analysis Simulation Program (WASP)—water quality models	Ongoing
Carters Lake, Georgia	Georgia EPD	TMDL	LSPC—Watershed, EFDC—three-dimensional hydrodynamic, and WASP—water quality models	Ongoing
Weiss Lake, Alabama	USEPA Region 4	TMDL nutrient criteria development	SPC—watershed, EFDC—three-dimensional hydrodynamic, and WASP—water quality models	2008
H. Neely Henry Lake, Alabama	ADEM	TMDL nutrient criteria development	LSPC—watershed, EFDC—three-dimensional hydrodynamic, and WASP—water quality models	2008
Logan Martin Lake, Alabama	ADEM	TMDL Nutrient criteria development	LSPC—watershed, EFDC—three-dimensional hydrodynamic, and WASP—water quality models	2008
Lay Lake, Alabama	ADEM	TMDL Nutrient criteria development	LSPC—watershed, EFDC—three-dimensional hydrodynamic, and WASP—water quality models	2008
Mitchell Lake, Alabama	ADEM	TMDL Nutrient criteria development	LSPC—watershed, EFDC—three-dimensional hydrodynamic, and WASP—water quality models	2008
Jordan Dam and Lake, Alabama	ADEM	TMDL Nutrient criteria development	LSPC—watershed, EFDC—three-dimensional hydrodynamic, and WASP—water quality models	Ongoing

Table 2.1-33. Continued

Waterbody	Agency	Purpose of project	Type of model or tool	Completed
Saugahatchee River and Yates Lake	ADEM	TMDL	LSPC—watershed, EFDC—three-dimensional hydrodynamic, and WASP—water quality models	2008
William "Bill" Dannelly Lake, Alabama	ADEM	Nutrient criteria development		Ongoing
Cahaba River, Alabama	ADEM	TMDL wasteload allocations	LSPC—watershed and RIV1—riverine models Nutrient spreadsheet tool	2006
R.E. "Bob" Woodruff Lake, Alabama	ADEM	Nutrient criteria development	LSPC—watershed, EFDC—three-dimensional hydrodynamic, and WASP—water quality models	Ongoing
Claiborne Lake, Alabama	ADEM	TMDL	Hydrologic Simulation Program in Fortran — watershed, EFDC—three-dimensional hydrodynamic, and WASP—water quality models	2005
Mobile Bay, Alabama	ADEM	TMDL wasteload allocations	LSPC—watershed and EFDC—three-dimensional hydrodynamic models	2006
Mobile Bay, Alabama	USEPA Region 4	TMDL	WASP—three-dimensional water quality model	Ongoing

2.2 Geology and Soils

2.2.1 Geology and Soils Affected Environment

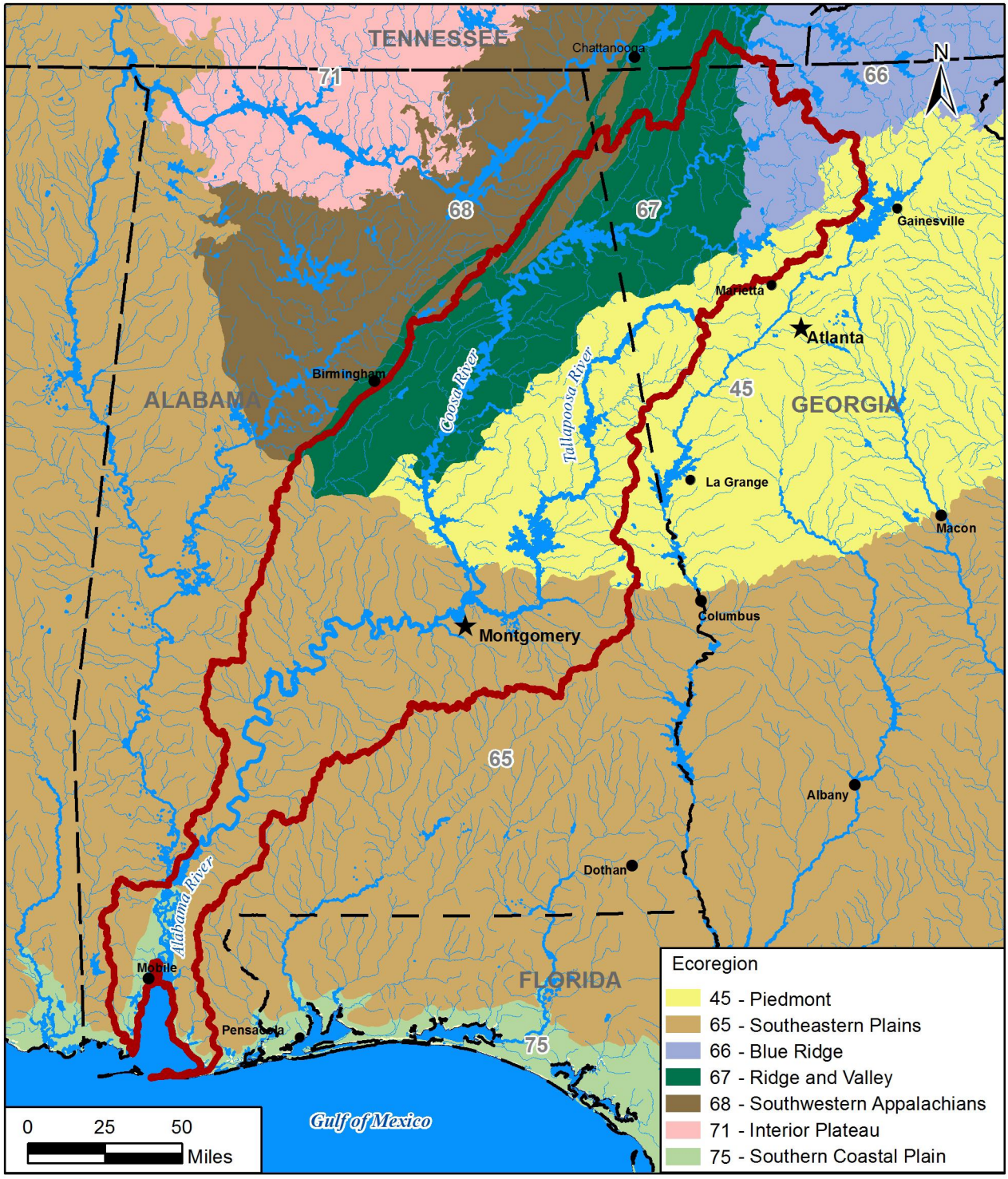
The ACT Basin is divided into five level 3 ecoregions with similar physical, chemical, and biological environmental attributes. All levels of government and research organizations use the ecoregions as the spatial framework for research and policy decisions, including the development of site-specific water quality standards and stream pollutant loads. The five ecoregions in the ACT Basin are the Southwestern Appalachians, Ridge and Valley, Blue Ridge, Piedmont, and Southeastern Plains (Figure 2.2-1). Those ecoregions reflect a geologic history of mountain-building in the Appalachian Mountains and long periods of repeated land submergence in the Southeastern Plains ecoregion. Of the 17 dams on the mainstem rivers in the basin, 14 are in the higher relief ecoregions; Southwestern Appalachians, Ridge and Valley, Blue Ridge, and Piedmont. A description of the major aquifers in the ACT Basin is presented in Section 2.1.1.1.5.

2.2.1.1 ACT Basin Ecoregions

2.2.1.1.1 Ridge and Valley and Southwestern Appalachians

The Ridge and Valley ecoregion has a high relief, with altitudes ranging from 400 ft in valleys to 1,600 ft at ridge tops (Robinson et al. 1997). The ridges run northeast to southwest and are composed of sandstone, siltstone, and shale (Griffith et al. 2001). Streams are typically trellised and rectangular, and their movement is controlled by the ridge features and weathering of the rocks. Soils are shallow and well drained, and water moves rapidly toward streams during precipitation events.

Located in the Southwestern Appalachians, the Cumberland Plateau is a high-altitude, flat plateau with altitudes ranging from 1,500 to 1,800 ft (Mooty and Kidd 1997). The plateau runs parallel to the northeast-southwest trending ridges and valleys and is composed of sandstone, siltstone, and shale. The area receives more precipitation than the surrounding ecoregions because of its higher altitude (Griffith et al. 2001).



Level III Ecoregions

Figure 2.2-1

2.2.1.1.2 Blue Ridge and Piedmont Ecoregions

The Blue Ridge ecoregion is in the northeastern corner of the ACT Basin and composes a relatively small amount of the basin. The topography is steep, and mountain elevations are as high as 3,000 to 3,500 ft. Relative to other ecoregions in the ACT Basin, soils are shallow and poorly developed. They are underlain by saprolite, a type of weathered rock, and impermeable metamorphic and igneous crystalline rocks. Runoff in the Blue Ridge is rapid because the steep terrain sheds water quickly, and the shallow soils do not store large quantities of water. Average runoff ranges from 15 to 40 in/yr and is relatively high compared to other ACT Basin ecoregions because of excessive precipitation and soil-runoff potential (Journey and Atkins 1997).

The topography of the Piedmont is characterized by low, rolling hills in the north and broad rolling uplands in the south. Land surface altitudes range from 500 to 1000 ft (Journey and Atkins 1997). Like the Blue Ridge, the Piedmont is underlain by impervious metamorphic and igneous crystalline rocks. The regolith, composed of soils and saprolite, can be 10 to 150 ft depending on the differential weathering of the crystalline rocks. Groundwater is stored in the regolith and enters the crystalline rocks at fault zones. The ecoregion has a dissected upland with rounded interstream valleys with typically dendritic streams. The streams in the Piedmont are fast flowing and are characterized by rapids and riffles, making them ideal for hydropower development (Journey and Atkins 1997).

Both the Blue Ridge and Piedmont ecoregions are underlain by Precambrian and Paleozoic crystalline rocks, which include mica schist, felsic gneiss and schist, and granite and granite gneiss. Less extensive outcrops of quartzites are also present. The principal aquifers in the Blue Ridge and Piedmont provinces are fracture-conduit aquifers in the bedrock, where water-bearing zones occur along geologic features such as lithologic contacts, joints, fractures, faults, folds, and veins (Robinson et al. 1997).

2.2.1.1.3 Southeastern Plains Ecoregion

The Southeastern Plains ecoregion begins at the contact point, known as the Fall Line, between the crystalline bedrock of the Piedmont and unconsolidated sediments of the plains. The soils are deep, and parent material in the northern portion of the plains is composed of Cretaceous or Tertiary-age sand, silt, and clays, and parent material in southern portion of the plains is composed of limestone, shale, and sandstone. The Southeastern Plains ecoregion is hilly with rolling topography that ranges from 50 ft to 850 ft (Kidd et al. 1997).

2.2.1.2 Soils Affected Environment

2.2.1.2.1 Soil Types

The sediments that are transported by the streams and deposited in the reservoirs of the ACT Basin originate as soils throughout the watershed. The different soils have a variety of compositions and differing proportions of rocks, sand, silt, and clay. The composition and location of the soils indicate the portions of the ACT Basin that are the most likely to contribute eroded sand, silt, and clay materials into streams and river. Six soils orders are within the ACT Basin, three of which make up most of the soils—ultisols, entisols, and inceptisols:

- Ultisols are characterized by sandy or loamy surface horizons overlying loamy or clayey subsurface horizons. These soils are formed in place through the deep, long-term weathering of parent igneous and metamorphic bedrock. Although commonly called *red clay soil*, these soils range in color from bright orange to pale yellow-brown.
- Inceptisols are characterized by minimal horizon development and are often found on young geomorphic surfaces, steep slopes, or weathering-resistant parent material. The soils typically

have a weak indication of either an argillic or spodic horizon and still retain most weatherable minerals.

- Entisols are characterized as sandy, deep, infertile, well-drained, and subject to active erosion. These soils show poorly developed horizons and are called *young* because little change is exhibited from the parent material.

Ultisols dominate the Piedmont ecoregion. They generally lack the original topsoil because of erosion during intensive cotton farming beginning in the 18th century (Couch et al. 1996). The soils of the Coastal Plain ecoregion are formed from marine sediments. These soils are primarily ultisols with the exception of entisols along major river basins.

2.2.1.2.2 Hydraulic Conductivity

The portions of precipitation that either run off the landscape or infiltrate the soil are regulated by the ability of soil layers to infiltrate water. The infiltration ability is expressed as the *hydraulic conductivity* of the least pervious soil layer in a soil profile. For use in hydrologic runoff calculations, the many different soil types in a watershed are typically classified into one of four hydrologic groups—A, B, C, or D—on the basis of hydraulic conductivity, expressed in inches per hour (Table 2.2-1). Infiltration ability can also be affected by the proximity of the water table to the ground surface. If a D group soil, when drained, has a higher hydraulic conductivity, it is given a dual group name (Table 2.2-1). The Disturbed Soil classification is used for soils with hydraulic conductivities that might have become altered during land development; such soils need to be directly tested to determine their hydrologic soil groups (NRCS 2009).

Table 2.2-1.
Hydraulic conductivities of the hydrologic soil groups

Hydrologic soil group	Hydraulic conductivity (in/hr)	Runoff potential when thoroughly wet
A	Greater than 5.67	Low
B	1.42 to 5.67	Moderately Low
C	0.14 to 1.42	Moderately High
D	Less than 0.14	High
Disturbed Soil	N/A	N/A
A/D, B/D, C/D	D group soil, but drainable to the greater conductivity.	High when undrained

Source: NRCS 2009

The soil groups can also be described qualitatively:

- Group A soils are typically less than 10 percent clay and more than 90 percent sand or gravel, with textures described as a sand, gravel, or loam.
- Group B soils are typically 10 to 20 percent clay and 50 to 90 percent sand, with textures typically described as a loamy-sand.
- Group C soils are typically 20 to 40 percent clay and less than 50 percent sand, with textures that include loam plus sand, silt, or clay.
- Group D soils are typically greater than 40 percent clay and less than 50 percent sand and are described as having a clayey texture. Also, a soil is classified as Group D if the water table is within 2 ft of the surface.

The four soil hydrologic groups can be found throughout the ACT Basin, but occurrence tends to coincide with the five ecoregions of the ACT Basin (Figure 2.2-2). North of the Fall Line, within the Piedmont, Blue Ridge and Southwestern Appalachians ecoregions, the soils are over 85 percent group B. The Ridge and Valley and Southeastern Plains ecoregions are composed of about 50 percent group C soils. The group A soils occur primarily in a thin band directly south of the Fall Line in the Southeastern Plains ecoregion, although most of the Southeastern Plains ecoregion is dominated by C and D soils (NRCS 2010a, 2010b).

In general, regions of C and D soil groups generate the greatest amount of runoff per acre. That effect is increased in areas with steep topography, where precipitation has less time to infiltrate before running off into streams. The areas with the highest runoff potential are in the mountain areas of the Ridge and Valley, the clay-rich C soils south of the Fall Line, the clay-rich stream valleys in the Southeastern Plains ecoregion, and the areas of the Southeastern Plains ecoregion that have a high water table.

In general, regions of A and B soil groups promote the greatest amount of infiltration and groundwater recharge. This effect is increased in areas of low relief where precipitation is slow to run off and might even pond. The areas with the highest infiltration potential include the sandy A group soils south of the Fall Line and the sandy soils in the northern portion of the Southeastern Plains ecoregion.

2.2.1.2.3 Prime Farmland

As designated by the USDA, prime farmland has the best combination of physical and chemical characteristics for producing beneficial crops, and it is available for this use. Prime farmland can be cropland, pastureland, range land, forest land, or other land but not urban built-up land or water. In general, prime farmlands have an adequate and dependable water supply, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, few or no rocks, and soils that are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for a long period, and they either do not flood frequently or are protected from flooding. On the basis of information from the NRCS State Soil Geographic Database, approximately 18 percent of the ACT Basin has been designated as prime farmland. Most prime farmland is concentrated in the southern third of the ACT Basin along stream channels and in areas in which groundwater resources are more readily available (Figure 2.2-3). The presence of actively cultivated prime farmlands creates greater local demands on surface water or groundwater (or both) supplies for irrigation during the growing seasons from April through September for the region.

2.2.1.2.4 Erosion and Sedimentation

This EIS is focused on the operations of USACE reservoirs; therefore, it is most appropriate to focus on sediment transported by rivers rather than inputs from overland sources. However, comments are included where information was found that links land use change with an apparent effect on sediment loads. In general, the quantity and size of sediment transported by rivers is related to the size and frequency of dams in the river system. Impoundments behind dams serve as sediment traps where coarse bed material particles, typically sand and larger, settle in the lake headwaters where entering flows are slowed. Fine particles, typically silts and clays, can remain in suspension and pass through the lake downstream. Large impoundments typically trap most of the sediment load retaining all the sand and coarser particles plus much of the silt- and clay-sized particles. Smaller, run-of-the-river impoundments tend to pass all sizes of suspended particles during low to moderate flows and coarser bed material particles during high flows. The impact of the impoundments on river form is that the upstream channels can aggrade sediment and undergo an increase in bed elevation, thus reducing the channel gradient. Downstream of a dam, the river

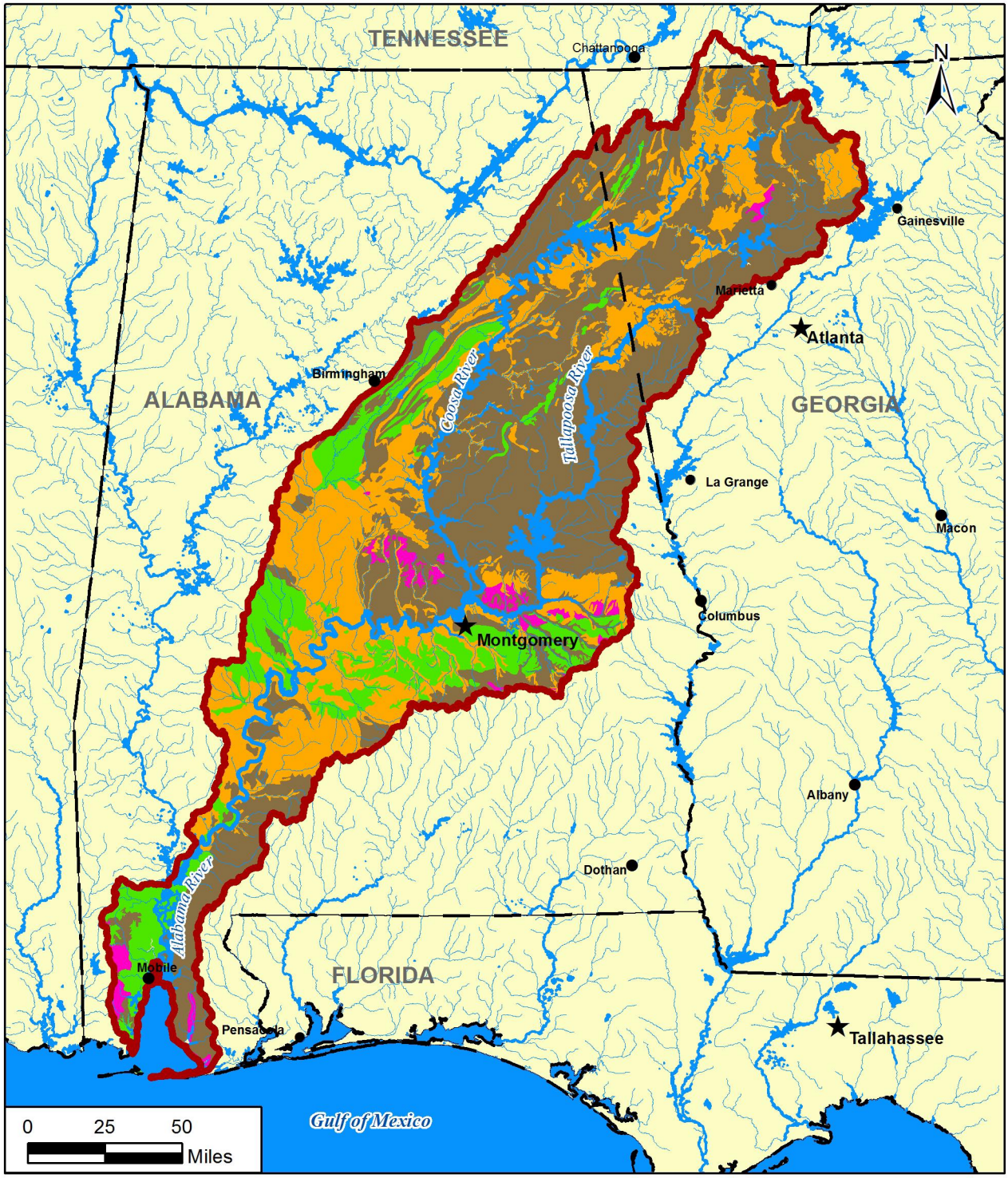


Figure 2.2-2

Source: NRCS 2009.



Prime Farmland

Figure 2.2-3

typically becomes starved for sediment. The channel downstream of a dam might or might not respond to the reduction in sediment load. The channel response depends on how resistant to erosion the channel bed and banks are and how quickly sediment is replenished from downstream tributaries and upland erosion sources. A typical response for channels, with bed and banks composed of easily eroded sands, silts, or soft clays, is for the bed to degrade to a reduced elevation; the channel might also widen through bank erosion.

The four largest impoundments in the system—Lake Martin, Allatoona Lake, Carters Lake, and R.L. Harris Lake—act as sediment traps, retaining most of the sand and larger bed material. Lake Martin accounts for 31 percent of the storage volume in the basin. Allatoona Lake is next largest, with 13 percent, followed by Carters Lake and R.L. Harris Lake, each with 8 percent. Shoaling in Lake Martin is not considered to be a problem because of the huge volume of storage available. A summary of the 2000 Allatoona Lake sedimentation study is included in Section 2.2.1.2.6.7.

In addition to the information on erosion and sedimentation provided in the following sections, the draft ACT Master Manual and individual project WCMs (Appendix A to the EIS) include additional detailed information on erosion and sedimentation at the projects.

2.2.1.2.5 Tailwater Degradation

Tailwater degradation is the lowering of the river bed elevation immediately downstream of a dam. Three factors drive the occurrence and rate of tailwater degradation: a ready supply of sediment from upstream, erodibility of the bed material, and sufficient flow energy to transport the bed material. After a dam's construction, a large portion of the sediment (as much as 90 percent for large reservoirs) often becomes trapped in the lake above the dam. Flow downstream of the dam, having lost its sediment load to the lake, now has excess capacity to transport sediment. If the bed and bank materials downstream of the dam are composed primarily of erodible sands, silts, and clays, tailwater degradation occurs until either the gradient of the river is sufficiently reduced to dissipate the flow energy, or the bed erodes to a more durable material such as bedrock. A cursory investigation of the tailwater degradation downstream of the ACT projects was made using available data.

2.2.1.2.5.1 Claiborne Lock and Dam and Lake

On the ACT system, the most downstream project is Claiborne Lock and Dam and Lake. The tailwater reach extends approximately 72.5 mi downstream to the mouth of the Tombigbee River. Construction on the project began in May 1965 and was completed in September 1976. The pool has little storage, and it is considered a run-of-the-river project. The slope of the river downstream of the dam is approximately 0.06 ft/mi. The federally authorized 9-ft-deep by 200-ft-wide Alabama River navigation channel extends from Claiborne Lock and Dam downstream to the river's confluence with the Tombigbee River. The navigation channel is maintained by a combination of flows from Claiborne Lock and Dam, maintenance dredging, and training works.

Flow and gage measurements have been made downstream of the dam since 1980. They were collected and analyzed to evaluate the degradation downstream of the dam. The tailwater is tidally influenced, and there is a noticeable hysteresis effect in the tailwater rating curve. However, some trends are noticeable. The data were used, along with the rating curves applicable during the time of the measurements, to relate the observed gage heights and flows to a theoretical flow of 10,000 cfs (Figure 2.2-4).

A data gap exists between 1995 and 1999. In addition, the measurements after 2002 were all taken during extremely low flow and, thus, are less reliable because they are farther from the 10,000-cfs target. However, the data show a definite trend toward degradation from 1980 to 2000, perhaps caused by

deepening and widening of the channel downstream of the dam. From 2000 to 2007, the channel seems to be more stabilized. USGS has discontinued the rating curve at the site because of the variance in the gage caused by lockages, tides, and power generation at Millers Ferry Lock and Dam upstream.

2.2.1.2.5.2 Millers Ferry Lock and Dam and William "Bill" Dannelly Lake

Rating curve data are not available for Millers Ferry Lock and Dam tailwater.

2.2.1.2.5.3 Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake

Tailwater rating curve data are not available for Robert F. Henry Lock and Dam; however, historical sedimentation range surveys for the upper end of the Millers Ferry Lock and Dam pool (William "Bill" Dannelly Lake) were assessed for changes in the channel form. At range 30A, both widening and degradation have taken place since 1973 (Figure 2.2-5). However, the data show a drop in both widening and degradation rates since 1982. A trend plot of the sedimentation rates along the entire William "Bill" Dannelly Lake shows, for ranges 28A and 30A, bed degradation of about 0.5 ft per year from 1973 to 1982, and about 0.2 ft per year from 1980 to 1988 (Figure 2.2-6). For the next several ranges downstream from 28A, the bed has been at nearly a constant elevation. Data below range 20A indicate that the bed has been aggrading by several inches per year; thus, the scour is limited to the reach immediately downstream of Robert F. Henry Lock and Dam.

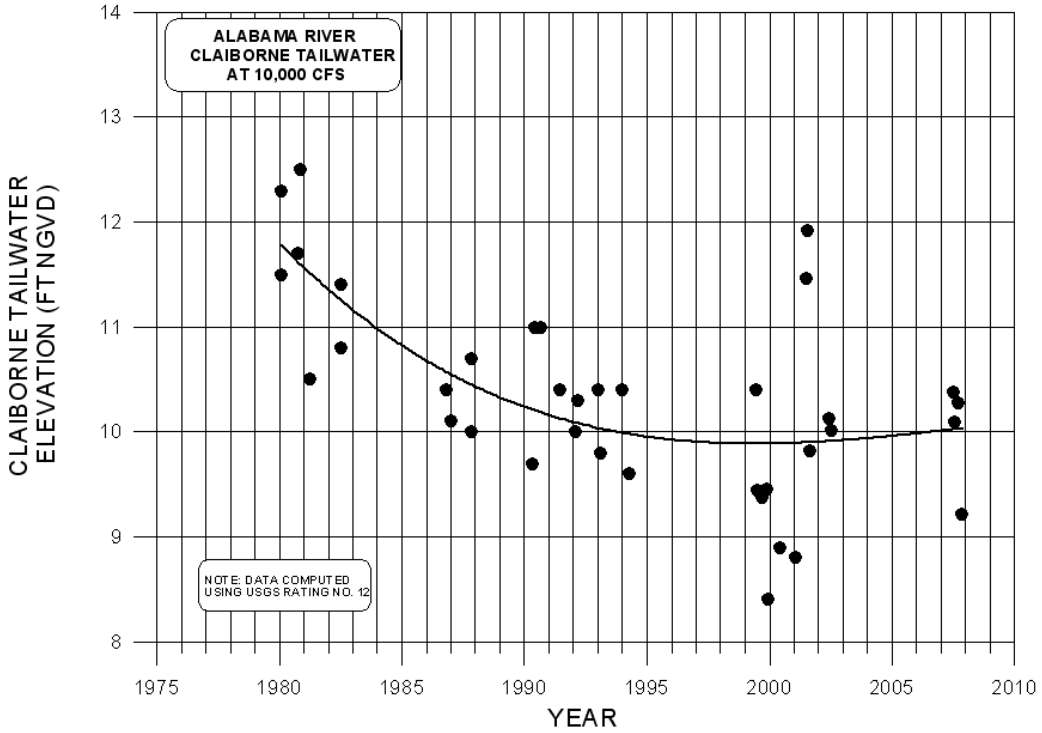


Figure 2.2-4. Claiborne Lock and Dam and Lake tailwater degradation.

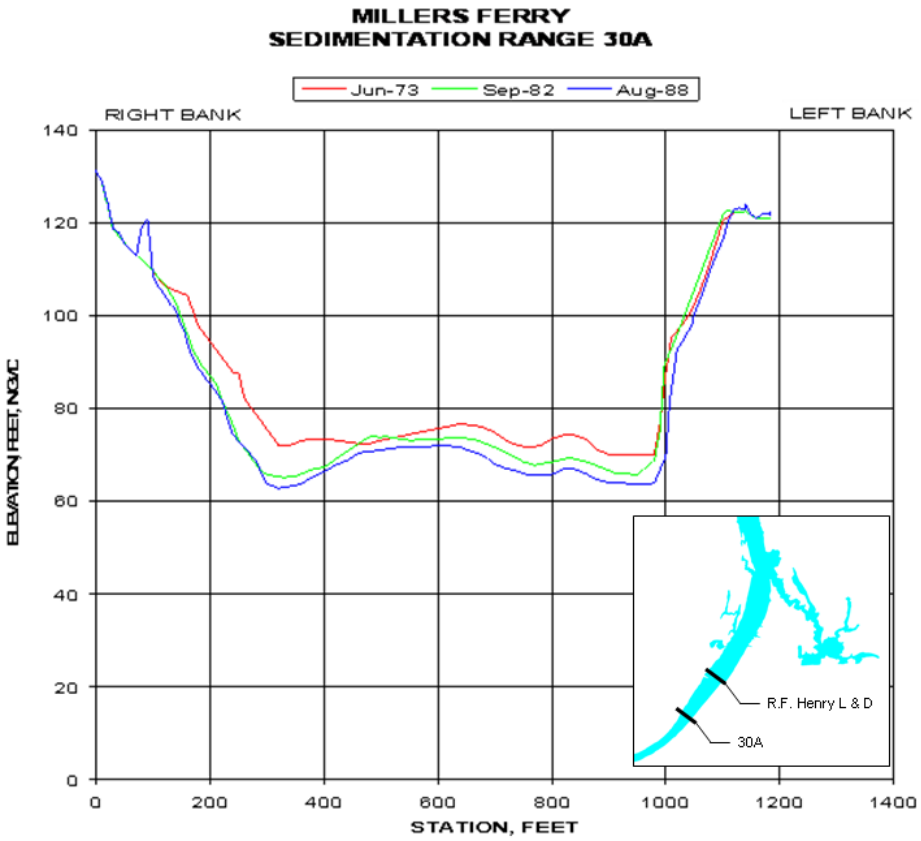


Figure 2.2-5. Tailwater degradation downstream of Robert F. Henry Lock and Dam.

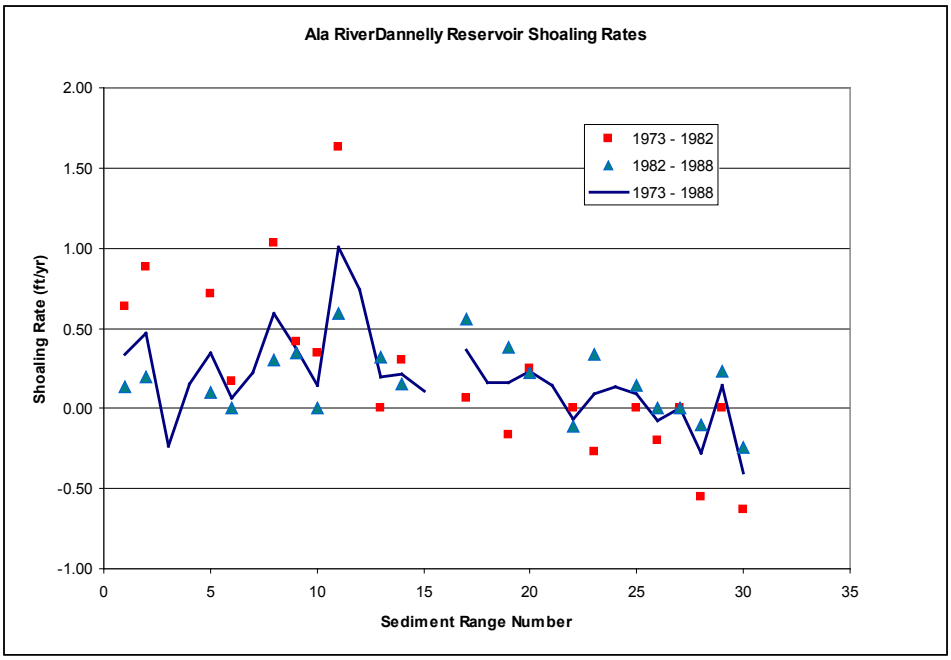


Figure 2.2-6. Shoaling rates for Millers Ferry Lock and Dam Pool, William "Bill" Dannelly Lake.

2.2.1.2.5.4 Logan Martin Lake

This APC project was the second built as a part of an APC construction program that further developed the Coosa River in the late 1950s and the 1960s. Construction began in 1960, and operation began in 1964. No observable change has occurred in the tailwater rating curve developed for the project (Figure 2.2-7).

2.2.1.2.5.5 H. Neely Henry Lake

This APC project was part of an APC construction program that further developed the Coosa River in the late 1950s and the 1960s. Construction began in 1962, and operation began in 1966. No observable change has occurred in the tailwater rating curve developed for the project (Figure 2.2-8).

2.2.1.2.5.6 Weiss Lake

This APC project was part of an APC construction program that further developed the Coosa River in the late 1950s and the 1960s. Construction began in 1958, and operation began in 1961. There is a tailwater rating curve at both the power house and the spillway locations (Figure 2.2-9). No observable change has occurred in either of the tailwater rating curves developed for the project.

2.2.1.2.5.7 R.L. Harris Lake

Construction began for this newest project on the Tallapoosa River in 1974, and operation began in 1983. No observable change has occurred in the tailwater rating curve developed for the project (Figure 2.2-10).

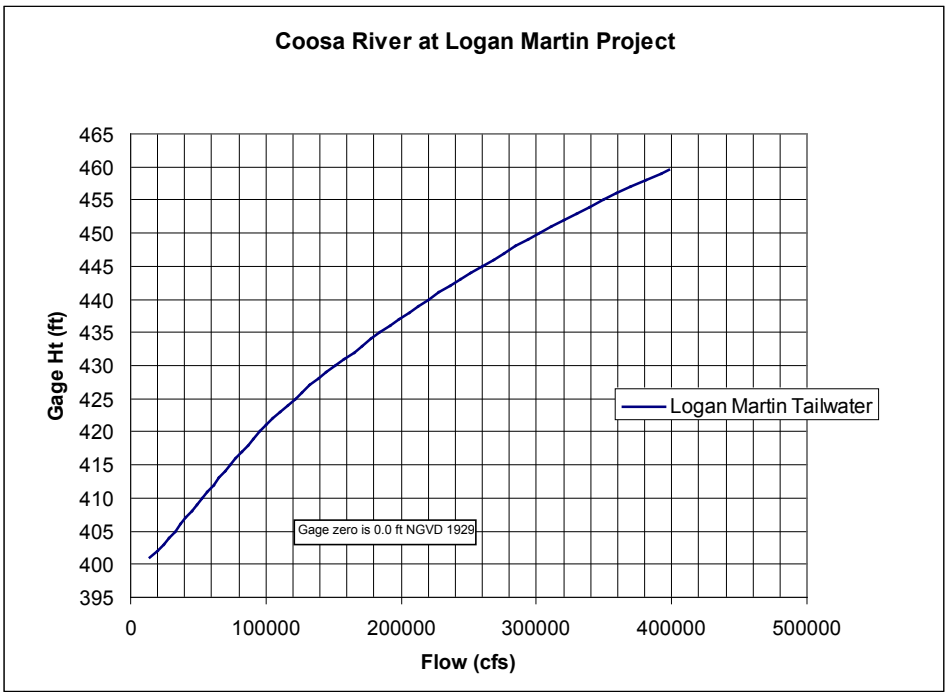


Figure 2.2-7. Logan Martin Dam tailwater rating curve.

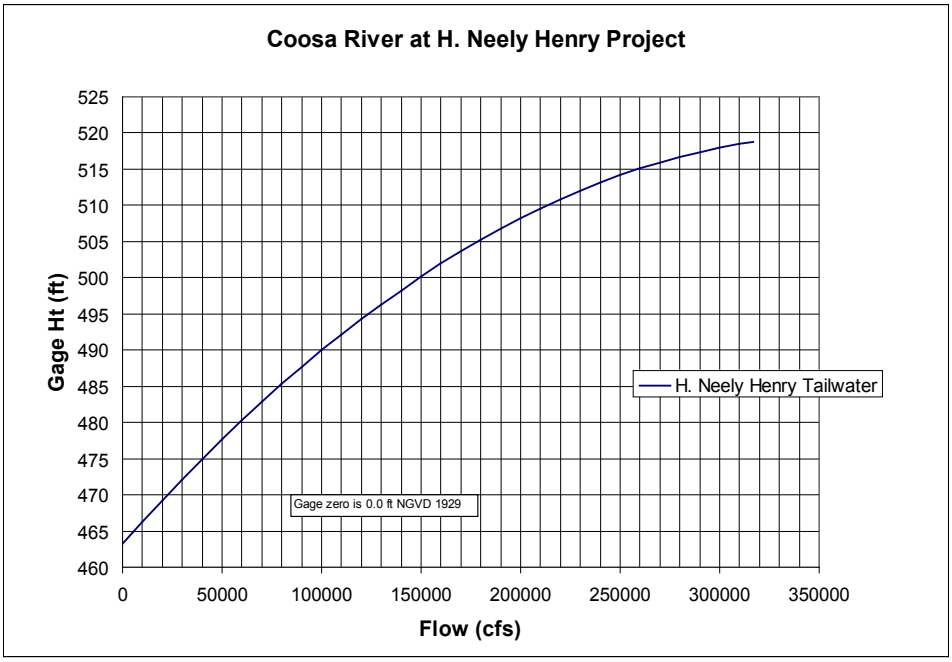


Figure 2.2-8. H. Neely Henry Dam tailwater rating curve.

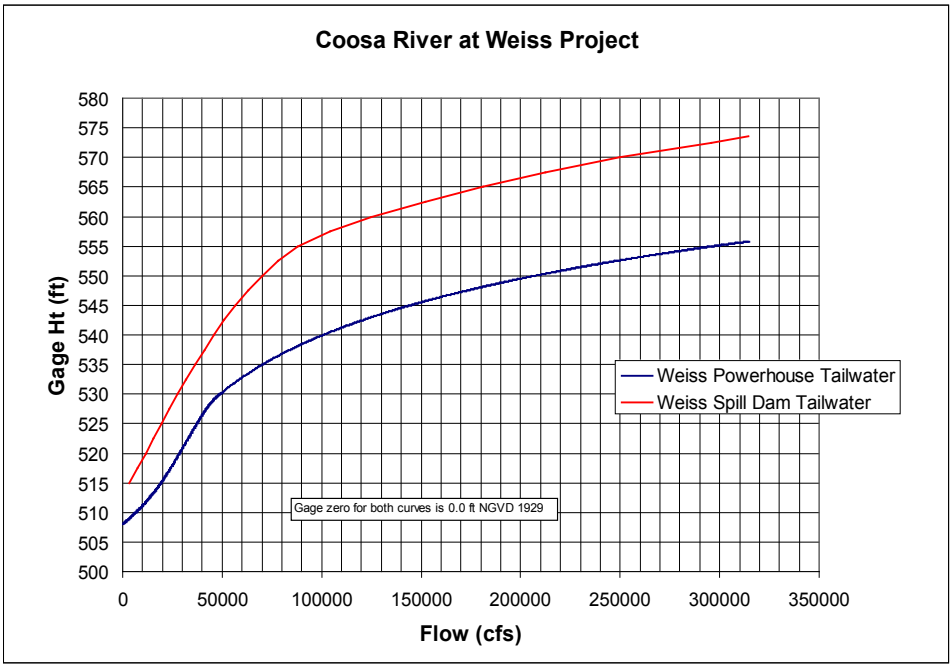


Figure 2.2-9. Weiss Dam tailwater rating curves.

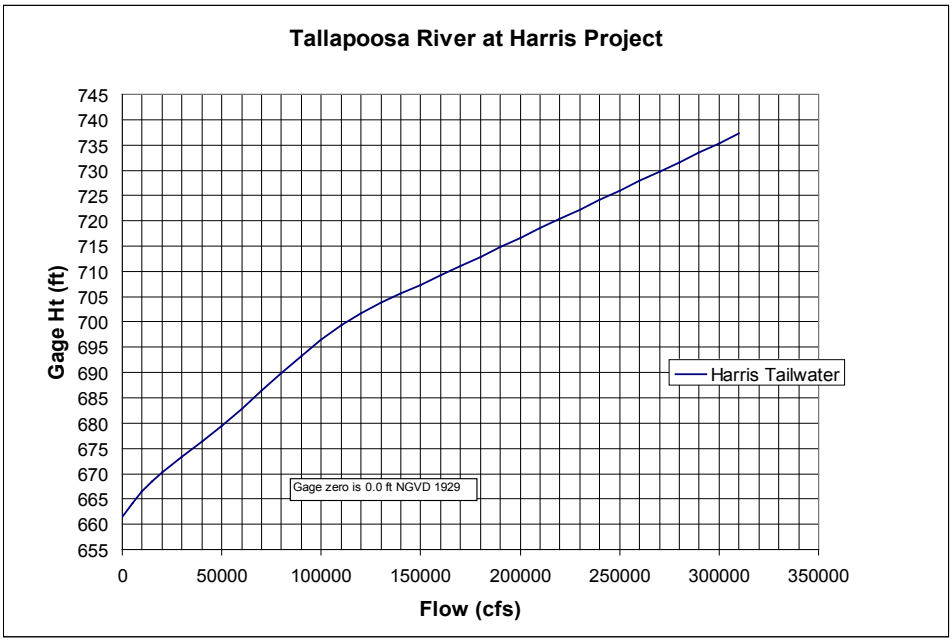


Figure 2.2-10. R.L. Harris Dam tailwater rating curve.

2.2.1.2.5.8 Carters Lake

Construction on Carters Lake was started in 1962 and completed in 1977. The USGS gage 0238500, (Coosawattee River at Carters) is at U.S. Hwy 411, just downstream of the Carters Reregulation Dam. Historic rating curve data extending from 1978 to 2008 at this gage were obtained from the USGS. The curves were plotted to determine the degree of movement in the curve over time (Figure 2.2-11).

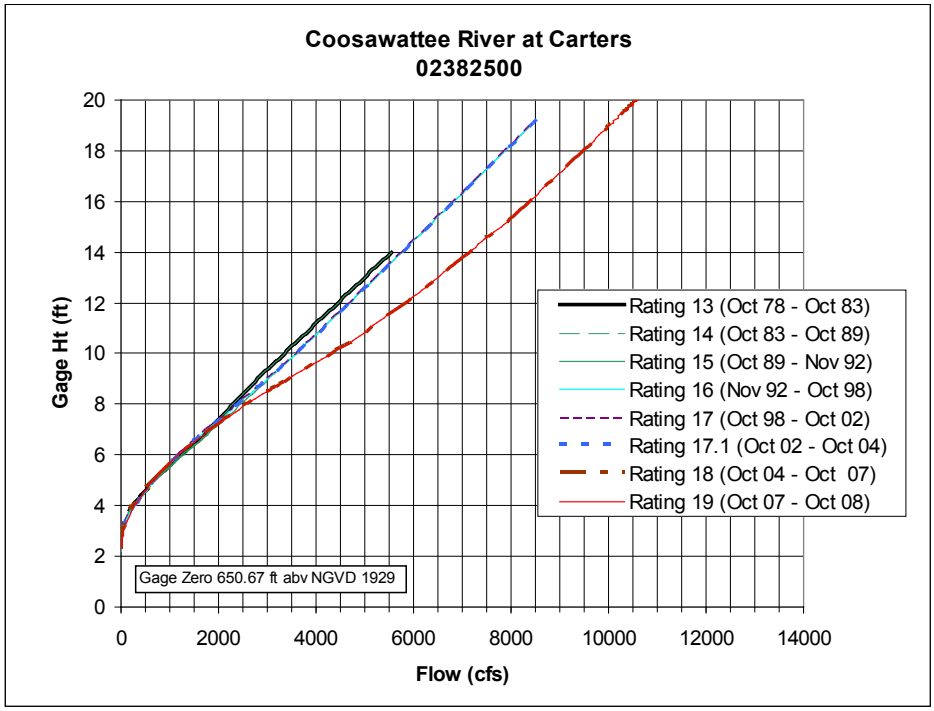


Figure 2.2-11. Carters Dam historic tailwater rating curves.

The curves show an obvious lowering of the tailwater of approximately 2–2.5 ft at flows above 3,000 cfs. However, the low flows do not appear to have been affected (Figure 2.2-12).

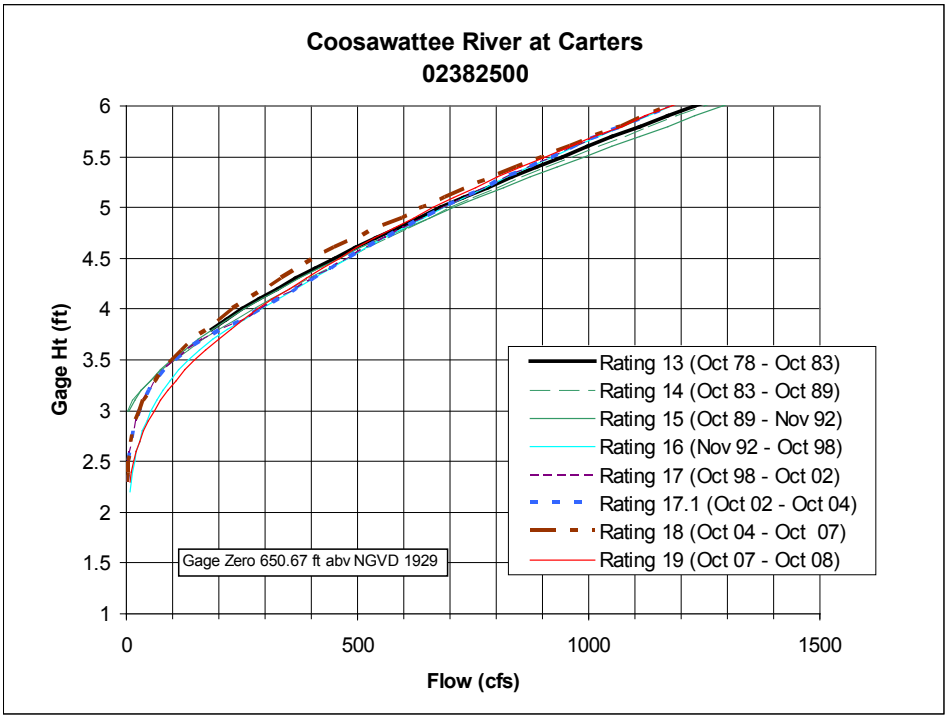


Figure 2.2-12. Carters Dam low-flow tailwater rating curves.

The lower part of the curve indicates that the channel has not degraded over time. The change in the upper part of the curve might have been because of the lack of high-flow data during the early years, and as more storms were observed, that part of the curve was well defined. Another possibility is that overbank clearing downstream might have occurred, or modifications to Hwy 411. The significant point is that the channel does not appear to have degraded. The presence of rock in the channel offers a reasonable and probable explanation.

2.2.1.2.5.9 Allatoona Lake

Construction on the dam was completed in 1949. The USGS gage 02394000, (Etowah River at Allatoona Dam, above Cartersville, Georgia) is 0.8 mi downstream from Allatoona Dam. Historic rating curve data extending from 1979 to 2008 at this gage were obtained from the USGS. The curves were plotted to determine the degree of movement in the curve over time. The curves, over the full range of flows in Figure 2.2-13, show little difference over the period of record. Physical changes to the channel in the form of bed and bank erosion are typically more clearly represented in the lower part of the curve (Figure 2.2-14). This lower part of the curve shows no tailwater degradation over the 1979 – 2008 period. If tailwater degradation had occurred following impoundment in1949, by 1979 the erosion had ceased due the channel coming to a stable condition. This stable condition was likely due to the exposure of erosion resistant bed and bank materials such as bedrock.

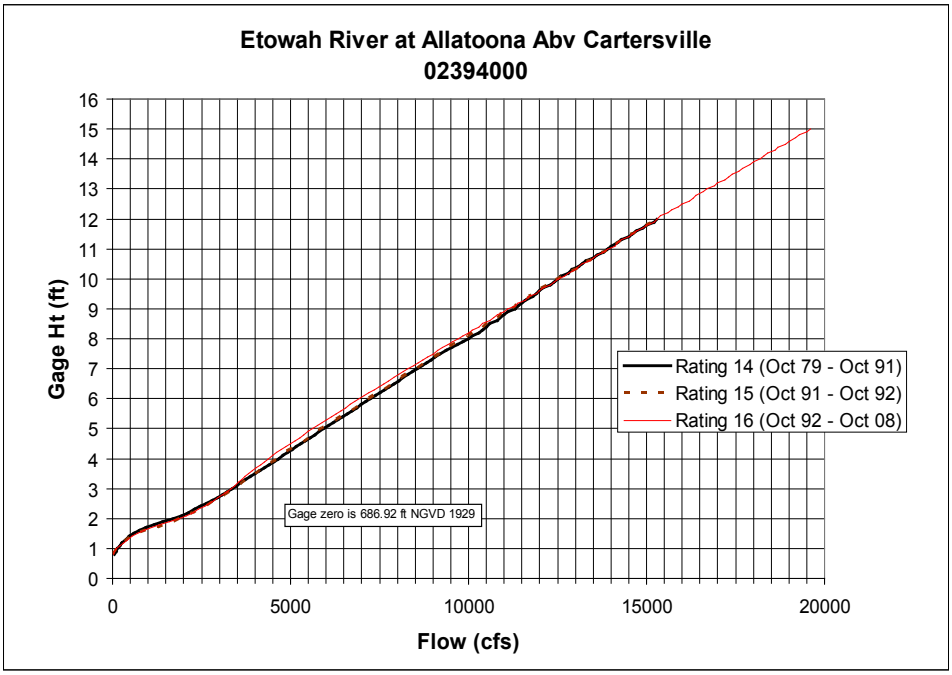


Figure 2.2-13. Allatoona Dam tailwater rating curve.

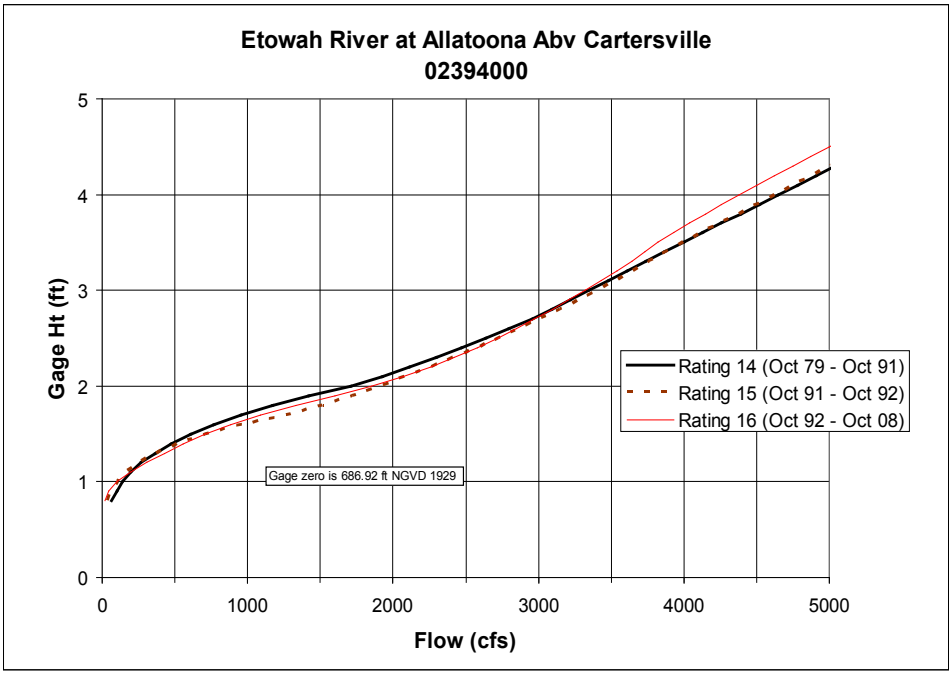


Figure 2.2-14. Allatoona Dam low-flow tailwater rating curve.

2.2.1.2.6 Impact of Existing Operations on River Channel Stability

A specific gage analysis was conducted at several USGS stream gaging stations in the basin to better understand the impact of dam operations on the stability of the rivers.

A cursory investigation of the condition of the pools was made to see if shoaling is a significant issue. Historic sediment ranges were evaluated where possible and other available data were used to estimate the appropriateness of using the existing area-capacity relationships in the modeling efforts.

2.2.1.2.6.1 Claiborne Lock and Dam and Lake

Storage volume of the lake is listed at 102,480 ac-ft at elevation 36 ft. Sediment range surveys of the Claiborne Lake were made initially in 1982 and updated again in 2009. However, the pool has a relatively small amount of storage, and it is a run-of-the-river project. Operation of the project is not affected by the storage lost to shoaling in the lake, and it is reasonable to assume that the existing area/capacity curve is adequate to use in modeling the system and to include in the present WCM update.

A table of the shoaling locations and total dredging amounts since 1981 is shown below (Table 2.2-2). The data show that the location of the greatest dredging/shoaling is at the Millers Ferry Lock and Dam lower approach at RM 133, although the frequency of dredging is greatest at the Claiborne Lake upper approach, with consecutive periods between dredging events of 2, 6, 5, and 12 years since 1985. Note, however, that dredging on the Alabama River is greatly influenced by funding availability, which can skew some of the frequency and volume statistics.

Table 2.2-2.
Claiborne Lock and Dam and Lake dredging 1981–2007

Mile	Bar name	Period	Dredged	Cubic yards
72.5	Claiborne Lock	05/28/85–05/31/85	34+45 to 41+95	8,706
	Upper Approach	05/24/87–05/26/87	NA	12,044
		07/22/93–07/23/93	0+00 to 4+50	9,451
		06/05/95–06/06/95	66+50 to 64+00	8,730
		10/15/07–10/16/07	2+06 to 7+37	8,120
107.9	Wilcox (Bar 107)	10/07/92–10/10/92	22+00 to 36+40	24,313
		09/21/97–09/25/97	44+83 to 30+60	28,263
		10/19/07–10/20/07	32+17 to 43+78	4,237
117.5	Holly Ferry	10/05/92–10/07/92	5+00 to 15+00	15,977
122.7	Walnut Bluff	09/25/92–10/05/92	1+00 to 14+50	38,529
		10/20/07–10/23/07	3+28 to 14+28	25,076
133.0	Millers Ferry Lock and Dam	08/15/90–08/25/90	21+10 to 24+60	86,710
	Lower Approach		33+90 to 55+23	
		08/17/92–08/23/92	22+00 to 25+00	1,242
		10/23/07–10/23/07	54+00 to 55+59	735

2.2.1.2.6.2 Millers Ferry Lock and Dam and William "Bill" Dannelly Lake

Storage volume of the lake is listed at 346,254 ac-ft at elevation 80.8 ft. Surveys of the 30 sediment ranges in William "Bill" Dannelly Lake were made initially in 1973, 1982, and again in 1988 (Figure 2.2-15). The surveys were repeated in 2009. A comparison of selected cross sections is presented in the 1990 revision of the WCM, Appendix E.

The sections show some shoaling in the lower part of the reservoir between 1973 and 1982, at a reduced rate between 1982 and 1988. All 30 ranges were compared using approximate methods on the basis of the

channel elevation change for the two periods. Data were not available for all the sections in the 1982 survey, but rates were computed for all the available data (Figure 2.2-15).

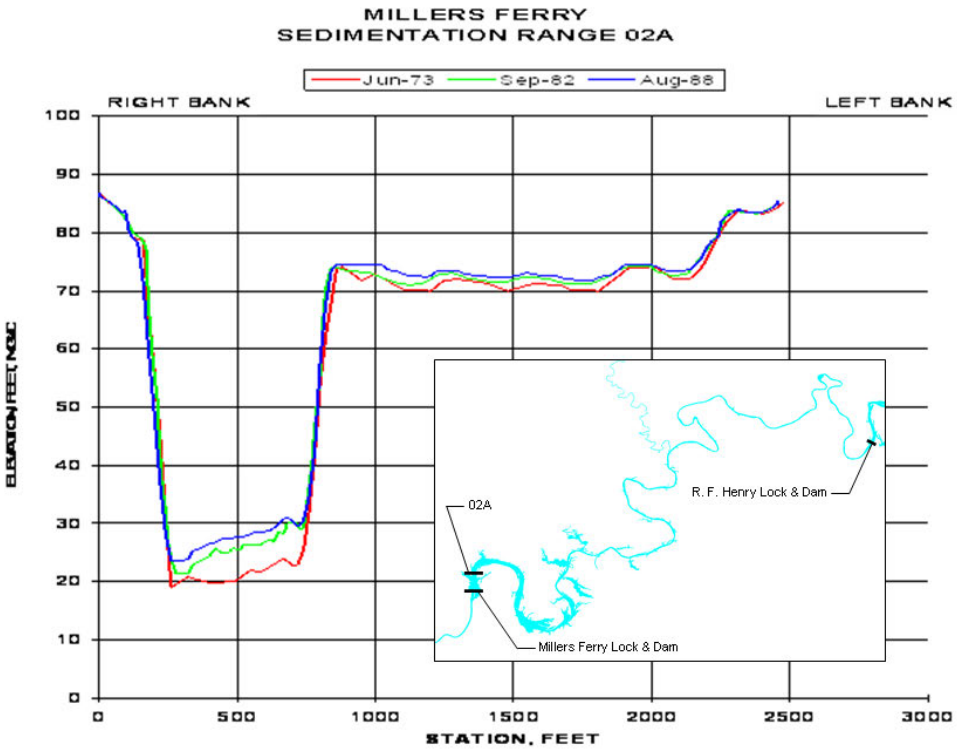


Figure 2.2-15. Cross section of Millers Ferry Lock and Dam Pool, William "Bill" Dannelly Lake, sedimentation range 02A.

For the 1973 to the 1982 period, shoaling and scour rate were the greatest, ranging from shoaling 1.6 ft/yr near Range 11, in the lower part of the lake to scouring 0.6 ft/yr at range 30 just downstream of Robert F. Henry Lock and Dam. The 1982–1988 period shows that some shoaling occurred during that period over much of the lake with only minor scour in the upper lake reach. The overall trend from 1973 to 1988 indicates that, in general, scour has taken place immediately downstream of Robert F. Henry Lock and Dam at range 30 downstream to about range 26. Sediment deposition has taken place from range 25 downstream to range 01, immediately above Millers Ferry Lock and Dam, at a rate of about 0.1 ft to 1.0 ft per year.

Geographic information system (GIS) data for the channel above Millers Ferry Lock and Dam were obtained in February 2009. The data can be used to develop a new area/capacity curve but would require additional hydrographic surveys to extend the limits to the top of banks. An update of the area/capacity curve would be helpful, but using the present curve for the present modeling effort is not unreasonable.

2.2.1.2.6.3 Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake

Storage volume of the lake is listed at 247,210 ac-ft at elevation 126 ft. Surveys of the R.E. "Bob" Woodruff Lake were made initially in 1974. The surveys were repeated in 1982 and 1988. They were re-surveyed again in 2009. Throughout the entire pool from 1974 to 1988, minor amounts of both shoaling and bank erosion occurred with the highest rates occurring between 1974 and 1982. The shoaling and bank erosion shown in Figure 2.2-16 is representative for all the sedimentation ranges in the pool.

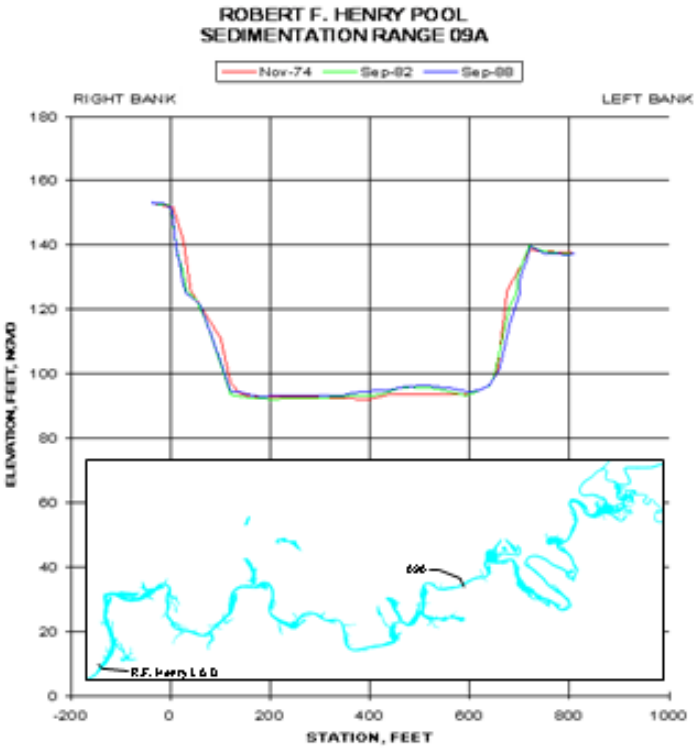


Figure 2.2-16. Cross section of Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake, sedimentation range 09A.

The sedimentation range surveys indicate that the overall change in storage is small, thus operation of the project would not be affected by the shoaling shown in the lake, and it is reasonable to assume that the existing area/capacity curve is adequate to use in modeling of the system and to include in the present WCM update for.

2.2.1.2.6.4 Logan Martin Lake

Logan Martin Lake is in the Alabama counties of Calhoun, St. Clair, and Talladega. The lake has a surface area of 15,269 ac and 275 mi of shoreline at a normal pool elevation of 465 ft. Siltation studies by APC have been limited to evaluating the recreational impact of siltation at the mouths of tributaries. Studies indicate that shoaling over the years is reduced because of increased vegetation in the basin. Erosion studies indicate that sheet and rill erosion on cropland for 1982 was approximately 7.2 tons/ac/yr in Alabama. Sheet and rill erosion on cropland for 1997 was approximately 6.0 tons/ac/yr in Alabama. Cropland acreages were obtained from the National Agricultural Statistics Service (NASS) Web site for the years 1970 and 2001. Assuming no improvement in erosion control (worst case) from 1970 to 1982 and no improvement from 1997 to 2001, the percent change in erosion from 1970 to 2001 was derived (Table 2.2-3). The impact of the erosion on the Area/Capacity relationship has not been determined.

Table 2.2-3.
Erosion 1970–1982 for counties in the ACT Basin

County	Year	Acres cultivated	% Change	Erosion rate	Tons soil eroded	% Change
Calhoun	1970	14,210		7.2	102,312	
	2001	5,518	–61.2%	6.0	33,108	–67.6%
Cherokee	1970	40,080		7.2	288,576	
	2001	32,518	–18.9%	6.0	195,108	–32.4%
Etowah	1970	20,200		7.2	145,440	
	2001	6,018	–70.2%	6.0	36,108	–75.2%
St. Clair	1970	4,810		7.2	34,632	
	2001	18	–99.6%	6.0	108	–99.7%
Talladega	1970	28,250		7.2	203,400	
	2001	18,318	–35.2%	6.0	109,908	–45.96%

2.2.1.2.6.5 H. Neely Henry Lake

H. Neely Henry Lake is in the Alabama counties of Calhoun, Cherokee, Etowah, and St. Clair. H. Neely Henry Lake has a surface area of 11,235 ac and 339 mi of shoreline at a normal pool elevation of 508 ft. Siltation studies by APC have been limited to evaluating the recreational impact of siltation at the mouths of tributaries. Studies indicate that shoaling over the years is reduced because of increased vegetation in the basin. Erosion studies indicate that sheet and rill erosion on cropland for 1982 was approximately 7.2 tons/ac/yr in Alabama. Sheet and rill erosion on cropland for 1997 was approximately 6.0 tons/ac/yr in Alabama. Cropland acreages were obtained from the NASS Web site for the years 1970 and 2001. Assuming no improvement in erosion control (worst case) from 1970 to 1982 and no improvement from 1997 to 2001, the changes shown in Table 2.2-3, for H. Neely Henry Lake are applicable.

2.2.1.2.6.6 Weiss Lake

Weiss Lake is in Cherokee County, Alabama (population 23,988, year 2000) and Floyd County, Georgia (population 90,565, year 2000). The surface area of the reservoir at a normal pool elevation of 564 ft is approximately 30,027 ac with approximately 447 mi of shoreline. Siltation studies by APC have been limited to evaluating the recreational impact of siltation at the mouths of tributaries. Studies indicate that shoaling over the years is reduced because of increased vegetation in the basin. Erosion studies indicate that sheet and rill erosion on cropland for 1982 was approximately 7.2 tons/ac/yr in Alabama. Sheet and rill erosion on cropland for 1997 was approximately 6.0 tons/ac/yr in Alabama. Cropland acreages were obtained from the NASS Web site for the years 1970 and 2001. Assuming no improvement in erosion control (worst case) from 1970 to 1982 and no improvement from 1997 to 2001, the changes shown in Table 2.2-3, for Weiss Lake are applicable.

2.2.1.2.6.7 Allatoona Lake

One hundred thirty-one sedimentation ranges were established in 1949 for the purpose of long-term monitoring of sedimentation and shoreline erosion. These ranges were re-surveyed 1981-84, 1997, and 2010. An analysis comparing the historic and recent data was conducted to determine the sedimentation and erosion trends throughout the lake (USACE 2011b). The analysis concluded that, in general, the erosion processes occur along the shoreline near the prevailing water surface elevation. The 17 foot range between winter and summer pool elevations creates an annual cycle of varying erosional surfaces with

those near the summer pool elevation being the most highly impacted. In general, sedimentation only occurs beneath the water surface in still or slow moving water. So although sedimentation is occurring at elevations up to the summer pool, during the winter months the summertime deposits may become re-eroded and transported to beneath the winter pool water surface.

Summer pool shoreline erosion was pervasive along the downstream sections of major tributary bays and along the main lake body. Unconsolidated materials near the summer pool level have been eroded until exposing either underlying bedrock or erosion resistant partially weathered rock. This erosion likely occurred within the first few decades after the lake was constructed. Thus, these bedrock and partially weathered rock lined shores now appear to be very stable and presently are undergoing little erosion. Where unconsolidated materials still line the shore, erosion is likely driven by the fluctuation lake levels and wave action from wind and boat wakes. Erosion appears the most severe along more steeply sloping shorelines with the mass wasting of high banks being the primary process.

Sedimentation impacts are greatest where flowing tributaries enter the non-flowing body of the lake. When flows transition from streams to the lake there is a drop in flow velocity. As the velocity decreases, so does the ability to transport any sediment carried by the tributary. Thus, essentially all of the uppermost portions of the Allatoona Lake bays are impacted by sedimentation. The two types of areas most severely impacted by sedimentation are where streams draining urban areas enter the lake, or where large watersheds drain to the lake. In particular the main stem of the Etowah River, and the Little River bay have the heaviest deposits. The main body of the lake has been relatively unimpacted by sedimentation as the majority of sediment tends to become deposited in the tributary bays before reaching the main lake.

A second component of the year 2010 study was to collect sufficient bathymetric data to update and evaluate the area-capacity curves for Allatoona Lake (USACE 2012). The results indicate about a 10 percent reduction in the capacity of Allatoona Lake over time when compared to the previous area-capacity curves. This change is partially the result of (1) actual sedimentation and (2) differences in historical and present day bathymetric survey methods, It is not clear how much of the change is attributable to actual sedimentation and to differences in survey methodologies over time.

2.2.1.2.6.8 Carters Lake

Storage volume of Carters Lake is listed at 242,163 ac-ft for inactive storage, 141,402 ac-ft for conservation storage, and 89,191 ac-ft for flood storage, for a total storage of 472,756 ac-ft at the top of the flood-control pool elevation of 1,099 ft. No post-construction surveys of the pool have been made since the pool was filled because the pool is 300–400 ft deep near the dam, and until recently, surveying equipment adequate to reach these depths was not available. Surveys were conducted in 2009. Modern equipment now exists to adequately survey at the depths required at Carters Lake.

2.2.1.2.6.9 R.L. Harris Lake

R.L. Harris Lake is in the Alabama counties of Randolph and Clay. The lake has a surface area of 10,660 ac at a normal summer pool elevation of 793 ft. Construction was completed in 1983, and no sedimentation studies have been done on R.L. Harris Lake. However, because of the relatively recent completion date and other erosion/sedimentation data developed for other locations, it is reasonable to assume that the existing area/capacity relationship would be adequate for modeling purposes.

2.3 Climate Change

2.3.1 Climate Change Affected Environment

2.3.1.1 Existing Climate

The climate of Alabama and Georgia including all areas associated with the ACT Basin is classified as humid subtropical, and characterized by hot, humid summers and cool winters. Significant amounts of precipitation occur in all seasons in most areas. Winter rainfall (and sometimes snowfall) is associated with large storms steering from west to east. Most summer rainfall occurs during thunderstorms and an occasional tropical storm, hurricane, or tropical cyclone (Peel et al. 2007). Below is a brief outline of the existing climate in Alabama and Georgia. Notably, detailed information about precipitation in the ACT Basin is outlined in Sections 2.3.1.3 and 2.1.1.1.1.

Summers in Alabama are among the hottest in the United States, with high temperatures averaging over 90 degrees Fahrenheit (°F) (32 degrees Celsius [°C]) in some parts of the state. The average winter minimum temperature for the entire state is 35 °F (2 °C). Alabama enjoys a lengthy growing season of up to 300 days in the southern part of the state (Encyclopedia Britannica 2010).

The Chattahoochee River divides Georgia into separate climatic regions. The mountain region to the northwest is colder than the rest of Georgia with the average temperatures in January of 39 °F (4 °C) and 78 °F (26 °C) in July. Many summer days in Georgia exceed 90 °F (32 °C). Winter is characterized by mild temperatures and little snowfall, with colder, snowier weather and icing most likely across northern and central Georgia (City Data 2010).

More detailed information on air temperature in the ACT Basin is included the draft ACT Master Manual and individual project WCMs (Appendix A to the EIS).

2.3.1.2 Greenhouse Gases and Global Warming

Greenhouse gases (GHG) are components of the atmosphere that contribute to the greenhouse effect and global warming. Some GHG occur naturally in the atmosphere, while others result from human activities such as burning fossil fuels. Federal agencies, states, and local communities address global warming by preparing GHG inventories and adopting policies that will result in a decrease of GHG emissions. According to the Kyoto Protocol and California Climate Action Registry, there are six GHGs: carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6) (UNFCCC 2007; CARB 2007). Although the direct GHG (CO_2, CH_4, and N_2O) occur naturally in the atmosphere, human activities have increased their atmospheric concentrations. From the preindustrial era (i.e., ending about 1750) to 2004, concentrations of CO_2 have increased globally by 35 percent. In the United States, fossil fuel combustion accounted for 94 percent of all CO_2 emissions released in 2005. On a global scale, fossil fuel combustion added approximately 30×10^9 tons (27×10^9 metric tons) of CO_2 to the atmosphere in 2004, of which the United States accounted for about 22 percent (USEPA 2007). The DOE's Energy Information Administration report indicates that U.S. CO_2 emissions have grown by an average of 1.2 percent annually since 1990 and energy-related CO_2 emissions constitute as much as 83 percent of the total annual CO_2 emissions (DOE EIA 2007).

Since 1900, the earth's average surface air temperature has increased by about 1.2 to 1.4 ºF. The warmest global average temperatures on record have all occurred in the past 10 years, with the warmest year being 2005 (USEPA 2011).

CEQ recently released draft guidance on when and how federal agencies should consider GHG emissions and climate change in NEPA analyses. The draft guidance includes a presumptive effects threshold of 27,563 tons (25,000 metric tons) of CO_2 equivalent emissions from a federal action on an annual basis (CEQ 2010).

2.3.1.3 Historical Precipitation and Droughts

Hydrological variability over time in a catchment is influenced by variations in precipitation over daily, seasonal, annual, and decadal time scales. The frequency of low or drought flows in a river basin is affected primarily by changes in the seasonal distribution of precipitation, year-to-year variability, and the occurrence of prolonged droughts. Evaporation from the land surface includes evaporation from open water, soil, shallow groundwater, and water stored on vegetation, along with transpiration through plants. The rate of evaporation from the land surface is driven, essentially, by meteorological controls, mediated by the characteristics of vegetation and soils, and constrained by the amount of water available. Climate change has the potential to affect all these factors—in a combined way that is not yet clearly understood—with different components of evaporation affected differently (IPCC 2001).

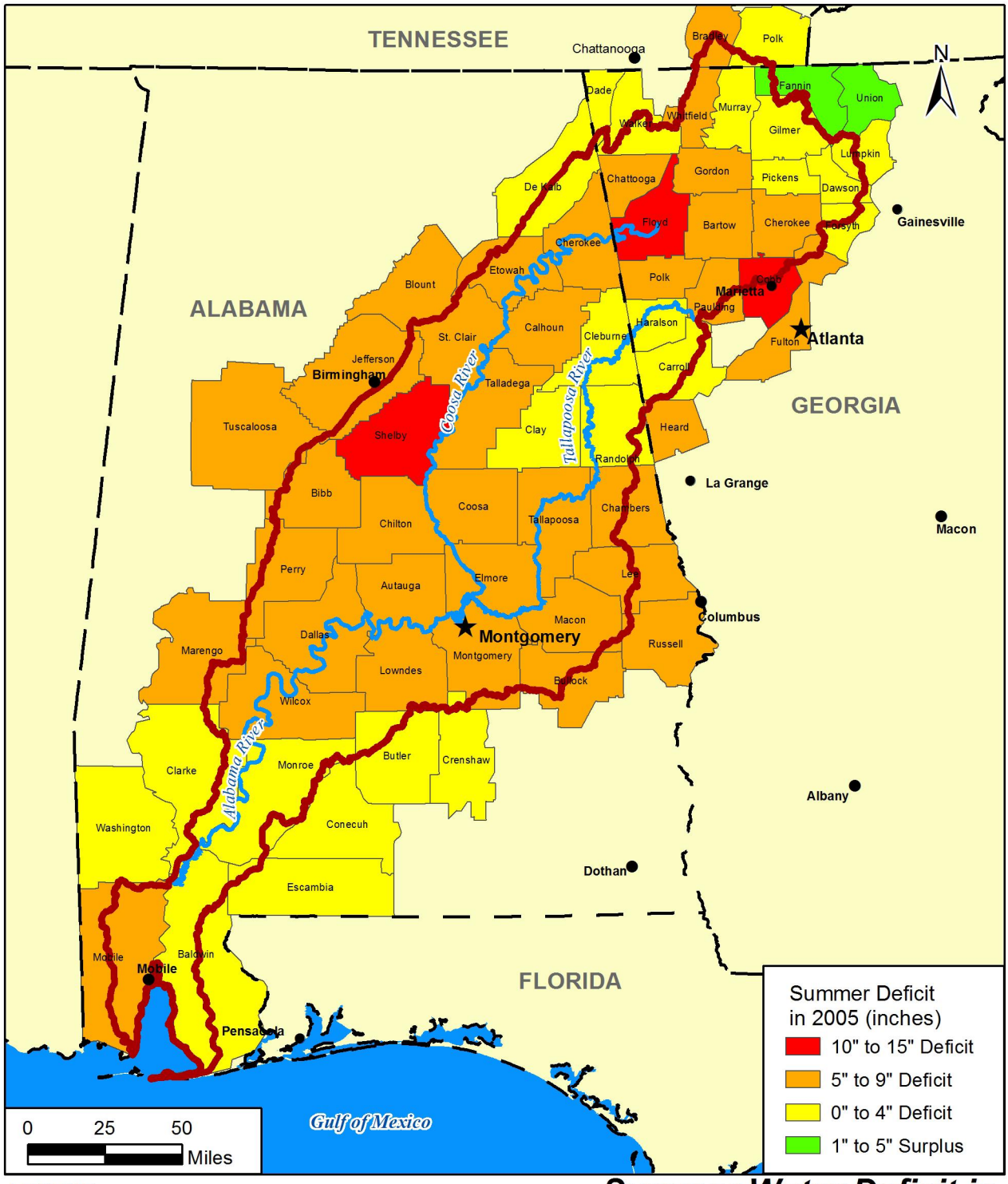
The recent drought in the southeastern United States began in the winter of 2005/2006. It was part of a drying that stretched from Arizona to the Atlantic Ocean, and it persisted through October 2007. After a few years with precipitation in the normal range, drought conditions returned in 2011. The 2005–2007 drought was caused by a reduction in both precipitation and evaporation; it cannot be linked to man-made climate change or global warming (Seager et al. 2009). Although the exact areas of the Southeast affected varied, precipitation reduction has not exceeded earlier droughts, including those from the earlier centuries and one as recently as 1998 through 2002 (IPCC 2001).

Historically, the drought was a typical event in terms of amplitude and duration. Tree-ring records show a 21-year-long drought in the mid-16th century, a long dry period in the early- to mid-19th century, and that the Southeast was affected by medieval mega-droughts centered in western North America. In general, the 20th century was moist from the perspective of the previous millennium and free of long and severe droughts that were abundant in previous centuries (Seager et al. 2009).

Available precipitation is the total precipitation minus potential evapotranspiration. It is a direct measure of inflows in the basin. The *summer deficit* is the available precipitation minus withdrawal in June, July, and August—typically the three warmest months of the year that correspond to increased municipal, thermoelectric cooling, and irrigation demand. The summer deficit is an indicator of water shortage (in inches) on a seasonal basis that must be met through stored sources (i.e., ACT projects) or groundwater. The historical (1934–2000) average summer deficit ranges from 13 inches to negative 1 inch for any given county in the ACT Basin (Figure 2.3-1). Historically, the average summer deficit is 5.3 inches across all counties in the ACT Basin.

2.3.1.4 Historical Sea Level Rise

Understanding trends in sea level and the relationship between global and local sea level provides critical information about the effects of earth's climate on oceans. Changes in sea level are directly linked to a number of atmospheric and oceanic processes such as global temperatures, hydrologic cycles, coverage of glaciers and ice sheets, and storm frequency and intensity.



Summer Water Deficit in 2005 for Counties in the ACT Basin (inches)

Figure 2.3-1

Ocean levels have always fluctuated with changes in global temperatures. During the ice ages, when the earth was 9 °F (5 °C) colder than today, much of the ocean's water was frozen in glaciers, and the sea level often was more than 300 ft below the present level. Conversely, during the last interglacial period (100,000 years ago) when the average temperature was about 2 °F (1 °C) warmer than today, the sea level was approximately 20 ft higher than the current sea level (Titus 1989). Sea level has risen more than 5 inches since the peak of the last ice age (about 20,000 B.P.) and by 0.04 to 0.08 in/yr during the 20th century. The rate of global sea level rise since 1963 is estimated at 0.07 in/yr. There is high confidence that the rate of observed sea level rise was greater in the 20th century compared to the 19th century.

2.3.1.4.1 Mobile Bay

A monitoring station near the Mobile Bay has more than 40 years of tidal data. Oceanographic and geologic conditions at the station are comparable to the bay. The rate of sea level rise along the Gulf Coast near Mobile, Alabama, was about 0.12 in/yr from 1970 to 2010 (NOAA 2011).

2.4 Land Use

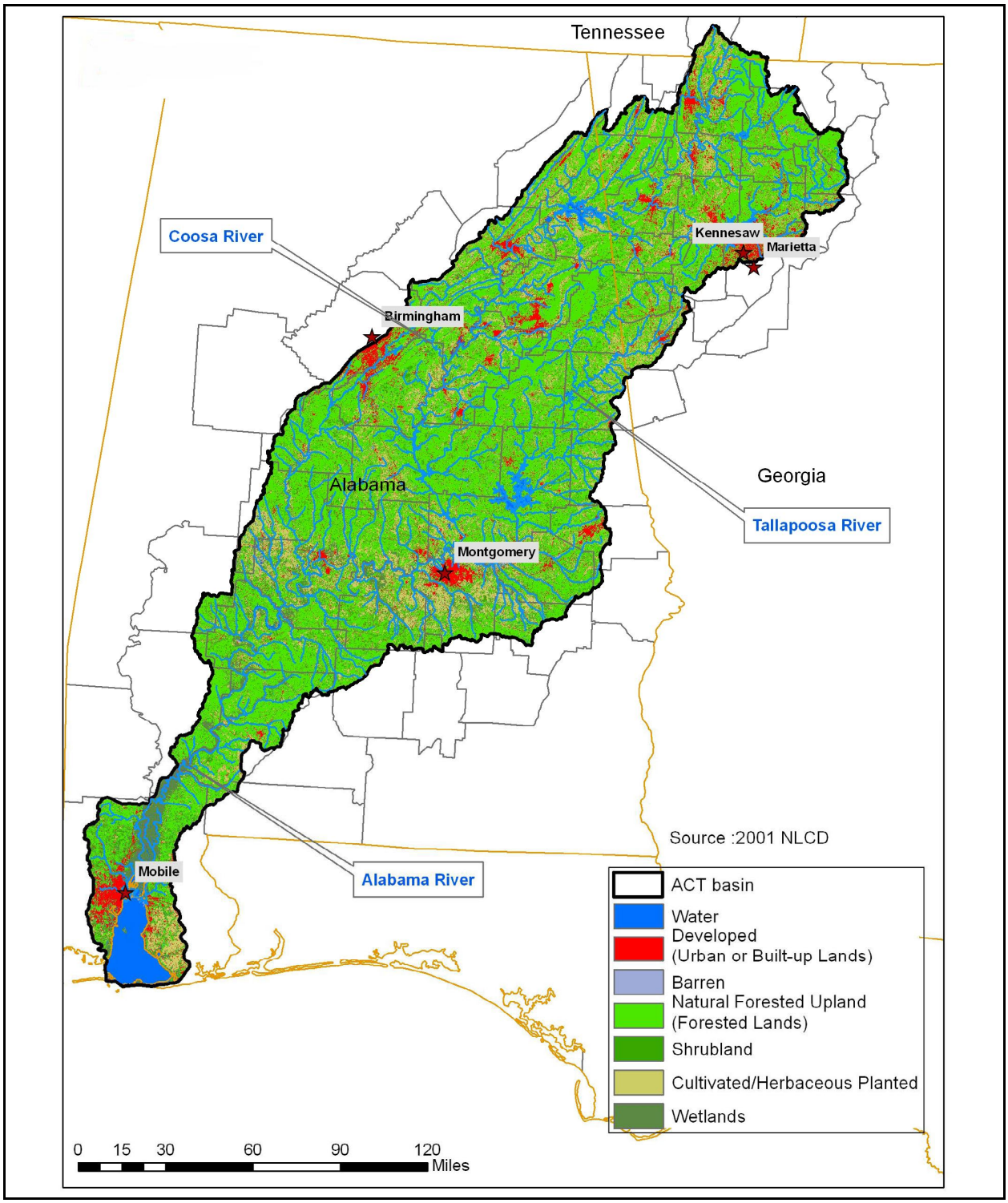
This section summarizes the land use in the ACT Basin and around each USACE project in the basin. A project is the lock and dam and the associated reservoir or lake (e.g., Millers Ferry Lock and Dam and William "Bill" Dannelly Lake). The focus of the land use analysis is on the project land over which USACE has proprietary or managerial jurisdiction and the immediately adjacent land. The proposed action to manage project pool levels and flow requirements could change lake elevation levels, affecting the project shoreline and the adjacent land; therefore, the project land and the adjacent public or private land is the ROI for land use. The land use analysis is organized by project running from north to south in the ACT Basin. GIS data, maps, and shoreline management plans were used to identify and define the land use in the ACT Basin and around each project.

2.4.1 Land Use Affected Environment

2.4.1.1 Current ACT Basin Land Use

ACT Basin land use data were compiled from the USGS 2001 National Land Cover Database (NLCD). The data were specifically developed to provide consistent land use coverage for the United States. The NLCD land cover uses are categorized as water, developed, barren land, forested land, shrubland, cultivated herbaceous or planted (i.e., agricultural), and wetlands. The overall proportions of the land cover categories in the ACT Basin are illustrated in Figure 2.4-1, and the acreage associated with the land cover categories are summarized in Table 2.4-1.

Water includes all areas of open water with less than 25 percent cover of vegetation or soil (USGS NLCD 2001). As listed in Table 2.4-1, water covers approximately 563,400 ac or almost 4 percent of the ACT Basin. Developed land is urban or built-up land that consists of residential, commercial, industrial, and recreational land use. Developed land accounts for more than 1.25 million ac or 8 percent of the ACT Basin land use. The largest developed areas in the ACT Basin are Kennesaw and Marietta, Georgia (considered suburbs of the Atlanta metropolitan area), which are in the northern portion of the ACT Basin, south of Allatoona Lake; Birmingham, Alabama (Alabama's largest city), in the west-central portion of the ACT Basin; Montgomery, Alabama (the capital of Alabama), in the east-central portion of the ACT Basin along the Alabama River; and Mobile, Alabama, at the southern end of the ACT Basin on Mobile Bay (see Figure 2.4-1). Barren land consists of areas of bedrock, desert pavement, sand dunes, strip mines, gravel pits, and other accumulations of earthen material (USGS NLCD 2001). Barren land covers approximately 73,980 ac or less than 1 percent of land in the ACT Basin.



ACT Land Use

Figure 2.4-1

Table 2.4-1.
ACT Basin current land use

	Acres	Percent of total acreage
Water	563,381	3.6%
Developed (urban or built-up land)	1,254,156	8.0%
Barren	73,980	0.5%
Natural forested upland (forested lands)	8,887,586	56.6%
Shrubland	1,439,520	9.2%
Cultivated herbaceous/planted	2,444,589	15.6%
Wetlands	1,030,440	6.6%
Total - ACT Basin	15,693,651	100.0%

Source: USGS NLCD 2001

The forested category of land use consists of deciduous forest (tree species that shed foliage in response to seasonal change), evergreen forest (tree species that maintain their foliage all year), and mixed forest. Forested land is the predominant land use in the ACT Basin and accounts for more than 8.8 million ac or almost 57 percent of land use.

Shrubland includes areas dominated by shrubs, young trees, or trees stunted from environmental conditions (USGS NLCD 2001). Shrubland accounts for more than 1.4 million ac or about 9 percent of the ACT Basin land.

Cultivated herbaceous or planted land is the second most predominant land use in the ACT Basin, accounting for more than 2.4 million ac or about 16 percent of land use. Cultivated herbaceous land consists of grazing land and herbaceous vegetation areas not subject to intensive management such as tilling. Cultivated planted land consists of all land being actively tilled for the production of annual crops such as corn, soybeans, vegetables, tobacco, cotton, and perennial woody crops such as orchards and vineyards (USGS NLCD 2001).

Wetlands consist of palustrine and estuarine emergent wetlands and account for more than 1 million ac or almost 7 percent of ACT Basin land. Palustrine wetlands are inland wetlands that lack flowing water, are nontidal, and include inland marshes, swamps, bogs, and floodplains. Estuarine wetlands are coastal wetlands that are tidal and consist of vegetated and nonvegetated brackish and saltwater marshes, shoals, flats, estuaries, bays, and sounds (USGS NLCD 2001).

2.4.1.2 Historic ACT Basin Land Use

Historic ACT Basin-wide land use are available for 1992 from the USGS NLCD. The 1992 NLCD land cover uses included categories such as water, developed, barren land, forested land, shrubland, pasture and row crop (i.e., agricultural), and wetlands. The overall proportions of those land cover categories in the ACT Basin as of 1992 are summarized in Table 2.4-2.

USGS does not recommend direct comparison of the 1992 land cover data with the 2001 data. The 1992 and 2001 data sets were mapped with different methods and slightly different classes. The slight differences in classifications, combined with the final accuracy of the mapping, result in two distinct products. The typical result of direct comparison will result in a change map showing a difference between mapping methods rather than real change on the ground (USGS NLCD 2009).

Table 2.4-2.
ACT Basin historic land use

Land use classification	Acres	Percent of total acreage
Water	522,839	3%
Developed	342,557	2%
Barren	330,132	2%
Forested	11,146,703	71%
Grassland/herbaceous	568	0.004%
Agricultural	2,507,336	16%
Wetlands	843,518	15%
Total Basin	15,693,651	100%

Source: USGS NLCD 1992

As of 1992, forested land, which includes evergreen, deciduous, and mixed forest, accounted for the largest percentage (71 percent) of total land use in the basin. Agricultural land use represented the next highest percentage of total acreage, accounting for 16 percent of ACT Basin land use. Agricultural land use includes pasture and hay areas, row crops, and orchards, vineyards, and other planted areas. Wetlands were 15 percent of total acreage. Water accounted for 3 percent of ACT Basin land use. Developed land (residential, commercial, industrial, transportation, and urban/recreation grasses such as parks, lawns, golf courses, and airport and industrial site grasses) and barren land (barren land of rock, sand, or clay; quarries, strip mines, or gravel pits; and transitional areas of sparse vegetative cover) each accounted for 2 percent of ACT Basin land use. The smallest percentage of total acreage (less than 1 percent) was grasslands and herbaceous land (USGS NLCD 1992).

2.4.1.3 Land Use at ACT Basin Projects

2.4.1.3.1 Allatoona Lake

The Allatoona Lake project is in north Georgia on the Etowah River (a tributary of the Coosa River) about 30 mi north of Atlanta, Georgia. At normal summer lake elevation of 840 ft, the lake shoreline is 270 mi (USACE, Mobile District 1998b). Allatoona Lake consists of 49,545 ac at normal summer level—11,862 ac of water and 37,683 ac of land (USACE 2006). The project land was acquired to a contour elevation of 863 ft to provide an area necessary for flood risk management. In some areas around the lake, blocks of land above the 863 ft contour were purchased to provide recreational areas, natural resource protection areas, and public access areas. The land acquisition provides a continuous area of land around the reservoir above the flood-control pool to ensure public access along the shore and to accommodate project-related activities (USACE, Mobile District 1998b).

USACE developed the *Allatoona Lake Shoreline Management Plan* to provide guidance and information for the effective management of the Allatoona Lake shoreline and adjacent public land and water. The plan allocates the lake's shoreline into four land use categories: prohibited access areas, protected areas, public recreation, and limited development for shoreline and lake access (USACE, Mobile District 1998b).

Prohibited access land protects certain project operation areas for public safety reasons. No shoreline use permits or licenses are issued for those areas. Prohibited access land is in the proximity of the dam and spillway. Of the 270 mi of shoreline at normal summer level, one percent is categorized as prohibited access land (USACE, Mobile District 1998b).

Protected shoreline areas are designated in accordance with USACE regulations (ER 1130-2-406, *Shoreline Management at Civil Works Projects*, dated May 28, 1999) to protect or restore fish and wildlife habitat, aesthetics, cultural resources, or other environmental values. Shoreline use permits or licenses are not issued for protected shoreline areas, but pedestrian access and boating are permitted in those areas provided aesthetic, environmental, historical, or natural resources are not damaged. Protected areas are around the lake and account for 40 percent of the shoreline. On the north side of Allatoona Lake is a nearly 7,000-ac wildlife management area. The Game and Fish Division of GADNR operates that area (USACE, Mobile District 2009a).

Public recreation areas are specifically designated for present or future recreational development, such as campgrounds, day-use parks, primitive or natural areas, or marine services. No permits for private uses are issued for public recreation areas. Public recreation, the largest shoreline allocation at Allatoona Lake, accounts for 45 percent of the shoreline. USACE manages 18 recreation areas around the lake with picnic and camping sites, playgrounds, swimming areas, hunting areas, hiking trails, and boat ramps (USACE 2008; USACE, Mobile District 2009a).

The last shoreline allocation category, limited development, allows for USACE to permit specific private uses of public lands along the lake shoreline. Limited development accounts for 14 percent of the shoreline. Certain private uses (e.g., floating or land-based facilities such as boat docks, boat houses, and covered docks) may be authorized in the areas if a permit is obtained. The facilities provide lake access to private property owners who have land adjoining Allatoona Lake project land. By the end of 1997, USACE had issued more than 900 consolidated permits or licenses to private property owners for floating and land-based facilities (USACE, Mobile District 1998b). However, since then, 226 of the dock permits are in lease areas not managed by USACE and are no longer part of Allatoona Lake's Shoreline Management Plan; therefore, the number of dock permits is 738 (Haynes 2010a, personal communication).

Allatoona Lake has 21 county, municipal, or privately operated recreation areas. USACE leases the land to the county or city governments, organizations, or private citizens that operate the facilities. Recreational facilities include day-use parks, beaches, picnic and camping sites, and marinas (USACE 2008). Eight privately operated marinas are around the lake with about 2,600 boat slips (USACE 2006). On the south side of the lake near the dam, GADNR owns the 1,776-ac Red Top Mountain State Park; USACE leases the land to the state (GADNR 2009b; Purcell 2010, personal communication).

The land bordering Allatoona Lake is a mix of residential, commercial, recreational, and undeveloped forested land. As metropolitan Atlanta has expanded, residential and commercial development on the southern side of Allatoona Lake has increased (USACE, Mobile District 1998b). Homes, boat docks, and marinas line the shoreline. In comparison, the northern side of the lake is much less populated, with the project land bordered primarily by forested land, with a few housing developments or individual homes.

2.4.1.3.2 Carters Lake

The Carters Lake project is in north Georgia on the Coosawattee River (a tributary of the Coosa River) about 80 mi north of Atlanta. The project consists of 11,789 ac—3,275 ac of water and 8,514 ac of land. The lake has 62.7 mi of shoreline (USACE, Mobile District 2011a). Carters Lake has no private docks or development along its shoreline. Adjacent landowners have no special privileges, and USACE does not issue permits for boat docks, removal of vegetation, or any shoreline alteration (USACE, Mobile District 2009b).

USACE does not have a shoreline management plan for Carters Lake because all shoreline is protected, and no private development is permitted around the lake (Lackey, personal communication 2010).

USACE manages nine recreation areas around the reservoir with picnic and camping sites, playgrounds, swimming areas, hiking trails, a fishing dock, and boat ramps (USACE 2008). The Coosawattee Wildlife Management Area at Carters Lake consists of about 6,060 ac and is open for archery hunting in season (USACE, Mobile District 2009b). USACE leases land in the Carters Lake project area for the privately operated Carters Lake Marina and Resort (USACE 2006). The marina has 180 boat slips, and the resort has lakeside cabins, houseboats, and pontoon boats for rent.

Land use bordering the Carters Lake project is primarily undeveloped, forested land. Other than the Carters Lake Marina and Resort, no development is along the lake's shoreline.

2.4.1.3.3 Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake

The Robert F. Henry Lock and Dam is in central Alabama on the Alabama River. Montgomery, Alabama, is on the eastern end of R.E. "Bob" Woodruff Lake about 30 mi east of the dam. At normal summer lake elevation of 126 ft, the lake's shoreline is 368 mi (USACE, Mobile District 2011a). The Robert F. Henry Lock and Dam project contains 19,073 ac at normal summer level—13,500 ac of water and 5,573 ac of land (Chang, personal communication 2010; USACE 2006).

USACE does not have a shoreline management plan for R.E. "Bob" Woodruff Lake because it is a run-of-river project, and the land around the lake is in flowage easement (McIntosh, personal communication 2010). Therefore, the lake's shoreline is not allocated to land use categories.

USACE manages seven recreation areas around the lake with picnic and camping sites, playgrounds, swimming areas, hiking trails, fishing docks, and boat ramps (USACE 2008). Bowhunting and small game hunting is permitted in 1,671 ac in USACE-managed recreation areas around the lake (USACE, Mobile District 2009c). In addition to USACE-managed areas, four recreation areas at the lake are managed by other private or public organizations with camping sites, picnic areas, boat ramps, and a marina. USACE leases the land to the organizations that operate the facilities on Robert F. Henry Lock and Dam project land. As discussed in Section 2.1.1.1.4.14, USACE acquired 10,566 ac of land along the river in Lowndes County in the 1990's as wildlife mitigation lands for impacts associated with construction of the Tennessee-Tombigbee Waterway. These lands are managed by the ADCNR Division of Wildlife and Freshwater Fisheries, under a lease from USACE, as part of the 12,531-ac Lowndes Wildlife Management Area in northern Lowndes County near White Hall, southeast of the dam and lake. In-season big and small game hunting is permitted in the Lowndes Wildlife Management Area (ADCNR 2009).

Land use bordering the Robert F. Henry Lock and Dam project is primarily undeveloped, forested land or farmland, with the exception of Montgomery, Alabama. In Montgomery, residential, commercial, recreational, and military (Maxwell Air Force Base) development border the project land.

2.4.1.3.4 Millers Ferry Lock and Dam and William "Bill" Dannelly Lake

The Millers Ferry Lock and Dam project is in southwest Alabama on the Alabama River. The town of Camden, Alabama, is about 13 mi south of the dam, and Selma, Alabama, is on the reservoir about 45 mi northeast of the dam. At normal summer elevation of 80.8 ft, William "Bill" Dannelly Lake has 516 mi of shoreline (USACE, Mobile District 2011a). The project contains 22,728 ac—18,528 ac of water and 4,200 ac of land (Chang, personal communication 2010; USACE, Mobile District 2011a). The reservoir encompasses 103 RMs of the Alabama River, from the Millers Ferry Lock and Dam upstream to the Robert F. Henry Lock and Dam (USACE 2008).

USACE does not have a shoreline management plan for William "Bill" Dannelly Lake because it is a run-of-river project, and the land around the lake is in flowage easement (Haynes, personal communication 2010b). Therefore, the lake's shoreline is not allocated to land use categories.

USACE manages 13 recreation areas at the Millers Ferry Lock and Dam project with picnic and camping sites, playgrounds, swimming areas, hiking trails, and boat ramps (USACE 2008). Bowhunting and small game hunting is permitted in 1,620 ac in USACE-managed recreation areas around the reservoir (USACE, Mobile District 2009d). In addition to USACE-managed recreation areas, five recreation areas are managed by other private or public organizations with camping sites, picnic areas, boat ramps, and three marinas (ADCNR 2008a). USACE leases the land to the organizations that operate the facilities on Millers Ferry Lock and Dam project land. On the southern shore of the reservoir is the Roland Cooper State Park, about 15 mi east of the dam. The park is 236 ac with a nine-hole golf course, vacation cottages for rent, a campground, picnic area, and boat launch (ADCNR 2010a). USACE also conducts intensive wildlife management activities on 1,703 acres of designated project lands on Dannelly Lake as part of a comprehensive wildlife mitigation project for impacts associated with construction of the Tennessee-Tombigbee Waterway project (see Section 2.1.1.1.4.15).

Land use bordering the Millers Ferry Lock and Dam project is a mix of undeveloped farmland or forested land, residential, and recreational. The predominant land use is undeveloped, forested land or farmland, reflecting the primary industries in the area: agriculture, forestry, and manufacturing (logging, paper mills, and flooring and furniture manufacturing). Several areas of light residential development are around the project, such as on the south side of the reservoir near the dam; east of the reservoir near Camden, Alabama; and in the historic Gees Bend community. Higher density development occurs on the north shore of the reservoir in Selma.

2.4.1.3.5 Claiborne Lock and Dam and Lake

The Claiborne Lock and Dam and Lake project is in southwest Alabama on the Alabama River. Mobile, Alabama, is about 100 mi south of the dam. At the maximum operating pool elevation of 36 ft, the lake shoreline is 204 mi (USACE, Mobile District 2011a). The footprint of the Claiborne project is 9,305 ac 6,290 ac of water and 3,015 ac of land (Chang, personal communication 2010; USACE, Mobile District 2011a). The reservoir encompasses 60 RMs of the Alabama River from the Claiborne Lock and Dam upstream to the Millers Ferry Lock and Dam. The lake remains mostly within the original river banks (USACE 2008).

USACE does not have a shoreline management plan for Claiborne Lock and Dam and Lake because it is a run-of-river project, and the land around the lake is in flowage easement (Haynes, personal communication 2010b). Therefore, the lake's shoreline is not allocated to land use categories.

USACE manages 11 recreation areas around the lake with picnic and camping sites, playgrounds, hiking trails, fishing dock, and boat ramps (USACE 2008). Bowhunting and small game hunting is permitted in 2,335 ac of USACE-managed recreation areas around the lake (USACE, Mobile District 2009e). In addition to USACE-managed areas, a park and a boat ramp are managed by other organizations. USACE leases the land to the organizations that operate the facilities on Claiborne Lock and Dam and Lake project land. No marinas are at Claiborne Lake. USACE also conducts intensive wildlife management activities on 2,567 acres of designated project lands on Claiborne Lake as part of a comprehensive wildlife mitigation project for impacts associated with construction of the Tennessee-Tombigbee Waterway project (see Section 2.1.1.1.4.16).

Land use bordering the lake is predominantly undeveloped, forested land, or open land. No residential development is along the lake's shoreline. Most of the lake's surrounding park land is in or is being allowed to revert to its natural state (USACE, Mobile District 2009e). In the northern portion of Claiborne

Lake in Yellow Bluff, Alabama, an International Paper Company plant lies about one-half mile from the lake's western shore.

2.4.1.3.6 APC Projects

WCMs are required for four APC projects. Those four projects are addressed in this section because USACE has flood risk management operations responsibility at the projects. Note that APC has other projects on the Coosa and Tallapoosa rivers, but those projects are only discussed in this EIS to the extent that measures to update the USACE WCMs may affect those projects. The four APC projects at which USACE has flood risk management responsibility are Weiss, H. Neely Henry, Logan Martin, and R.L. Harris lakes. For those projects, APC maintains shoreline management plans and a permitting program to manage the property in the project boundaries. APC's permitting program controls all development activities and monitors the shoreline areas to preserve the scenic, recreational, and environmental attributes of the lakes. All construction activity and vegetation modification within APC project boundaries are subject to preapproval and permitting by APC. The goals of the APC shoreline management plans and permitting program are to provide for reasonable public access, protect fish and wildlife habitat, protect cultural resources, protect operational needs, facilitate compliance with license articles, minimize adverse effects on water quality, minimize erosion, minimize adverse scenic effects, and guide shoreline development at the lakes (APC and Kleinschmidt Associates 2000a, 2000b, 2000c; FERC 2009).

2.4.1.3.6.1 Weiss Lake

The Weiss Lake is on the Coosa River in northeast Alabama, about 80 mi northeast of Birmingham, Alabama. The dam impounds a 30,027-ac reservoir (Weiss Lake) with 447 mi of shoreline at the normal summer elevation of 564 ft (USACE, Mobile District 2011). APC owns land up to the normal pool elevation and owns land and holds easements for flood storage. Weiss Lake extends into northwest Georgia for about 13 mi upstream on the Coosa River (APC 2009b). The major shoreline land uses at Weiss Lake are residential, forest management, sensitive resources,[2] and project operations. The shoreline of Weiss Lake is heavily developed by commercial and private entities (FERC 2009). Residential, commercial, retail, and recreational land uses border the reservoir.

2.4.1.3.6.2 H. Neely Henry Lake

The H. Neely Henry Lake is on the Coosa River in northeast Alabama, about 60 mi northeast of Birmingham, Alabama. The dam impounds an 11,235-ac reservoir with 339 mi of shoreline at the normal summer elevation of 508 ft (USACE, Mobile District 2011a). APC owns land up to the full pool elevation of 508 ft and owns land and holds easements for flood storage. The major shoreline land uses at the H. Neely Henry Lake are forest management, residential, and sensitive resources. Commercial and private development in the vicinity of the reservoir is moderate but growing, and much of the shoreline property directly adjacent to the reservoir is developed (FERC 2009). The Jim Martin Wildlife Refuge covers 180 ac of wetlands and forest along the northwest shoreline of the lake.

[2] Sensitive resources are project lands managed for protecting and enhancing sensitive resources that consist of resources protected by state or federal law, EO, and other natural features considered important to the area or natural environment. Examples of sensitive resources are archaeological sites or structures listed on or eligible for listing on the NRHP, wetlands, floodplains, habitat protection areas, and significant scenic areas (FERC and USACE, Mobile District 2009).

2.4.1.3.6.3 Logan Martin Lake

The Logan Martin Lake is in northeast Alabama on the Coosa River, about 40 mi east of Birmingham, Alabama. The dam impounds a 15,269-ac reservoir with 275 mi of shoreline at the normal summer elevation of 465 ft (USACE, Mobile District 2011a). APC owns land up to the full pool elevation of 465 ft and owns lands and holds easements for flood storage. The major shoreline land uses at Logan Martin Lake are residential, sensitive resources, and forest management. The reservoir shoreline is heavily developed by commercial and private entities (FERC 2009).

2.4.1.3.6.4 R.L. Harris Lake

The R.L. Harris Lake (locally known as Lake Wedowee) is on the Tallapoosa River in eastern Alabama, about 100 mi east of Birmingham, Alabama. The dam impounds a 10,660-ac reservoir with 271 mi of shoreline at the normal summer elevation of 793 ft (USACE, Mobile District 2011a). APC owns land up to the full pool elevation of 793 ft and owns lands and holds easements for flood pool. A mix of developed and undeveloped forested land borders the shoreline. Commercial and private residential development in the vicinity of the reservoir is moderate, with the majority of the development in the northern reaches of the reservoir, about 5 mi west of the town of Wedowee, Alabama.

2.5 Biological Resources

This section evaluates the existing conditions of biological resources in the rivers, tributaries, reservoirs, and wetlands throughout the ACT Basin. Specific resources discussed include vegetation resources, wildlife resources, fish and aquatic resources, protected state and federal species, and fish and wildlife management facilities.

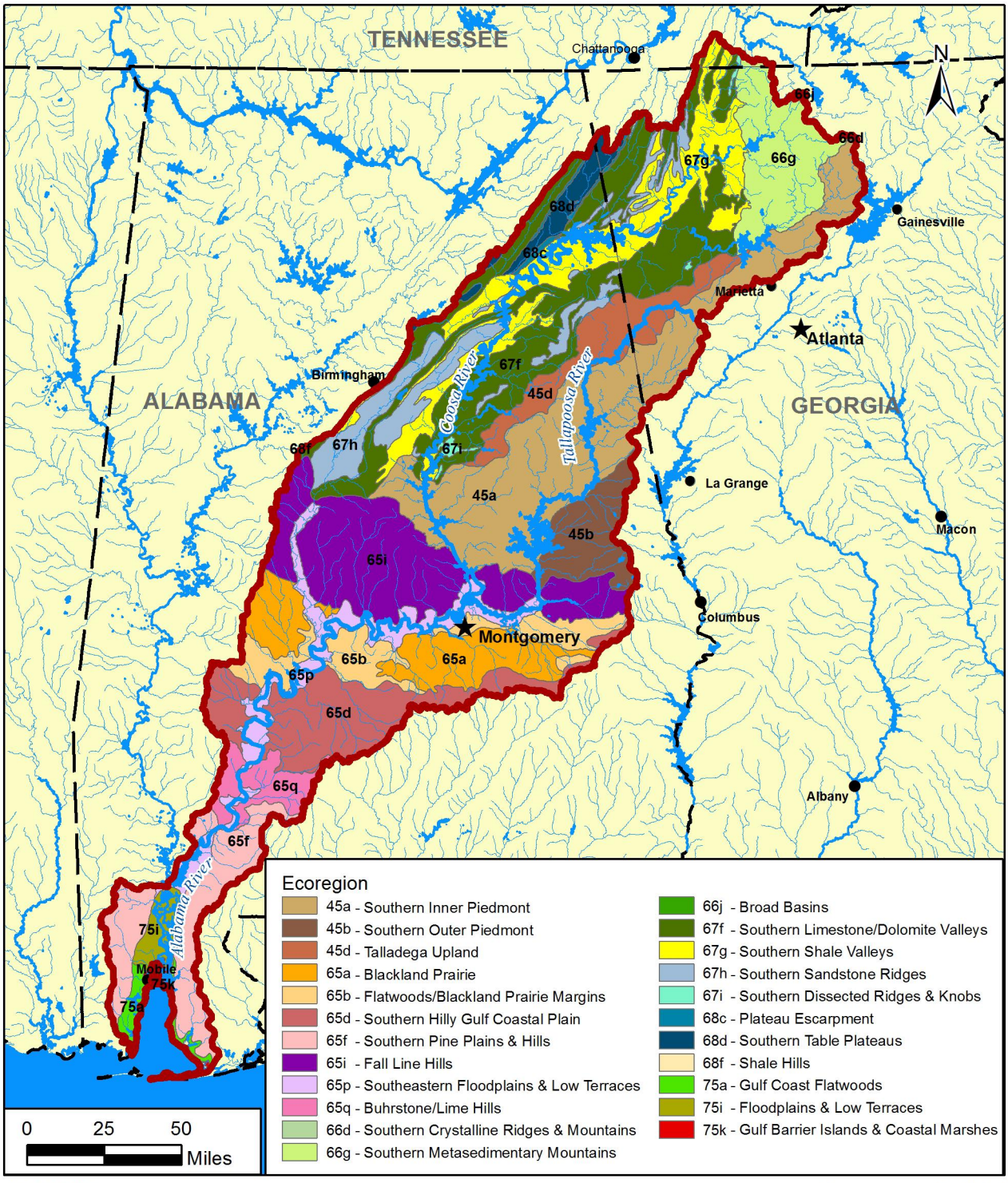
2.5.1 Vegetation Resources Affected Environment

This section discusses the phytogeographic patterns of the ACT Basin, which generally correspond to the existing ecoregional framework (Omernik 1987, 1995; Griffith et al. 2001; Feminella 2000). Resources for terrestrial and wetland communities within the ACT Basin are also discussed below.

2.5.1.1 Terrestrial Communities

2.5.1.1.1 Ecoregion Framework

The ACT Basin contains portions of five ecoregions (Griffith et al. 2001), including the Blue Ridge and Ridge and Valley (level 3 ecoregions 66 and 67, respectively) that are northern and central, the Piedmont (level 3 ecoregion 45) in the east east-central region, the Southeastern Plains ecoregion (ecoregion 65), and the Southern Coastal Plains (ecoregion 75) (Figure 2.5-1). The northernmost headwaters of the Coosa River are in the Blue Ridge ecoregion east of Chattanooga, in Bradley and Polk counties, Tennessee. The river flows south-southwest until it turns to the southeast to anastomose with the Tallapoosa and forms the Alabama River just north of Montgomery. Headwaters of the Tallapoosa River are in Haralson, Paulding, and Carroll counties (Georgia), from which the river heads southwesterly to the Coosa confluence. From that juncture, the Alabama River flows south-southwest through the Southeastern Plains ecoregion (ecoregion 65), and finally to the Southern Coastal Plains (75), where it contributes to the Mobile-Tensaw River Delta and the freshwater inflow to Mobile Bay. By covering such a large spatial area, and running through such a diverse physiography, it supports a diverse biota.



Level IV Ecoregions

Figure 2.5-1

The Ridge and Valley ecoregion in the northern ACT Basin (level 4 ecoregions 67f-i; Figure 2.5-1) has a mixed land cover and is approximately 50 percent forested (Griffith et al. 2001); vegetative cover includes oak-hickory and oak-pine forests, interspersed with areas of intensive agriculture, pasture, and urban development. The southern shale valleys consist of late-growth brush and mixed forests, with steeper slopes often used as pastureland. Areas of lesser relief support agricultural operations of hay, corn, soybeans, tobacco, and other products. The southern sandstone ridges typically are not as fertile as other areas of the Ridge and Valley and have stony and sandy soils. Steep ridges can be heavily forested but usually are without expansive stands of trees.

The northeastern area of the ACT is in the Blue Ridge ecoregion (Griffith et al. 2001). The southern Blue Ridge is recognized as one of the worldwide centers of biological diversity and may be the principle zone of diversity for flowering plants (angiosperms) on the planet. The ecoregion (level 4 ecoregion 66d, g, j; Figure 2.5-1) includes Appalachian oak forests and northern hardwoods and, at higher elevations, grades into Southeastern spruce-fir forests. There are also substantial areas of shrub, grass, and heath balds, hemlock, cove hardwoods, and oak-pine forests. The lower areas of the Blue Ridge, called the Broad Basins (66j), are mostly forested but have more area as pastureland than others.

The Piedmont ecoregion largely parallels the Ridge and Valley on its southeastern edge (level 4 ecoregion 45a, b, d; Figure 2.5-1). It was once under extensive agricultural production, but in recent decades much of it has returned to late-growth pine and hardwood forestland, with occasional loblolly-shortleaf pine (Griffith et al. 2001). There are areas of hay, cattle, and poultry, and there has been extensive and intensive development of urban/suburban land cover. Natural vegetation of the Talladega Uplands (45d) is oak-hickory-pine and is known to have once harbored substantial stands of longleaf pine.

The Piedmont and Ridge and Valley ecoregions grade into the Southeastern Plains ecoregion north of Montgomery, Alabama (level 4 ecoregions 65a, b, d, f, i, p; Figure 2.5-1). Although the natural vegetation of the Southeastern Plains ecoregion is oak-hickory-pine and Southern mixed forest (Griffith et al. 2001), it is now broadly interspersed with cropland, pastureland, and urban development. The Fall Line Hills subecoregion (65i) is the transition between the Piedmont/Ridge and Valley and the Southeastern Plains ecoregion and is vegetated mostly oak-hickory-pine forests with many areas of Longleaf pine re-introduction. Natural vegetation in the Blackland Prairie (65a) was dominated by sweetgum, post oak, and red cedar, along with patches of bluestem prairie. In the Southeastern Floodplains and Low Terraces region (75i), which includes the northern areas of the Mobile-Tensaw River delta, there are swamp forests of bald cypress and water tupelo and oak-dominated bottomland hardwood forests.

2.5.1.1.2 Vegetative Communities

Distributed among the ecoregions are six different vegetative communities, each of which is commonly made up of characteristic plant species.

2.5.1.1.2.1 Appalachian Oak Forests

The Appalachian oak forests in the ACT Basin are limited to the Blue Ridge ecoregion in north-central Georgia and the northernmost headwaters of the Coosa River in the Ridge and Valley ecoregion. Dominant canopy species in these forests include deciduous oaks (*Quercus* spp.), hickories (*Carya* spp.), buckeyes (*Aesculus* spp.), and magnolias (*Magnolia* spp.), as well as evergreen species. Specific species found on drier slopes and ridges in Appalachian oak forests include chestnut oak (*Quercus prinus*), northern red oak (*Q. rubra*), southern red oak (*Q. falcata*), white oak (*Q. alba*), black oak (*Q. velutina*), blackjack oak (*Q. marilandica*), pignut hickory (*Carya glabra*), sand or pale hickory (*C. pallida*), mockernut hickory (*C. tomentosa*), and tulip poplar (*Liriodendron tulipifera*). Also present are pitch pine (*Pinus rigida*) and red maple *(Acer rubrum*). The subcanopy typically includes saplings of the canopy

species, as well as shrub species such as mountain laurel *(Kalmia latifolia*), various azaleas (*Rhododendron* spp.), blueberries (*Vaccinium* spp.), strawberry-bush (*Euonymus americanus*), and sweet-shrub (*Calycanthus floridus*). Wildflowers found on dry sites include asters (*Aster* spp.), violets (*Viola* spp.), trilliums (*Trillium* spp.), yellow star-grass (*Hypoxis hirsuta*), and spiderwort (*Tradescantia ohiensis*). The oak-hickory forests of the Piedmont ecoregion are similar in composition to the Appalachian oak forests of the Blue Ridge ecoregion; the primary difference is the flatter topography of the Piedmont ecoregion. Many consider these oak-hickory forests the climax community for the Piedmont ecoregion (Wharton 1978).

Sites on rich soil slopes typically have more moisture and are dominated by red maple, American beech (*Fagus grandifolia*), basswood (*Tilia herterophylla*), hickories, tulip poplar, white ash (*Fraxinus americana*), and eastern hemlock (*Tsuga canadensis*). Shumard's oak (*Quercus shumardii*), yellow buckeye (*Aesculus flava*), cucumber tree (*Magnolia acuminata*), and Fraser's magnolia (*Magnolia fraseri*) also occur on these sites. Mountain-like microclimates often form on steep slopes and ravines in the Piedmont ecoregion and support oak-hickory forests that are similar to the Appalachian oak forests of moist sites in the Blue Ridge ecoregion.

The moist, rich slopes, often associated with the Blue Ridge ecoregion and the steep slopes and ravines in the Piedmont ecoregion, support various wildflowers, ferns, and shrubs. Rhododendrons, azaleas, and mountain laurel are common shrubs on moist sites in the Appalachian oak forest. Specific species include mountain rosebay (*Rhododendron catawbiense*), rosebay rhododendron (*R. maximum*), dwarf rhododendron (*R. minus*), flame azalea (*R. calendulaceum*), and mountain laurel. Other shrubs in these forests include bush honeysuckle (*Diervilla sessilifolia*), spice bush (*Lindera benzoin*), sweet shrub (*Calycanthus floridus*), mountain pepperbush (*Clethra acuminata*), and red buckeye (*Aesculus pavia*). Some of the wildflower species occurring in this area are trout-lily (*Erythronium americanum*), violets, trilliums, bee-balm (*Monarda didyma*), blood root (*Sanguinaria canadensis*), mountain jewelweed (*Impatiens pallida*), giant chickweed (*Stellaria pubera*), fire pink (*Silene virginica*), and false Solomon's seal (*Smilacina racemosa*). Ferns in these communities include maidenhair fern (*Adiantum pedatum*), southern lady fern (*Athyrium filix-femina*), marginal shield fern (*Dryopteris marginalis*), broadbeech fern (*Phegopteris hexagonoptera*), mountain spleenwort (*Asplenium montanum*), and New York fern (*Thelypteris noveboracensis*).

2.5.1.1.2.2 Oak-hickory-pine Forests

This forest type is abundant in the ACT Basin and can be found throughout large parts of the area occupied by the Coosa and Tallapoosa rivers in northwest Georgia and northeast Alabama. The community type is similar in composition to the Appalachian oak forest communities on drier sites; the major difference is the occurrence of pine species. Pine species typical of the oak-hickory-pine forest include shortleaf pine (*Pinus echinata*) and loblolly pine (*P. taeda*). The dominant deciduous canopy species in the oak-hickory-pine forests of the uplands are white oak, northern red oak, post oak (*Quercus stellata*), several hickories, tulip poplar, persimmon (*Diospyros virginiana*) and eastern red cedar (*Juniperus virginiana*). In areas managed primarily for forestry products, dominant canopy species are often limited to loblolly and short-leaf pine. Subcanopy species in the upland forests typically include flowering dogwood (*Cornus florida*), sourwood (*Oxydendrum arboreum*), eastern redbud (*Cercis canadensis*), shadbush (*Amelanchier canadensis*), black gum (*Nyssa sylvatica*), American holly (*Ilex opaca*), blackberries (*Rubus* spp.), viburnums *(Viburnum* spp.), sumacs (*Rhus* spp.), greenbriars (*Smilax* spp.), grapes (*Vitis* spp.), and Japanese honeysuckle (*Lonicera japonica*).

The oak-hickory-pine community type in the Piedmont ecoregion is similar in composition to that of the Blue Ridge ecoregion; the major difference is the occurrence of pine species. Pine species typical of the community type in the Piedmont ecoregion include Virginia pine (*Pinus virginiana*) and white pine (*P. strobus*), as well as the shortleaf pine and loblolly pine found in the Blue Ridge communities.

2.5.1.1.2.3 Rock Outcrop Communities

Rock outcrop communities are highly specialized plant communities associated with either granite or limestone outcrops (Martin et al. 1993). The ACT Basin contains small areas of both communities. These plant communities are found in areas that lack sufficient soil to support large shrubs or trees, thus maintaining communities dominated by herbaceous species. Because of the temperature and moisture extremes associated with rock outcrop areas, numerous types of vegetative communities have evolved to take advantage of the varying moisture and soil conditions. Each community is composed of a unique assemblage of plants, although some species can be found in more than one community type. Many of these outcrop-adapted plant species are either officially protected or considered rare where they are found, and many are classified as endemic.

2.5.1.1.2.4 Grass-Dominated Communities

The grass-dominated communities in the ACT Basin are near the lower Coosa, Tallapoosa, and Cahaba river watersheds. These communities are typically dominated by little bluestem (*Andropogon scoparius*), although 58 other herbaceous species have been documented in the remnant Black Belt grasslands in Alabama. Although occasionally invaded by sweet gum and eastern red cedar, the remnant grass-dominated communities are maintained by periodic droughts, floods, and burns that prevent most tree and shrub species from becoming established.

2.5.1.1.2.5 Longleaf Pine-Turkey Oak Sand Hill Community

The longleaf pine-turkey oak sand hill community is common in the Southeastern Plains ecoregion of the ACT Basin, the lower Alabama River watershed. The dominant plant species in this community are typically longleaf pine (*Pinus palustris*), turkey oak (*Quercus laevis*), bluejack oak (*Q. incana*), mockernut hickory, flowering dogwood, and wiregrass (*Aristida stricta*). This community is typically maintained by periodic burns. In areas where longleaf pine has been selectively removed, turkey oak and mockernut hickory dominate the canopy. Fire-intolerant species, such as magnolia and holly, can invade areas that do not burn regularly.

2.5.1.1.2.6 Maritime Shrub Community

The maritime shrub community is limited to the coastal areas of Alabama and Florida. This community type is typically divided into two subcommunities—dune oak-buckthorn and oak scrub—that can be distinguished by their dominant canopy species and typical location along the coast. The dune oak-buckthorn community typically occurs on the tops and landward slopes of dunes. The canopy of this community is typically composed of live oak (*Quercus virginiana*), tough buckthorn (*Bumelia tenax*), red bay (*Persea borbonia*), slash pine (*Pinus elliotii*), and loblolly pine. Understory species include saw palmetto (*Serenoa repens*), Hercules club (*Zanthoxylum clava-herculis*), myrtle (*Myrica* spp.), yaupon (*Ilex vomitoria*), rusty lyonia (*Lyonia ferruginea*), muscadine grape (*Vitis rotundifolia*), bamboo briar (*Smilax laurifolia*), pepper-vine (*Ampelopsis arborea*), and juveniles of the dominant canopy species. Oak-scrub forests occur in moderately drained areas of old dune complexes. That community is typically a dense, scrubby growth of broad-leaved evergreens and pines. The only examples of evergreen maritime forests and maritime shrub communities in the ACT Basin are limited to coastal areas in Alabama

(USACE, Mobile District 1998a). Evergreen maritime forests are found along the coast in Alabama. These forests are dominated by magnolia (*Magnolia virginiana*), laurel oak, and live oak. Subcanopy species are often limited to juveniles of the dominant canopy species, red bay, cabbage palm (*Sabal palmetto*), and slash pine.

2.5.1.1.2.7 Riverine and Reservoir Aquatic Macrophyte Community

2.5.1.1.2.7.1 Emergent aquatic vegetation

The saline marshes of the Mobile-Tensaw Delta are dominated by Smooth cordgrass (*Spartina alterniflora)* and black needlerush (*Juncus roemerianus)*. Most of the saline marsh area is covered by black needlerush, and the seaward boundaries are dominated by smooth cordgrass. The brackish marshes occur farther inland and have less smooth cordgrass and black needlerush than the saline marshes. The brackish marshes are mostly made up of freshwater species such as sawgrass (*Cladium jamaicense*), club rush (*Eleocharis cellulosa*)*,* and three-square bulrush (*Scirpus americanus*). The freshwater marshes occur outside the tidal reach, and a total of 85 plant species have been identified in the freshwater marshes of coastal Alabama. Dominant freshwater marsh species include giant reed (*Phragmities australis*), cattail (*Typha latifolia*)*,* bulrushes (*Scirpus* spp.), sedges (*Carex* spp.), and spikerushes (*Eleocharis* spp.) (USACE, Mobile District 1998a). In one study in the Choctafaula Creek watershed (Tallapoosa River subbasin), Fritz et al. (2004) found in-stream beds of the emergent water willow, *Justicia americana* (L.) Vahl, ranging in extent from 91 to 102 m^2. In four different streams of the Coosa River subbasin (Hatchett, Shoal, Talladega, and Terrapin creeks), they also found stands ranging in area from, respectively, 102 to 271 m^2, 37 to 149 m^2, 145 to 708 m^2, and 69 to 199 m^2). Given the right conditions, primarily light availability and conductivity conditions, *Justicia* can contribute substantially to habitat quality of streams in terms of nutritional resources for primary consumers, as shelter for predator avoidance, and to help hold stream deposits in place (Fritz and Feminella 2003). Water willow can be found in even larger stands in reservoirs with greater exposure to solar radiation.

2.5.1.1.2.7.2 Submerged Aquatic Vegetation (SAV)

Chaplin and Valentine (2009) conducted a study of the Mobile-Tensaw Delta, investigating the relationship between population productivity of an amphipod crustacean (*Gammarus*) and increasing dominance of a nonnative species of SAV, specifically, Eurasian water milfoil *(Myriophyllum spicatum)*. They estimate that the southern reaches of the delta, with numerous bayous, marshes, and bays, support up to approximately 24 species of SAV. In addition to *M. spicatum*, the assemblage was dominated by the native species water stargrass (*Heteranthera dubia*) and wild celery (*Vallisneria americana*). Additional species that are native to, and abundant in, the lower delta are coontail (*Ceratophyllum demersum*), southern naiad (*Najas guadalupensis*), narrow-leaf pondweed (*Potamogeton pusillus*), and wigeongrass (*Ruppia maritima*) (Newbolt 2005). In 1975 milfoil was documented for the first time in the delta, and by 1979 it was estimated to cover approximately 85 percent of the shallow water areas (Zolczynski and Eubanks 1990). More recent surveys show that it is still the overly dominant nonnative species (Vittor and Associates 2004; Newbolt 2005; Handley et al. 2007; Chaplin and Valentine 2009).

2.5.1.1.2.7.3 Floating Aquatic Vegetation (FAV)

In Alabama, 12 species of freshwater plants grow as FAV (Lovell 2007), including those where just the leaves float (5 species) and where the entire plant floats (7 species). The leaf-floating group of FAV has four species that are native to Alabama and one considered exotic—the yellow floating heart (*Nymphoides peltata*); the natives are the watershield (*Brasenia schreberi*), the American lotus (*Nelumbo* spp.), spatterdock (*Nuphar luteum*), and the fragrant water lily (*Nymphaea odorata*). Six Alabama-native

whole-plant FAVs are mosquito fern (*Azola caroliniana*), potentially several species of duckweed (*Lemna* spp.), water lettuce (*Pistia stratiodes*), water fern (*Slavinia minima*), giant duckweed (*Spirodela polyrhiza*) and potentially several species of watermeal (*Wolffia* spp.). One whole-plant FAV is a well-known exotic, the water hyacinth (*Eichhornia crassipes*).

2.5.1.2 Wetland Communities

Wetlands are transitional lands, between terrestrial and aquatic habitats. As defined by USACE, wetlands are "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (USACE 1987). Wetland communities found within the ACT Basin include palustrine wetlands and estuarine wetlands. Palustrine wetlands are nontidal wetlands that are commonly dominated by trees, shrubs, persistent or emergent species, or emergent mosses or lichens. Estuarine wetlands include deepwater tidal areas and adjacent tidal wetlands, which are usually semi-enclosed by land but have access to open ocean and in which ocean water is occasionally diluted by freshwater runoff from the land.

2.5.1.2.1 Palustrine Wetlands

Palustrine wetlands include all nontidal wetlands dominated by trees, shrubs, persistent emergent species, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity from ocean-derived salts is below 0.5 percent. It also includes wetlands lacking such vegetation but having all of the following four characteristics: (1) area less than 20 ac; (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 6.6 ft at low water; and (4) salinity from ocean-derived salts less than 0.5 percent (USGS 2006).

The majority of wetlands in the ACT Basin are made up of forested palustrine wetlands in the floodplains of rivers. The ACT Basin consists of approximately 273,595 ac of palustrine wetlands. The Alabama River subbasin contains the majority (86 percent) of the palustrine wetlands in the ACT Basin, and the Coosa and Tallapoosa River subbasins each have approximately equal shares of the remaining 14 percent.

The riparian (river-associated) forested systems in this area can also be referred to as bottomland hardwoods, and palustrine wetlands in the ACT Basin largely consist of bottomland hardwoods. Dominant tree species found in bottomland hardwoods include water tupelo (*Nyssa aquatica*), bald cypress (*Taxodium distichum*), Carolina ash (*Fraxinus caroliniana*), swamp tupelo (*Nyssa sylvatica*), red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), overcup oak (*Quercus lyrata*), plantertree (*Planera aquatica*), green ash (*Fraxinus pennsylvanica*), and water hickory (*Carya aquatica*) (USACE, Mobile District 1998a).

The palustrine systems in the ACT Basin also contain small areas of non-forested wetlands, such as marsh or shrub wetlands. These riparian areas depend on natural flooding of rivers to maintain the water and habitat quality of the riverine ecosystems of the various subbasins below. Other palustrine wetlands in the ACT Basin are those that occur along and are influenced by reservoirs.

2.5.1.2.1.1 Alabama River Subbasin

There are approximately 187,339 ac of palustrine wetlands in the Alabama River subbasin. The palustrine wetlands consist of approximately 99 percent (186,626 ac) riparian wetlands and less than 1 percent (714 ac) reservoir-associated wetlands.

2.5.1.2.1.2 Coosa River Subbasin

Approximately 21,069 ac of palustrine wetlands are in the Coosa River subbasin. The palustrine wetlands consist of approximately 55 percent (11,688 ac) riparian wetlands and 45 percent (9,381 ac) reservoir-associated wetlands. The reservoir-associated wetlands were created by hydropower development along the Coosa River in Alabama.

2.5.1.2.1.3 Etowah/Oostanaula/Consauga River Subbasin.

Approximately 4,651 ac of palustrine wetlands are in this subbasin. The palustrine wetlands consist of 84 percent (4,115 ac) riparian wetlands and 12 percent (536 ac) reservoir-associated wetlands.

2.5.1.2.1.4 Tallapoosa River Subbasin

Approximately 22,387 ac of palustrine wetlands are in the Tallapoosa River subbasin. The palustrine wetlands consist of 97 percent (21,702 ac) riparian wetlands and 3 percent (684 ac) reservoir-associated wetlands (USACE, Mobile District 1998a).

2.5.1.2.2 Estuarine Wetlands

Estuarine wetlands constitute only a small percentage of the total wetland area in the ACT Basin, but they provide a high economic value to coastal communities (USACE, Mobile District 1998a). Approximately 75 percent of the nation's commercial fish and shellfish depend on estuaries at some stage in their life cycle. Estuaries themselves depend on their wetlands to maintain water quality and provide the basis for food chains that culminate in human consumption of seafood. Many estuarine-dependent species have even closer ties to wetlands in that they feed, take refuge, or reproduce in the wetlands themselves. Without wetlands, these fish and shellfish cannot survive (NOAA 2009).

Estuarine wetlands within the ACT Basin are found in the Mobile Bay estuary system, which is between Mobile and Baldwin counties in coastal Alabama. This estuary system consists of Mobile Bay and the Mobile-Tensaw River Delta.

2.5.1.2.2.1 Mobile Bay

Mobile Bay is a drowned river valley in coastal Alabama that extends 31 mi from the Gulf of Mexico north to the Mobile–Tensaw River Delta. It has an average width of approximately 10.8 mi and an average depth of about 9.7 ft; it receives drainage from a watershed area exceeding 43,300 sq mi. Mobile Bay has approximately 6,224 ac of tidal marsh, 3,261 ac of bayous and rivers, 11,110 ac of connecting bays, 248,343 ac of open water, and a total shoreline length of 162 mi. Open-water areas of the Mobile Bay estuary are home to highly diverse populations of phytoplankton (250 species), benthic algae (245 species), and submersed aquatic vegetation (33 species). Phytoplankton are recognized as the most important primary producers in the open waters of the estuary, while benthic algae and submersed aquatic vegetation provide important habitat for small aquatic organisms and produce a substantial amount of organic matter that enters the food chain.

2.5.1.2.2.2 Mobile-Tensaw River Delta

The Mobile-Tensaw River is a 185,000-ac wetland ecosystem dominated by deeply flooded swamp forest and seasonally flooded bottomland hardwoods, originating near the confluence of the Alabama and Tombigbee rivers and extending southward for about 35 mi to the head of Mobile Bay. The delta opens into the northern end of Mobile Bay through the Mobile, Tensaw, Apalachee, and Blakely rivers. The area

within the delta consists of 20,323 ac of open waters, 10,430 ac of fresh/mixed marsh, 69,348 ac of swamp, and 84,839 ac of mixed bottomlands forests (SARPC 2001).

Tidal marshes are mostly found in the Mobile-Tensaw River Delta and the lower reaches of Mobile Bay. The tidal marshes in this area are made up of 60 percent (16,992 ac) saline and brackish marshes and 40 percent (11,232 ac) freshwater marsh.

Freshwater swamps in the area account for more than 69,000 ac, and they are primarily in the Mobile-Tensaw River Delta. The composition of plant species in freshwater swamps is controlled by the amount of flooding the area receives. Extensively flooded areas are dominated by bald cypress and swamp tupelo. Moderately flooded areas are dominated by sweet bay (*M. virginiana*), red maple, and Virginia willow (*Itea virginica*). Areas where there is little flooding are dominated by water oak (*Quercus nigra*), laurel oak (*Quercus larifolia*), sweet gum (*Liquidambar styraciflua*), southern magnolia (*Magnolia grandiflora*), and devilwood (*Osmanthus americana*). A total of 62 species of trees, shrubs, and herbaceous plants have been identified in the freshwater swamps of coastal Alabama.

Wet pinelands, pine savannahs, and bogs represent the remaining wetland communities that occur within the Mobile Bay estuary system. Wet pinelands and pine savannahs are pine-dominated communities characterized by low relief and poor drainage. The dominant pine species in these communities is typically slash pine (*Pinus elliottii*). Pine savannahs typically have less shrub species and are more herbaceous than wet pinelands. Bogs support a unique flora and can be found scattered throughout the wetland and upland pine communities. Typical species found in bogs include pitcher plants (*Sarracenia* spp.), sundews (*Drosera* spp.), butterworts (*Pingiucula* spp.), milkworts (*Polygala* spp.), and several types of orchids. A total of 103 plant species have been identified throughout the pine woodlands, savannahs, and bogs of coastal Alabama (USACE, Mobile District 1998a).

2.5.1.2.2.3 Nonnative or invasive plant species

Miller et al. (2004) present 12 plant species that are listed as nonnative by Alabama's Department of Conservation and Natural Resources (Table 2.5-1). The three aquatic species have been discussed elsewhere, but the others are grasses, trees, shrubs, or vines that could ultimately affect the integrity of floodplain or riparian vegetative communities, altering the basic conditions associated with native plants and the habitat and nutritional resources of the resident animal community.

Table 2.5-1.
Plants listed as nonnative in Alabama

Growth form	Latin name	Common name
Aquatic	*Alternanthera philoxeroides* (Mart.) Griseb.	alligatorweed
Aquatic	*Hydrilla verticillata* (L. f.) Royle	hydrilla
Aquatic	*Myriophyllum aquaticum* (Vell.) Verdc.	parrotfeather
Grass or Grasslike	*Imperata cylindrica* (L.) Beauv.	cogongrass
Hardwood Trees	*Triadica sebifera* (L.) Small	Chinese tallowtree
Shrub or Subshrub	*Ligustrum sinense* Lour.	Chinese privet
Shrub or Subshrub	*Rosa bracteata* J.C. Wendl.	Macartney rose
Shrub or Subshrub	*Rosa laevigata* Michx.	Cherokee rose
Shrub or Subshrub	*Rosa multiflora* Thunb. ex Murr.	multiflora rose
Shrub or Subshrub	*Solanum viarum* Dunal	tropical soda apple
Vines	*Lygodium japonicum* (Thunb. ex Murr.) Sw.	Japanese climbing fern
Vines	*Pueraria montana* var. *lobata* (Willd.) Maesen & S. Almeida	kudzu

Source: Miller et al. 2004

2.5.2 Wildlife Resources Affected Environment

This section is focused on the wildlife resources in the ACT Basin and specifically on those species known or likely to occur in riparian or terrestrial areas. Fish species are discussed separately in Section 2.5.4.2. Divisions between and among ecosystems or ecosystem types, however, are artificial, and some of the most important ecological processes operate across these boundaries, from terrestrial to riparian to aquatic (Bailey 1996; Hunter 1997). Riparian zones form the interface between aquatic and terrestrial components of the landscape, and therefore many important ecological connections are maintained by their protection and enhancement. The terrestrial forests in the riparian zones of the southeastern United States are among the most biologically productive in the world, due largely to the temperate climate, long growing season, nutrient input from flooding, productive soils, and abundance and diversity of plant and animal communities (Dickson and Warren 1993). As those relationships become more widely recognized, so does the importance of documenting and maintaining multidimensional connectivity (longitudinal, lateral, and vertical) among the components of the ecosystems for effective watershed management (Allan 2004; Cote et al. 2009; Cloern 2007; Fausch et al. 2002; Freeman et al. 2007; Kondolff et al. 2006; Pringle 2001; Thorp et al. 2006; Ward 1989; Weins 2002). From the aspect of freshwater riverine fish, lateral dimensions of rivers and streams are directly linked to food resources, including riparian areas contributing vegetative materials and other organisms to the water as food resources for fish, and periodic inundation of floodplains providing access to, for example, terrestrial insects as food (Dickson and Warren 1993).

Stallins et al. (2010) found that there was a decrease in obligate wetland tree species (such as water tupelo, Ogeche tupelo, and Carolina ash) along corridors in the Apalachicola River Basin that experience reduced frequencies of overbank flows because of large impoundments. Obligate wetland tree species, such as the overcup oak and green ash, were also found in reduced stands. Furthermore, they documented what seems to be reduced success in upland species becoming established at lower elevations when those areas are exposed to sustained high flows, often because of undersized impoundments. Maintaining floodplain connectivity is critical not only to provide appropriate moisture regimes to vegetative communities in the surrounding landscape, but also to support the wildlife assemblages dependent on the vegetation for habitat and nutritional resources. Similar conditions could exist in the Mobile-Tensaw River delta.

2.5.2.1 General Basin-Wide Wildlife Assemblages

All organisms, whether aquatic, semiaquatic (spending a portion of their lives in water), terrestrial, or plant or animal, are dependent on immediate, local-scale habitat features, as well as broadscale environmental characteristics that influence the habitat. Different species also have different environmental and ecological requirements that control whether they can survive and reproduce in a given area (Southwood 1977). Vegetative communities provide not only shelter from severe weather events, nesting areas, and protection from predation, but also food sources for plant-eating animal species. Thus, the characteristics of wildlife assemblages can strongly (and usually do) reflect available and accessible vegetative resources. The ecological variability of the ACT Basin is acknowledged and reflected by its position within six level 3 ecoregions—the Piedmont, the Blue Ridge, Ridge and Valley, Southwestern Appalachians, the Southeastern Plains, and the Southern Coastal Plain (Figure 2.5-1)—within which are nested 23 level 4 ecoregions (Omernik 1987; Griffith et al. 2001). The ecoregional framework represents the diversity of habitat features (soils, topography, vegetation, and climate) contained within that landscape. Such variable landscapes as those ecoregions, and the ACT Basin in particular, can support a wide variety of biota.

2.5.2.1.1 Birds

There are 142 species of birds that are known to occur in, or potentially inhabit areas of, the ACT Basin (Table 2.5-2) (USGS 2003; AL-GAP 2010). Riparian forests typically support a wide diversity of birds; however, the exact makeup of a bird assemblage depends on specific characteristics of the forest. Suitability of a forest for birds is affected by age and size of a stand; in fact, Dickson and Warren (1993) note that bird assemblages are associated with vertical foliage layers, total foliage volume, habitat patchiness, stand successional stage, moisture gradient, and hydroperiod. Forested, poorly drained wetlands are known to support higher densities and more diverse assemblages of breeding birds, and generally riparian zones with lower vegetative diversity support fewer birds from a less diverse assemblage (Dickson and Warren 1993). Bird censuses have shown that yellow-billed cuckoos, Acadian flycatchers, tufted titmice, Carolina wrens, red-eyed vireos, and northern cardinals are consistently abundant in mature forests of this type (Dickson and Warren 1993). Various raptors prefer living and hunting in riparian hardwood forests, including the Mississippi and American swallow-tailed kites, bald eagles, and ospreys; whereas barred owls and red-shouldered hawks are more frequently found in forested wetland. Wood storks, purple gallinules, and moorhens rely on aquatic areas for habitat and for foraging zones; in addition, wood storks require tall cypress and hardwoods for nesting spots. Woodpeckers are adapted to more mature hardwood forests, and red- and white-eyed vireos live in the forest canopy and low, shrubby vegetation of riparian habitats, respectively. Bottomland hardwood forests support a diverse bird assemblage, which can include numerous warblers (Prothonotary, Swainson's, northern parula, Kentucky, and hooded), some of which nest in cavities of trees killed by floods (Prothonotary) or prefer bottomland understory thickets (Swainson's) or Spanish moss (northern parula) (Dickson and Warren 1993).

Table 2.5-2.
Birds known or potentially occurring in at least a portion of the ACT Basin

Scientific name	Common name	Scientific name	Common name
Accipiter cooperii	Cooper's hawk	*Lophodytes cucullatus*	Hooded merganser**
Accipiter striatus	Sharp-shinned hawk	*Loxia curvirostra*	Red crossbill
Agelaius phoeniceus	Red-winged blackbird	*Megaceryle alcyon*	Belted kingfisher
Aimophila aestivalis	Bachman's sparrow*	*Megascops asio*	Eastern screech-owl
Aix sponsa	Wood duck	*Melanerpes carolinus*	Red-bellied woodpecker
Ammodramus savannarum	Grasshopper sparrow	*Melanerpes erythrocephalus*	Red-headed woodpecker
Anas platyrhynchos	Mallard	*Meleagris gallopavo*	Wild turkey
Anhinga anhinga	Anhinga	*Melospiza melodia*	Song sparrow
Archilochus colubris	Ruby-throated hummingbird	*Mimus polyglottos*	Northern mockingbird
Ardea alba	Great egret	*Mniotilta varia*	Black-and-white warbler
Ardea herodias	Great blue heron	*Molothrus ater*	Brown-headed cowbird
Baeolophus bicolor	Tufted titmouse	*Myiarchus crinitus*	Great crested flycatcher
Bombycilla cedrorum	Cedar waxwing	*Nyctanassa violacea*	Yellow-crowned night-heron
Branta canadensis	Canada goose	*Nycticorax nycticorax*	Black-crowned night-heron
Bubo virginianus	Great horned owl	*Oporornis formosus*	Kentucky warbler
Bubulcus ibis	Cattle egret	*Pandion haliaetus*	Osprey
Buteo jamaicensis	Red-tailed hawk	*Parula americana*	Northern parula
Buteo lineatus	Red-shouldered hawk	*Passer domesticus*	House sparrow
Buteo platypterus	Broad-winged hawk**	*Passerina caerulea*	Blue grosbeak

Table 2.5-2. (continued)

Scientific name	Scientific name	Scientific name	Scientific name
Butorides virescens	Green heron	*Passerina ciris*	Painted bunting
Caprimulgus carolinensis	Chuck-will's-widow	*Passerina cyanea*	Indigo bunting
Caprimulgus vociferus	Whip-poor-will	*Petrochelidon pyrrhonota*	Cliff swallow
Cardinalis cardinalis	Nothern cardinal	*Pheucticus ludovicianus*	Rose-breasted grosbeak
Carpodacus mexicanus	House finch	*Picoides borealis*	Red-cockaded woodpecker
Cathartes aura	Turkey vulture	*Picoides pubescens*	Downy woodpecker
Catharus fuscescens	Veery	*Picoides villosus*	Hairy woodpecker
Chaetura pelagica	Chimney swift	*Pipilo erythrophthalmus*	Eastern towhee
Charadrius vociferus	Killdeer	*Piranga olivacea*	Scarlet tanager
Chondestes grammacus	Lark sparrow	*Piranga rubra*	Summer tanager
Chordeiles minor	Common nighthawk	*Podilymbus podiceps*	Pied-billed grebe
Coccyzus americanus	Yellow-billed cuckoo	*Poecile carolinensis*	Carolina chickadee
Colaptes auratus	Northern flicker	*Polioptila caerulea*	Blue-gray gnatcatcher
Colinus virginianus	Northern bobwhite	*Porphyrio martinica*	Purple gallinule
Columba livia	Rock pigeon	*Progne subis*	Purple martin
Columbina passerina	Common ground-dove	*Protonotaria citrea*	Prothonotary warbler
Contopus virens	Eastern wood-pewee	*Quiscalus quiscula*	Common grackle
Coragyps atratus	Black vulture	*Rallus elegans*	King rail
Corvus brachyrhynchos	American crow	*Sayornis phoebe*	Eastern phoebe
Corvus ossifragus	Fish crow	*Scolopax minor*	American woodcock
Cyanocitta cristata	Blue jay	*Seiurus aurocapilla*	Ovenbird
Dendroica caerulescens	Black-throated blue warbler	*Seiurus motacilla*	Louisiana waterthrush
Dendroica cerulea	Cerulean warbler	*Setophaga ruticilla*	American redstart
Dendroica discolor	Prairie warbler	*Sialia sialis*	Eastern bluebird
Dendroica dominica	Yellow-throated warbler	*Sitta canadensis*	Red-breasted nuthatch
Dendroica fusca	Blackburnian warbler	*Sitta carolinensis*	White-breasted nuthatch
Dendroica pensylvanica	Chestnut-sided warbler	*Sitta pusilla*	Brown-headed nuthatch
Dendroica petechia	Yellow warbler	*Spinus tristis*	American goldfinch
Dendroica pinus	Pine warbler	*Spiza americana*	Dickcissel
Dendroica virens	Black-throated green warbler	*Spizella passerina*	Chipping sparrow
Dryocopus pileatus	Pileated woodpecker	*Spizella pusilla*	Field sparrow
Dumetella carolinensis	Gray catbird	*Stelgidopteryx serripennis*	Northern rough-winged swallow
Egretta caerulea	Little blue heron	*Streptopelia decaocto*	Eurasian collared-dove
Egretta thula	Snowy egret	*Strix varia*	Barred owl
Elanoides forficatus	Swallow-tailed kite	*Sturnella magna*	Eastern meadowlark
Empidonax virescens	Acadian flycatcher	*Sturnus vulgaris*	European starling
Eremophila alpestris	Horned lark	*Tachycineta bicolor*	Tree swallow
Eudocimus albus	White ibis	*Thryothorus ludovicianus*	Carolina wren
Falco sparverius	American kestrel	*Toxostoma rufum*	Brown thrasher
Gallinula chloropus	Common moorhen	*Troglodytes aedon*	House wren
Geothlypis trichas	Common yellowthroat	*Troglodytes troglodytes*	Winter wren
Haliaeetus leucocephalus	Bald eagle	*Turdus migratorius*	American robin
Helmitheros vermivorum	Worm-eating warbler	*Tyrannus tyrannus*	Eastern kingbird
Hirundo rustica	Barn swallow	*Tyto alba*	Barn owl
Hylocichla mustelina	Wood thrush	*Vermivora pinus*	Blue-winged warbler

Table 2.5-2. (continued)

Scientific name	Scientific name	Scientific name	Scientific name
Icteria virens	Yellow-breasted chat	*Vireo flavifrons*	Yellow-throated vireo
Icterus spurius	Orchard oriole	*Vireo griseus*	White-eyed vireo
Ictinia mississippiensis	Mississippi kite	*Vireo olivaceus*	Red-eyed vireo
Ixobrychus exilis	Least bittern	*Vireo solitarius*	Solitary vireo
Junco hyemalis	Dark-eyed junco	*Vireo solitarius*	Blue-headed vireo
Lanius ludovicianus	Loggerhead shrike	*Wilsonia citrina*	Hooded warbler
Limnothlypis swainsonii	Swainson's warbler	*Zenaida macroura*	Mourning dove

Source: USGS 2003; AL-GAP 2010

* IUCN Redlist used to confirm AL range (IUCN 2010)

** *Birds of North America* (Cornell Lab of Ornithology 2010)

2.5.2.1.2 Mammals

Sixty-eight species of mammals actually or potentially inhabit riparian and/or upland areas in the ACT Basin (USGS 2003; AL-GAP 2010) (Table 2.5-3). In addition to the larger species, such as black bear (*Ursus americana*), white-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), wild pig (*Sus scrofa*), red fox (*Vulpes vulpes*), and American beaver (*Castor canadensis*), there are several species each of bats, squirrels, shrews and voles, otters, skunks, and mice. The extent to which each species uses riparian habitat differs depending on specific life history traits, especially their requirements for food, cover, protection from natural enemies, and refuge from extreme weather events. The black bear is omnivorous and thus has many options for food, including carrion, herbs, small mammals, reptiles, amphibians, and the fruit of different plants such as blackberries (Dickson and Warren 1993). These animals are frequently sighted in bottomland forests in the southeastern United States, as well as upland riparian areas. White-tailed deer exhibit an overwhelming preference for the bottomland hardwood in the Coastal Plain, and riparian zones apparently enhance the suitability of pine plantations as habitat for them.

Habitat features often present in riparian areas, such as ample forage, fruits, seeds, downed logs, debris, and stumps, have been found to be positively correlated to small mammal abundance and diversity. The three species of squirrels, the eastern gray squirrel (*Sciurus carolinensis*), the eastern fox squirrel (*S. niger*), and the southern flying squirrel (*Glaucomys volans*) have a solid association with riparian woodlands (Dickson and Warren 1993). The eastern pipistrelle (*Pipistrellus subflavus*) occurs in the ACT Basin (USGS 2003; AL-GAP 2010) and has been documented as preferentially roosting in foliage, which is counter to the roost choice of most bats, tree hollows (Veilleux et al. 2003). Although mostly found in oak and maple trees in upland areas, they use those trees in riparian zones as well.

2.5.2.1.3 Reptiles

The diversity of the reptile fauna known or likely to occur in the ACT Basin is reflected by 81 species (USGS 2003; AL-GAP 2010), including the American alligator (*Alligator mississippiensis*), the common and alligator snapping turtles (*Chelydra serpentine* and *Macroclemys temmincki*, respectively), 24 other turtles and tortoises, 46 species of snakes (of which six are poisonous), the green anole (*Anolis carolinensis*), six skinks, and five lizards (Table 2.5-4). Many reptiles are associated with riparian areas because of their reliance on the moisture and/or on the locations of food sources, whether they are predators or herbivores. Dickson and Warren (1993, citing Wharton et al. 1981) noted that a gum-cypress forest in South Carolina had a diverse reptilian fauna, including the eastern mud snake, yellow-bellied turtle, brown water snake, eastern cottonmouth, rat snake, green anole, river and Florida cooters, red-bellied water snake, banded watersnake, gray and green tree frogs, and five-lined and brown-headed skinks.

Table 2.5-3.
Mammals known or potentially occurring in at least a portion of the ACT Basin

Scientific name	Common name	Scientific name	Common name
Blarina brevicauda	N. short-tailed shrew	*Nycticeius humeralis*	Evening bat
Blarina carolinensis	S. short-tailed shrew	*Ochrotomus nuttalli*	Golden mouse
Canis latrans	Coyote	*Odocoileus virginianus*	White-tailed deer
Castor canadensis	American beaver	*Ondatra zibethicus*	Muskrat
Corynorhinus rafinesquii	Rafinesque's big-eared bat	*Oryzomys palustris*	Marsh rice rat
Cryptotis parva	Least shrew	*Peromyscus gossypinus*	Cotton mouse
Dasypus novamcinctus	Nine-banded armadillo	*Peromyscus leucopus*	White-footed mouse
Didelphus virginiana	Virginia opossum	*Peromyscus maniculatus*	Deer mouse
Eptesicus fuscus	Big brown bat	*Peromyscus polionotus*	Oldfield mouse
*Geomys pinetis**	SE pocket gopher	*Pipistrellus subflavus*	Eastern pipistrelle
Glaucomys volans	Southern flying squirrel	*Procyon lotor*	Common racoon
Lasionycteris noctivagans	Silver-haired bat	*Rattus norvegicus*	Norway rat
Lasiurus borealis	Eastern red bat	*Rattus rattus*	Black rat
Lasiurus cinereus	Hoary bat	*Reithrodontomys humulis*	Eastern harvest mouse
Lasiurus intermedius	Northern yellow bat	*Scalopus aquaticus*	Eastern mole
Lasiurus seminolus	Seminole bat	*Sciurus carolinensis*	Eastern gray squirrel
Lutra canadensis	Northern river otter	*Sciurus niger*	Eastern fox squirrel
Lynx rufus	Bobcat	*Sigmodon hispidus*	Hispid cotton rat
Marmota monax	Woodchuck	*Sorex cinereus*	Masked shrew
Mephitis mephitis	Striped skunk[a]	*Sorex fumeus*	Smoky shrew
Microtus ochrogaster	Prairie vole	*Sorex hoyi*	Pygmy shrew
Microtus pennsylvanicus	Meadow vole	*Sorex longirostris*	Southeastern shrew
Microtus pinetorum	Woodland vole	*Spilogale putorius*	Eastern spotted skunk
Mus musculus	House mouse	*Sus scrofa*	Wild pig
Mustela frenata	Long-tailed weasel	*Sylvilagus aquatious*	Swamp rabbit
Mustela vison	Mink	*Sylvilagus floridanus*	Eastern cottontail
Myotis austroriparius	Southeastern myotis	*Sylvilagus obscurus*	Appalachian cottontail
Myotis grisescens	Gray bat	*Tadarida brasiliensis*	Brazilian free-tailed bat
Myotis leibii	E. small-footed myotis	*Tamias striatus*	Eastern chipmunk
Myotis lucifugus	Little brown myotis	*Tamiasciurus hudsonicus*	Red squirrel
Myotis septentrionalis	Northern myotis	*Urocyon cinereoargenteus*	Common gray fox
Myotis sodalis	Indiana bat	*Ursus americanus*	Black bear
Napaeozapus insignis	Woodland jumping mouse	*Vulpes vulpes*	Red fox
Neotoma floridana	Eastern woodrat[a]	*Zapus hudsonicus*	Meadow jumping mouse

Source: USGS 2003; AL-GAP 2010

Note:

a *IUCN Redlist used to confirm AL range (*IUCN 2010*)*

Table 2.5-4.
Reptiles known or potentially occurring in at least a portion of the ACT Basin

Scientific name	Common name	Scientific name	Common name
Agkistrodon contortrix	Copperhead	*Lampropeltis t. triangulum*	Eastern milk snake
Agkistrodon piscivorus	Cottonmouth	*Macroclemys temmincki*	Alligator snapping turtle
Alligator mississippiensis	American alligator	*Malaclemys terrapin*	Diamondback terrapin
Anolis carolinensis	Green anole	*Masticophis flagellum*	Coach whip
Apalone mutica calvata	Gulf coast smooth softshell	*Micrurus fulvius*	Coral snake
Apalone spinifera aspera	Gulf coast spiny softshell	*Nerodia erythrogaster*	Plainbelly water snake[a]
Carphophis amoenus	Worm snake	*Nerodia fasciata*	Southern water snake[b]
Cemaphora coccinea	Scarlet snake	*Nerodia floridana*	Florida green water snake
Chelydra serpentina	Snapping turtle	*Nerodia rhombifer*	Diamondback water snake
Chrysemys picta	Painted turtle	*Nerodia sipedon*	Midland water snake
Clemmys muhlenbergii	Bog turtle	*Nerodia taxispilota*	Brown water snake
Cnemidophorus sexlineatus	Six-lined racerunner	*Opheodrys aestivus*	Rough green snake
Coluber constrictor	North American racer	*Ophisaurus attenuatus*	Slender glass lizard
Crotalus adamanteus	E. Diamondback rattlesnake	*Ophisaurus compressus*	Island glass lizard
Crotalus horridus	Timber rattlesnake	*Ophisaurus mimicus*	Mimic glass lizard
Deirochelys retizularia	Chicken turtle	*Ophisaurus ventralis*	Easter glass lizard
Diadophis punctatus	Ringneck snake	*Pituophis m. lodingi*	Black pine snake
Drymarchon corais couperi	Eastern Indigo snake	*Pituophis m. melanoleucus*	Northern pine snake
Elaphe guttata	Corn snake	*Pituophis m. mugitus*	Florida pine snake
Elaphe obsoleta	Rat snake	*Pseudemys alabamensis*	Alabama redbelly turtle
Eumeces anthracinus	Coal skink	*Pseudomys floridana*	Florida cooter
Eumeces egregius	Mole skink	*Pseudonmys concinna*	River cooter
Eumeces fasciatus	Five-lined skink	*Regina rigida*	Glossy crayfish snake
Eumeces inexpectatus	SE Five-lined skink	*Regina septembittata*	Queen snake
Eumeces laticeps	Broadhead Skink	*Sceloporus undulatus*	Fence lizard
Farancia abacura	Mud snake	*Scincella lateralis*	Ground skink
Farancia erytrogramma	Rainbow snake	*Sistrurus miliarius*	Pigmy rattlesnake
Gopherus polyphemus	Gopher tortoise	*Sternotherus minor*	Loggerhead musk turtle
Graptemys barbouri	Barbour's map turtle	*Sternotherus odoratus*	Common musk turtle
Graptemys geographica	Common map turtle	*Storeria dekayi*	Brown Snake
Graptemys nigrinoda	Black-knobbed map turtle	*Storeria occipitomaculata*	Red-bellied snake
Graptemys polchra	Alabama map turtle	*Tantilla coronata*	SE crowned snake
Heterodon platirhinos	Eastern hognose snake	*Terrapene carolina carolina*	Eastern box turtle
Heterodon simus	Southern hognose snake	*Terrapene carolina major*	Gulf coast box turtle
Kinosternon baurii	Striped mud turtle	*Terrapene carolina triunguis*	Three-toed box turtle
Kinosternon subrubrum	Eastern mud turtle	*Thamnophis sauritus*	Eastern ribbon snake
Lampropeltis calligaster	Mole kingsnake	*Thamnophis sirtalis*	Common garter snake[c]
Lampropeltis elapsoides	Scarlet kingsnake	*Trachemys scripta*	Slider
Lampropeltis g. getula	Eastern kingsnake	*Virginia striatula*	Rough earth snake
Lampropeltis g. holbrooki	Speckled kingsnake	*Virginia valeriae*	Smooth earth snake
Lampropeltis g. nigra	Black kingsnake		

Source: USGS 2003; AL-GAP 2010

Notes:

a In Georgia, it is called the Redbelly/Yellowbelly Water Snake (USGS 2003)

b In Georgia, it is called the Banded Water Snake (USGS 2003)

c In Georgia, it is called the Eastern Water Snake (USGS 2003)

2.5.2.1.4 Amphibians

Slightly less diverse than reptiles, amphibians are represented by 57 species known from or likely to occur in the ACT Basin (USGS 2003; AL-GAP 2010). Salamanders and frogs are the most diverse groups of amphibians in the basin. There are 27 species of salamanders representing nine genera (Table 2.5-5). *Eurycea*, *Desmognathus* and *Ambystoma* have eight, five, and four species, respectively. These genera include species such as the Southern two- and three-lined, long-tailed, cave, blackbelly, flatwoods, seepage, tiger, and dwarf salamanders. The 21 frog species are in the genera *Rana*, *Hyla*, *Pseudacris*, and *Acris*; other than the American bullfrog (*Rana calesbeiana*), this group includes species such as the southern leopard, wood, pickerel, and gopher frogs. There are six tree frogs of the genus *Hyla*—the bird-voiced, Cope's gray, green, pinewoods, barking, and squirrel. The three chorus frogs (*Pseudacris*) are the southern, western, and ornate chorus frogs. Other than the salamanders and frogs, there are three toads, two sirens, two- and three-toed amphiuma, one newt, the hellbender (*Cryptobranchus alleganiensis*), and the Alabama waterdog (*Necturus alabamensis*). Although some salamanders and frogs can be found in upland areas, most amphibians require nearly constant contact with moisture, if not for their entire life cycle, then for most of it. Wharton (1981, in Dickson and Warren 1993) reported that some upland salamander species became established in the floodplain of the Chattahoochee River after dams were constructed, the drier floodplain becoming more suitable for those particular *Plethodon* species; similar occurrences likely could have happened in the ACT Basin.

2.5.2.1.5 Terrestrial Macroinvertebrates

There is insufficient space in this document to cover this important group of animals, thus, the text below is intended to provide an overview of the enormity of their taxonomic and functional diversity, and of their contributions to ecosystem processes. Non-aquatic insects are hyper-diverse and abundant in the humid, subtropical zone of the southeastern United States and even more so in riparian areas owing to nutrient-rich soils, substantial vegetative growth and productivity, and complexity of habitat structure.According to Borror et al. (1989),

> Insects are the most dominant group of animals on the earth today. They far surpass all other terrestrial animals in numbers, and they occur practically everywhere. Several hundred thousand different kinds (species) have been described—three times as many as there are in the rest of the animal kingdom—and some authorities believe that the total number of different kinds may approach 30 million. More than a thousand kinds may occur in a fair-sized backyard, and their populations may number in the many millions per ac.

Insects feed on green vegetation, live and decaying woody materials, seeds, fungi, lichens, mosses, and algae (Slansky and Rodriguez 1987). They prey on each other and other invertebrates. They can be blood-feeders or ectoparasites on birds or mammals, scavengers feeding on dung or carrion, or parasitoids on other invertebrates. Many terrestrial insects can fly as adults, and in riparian areas they can accidentally fall into water, becoming food for fish. Flooding of riparian zones gives fish immediate access to this substantial food source.

Table 2.5-5.
Amphibians known or potentially occurring in at least a portion of the ACT Basin

Scientific name	Common name	Scientific name	Common name
Acris crepitans	Northern cricket frog	*Hyla Cinerea*	Green treefrog
Acris gryllus	Southern cricket frog	*Hyla femoralis*	Pine woods treefrog
Ambystoma maculatum	Spotted salamander	*Hyla gratiosa*	Barking treefrog
Ambystoma opacum	Marbled salamander	*Hyla squirella*	Squirrel treefrog
Ambystoma talpoideum	Mole salamander	*Necturus alabamensis*	AL/black warrior waterdog
Ambystoma texanum	Smallmouth salamander	*Necturus beyeri complex*	Gulf coast waterdog
Ambystoma tigrinum	Tiger salamander	*Necturus maculosus*	Mudpuppy
Amphiuma means	Two-toed amphiuma	*Notophthalmus viridescens*	Eastern newt
Amphiuma tridactylum	Three-toed amphiuma	*Phaeognathus hubrichti*	Red hills salamander
Aneides aeneus	Green salamander	*Plethodon dorsalis*	Zigzag salamander
Bufo americanus	American toad	*Plethodon glutinosus*	Slimy salamander complex
Bufo fowleri	Fowler's toad	*Plethodon petraeus*	Pigeon mtn. salamander
Bufo quercicus	Oak toad	*Plethodon serratus*	S. redback salamander
Bufo terrestris	Southern toad	*Plethodon ventralis*	Zigzag salamander
Cryptobranchus alleganiensis	Hellbender	*Plethodon websteri*	Webster's salamander
Desmognathus aeneus	Seepage salamander	*Pseudacris brachyphona*	Mountain chorus frog
Desmognathus conanti	Spotted dusky salamander	*Pseudacris crucifer*	Spring peeper
Desmognathus fuscus	Dusky salamander	*Pseudacris feriarum*	Upland chorus frog
Desmognathus monticola	Seal salamander	*Pseudacris nigrita*	Southern chorus frog
Desmognathus ocoee	Ocoee salamander	*Pseudacris ornata*	Ornate chorus frog
Eurycea aquatica	Brownback salamander	*Pseudacris triseriata*	Western chorus frog
Eurycea cirrigera	Southern two-lined salamander	*Pseudotriton montanus*	Mud salamander
Eurycea guttolineata	Southern three-lined salamander	*Pseudotriton ruber*	Red salamander
Eurycea longicauda	Long-tailed salamander	*Rana capito*	Gopher frog
Eurycea lucifuga	Cave salamander	*Rana catesbeiana*	American bullfrog
Eurycea quadridigitata	Dwarf salamander	*Rana clamitans*	Green frog/bronze frog
Eurycea wilderae	Blue ridge two-lined salamander	*Rana grylio*	Pig frog
Gastrophryne carlinensis	Eastern narrow mouth toad	*Rana palustris*	Pickerel frog
Gyrinophilus palleucus	Tennessee cave salamander	*Rana sphenocephala*	Southern leopard frog
Gyrinophilus porphyriticus	Spring salamander	*Rana sylvatica*	Wood frog
Hemidactylium scutatum	Four-toed salamander	*Scaphiopus nolbrokii*	Eastern spadefoot toad
Hemidactylium scutatum	Four-toed salamander	*Siren intermedia*	Lesser siren
Hyla avivoca	Bird-voiced treefrog	*Siren lacertina*	Greater siren
Hyla chrysoscelis	Cope's gray treefrog		

Source: USGS 2003; AL-GAP 2010

2.5.3 Fish and Aquatic Resources Affected Environment

This section describes the current state of fish and aquatic resources for each of the various subbasins in the ACT Basin. Riverine, reservoir, and estuarine community resources with a potential to be affected by changes in ACT Basin operations are discussed below.

2.5.3.1 Riverine

2.5.3.1.1 Alabama River Subbasin

There is only one remaining stretch of unimpounded water in the mainstem of the Alabama River, beginning at Claiborne Lock and Dam and running south for approximately 73 mi through Monroe, Clarke, and Baldwin counties, where it joins the Tombigbee River and is identified as the Lower Alabama River. The Lower Alabama River was known as one of the richest freshwater mussel beds in the state, as well as hosting several unique fish species such as alligator gar (*Atractosteus spatula*), paddlefish (*Polyodon spathula*), Alabama darter (*Etheostoma ramseyi*), and the federally endangered Alabama sturgeon (*Scaphirhynchus suttkusi*). The reach has been designated as critical habitat for the Alabama sturgeon; however, during the past decade, the only specimen captured was in 2008 in the tailwaters of Claiborne Lake (USFWS 2009a).

Up to 144 species of fish have been documented in the Alabama River Basin, excluding the Cahaba River. Notable species of federal/state interest include southeastern blue sucker (*Cycleptus meridionalis*), highfin carpsucker (*Carpiodes velifer*), quillback (*Carpiodes cyprinus*), skipjack herring (*Alosa chrysochloris*), river redhorse (*Moxostoma carinatum*), striped bass (*Morone saxatilis*), walleye (*Sander vitreus*), mooneye (*Hiodon tergisus*), and Gulf sturgeon (*Acipenser oxyrinchus desotoi*).

Populations of native freshwater mussel species persist in the lower and middle reaches of the subbasin, but have drastically declined in both diversity and abundance. Recent surveys have documented inflated heelsplitter (*Potamilus inflatus*), heavy pigtoe (*Pleurobema taitianum*), spotted rocksnail (*Leptoxis picta*), and tulotoma snail (*Tulotoma magnifica*). Heavy pigtoe have been found in only a few hundred square yards, immediately downstream of Robert F. Henry Lock and Dam (USFWS 2009b). This find represents the only known population of the species. Similarly, in 2006, a single population of tulotoma snail was discovered downstream of Claiborne Lake (USFWS 2008). All specimens were encountered under a single rock and further searches of the area only produced relic shells. This reach of the Alabama River also supports commercially harvested species, including the ebony mussel (*Fucconaia ebena*) and washboard mussel (*Megalonaisas nervosa*), as well as the federally endangered species, southern clubshell (*Pleurobema decisum*), heavy pigtoe and tulotoma snail (ADCNR 2008b).

2.5.3.1.2 Cahaba River Subbasin

The Cahaba River subbasin is a major tributary in the Alabama River, draining approximately 1,825 sq mi of central Alabama. One hundred thirty-five fish species are known to occur, including the Alabama sturgeon, Cahaba shiner (*Notropis cahabae*), crystal darter (*Crystallaria asprella*), freckled darter (*Percina lenticula*), goldline darter (*Percina aurolineata*), and frecklebelly madtom (*Noturus munitus*) (Boschung and Mayden 2004; Mettee et al. 1996). Sportfish species include largemouth bass (*Micropterus salmoides*), spotted bass (*Micropterus punctatus*), bluegill (*Lepomis macrochirus*), longear sunfish (*Lepomis megalotis*), crappie (*Pomoxis* spp.), chain pickerel (*Esox niger*), and several species of catfish.

The Cahaba River historically harbored 42 species of aquatic snails (known or suspected to occur), 10 of which occur nowhere else in the world and 9 of which are found only in the Cahaba and Coosa drainage

basins (ADCNR 2008c; Bogan and Pierson 1993). More recent surveys conducted by Bogan and Pierson (1993) found that the gastropod fauna decreased to just 24 species, 16 of which were candidates for federal listing. The Cahaba River system also historically supported 43 freshwater mussel species, but recent surveys document only 33 species (McGregor et al. 2000; Shepard et al. 1994). Mussels are no longer present in some reaches of the Cahaba River; other sections of the Cahaba River system hold some good populations of mussels, including some of the best remaining populations of some rare species (ADCNR 2008c; USACE, Mobile District 1998a).

2.5.3.1.3 Coosa River Subbasin

The mainstem of the Coosa River forms at the confluence of the Etowah and Oostanaula rivers in Georgia and runs 255 mi into and through Alabama. Six dams impound approximately 238 mi of the Coosa River before it meets the Tallapoosa River to form the Alabama River, effectively, fragmenting the few remaining reaches of free-flowing riverine habitat found in the subbasin.

The subbasin contains 147 fish species, including several that are unique to the Coosa River: pygmy sculpin (*Cottus paulus*), holiday darter (*Etheostoma brevirostrum*), Coosa darter (*Etheostoma coosae*), coldwater darter (*Etheostoma ditrema*), Etowah darter (*Etheostoma etowahae*) (Georgia only), Cherokee darter (*Etheostoma scotti*) (Georgia only), trispot darter (*Etheostoma trisella*), amber darter (*Percina antesella*) (Georgia only), and Conasauga logperch (*Percina jenkinsi*) (Georgia only). In 2002 GADNR initiated a lake sturgeon (*Acipenser fulvescens*) reintroduction program, stocking approximately 85,000 fingerlings in the upper reaches of the Coosa subbasin (GADNR 2010). To date, more than 350 recaptures have been documented, with growth and survival exceeding expectations. Recent angler reports indicate the fish have moved further downstream to H. Neely Henry and Logan Martin lakes in Alabama. The Coosa subbasin is home to 91 species of aquatic snails, of which 82 occur only in the Coosa River Basin. A total of 53 freshwater mussel species also have been documented in the subbasin, and 11 of these mussels are found only in the Coosa River Basin (USACE, Mobile District 1998a; ADCNR 2008d).

Although the six dams impound most of the river, some significant reaches of free-flowing riverine habitat on the mainstem Coosa River remain (USACE, Mobile District 1998a):

- An 8-mi reach of free-flowing habitat extends from Jordan Dam and Lake downstream to the lower Coosa River. The tailwaters of Jordan Dam and Lake support the federally listed endangered tulotoma snail (DeVries et al. 2003) and the federally threatened fine-line pocketbook mussel. This reach also supports many important local recreational fish species, including a regional spotted bass fishery.
- A 21-mi reach of bypassed historic Coosa River channel that extends downstream from Weiss Lake is a free-flowing segment of that river caused by the diversion of flow at the dam for hydropower generation. Recent surveys have documented 53 fish species within the bypassed reach (FERC 2009). Fish community diversity is highest downstream of Terrapin Creek, comprising species typically associated with lotic conditions (bronze darter, *Percina palmaris*; greenbreast darter, *Etheostoma jordani*; tricolor shiner, *Cyprinella trichroistia*; riffle minnow, *Phenacobius catostomus*; southern studfish, *Fundulus stellifer*). Lucustrine conditions upstream of Terrapin Creek are dominated by Centrachidae species, including bluegill and redear sunfish (Lepomis microlophus).
- A 9-mi, free-flowing reach extends from Rome, Georgia, downstream to the headwaters of Weiss Lake. The reach provides potential habitat for upstream migration by striped bass and other game fish. GADNR issued a fish consumption advisory in 1996 from elevated PCB levels of fish tissues.

Critical habitat for several mussel species has been established from Alabama State Highway 111 upstream to Jordan Dam and Lake (USFWS 2004). The species targeted by this designation include, the southern acornshell, ovate clubshell, southern clubshell, upland combshell, triangular kidneyshell, Alabama moccasinshell, Coosa moccasinshell, southern pigtoe and fine-lined pocketbook (USFWS 2004). Critical habitat has also been proposed for the interrupted rocksnail and rough hornsnail (*Pleurocera foremani*).

2.5.3.1.4 Etowah River Subbasin

The Etowah River originates as a high-gradient stream in the Blue Ridge province of the Southern Appalachian Mountains and flows approximately 69 mi westward through Piedmont upland to Allatoona Lake. Habitat loss and modifications resulting from impoundments, timbering, agriculture, gold mining, and urban development have caused at least 35 mussel species and seven fish species to be extirpated from the Etowah River subbasin. The upper mainstem and tributaries of the Etowah river support the federally endangered amber darter and Etowah darter, and the federally threatened Cherokee darter.

In ongoing monitoring of the 1,120-sq-mi upper Etowah River basin draining into Allatoona Lake, the benthic macroinvertebrate assemblage (which includes aquatic insects, crustaceans, worms, and snails) is being used as an indicator of overall ecological condition. Through 3 years of sampling and analysis (2005–07) (Stribling et al. 2006; Millard et al. 2007, 2008), approximately 43 percent of the stream channel miles in the upper watershed has been assessed (686 out of 1,613 mi). Of those, the structure and function of the benthic macroinvertebrate assemblage shows that there are 271 mi of biologically degraded streams (LAUE 2009). Cumulatively, there have been 421 taxa (primarily, genera) of benthic macroinvertebrates collected, of which approximately 37 percent are considered stressor sensitive. Biological degradation is attributed to physical and chemical stressors produced by the habitat loss and land use/land cover conversions discussed above.

The lower Etowah River extends 48.6 mi from the Allatoona Lake to its confluence with the Oostanaula River, forming the Coosa River in Rome, Georgia. Historically, the lower Etowah River contained more than 91 native fish species, including lake sturgeon and at least 51 mussel species. Most federal and state endangered fish species are found in the upper Etowah River (above Allatoona Lake) and to a lesser extent in the lower Etowah River. Nevertheless, the Cherokee darter (*Etheostoma scotti*), listed as threatened by the USFWS, has been documented in several tributaries of the lower Etowah River (Freeman and Wenger 2000).

A sampling of the Lower Etowah in 2002 showed that the lower Etowah River offers only a moderate sportfish population (GADNR 2002). The 2002 sampling found the following:

- Largemouth bass are present but are relatively few in number and small in size.
- The black bass fishery is dominated by spotted bass, with some larger individuals present.
- The sunfish population is larger (abundance) and of better quality (larger fish) than the Oostanaula River fishery.
- Striped bass and catfish likely offer anglers the best fishing opportunity in the lower Etowah River.
- Freshwater drum (*Aplodinotus grunniens*) are extremely abundant, with many large individuals in the population. Efforts should be made to make anglers aware of this underused fishery.

In 1996 American Rivers' list of the top 10 most endangered river systems in the United States included the Etowah River. The diversity of fish and mussels in the Etowah River is equal to the Conasauga River, which was considered to have the highest biodiversity in the Coosa River drainage. Of an estimated 91 native fish species, 15 species have been eliminated, and 65 percent of the 51 mussel species reported from this subbasin have been extirpated (USACE, Mobile District 1998a; GADNR 2002).

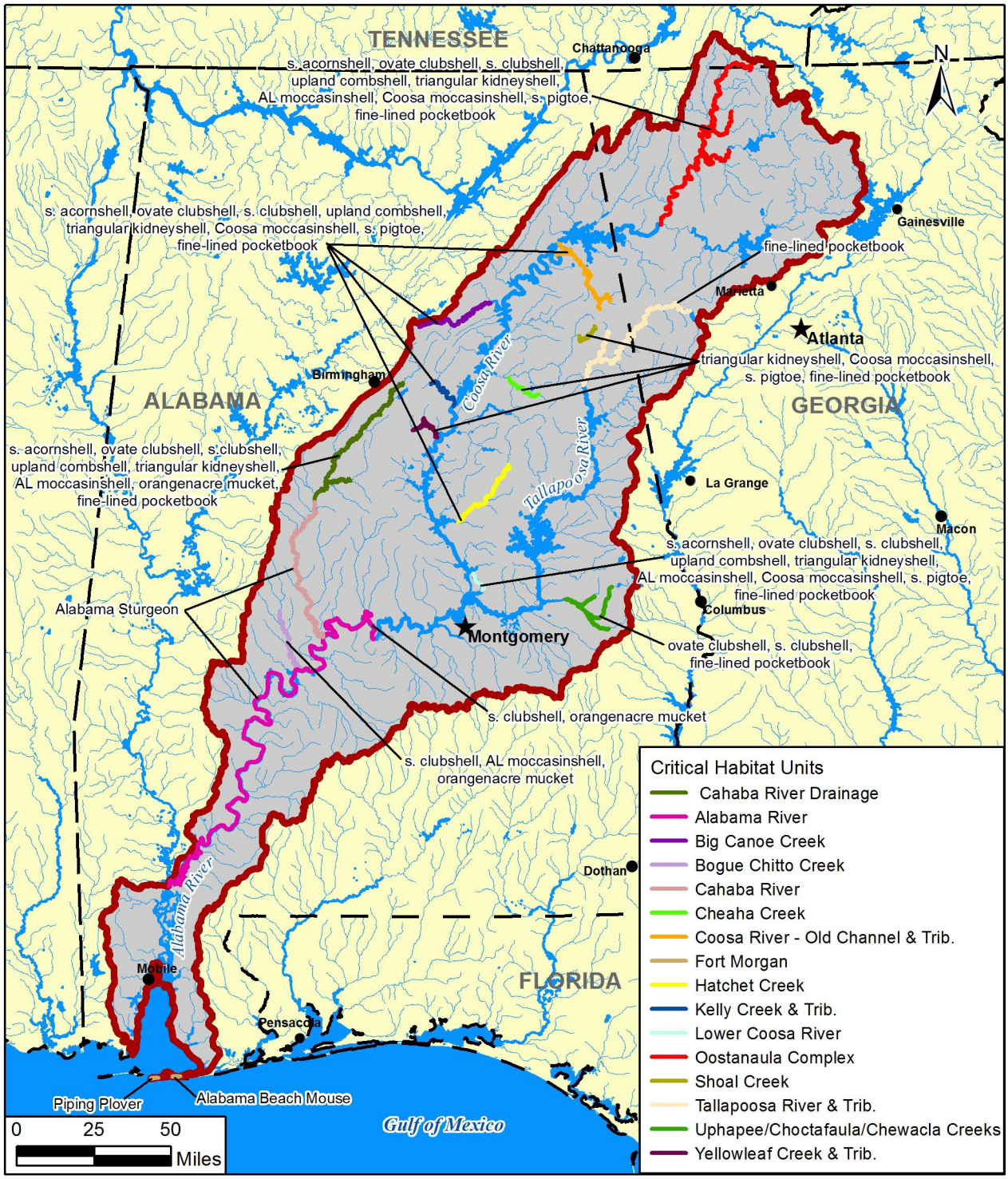
2.5.3.1.5 Oostanaula-Conasauga-Coosawattee River Subbasins

The Oostanaula River extends about 47 mi from the junction of the Conasauga and Coosawattee rivers to its confluence with the Coosa River at Rome, Georgia. As a result of habitat changes and degraded water quality, aquatic biodiversity has declined. Although no impoundments occur in the Oostanaula River mainstem, flows are affected by Carters Lake and Carters Reregulation Dam upstream on the Coosawattee River. Preliminary mussel survey data from the Oostanaula River indicate that its extant mussel community is relatively intact and healthy as compared to most of the Coosa River basin. The interrupted rocksnail (*Leptoxis formani*), previously thought to be extinct, was collected on the Oostaunuala River in the vicinity of Armuchee Creek (Williams and Hughes 1998). In 2010, Dinkins and Hughes (2011) found the species at three collection sites, including a location approximately two miles downstream of Armuchee Creek at Jones Bend. This finding represents a range extension for the species. In addition, a rare large-form of the federally endangered triangular kidneyshell has also been found in the lower reaches of the Oostanaula River. The river also supports the federally threatened blue shiner, Cherokee darter, and goldline darter, as well as the federally endangered Etowah darter, amber darter, and Conasauga logperch (USACE, Mobile District 1998a; Cook 2006).

The Conasauga River is an unregulated stream that flows for about 91 mi from southeast Tennessee and north Georgia to its junction with the Coosawattee River. Historically, about 90 fish and 44 mussel species have been reported from this drainage. Today, mussel diversity has been reduced by about 50 percent, and fish diversity has been similarly affected. Despite those declines, there are reaches of the Conasauga River that are considered high-priority research areas because they support good native aquatic species, including the holiday darter (*Etheostoma* sp. cf. *E. brevirostrum*), a possible undescribed endemic species. Striped bass and walleye populations have also been reported in the river. The Conasauga River supports the federally endangered fish species the amber darter and Conasauaga logperch, and the federally threatened blue shiner. Federally endangered mussel species include upland combshell, southern acornshell, Coosa moccasinshell (*Medionidus parvulus*), southern clubshell, southern pigtoe (*Pleurobema georgianum*), ovate clubshell, and triangular kidney shell. The federally threatened mussel species include the fine-lined pocketbook and the Alabama moccasinshell (*Medionidus acutissimus*) (USACE, Mobile District 1998a; Brooks 2000).

The regulated reach of the Coosawattee River extends about 25 mi downstream from Carters Lake and Carters Reregulation Dam to its confluence with the Conasauga River. This river supports sport fisheries for catfish, spotted bass, redeye bass, southern walleye, and striped bass. The Coosawattee River supports two federally endangered mussel species, the southern pigtoe and triangular kidneyshell.

Critical habitat has been designated for several mussel species in the subbasin, including the southern acornshell, ovate clubshell, southern clubshell, upland combshell, triangular kidneyshell, Alabama moccasinshell, Coosa moccasinshell, southern pigtoe and fine-lined pocketbook (USFWS 2004; Figure 2.5-2).



LEGEND

- ACT Basin Boundary
- Surface Water
- State Boundary
- State Capital
- City

Critical Habitat Units in the ACT Basin

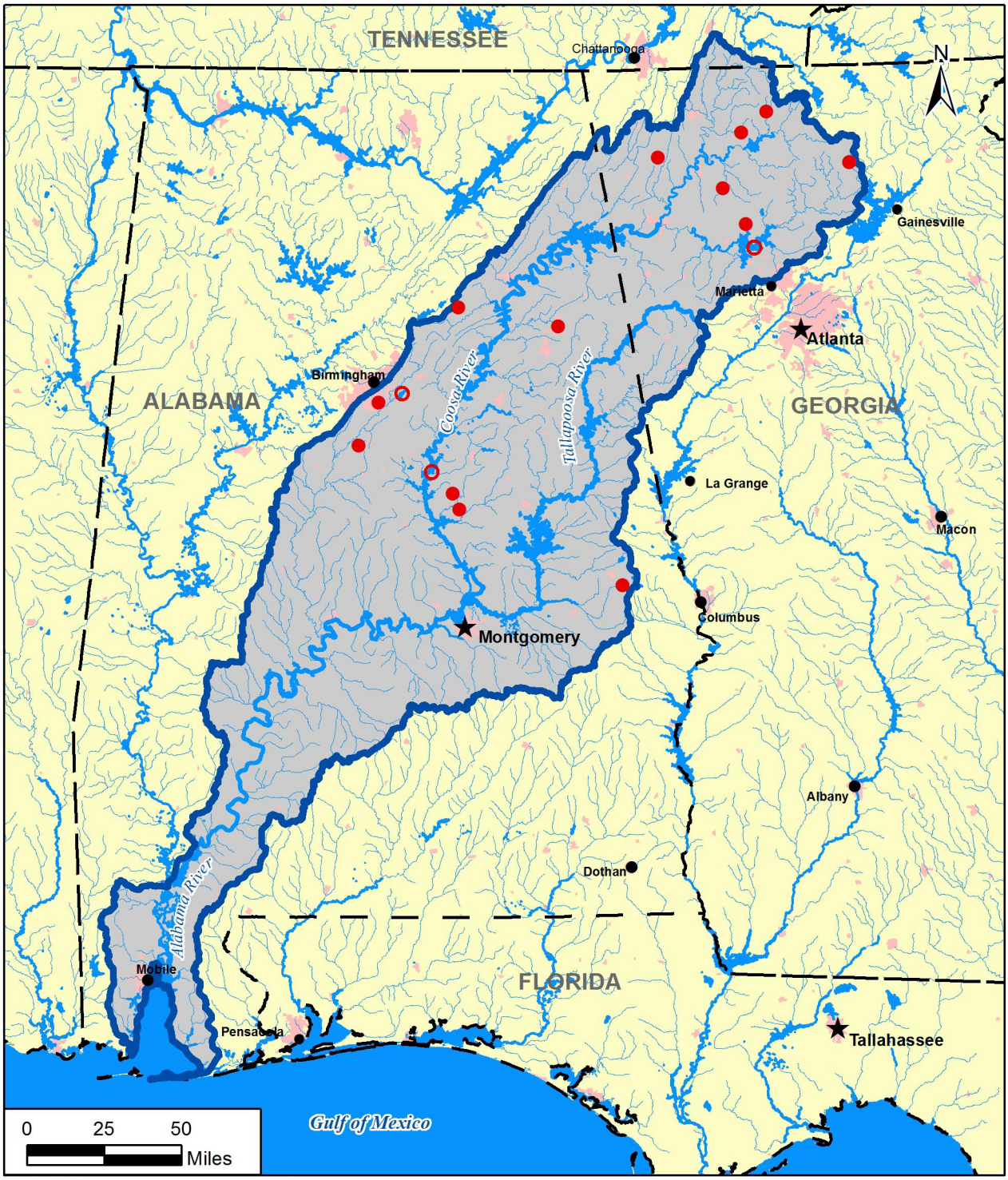
Figure 2.5-2

2.5.3.1.6 Tallapoosa River Subbasin

The Tallapoosa River, a 4,687-sq-mi watershed, originates in the Piedmont Province in west Georgia. The upper portion of the river (above R.L. Harris Lake) represents the last unimpounded and unregulated habitat in the watershed. Historic data compiled by Pierson et al. (1986) reported that 146 fish species occurred in the basin. More recent surveys suggest that diversity is considerably lower, estimating 86 species (Knight and Peyton 1996) from below the fall line and 42 species (Pierson 1999) above the fall line. Twenty species of mussels have also been documented from the river and its tributaries, including the federally threatened fine-lined pocketbook (Johnson 1997). Extant populations are mainly restricted to the upper portion of the basin (Freeman et al. 2003). Critical habitat has been designated along the upper reaches of the watershed for the fine-lined pocketbook and in tributaries of the mainstem for the ovate clubshell and southern clubshell (USFWS 2004; Figure 2.5-2). Two endemic crayfish, *Cambarus englishi* and *C. halli* (Crustacea: Decapoda: Cambaridae) are also known from the basin (Johnson 1997; Irwin et al. 1998; Freeman et al. 2003). Further, Ratcliffe and DeVries (2004) documented a total of 11 species of crayfish, including 5 species of *Cambarus*, four *Procambarus*, and a single species each of *Faxonella* (*F. clypeata*) and Orconectes (*O. holti*).

As part of the National Wadeable Streams Assessment (WSA) (USEPA 2006), 13 streams in the ACT Basin were sampled for benthic macroinvertebrates (Figure 2.5-3). That sampling produced a cumulative list of 80 families and 193 taxa, primarily at the genus level (Table 2.5-6). Of the major groups of benthic macroinvertebrates, the most diverse are the true flies (Insecta: Diptera) with 10 families and 57 genera, caddisflies (Insecta: Trichoptera) with 17 families and 28 genera, the mayflies (Insecta: Ephemeroptera) with nine families and 19 genera. Like most geographic regions of the world, the taxonomic diversity of true flies is overwhelmed by the 57 genera in a single family, the non-biting midges (Chironomidae).

The next most diverse insect orders for these sites include beetles (Coleoptera; 5 families and 13 genera); stoneflies (9 families and 12 genera); and dragonflies and damselflies (Odonata; 6 families and 10 genera). Other groups, such as snails and clams (Mollusca: Gastropoda and Bivalvia), water mites (Arachnida: Trombidiformes), and worms (Annelida: Haplotaxida, Lumbriculida), are less taxonomically diverse with 5-6 taxa but are also common at most sites. Beetles collected from these streams primarily are of the types that feed on periphytic growths on stream and river bottoms (algae and diatoms) and on decaying leaf litter and woody materials (Merritt et al. 2008). They are represented by riffle beetles (Elmidae), including nine genera; water pennies (Psephenidae: *Psephenus* and *Ectopria*), long-toed riffle beetles (Dryopidae: *Helichus*), a ptilodactylid beetle (Ptilodactylidae: *Anchytarsus*), and a weevil (Curculionidae). Caddisflies are typically recognized as a favorite prey item of insectivorous fish and are represented by 28 genera in 17 families, including web-spinning caddisflies (Hydropsychidae), building silken nets on substrate that filter suspended organic particles as foodstuff. The microcaddisflies (Hydroptilidae: *Hydroptila*) build sand cases that are carried around and used for refuge from predators. Another group of aquatic insects heavily fed on by fish are mayflies (Ephemeroptera), of which there were found four genera in three families—Ephemeridae (the burrowing mayflies), Caenidae, and Baetiscidae. There are several other families of mites, crustaceans, and mollusks (limpets [Ancylidae: *Ferrissia*], fingernail clams [Sphaeriidae], and basket clams [Corbiculidae]). Although (Table 2.5-6) is not a complete list of benthic macroinvertebrates, it can be considered an example of what is present in the streams and rivers of the ACT Basin.



WSA and NLA Samples in the ACT Basin

Figure 2.5-3

Table 2.5-6.
Cumulative list of invertebrate taxa identified from 13 streams in the ACT Basin, and that were sampled by USEPA National WSA

Class (or higher)	Order	Family	Genus	Common names	Class (or higher)	Order	Family	Genus	Common names
Nemertea	Hoplonemertea	Tetrastemmatidae	*Prostoma*	Nemerteans	Insecta	Diptera	Chironomidae	*Eukiefferiella*	Non-biting midges
Annelida	Haplotaxida	Enchytraeidae		Enchytraeids				*Gymnometriocnemus*	Non-biting midges
		Lumbricidae		Worms				*Heleniella*	Non-biting midges
		Naididae		Naidids				*Limnophyes*	Non-biting midges
		Tubificidae		Tubificids				*Lopescladius*	Non-biting midges
	Lumbriculida	Lumbriculidae		Aquatic earthworms				*Micropsectra*	Non-biting midges
Mollusca	Veneroida	Corbiculidae	*Corbicula*	Basket clams				*Microtendipes*	Non-biting midges
		Pisidiidae	*Musculium*	Fingernail clams				*Nanocladius*	Non-biting midges
			Pisidium	Peaclam				*Natarsia*	Non-biting midges
			Sphaerium	Fingernail clams				*Neostempellina*	Non-biting midges
	Basommatophora	Ancylidae	*Ferrissia*	Limpets				*Odontomesa*	Non-biting midges
		Physidae		Bladder snails				*Orthocladius*	Non-biting midges
		Planorbidae	*Menetus*	Ramhorn snails				*Pagastiella*	Non-biting midges
			Promenetus	Ramhorn snails				*Parachaetocladius*	Non-biting midges
	Neotaenioglossa	Pleuroceridae	*Elimia*	Oblong rocksnails				*Paracricotopus*	Non-biting midges
Arachnida	Trombidiformes	Hygrobatidae		Water mites				*Paralauterborniella*	Non-biting midges
		Lebertiidae		Water mites				*Parametriocnemus*	Non-biting midges
		Mideopsidae		Water mites				*Paraphaenocladius*	Non-biting midges
		Sperchontidae		Water mites				*Paratanytarsus*	Non-biting midges
		Torrenticolidae		Water mites				*Paratendipes*	Non-biting midges
		Unionicolidae		Water mites				*Phaenopsectra*	Non-biting midges
Crustacea	Isopoda	Asellidae	Lirceus	Aquatic sowbugs				*Polypedilum*	Non-biting midges

Table 2.5-6. (continued)

Class (or higher)	Order	Family	Genus	Common names	Class (or higher)	Order	Family	Genus	Common names
+	Decapoda	Cambaridae	*Orconectes*	Crayfish				*Potthastia*	Non-biting midges
	Anostraca			Anostracan				*Procladius*	Non-biting midges
Insecta	Ephemeroptera	Baetidae	*Acentrella*	Mayflies				*Pseudochironomus*	Non-biting midges
			Baetis	Mayflies				*Reomyia*	Non-biting midges
			Plauditus	Mayflies				*Rheocricotopus*	Non-biting midges
		Baetiscidae	*Baetisca*	Mayflies				*Rheosmittia*	Non-biting midges
		Caenidae	*Caenis*	Mayflies				*Rheotanytarsus*	Non-biting midges
		Ephemerellidae	*Attenella*	Mayflies				*Robackia*	Non-biting midges
			Ephemerella	Mayflies				*Stempellina*	Non-biting midges
			Eurylophella	Mayflies				*Stempellinella*	Non-biting midges
			Serratella	Mayflies				*Stenochironomus*	Non-biting midges
		Ephemeridae	*Ephemera*	Burrowing mayflies				*Stictochironomus*	Non-biting midges
			Hexagenia	Burrowing mayflies				*Sublettea*	Non-biting midges
		Heptageniidae	*Epeorus*	Flatheaded mayflies				*Tanytarsus*	Non-biting midges
			Heptageniidae	Flatheaded mayflies				*Thienemanniella*	Non-biting midges
			Leucrocuta	Flatheaded mayflies				*Thienemannimyia*	Non-biting midges
			Stenacron	Flatheaded mayflies				*Tribelos*	Non-biting midges
			Stenonema	Flatheaded mayflies				*Tvetenia*	Non-biting midges
		Isonychiidae	*Isonychia*	Slate drakes				*Tvetenia*	Nnon-biting midges
		Leptohyphidae	*Tricorythodes*	Mayflies				*Xylotopus*	Non-biting midges
		Leptophlebiidae		Prong-gilled mayflies				*Zavrelimyia*	Non-biting midges
	Odonata	Aeshnidae	*Boyeria*	Fawn darner				*Zavrelimyia*	Non-biting midges
		Calopterygidae	*Calopteryx*	Damselfly			Dixidae	*Dixa*	Dixid midges
		Coenagrionidae	*Argia*	Narrow-winged damselflies				*Dixella*	Dixid midges
		Cordulegastridae	*Cordulegaster*	Spiketails			Empididae	*Chelifera*	Dance flies

Table 2.5-6. (continued)

Class (or higher)	Order	Family	Genus	Common names	Class (or higher)	Order	Family	Genus	Common names
		Corduliidae	*Somatochlora*	Emerald dragonflies				*Empididae*	Dance flies
		Gomphidae	*Gomphus*	Clubtails				*Hemerodromia*	Dance flies
			Hagenius	Black clubtail dragonfly				*Neoplasta*	Dance flies
			Ophiogomphus	Snaketail dragonflies			Ephydridae		Shore flies
			Stylogomphus	Clubtails			Psychodidae	*Pericoma*	Drain flies
			Stylurus	Clubtails				*Telmatoscopus*	Drain flies
	Plecoptera	Capniidae		Small winter stoneflies				*Psychoda*	Drain flies
		Chloroperlidae		Green stoneflies			Simuliidae	*Simulium*	Black flies
		Leuctridae	*Leuctra*	Roll-winged stoneflies			Stratiomyidae	*Myxosargus*	Soldier flies
			Paraleuctra	Roll-winged stoneflies			Tabanidae	*Chrysops*	Deer flies
		Nemouridae	*Amphinemura*	Spring stoneflies			Tipulidae	*Antocha*	Crane flies
		Peltoperlidae	*Tallaperla*	Roachfly stoneflies				*Dicranota*	Crane flies
		Perlidae	*Acroneuria*	Common stoneflies				*Hexatoma*	Crane flies
			Agnetina	Common stoneflies				*Limnophila*	Crane flies
		Perlodidae	*Isogenoides*	Patterned stoneflies				*Pilaria*	Crane flies
			Yugus	Patterned stoneflies				*Pseudolimnophila*	Crane flies
		Pteronarcyidae	*Pteronarcys*	Giant stoneflies				*Tipula*	Crane flies
		Taeniopterygidae	*Taeniopteryx*	Winter Stoneflies		Lepidoptera	Nepticulidae		Aquatic moth
	Coleoptera	Curculionidae		Weevils		Megaloptera	Corydalidae	*Corydalus*	Hellgrammites
		Dryopidae	*Helichus*	Lont-toed Water beetles				*Nigronia*	Fishflies
		Elmidae	*Ancyronyx*	Riffle beetles			Sialidae	*Sialis*	Alderflies
			Dubiraphia	Riffle beetles		Trichoptera	Brachycentridae	*Micrasema*	Humpless case-makeris
			Elmidae	Riffle beetles			Calamoceratidae	*Anisocentropus*	Comb-lipped case-maker
			Macronychus	Riffle beetles				*Heteroplectron*	Comb-lipped case-maker
			Microcylloepus	Riffle beetles			Dipseudopsidae	*Phylocentropus*	Caddisflies
			Optioservus	Riffle beetles			Glossosomatidae	*Glossosoma*	Northern case-maker caddis

Table 2.5-6. (continued)

Class (or higher)	Order	Family	Genus	Common names	Class (or higher)	Order	Family	Genus	Common names
			Oulimnius	Riffle beetles			Goeridae	*Goera*	Goerid caddisflies
			Promoresia	Riffle beetles			Helicopsychidae	*Helicopsyche*	Snail case caddisflies
			Stenelmis	Riffle beetles			Hydropsychidae	*Ceratopsyche*	Web-spinning caddisflies
		Psephenidae	*Ectopria*	Water penny beetles				*Cheumatopsyche*	Web-spinning caddisflies
			Psephenus	Water penny beetles				*Diplectrona*	Web-spinning caddisflies
		Ptilodactylidae	*Anchytarsus*	Ptilodactylids				*Hydropsyche*	Web-spinning caddisflies
	Diptera	Ceratopogonidae	*Atrichopogon*	Biting midges			Hydroptilidae	*Hydroptila*	Microcaddis flies
			Bezzia/ Palpomyia	Biting midges			Lepidostomatidae	*Lepidostoma*	Bizarre caddisflies
			Culicoides	Biting midges			Leptoceridae	*Mystacides*	Long-horned caddisflies
			Dasyhelea	Biting midges				*Nectopsyche*	Long-horned caddisflies
			Probezzia	Biting midges				*Oecetis*	Long-horned caddisflies
		Chironomidae	*Ablabesmyia*	Non-biting midges				*Triaenodes*	Long-horned caddisflies
			Acricotopus	Non-biting midges			Molannidae	*Molanna*	Hood case-maker caddis
			Chironomus	Non-biting midges			Odontoceridae	*Psilotreta*	Strong case-maker caddis
			Cladopelma	Non-biting midges			Philopotamidae	*Chimarra*	Fingernet caddisflies
			Cladotanytarsus	Non-biting midges				*Dolophilodes*	Fingernet caddisflies
			Clinotanypus	Non-biting midges				*Wormaldia*	Fingernet caddisflies
			Conchapelopia	Non-biting midges			Polycentropodidae	*Cernotina*	Tube maker caddisflies
			Corynoneura	Non-biting midges				*Polycentropus*	Tube maker caddisflies
			Cricotopus	Non-biting midges			Psychomyiidae	*Lype*	Trumpet-net caddisflies
			Cryptochironomus	Non-biting midges				*Psychomyia*	Trumpet-net caddisflies
			Cryptotendipes	Non-biting midges			Rhyacophilidae	*Rhyacophila*	Green sedges
			Dicrotendipes	Non-biting midges			Uenoidae	*Neophylax*	Ueonid caddis
			Djalmabatista	Non-biting midges					

Source: USEPA 2006

2.5.3.2 Reservoirs

The ACT Basin contains more than 170,000 surface ac of reservoir habitat. These reservoirs offer excellent opportunities for public recreation because of the significant populations of striped and white bass, largemouth and spotted bass, sunfish or bream, crappie, and catfish (channel, blue, and flathead).

2.5.3.2.1 Alabama River Subbasin

The Robert F. Henry Lock and Dam impounds the Alabama River at RM 245 to create R.E. "Bob" Woodruff Lake. This lake extends 81 mi upstream and covers approximately 13,500ac at normal pool elevation (126 ft). The Millers Ferry Lock and Dam impound the river at RM 142 to create William "Bill" Dannelly Lake. The lake extends 103 mi upstream to the Robert F. Henry Lock and Dam and covers approximately 18,528 ac at normal pool elevation (80.8 ft). Claiborne Lock and Dam impound the river at RM 82 to create Claiborne Lake. That lake extends 60 mi upstream to Millers Ferry Lock and Dam and covers 6,290 ac at the maximum operating pool elevation (36 ft). The reservoirs support common species of game fish found in the subbasin and commercial fisheries for catfish, freshwater drum, and smallmouth buffalo (*Ictiobus bubalus*). The area also contains paddlefish, southeastern blue sucker and Alabama sturgeon (USACE, Mobile District 1998a; ADCNR 2008b).

In 2009 the Mobile District, The Nature Conservancy, and other partners agreed to and began implementation of a schedule of lock operations for the purpose of facilitating fish passage at Claiborne Lock and Dam and Millers Ferry Lock and Dam. From February through May, locks are allowed to remain open for a period of 4 to 6 hours to provide both upstream and downstream passage. Efforts are made to maintain consistency in the timing of the lock operations; however, hydrologic conditions, particularly flows at flood stage, and staff availability occasionally require some deviation from the preferred schedule. Monitoring of these operations is part of an ongoing collaborative study between the USACE, The Nature Conservancy, USFWS, ADCNR, Auburn University, and the Geological Survey of Alabama, to document the effectiveness of the fish lockages.

2.5.3.2.2 Cahaba River Subbasin

There is no reservoir habitat on the mainstem of the Cahaba River (USACE, Mobile District 1998a).

2.5.3.2.3 Coosa River Subbasin

As previously mentioned, the six mainstream reservoirs impound approximately 238 mi of the Coosa River and cover approximately 81,300 ac. These areas support the same sport and commercial fisheries as the impoundments in the Alabama River Basin. Redeye bass also occur in these reservoirs but are generally restricted to the head of lakes that receive tailwater discharges. Weiss Lake is well known for a crappie fishery that draws anglers from in-state and out-of-state to fish the waters (USACE, Mobile District 1998a; ADCNR 2008d).

2.5.3.2.4 Etowah River Subbasin

Allatoona Dam impounds approximately 30 mi of the Etowah River and creates approximately 11,862 ac of reservoir habitat. The reservoir supports the common sport fish species mentioned throughout this section, as well as walleye, and redeye bass (USACE, Mobile District 1998a).

2.5.3.2.5 Oostanaula-Conasauga-Coosawattee River Subbasins

Carters Dam and Carters Reregulation Dam impound approximately 13 mi of the Coosawatee River subbasin, creating 3,275 ac of reservoir habitat. This reservoir supports the common sport fish species discussed in this section, and it is the only development in this subbasin (USACE, Mobile District 1998a).

2.5.3.2.6 Tallapoosa River Subbasin

The four reservoirs (R.L. Harris Lake, Lake Martin, Yates Lake, and Thurlow Lake) in this subbasin impound 71 mi of the river to create approximately 53,225 ac of reservoir habitat. R.L. Harris Lake contains an abundance of Alabama spotted bass and largemouth bass. Lake Martin is known for producing great Alabama spotted bass fishing during the winter. Lake Martin spills immediately into two smaller lakes, Yates and Thurlow. Fisheries at the two lakes are dictated by the flow from Lake Martin. Rising or steady water levels can produce good fishing for striped bass, Alabama spotted bass, white bass, and various sunfish species (USACE, Mobile District 1998a).

As part of USEPA's National Lakes Assessment, three lakes in the ACT Basin were sampled for phytoplankton and zooplankton (USEPA 2009b) (Figure 2.5-3). Table 2.5-7 lists taxa identified from the plankton samples, including 23 species of zooplankton from 14 families, and nine species of planktonic diatoms. Although this is not a complete list of plankton, it shows some of the taxa that can be expected to be found in lakes and reservoirs of the ACT Basin, and they represent taxonomic components of primary producers and consumers.

Table 2.5-7.
ACT Basin plankton

Family	Genus/species	Family	Genus/species
Zooplankton		**Zooplankton**	
Asplanchnidae	*Asplanchna*	Synchaetidae	*Polyarthra*
Brachionidae	*Anuraeopsis fissa*		*Synchaeta*
	Brachionus angularis	Testudinellidae	*Pompholyx sulcata*
	Brachionus caudatus	Trichocercidae	*Trichocerca*
	Brachionus havanaensis	Filiniidae	*Filinia*
	Kellicottia bostoniensis	Sididae	*Diaphanosoma*
	Kellicottia longispina	**Planktonic diatoms**	
	Keratella cochlearis	Achnanthidiaceae	*Achnanthidium minutissumum*
	Keratella crassa	Anomoeoneidaceae	*Anomoeoneis brachysira*
Chaoboridae	*Chaoborus punctipennis*	Bacillariaceae	*Nitzschia* sp.
Collothecidae	*Collotheca*	Brachysiraceae	*Brachysira vitrea*
Conochilidae		Catenulaceae	*Amphora ovalis*
Cyclopidae	*Mesocyclops*	Fragilariaceae	*Fragilaria crotonensis*
Daphniidae	*Daphnia lumholtzi*		*Synedra delicatissima*
Diaptomidae		Stephanodiscaceae	*Cyclotella comensis*
Euchlanidae	*Euchlanis*	Thalassiosiraceae	*Discostella stelligera*
Synchaetidae	*Ploesoma*		

Note: List of zooplankton (21 taxa) and planktonic diatoms (9 taxa) collected as part of USEPA's National Lakes Assessment (USEPA 2009b) in the ACT Basin. The zooplankton list is a cumulative master taxa list from three samples collected from Lake Purdy and Lay Lake in Jefferson and St. Clair counties, respectively, in Alabama, and Allatoona Lake in Cherokee County, Georgia. The list of planktonic diatoms is from a single sample taken in Allatoona Lake.

2.5.3.3 Estuarine

Estuaries are semi-enclosed coastal waterbodies with a free connection to the ocean and one or more influent rivers or streams. As a result, they contain both freshwater and marine features but generally have a range of salinities. These unique and highly productive ecosystems include various habitat types, including marine waters, brackish bays and marshes, submerged aquatic vegetation beds, and inland rivers and swamps. The formation, maintenance, and productivity of these habitats depends on the flow of freshwater and sediment delivery from the rivers and on the regular flushing of the marine system. Because of their habitat diversity and great productivity, estuaries provide spawning, nursery, and feeding grounds for many estuary-dependent invertebrate and fish species and the food webs that depend on them. Unfortunately, because of their productivity and hydrology, estuaries provide great opportunities for human development, and of the 32 largest cities in the world, 22 are on estuaries (Ross 1995). As a result, these systems are often affected by various stressors generated locally and remotely.

The Mobile Bay estuary is the fourth largest estuary in North America and was recognized as an estuary of national significance in 1995, which established the National Estuary Program in Mobile Bay (ADEM 2006; USACE, Mobile District 2007). The estuary drains 44,600 sq mi including 65 percent of Alabama and portions of Georgia, Mississippi, and Tennessee. The area is 409 sq mi, has 162 mi of shoreline, has an average depth of 10 ft, and a tidal amplitude of 1.3 ft (range: 0.1-2.6 ft) (Wallace 1996; ADEM 2006). The estuary receives 460,000 gallons per second of freshwater (range: 60,000 to 3.7 million gallons per second) primarily from the Mobile, Tensaw, Apalachee and Blakely rivers but also the Dog, Deer, Fowl, and Fish rivers. This volume represents 20 percent of the total freshwater inflows in the continental US (Wallace 1996; Valentine and Sklenar 2006). The bay also receives 4.85 million metric tons of sediment annually, of which 33 percent stays on the delta, 52 percent stays in the bay, and 15 percent moves through to the Gulf. The bay consists of 6,224 ac of tidal marsh, 3,261 ac of bayous and rivers, 11,110 ac of connected bays, and 248,343 ac of open water (USACE, Mobile District 2007).

The Mobile-Tensaw Delta is the largest intact delta in the United States, has been designated an Alabama Geographic Area of Particular Concern, and is on the National Register of Natural Landmarks (USEPA 2006). It consists of 289 sq mi of marsh, swamp, and forested wetlands including 69,348 ac of swamp, 10,450 ac of fresh/missed salinity marsh, and 20,323 ac of open water (USACE, Mobile District 2007).

Nearly 20 percent of the Mobile Basin is wetland; the rest is forest (49 percent), agriculture (15 percent), and urban land cover (7 percent) (USEPA 2006). Wetland loss has been extensive, with nearly 50 percent of Alabama's wetlands lost between 1780 and 1980 (USEPA 2006). Similarly, submerged aquatic vegetation loss in the bay has been extensive, with a 55 percent cover decline in Mobile County and an 88 percent decline in Baldwin County (USEPA 2006).

Mobile Bay is an important ecosystem to both resident and migratory organisms. It contains 49 mammal species, 126 reptile/amphibian species, 337 freshwater and saltwater fishes, 355 bird species, more than 800 invertebrate animal species, 250 species of phytoplankton, 245 species of benthic algae, and 33 species of submerged aquatic vegetation (Mobile Bay NEP 2002; USEPA 2006; USACE, Mobile District 2007).

Many commercial fish species are found in the estuary. Various shrimp species, including brown shrimp (*Penaeus aztecus*), white shrimp (*P. setiferus*), and pink shrimp (*P. duorarum*); blue crab (*Callinectes sapidus*); oysters *(Crassostrea virginica*); and various finfish, such as flounder, croaker, mullet, and menhaden (Table 2.5-8) form the nucleus of the Mobile Bay commercial fishery valued at approximately $300 million per year in 1999 (Chang and Canode 1999) and more recently $450 million per year (Weeks Bay Reserve Website 2009). The Mobile Bay estuary is considered one of the most important habitats for these species in North America.

Table 2.5-8.
A partial list of common fish and invertebrate (invert) species found along the Mobile Bay estuary region, with known predominant habitat types or zones

Common name	Scientific name	Type	habitat type or zone						
			Muddy/sandy	Oyster reefs	Offshore	Rock jetties	Salt marsh	Seagrass beds	Surf zones
Sergeant majors	*Abudefduf saxatilis*	Fish				x			
Lined sole	*Achirus lineatus*	Fish	x						
Striped anchovy	*Anchoa hepsetus*	Fish			x				x
Dusky anchovy	*Anchoa lyolepis*	Fish			x				x
Bay anchovy	*Anchoa mitchilli*	Fish	x		x			x	x
Sheepshead	*Archosargus probatocephalus*	Fish	x	x		x			
Hardhead catfish	*Arius felis*	Fish	x		x				
Gafftopsail catfish	*Bagre marinus*	Fish			x				
Silver perch	*Bairdiella chrysoura*	Fish	x					x	
Gulf menhaden	*Brevoortia patronus*	Fish	x		x				x
Blue runner (hardtail)	*Caranx crysos*	Fish			x				
Rock sea bass	*Centropristis philadelphica*	Fish			x				
Spadefish	*Chaetodipterus faber*	Fish		x		x			
Striped blenny	*Chasmodes bosquinanus*	Fish		x			x		
Striped burrfish	*Chilomycterus schoepfi*	Fish	x					x	
Atlantic bumper	*Chloroscombrus chrysurus*	Fish			x				
Bay whiff	*Citharichthys spilopterus*	Fish	x		x				
Sand seatrout	*Cynoscion arenarius*	Fish	x		x				
Spotted seatrout	*Cynoscion nebulosus*	Fish	x					x	
Silver seatrout	*Cynoscion nothus*	Fish			x				
sheepshead minnow	*Cyprinidon variegatus*	Fish	x				x		
Atlantic stingray	*Dasyatis sabina*	Fish	x						x
Dwarf sand perch	*Diplectrum bivittatum*	Fish			x				
Spottail pinfish	*Diplodus holbrooki*	Fish				x			
Threadfin shad	*Dorosoma petenense*	Fish	x						
Fringed flounder	*Etropus crossotus*	Fish	x		x				
Silver jenny	*Eucinostomus gula*	Fish						x	
gulf killifish	*Fundulus grandis*	Fish	x						
longnose killifish	*Fundulus similis*	Fish	x						
killifish	*Fundulus spp.*	Fish					x		
darter goby	*Gobionellus boleosoma*	Fish		x			x		
naked goby	*Gobiosoma bosc*	Fish		x			x		
code goby	*Gobiosoma robustum*	Fish		x			x		
skilletfish	*Gobiosox strunosus*	Fish		x					
slippery richard	*Halichoeres bivittotus*	Fish							

Table 2.5-8. (continued)

Common name	Scientific name	Type	habitat type or zone						
			Muddy/sandy	Oyster reefs	Offshore	Rock jetties	Salt marsh	Seagrass beds	Surf zones
scaled sardine	*Harengula jaguana*	Fish	x		x				x
seahorse	*Hippocampus* spp.	Fish						x	
blennies	*Hypleurochilus* spp.	Fish				x			
pinfish	*Lagodon rhomboides*	Fish	x	x	x	x	x	x	
spot	*Leiostomus xanthurus*	Fish			x		x	x	x
blackedged cusk-eel	*Lepophidium brevibarbe*	Fish			x				
grey snapper	*Lutjanus griseus*	Fish				x			
inland silverside	*Menidia beryllina*	Fish	x					x	x
silversides	*Menidia* spp.	Fish					x		
southern kingfish	*Menticirrhus americanus*	Fish	x		x			x	x
Gulf kingfish	*Menticirrhus saxatilis*	Fish							x
Atlantic croaker	*Micropogonias undulatus*	Fish	x		x			x	
planehead filefish (juv.)	*Monochanthus hispidus*	Fish	x		x				
striped mullet	*Mugil cephalus*	Fish	x					x	x
white mullet	*Mugil curema*	Fish	x					x	x
mullet	*Mugil spp*	Fish				x	x		
leatherjacket	*Oligoplites saurus*	Fish	x						
shrimp eel	*Ophichthus gomesi*	Fish			x				
Gulf toadfish	*Opsanus beta*	Fish		x				x	
Pigfish	*Orthopristis chrysoptera*	Fish	x					x	
Southern flounder	*Paralichthys lethostigma*	Fish	x		x				
Harvestfish	*Peprilus alepidotus*	Fish	x		x				
Gulf butterfish	*Peprilus burti*	Fish	x		x				
Sailfin molly	*Poecilia latipinna*	Fish	x				x		
Cocoa damsels	*Pomacentrus variabolus*	Fish				x			
Bigeye searobin	*Prinotus longispinosus*	Fish			x				
Bigheaded searobin	*Prinotus tribulus*	Fish		x	x			x	
Inshore lizardfish	*Saurida brasiliensis*	Fish			x				
Spanish mackerel (juv.)	*Scomberomorus maculatus*	Fish	x						
Atlantic moonfish	*Selene setapinnis*	Fish			x				
Lookdown (juvenile)	*Selene vomer*	Fish	x		x				
Belted sandfish	*Serranus subligarius*	Fish				x			
Least puffer	*Sphoeroides parvus*	Fish			x			x	
Northern sennet (juv.)	*Sphyraena borealis*	Fish	x						
Longspined porgy	*Stenotomus caprinus*	Fish			x				
Atlantic needlefish	*Strongylura marina*	Fish	x						
Shoal flounder	*Syacium gunteri*	Fish			x				

Table 2.5-8. (continued)

Common name	Scientific name	Type	habitat type or zone						
			Muddy/sandy	Oyster reefs	Offshore	Rock jetties	Salt marsh	Seagrass beds	Surf zones
Offshore tonguefish	*Symphurus civitatus*	Fish	x		x				
Blackcheek tonguefish	*Symphurus plagiusa*	Fish	x		x				
Pipefish	*Syngnathus* spp.	Fish						x	
Inshore lizard fish	*Synodus foetens*	Fish	x					x	
Offshore lizardfish	*Synodus fotens*	Fish			x				
Florida pompano (juv.)	*Trachinotus carolinus*	Fish							x
Permit (juv.)	*Trachinotus falcatus*	Fish							x
Atlantic cutlass fish	*Trichiurus lepturus*	Fish	x						
Hogchoker	*Trinectes maculatus*	Fish	x						
Snapping shrimp	*Alpheus heterochaelis*	Invert		x			x		
Sea hares	*Aplysia brasiliana*	Invert				x			
Black urchin	*Arbacia punctulata*	Invert				x			
Hard corals	*Astrangia* spp.	Invert				x			
Spiny-beaded sea star	*Astropecten duplicatus*	Invert			x				
Pen shells	*Atrina* spp.	Invert						x	
Barnacles	*Balanus spp*	Invert				x			
Knobbed welk	*Busycon carica*	Invert							x
Lightning welk	*Busycon contarium*	Invert							x
Box crab	*Calappa* spp.	Invert			x				
Ghost shrimp	*Callianassa biformis*	Invert	x						
Blue crab	*Callinectes sapidus*	Invert	x	x	x	x	x	x	x
Lesser blue crab	*Callinectes similis*	Invert			x				
Acorn barnacles	*Chthamalus* spp.	Invert				x			
Striped hermit crab	*Clibanarius vittatus*	Invert	x	x		x	x	x	
Oysters	*Crassostrea virginica*	Invert		x			x		
Giant Atlantic cockle	*Dinocardium robustum*	Invert						x	x
Coquina clam	*Donax variabilis*	Invert							x
Common mole crab	*Emerita talpoida*	Invert							x
Flat-backed mud crab	*Eurypanopeus depressus*	Invert		x			x		
Brown shrimp*	*Farfantepenaeus aztecus*	Invert	x		x			x	
Ribbed mussel	*Geukensia demissa*	Invert					x		
Square-eyed mole crab	*Lepidopa websteri*	Invert							x
Sea whips	*Leptogorgia* spp.	Invert				x			
Spider crab	*Libinia dubia*	Invert			x				
Horseshoe crab	*Limulus polyphemus*	Invert	x						
White shrimp*	*Litopenaeus setiferus*	Invert	x		x			x	
Marsh periwinkle	*Littoraria irrorata*	Invert					x		

Table 2.5-8. (continued)

Common name	Scientific name	Type	habitat type or zone						
			Muddy/sandy	Oyster reefs	Offshore	Rock jetties	Salt marsh	Seagrass beds	Surf zones
Longfined squid	*Loligo pealeii*	Invert			x				
Slender inshore squid	*Loligo plei*	Invert			x				
Brief squid	*Lolliguncula brevis*	Invert	x						
Grey sea star	*Luidia clathrata*	Invert	x		x				
Sand dollar	*Mellita quinquiesperforata*	Invert							x
Stone crab	*Menippe adinia*	Invert		x		x	x		
Quahog (hard clam)	*Mercenaria mercenaria*	Invert						x	
Spider crabs	*Mithrax* spp.	Invert				x			
Mud snail	*Nassarius vibex*	Invert					x		
Olive nerite	*Neritina virginea*	Invert					x		
Hard corals	*Oculina diffusa*	Invert				x			
Lady crab	*Ovalipes ocellatus*	Invert							x
Long-wristed herm. crab	*Pagurus longicarpus*	Invert	x					x	x
Flat-clawed hermit crab	*Pagurus pollicaris*	Invert			x				
Hermit crabs	*Pagurus* spp.	Invert				x			
Grass shrimp	*Palaemonetes* spp.	Invert	x	x			x	x	
Atlantic mud crab	*Panopeus herbstii*	Invert		x			x		
White shrimp*	*Penaeus setiferus*	Invert					x		
Purse crab	*Persephona mediterranea*	Invert			x				
Sponges	Porifera	Invert				x			
Rock shrimp	*Sicyonia dorsalis*	Invert			x				
Mantis shrimp	*Squilla empusa*	Invert	x						
Oyster drill	*Stramonita haemastoma*	Invert	x			x	x		
Arrow shrimp	*Tozeuma carolinense*	Invert						x	
Leanback shrimp	*Trachypenaeus similis*	Invert			x				
Fiddler crabs	*Uca* spp.	Invert					x		

Source: Heck and Spitzer 2009

Oyster reefs can be affected by drought conditions, infestation by the oyster drill (*Thais haemastoma*), water quality, and poor reproductive success. Natural oyster reefs occur primarily in the lower reaches of the estuary, and the most extensive reefs are around the Dauphin Island Bridge at Cedar Point. In addition to high economic value (see above), oyster reefs of the Mobile Bay Estuary also have high ecological value. Oysters are important food for numerous fish and aquatic invertebrates that are components of the estuarine food chain, including the Gulf stone crab (*Menippe adina*), black drum (*Pogonia cromis*), red drum (*Sciaenovs ocellatus*), and spotted seatrout (*Cynoscion nebulosus*). The Alabama Department of Conservation and Natural Resources-Marine Resources Division (ADCNR-MRD) monitors marine commercial resources and has not found an appreciable decline in any of the commercial fishery species (shrimp, oysters, or fish) and predicted no decreases (ADEM 2008c), although better fishery status data is

a recommended focus of current National Estuarine Program efforts (Mobile Bay NEP 2002). The ADCNR-MRD actually noted level production or even increases in oyster reef coverage and shrimp and blue crab harvests through 2006 (ADEM 2008c). Nevertheless, a combination of extended drought in the mid-2000s, several severe hurricanes, the proliferation of the more saltwater-tolerant oyster drills, and other stressors led to a precipitous drop in the oyster fishery in 2008 to 73,000 bushels from more than 1,000,000 bushels in 2005. Alabama Marine Resources Division recently (early 2010) spent $1.65 million to relocate 6 million pounds of oysters to the lower Mobile Bay to stimulate the local oyster fishery. Also, several oyster regions within Mobile Bay have been affected by contamination from toxics and sewage. Potential stressors on the estuarine ecosystem have increased because of the Deepwater Horizon oil spill, which began with the well blowout on April 20, 2010, and continued to the well's static kill on August 4. In that period, an estimated 4.9 million barrels of oil were released; to date, it is unclear what the short- and long-term effects on the Gulf of Mexico ecosystem will be. Further, there is uncertainty as to whether and how much oil or oil dispersant or both might have entered the Mobile Bay system.

The commercial species, however, are only one part of a much larger food web that exists in the estuary. Benthic invertebrates are an important link between primary production and decomposers and higher trophic levels in Mobile Bay. Nematodes, copepods, polychaetes, and turbellarians are the most abundant group of meiofauna (< 0.2 in) in the bay. Annelids, primarily polychaetes, and mollusks (gastrods and bivalves) dominate the macrofauna (> 0.2 in) in diversity and abundance, representing 147 species and representing 70 percent of the individual organisms collected from benthic soft substrate in the estuary (Valentine and Sklenar 2006). Other common macrofauna include crustaceans, mollusks, echinoderms, and amphipods.

Approximately 337 freshwater and saltwater fish species have been documented across the Mobile Bay estuary (Mobile Bay NEP 2002; USEPA 2006). Common sport fish found in the estuary include spotted trout (*Cynoscion nebulosus*), red drum, bluefish (*Pomatomus saltatrix*), jack crevalle (*Carynx hippos*), king and Spanish mackerel (*Scomberomorus cavalla* and *S. maculates*), sand/white seatrout (*Cynoscion arenarius*), and southern flounder (*Paralighthys lethostigma*) (Table 2.5-9). The upper reaches of Mobile Bay and the Mobile-Tensaw River Delta also support a significant freshwater sportfishery, which includes largemouth bass, bluegill, redear sunfish, warmouth (*Lepomis gulosus*), and black and white crappie (*Pomoxis nigromaculatus* and *P. annularis*).

The threatened fish species of note in the bay region are the threatened Gulf sturgeon and endangered Alabama sturgeon. Gulf sturgeon are identified as occurring in Baldwin and Mobile counties, Alabama, but the final 2003 critical habitat rule for the Gulf sturgeon includes adjacent catchments and areas adjacent to the Mississippi Sound but not areas in the Mobile Bay estuary per se (*Federal Register* Vol. 68 [53]: 13369–13418). The Alabama sturgeon is similarly noted in adjacent catchments (principally upstream of the Alabama River), but the 2009 critical habitat final rule does not include areas in the Mobile Bay estuary (*Federal Register* Vol. 74 [104]: 26487–26510) (USFWS 2009c).

As mandated by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), the Gulf of Mexico Fishery Management Council (GMFMC) prepared a draft amendment to its Fishery Management Plans (FMPs) in June 1998 designating essential fish habitat (EFH) for 21 of the more than 60 species managed by the GMFMC. EFH refers to the waters and substrate necessary to support a sustainable fishery, including habitat for spawning, breeding, feeding, or growth to maturity. GMFMC is delineating EFH for the most important commercial and recreational species in the Gulf of Mexico, including areas in which a species is common, abundant, or highly abundant, based on catch per unit effort data. Additional designations will be included in subsequent FMP amendments as more data are gathered on the remaining species.

Table 2.5-9.
Fish game species commonly found in the Mobile Bay estuarine region

	Common name	Scientific name
Inshore species	White seatrout	*Cynoscion arenarius*
	Spotted seatrout	*Cynoscion nebulosus*
	Atlantic croaker	*Micropogonias undulatus*
	Spot	*Leiostomus xanthurus*
	Black drum	*Pogonias cromis*
	Red drum*	*Sciaenops ocellatus*
	Southern flounder	*Paralichthys lethostigma*
	Sheepshead	*Archosargus probatocephalus*
	Hardhead catfish	*Arius felis*
Offshore species	Cobia*	*Rachycentron canadum*
	Spanish mackerel*	*Scomberomorus maculatus*
	Red snapper*	*Lutjanus campechanus*
	Dolphinfish*	*Coryphaena hippurus*
	Gag grouper*	*Mycteroperca microlepis*
	Blue runner (hardtail)	*Caranx crysos*
	Black tip shark	*Carcharhinus limbatus*
	Spinner shark	*Carcharhinus brevipinna*
	Tripletail	*Lobotes surinamensis*

Source: GMFMC 2009; Heck and Spitzer 2009
Note *: Focus of Gulf of Mexico Fishery Management Council, Fishery Management Plan

The draft FMP amendment delineates Mobile Bay up to the limit of permanent freshwater as EFH for red drum, gray snapper (*Lutjanus griseus*), brown shrimp, pink shrimp, white shrimp, Gulf stone crab, and Spanish mackerel. Food, salinity, temperature, and/or refuge areas are the primary factors in determining the distribution and abundance of these species in the estuary. In addition, the shrimp and other estuarine-dependent species provide prey for nearshore juvenile stages of a snapper-grouper complex of at least nine species, which is also managed under MSFCMA.

Fish tissue contaminant data collected as part of the National Coastal Assessment indicates several contaminants of concern in Mobile Bay. Arsenic (26–43 percent of fishes), cadmium (38–61 percent), mercury (16–46 percent), and selenium (3–43 percent) were the most common metals or metalloids detected in fish tissue (ADEM 2006). Mercury concentrations were highest in largemouth bass and bluegill collected from the delta. Cadmium was also detected in the lower bay, mostly in penaeid shrimp. In addition, DDT and PCB congeners were the most common organic contaminants, mostly in the delta region. PCBs were detected above minimum detectable limits in hardhead catfish (*Arius felis*), channel catfish (*Ictalurus punctatus*), bluegill, largemouth bass, and striped mullet (*Mugil cephalus*). Overall, however, only 2 percent of the stations exceeded the guidance range, and 14 percent fell within the guidance range. The balance was below the guidance range concentrations.

The Mobile Bay estuary also provides habitat for many reptiles and amphibians, mostly notably three species of endangered sea turtles that nest in the bay region (green sea turtle [*Chelonia mydas*], Kemp's ridley sea turtle [*Lepidochelys kempii*], and loggerhead sea turtle [*Caretta caretta*]) (USEPA 2006). There are also several mammal species that use the bay, including bottlenose dolphin (*Tursiops truncates*, protected), sperm whale (*Physeter macrocephalus*, endangered and protected), and West Indian manatee (*Trichechus manatus*, endangered and protected) (USEPA 2006).

Finally, the aquatic habitats of the Mobile Bay estuary are also recognized as one of the most important stopover areas for migratory birds in North America. Dauphin Island and the Fort Morgan Peninsula serve as rest stops for numerous migratory bird species on their way to and from Central and South America. Approximately 350–379 species of birds may be found in the bay either resident or migratory, which represents more than 90 percent of the birds found in Alabama as a whole (USACE, Mobile District 1998a; SARPC 2001). Bird surveys are routinely conducted by the Audubon Society on Dauphin Island, which notes more than 379 species on their species list (Mobile Bay Audubon Society 2009). Species of birds of particular concern include the endangered least tern (*Sterna antillarum*, no critical habitat rules), threatened piping plover (*Charadrius melodus*, critical habitat around Dauphin Island and Fort Morgan), endangered wood stork (*Mycteria americana*, no critical habitat rules), endangered red-cockaded woodpecker (*Picoides borealis*, no critical habitat rules), recovered brown pelican (*Pelecanus occidentalis*, no critical habitat rules), and the recovered bald eagle (*Haleaeetus leucocephalus*, no critical habitat rules). The brown pelican's only known nesting colony within the bay exists on Gaillard Island, an artificial island created by dredge material. In 1983 there were four nests, but that had increased to an estimated 4,597 by 1997 (USEPA 2006). The island also hosts nesting colonies of laughing gull, Caspian tern, and sandwich tern (USEPA 2006).

To this point, the text has focused on native taxa. Unfortunately, many nonnative and invasive species have colonized the Mobile Bay estuary, and these, too, are of concern (Table 2.5-10). Many of these taxa benefit from human activities in the basin (e.g., eutrophication, shipping traffic, fisheries management). At this point, how freshwater flows affect all those invasive species is unclear; that is to say, to what extent the invasion by the species is affected by freshwater flows. Note, however, that flow modifications that might affect salinity profiles have the potential to affect species with varying salinity tolerances. Similarly, the degree to which flow modification will affect water quality parameters, such as nutrient concentrations, may exacerbate invasions by more nutrient-tolerant invasive species.

Flow variation affects estuaries, because their production is so dependent on riverine resources. One common effect occurs via effects on DO. Increased nutrient exports (affecting primary production), detrital carbon delivery, and decreased flows (increasing residence time) can contribute to decreased oxygen, which affects aquatic species in the estuary. One unique event in Mobile Bay in which low DO plays an important role is the Jubilee phenomena. Extreme low oxygen events fed by detrital carbon during stratification of the bay, combined with slow but steady easterly summer winds and a rising tide, contribute to the unique Jubilee phenomena where demersal fish and shellfish species are forced inshore because of low oxygen concentration return currents that trap the organisms primarily against the eastern shore of the bay from Daphne as far south as Mullet Point (USEPA 2006). Lower flows during droughts might also contribute to increased salinities that can reduce bay productivity and affect the survival of stenohaline species, although most estuarine species are euryhaline.

2.5.4 Protected Species (Federal and State) Affected Environment

This section discusses the federal and state protected species that could be adversely affected by changes in reservoir depths and water allocation, as defined in a scoping letter prepared by the USFWS (USFWS 2008a). The ACT Basin supports a wide variety of wildlife and is home to approximately 230 species that are protected or included as candidate species by the states and the federal government (USACE, Mobile District 1998a; USACE, Mobile District 2003b). These species can be further broken down to 58 federally protected (or candidate) species that are associated with riverine habitat, which, because of where they occur, have the greatest potential to be affected by changes in basin operations. These species are listed in Table 2.5-11. Of the 58 potentially affected species, 19 are endemic to the ACT Basin.

Table 2.5-10.
A partial list of obligate marine and facultative freshwater and brackish non-indigenous species in the Mobile Bay region

Group	Scientific name	Common name	Native habitat	Exotic/ transplant	Source
Coel.-Scyph.	*Phyllorhiza punctata*	Australian spotted jellyfish	Mar	Ex	1
Crustacea	*Balanus amphitrite*	Striped barnacle	Mar	Ex	2
Crustacea	*Balanus eburneus*	Ivory barnacle	Mar	Ex	2
Crustacea	*Callinectes bocourti*	Red blue crab	FW-B	Ex	2
Crustacea	*Callinectes bocourti*	Bocourt swimming crab	Mar	Ex	1
Crustacea	*Carcinus maenas*	Green crab	FW-B	Ex	2
Crustacea	*Charybdis hellerii*	Portunid crab	FW-B	Ex	2
Crustacea	*Penaeus monodon*	Asian tiger shrimp	Mar	Ex	1
Crustacea	*Scylla serrata*	Serrated swimming crab	FW-B	Ex	2
Fish	*Hypsoblennius invemar*	Tessellated blenny	Mar	Ex	1
Fish	*Morone chrysops*	White bass	FW-M	NT	1
Fish	*Morone chrysops x M. saxatilis*	Wiper	FW-M	NT	1
Fish	*Oncorhynchus mykiss*	Rainbow trout	FW-M	NT	1
Fish	*Pterois volitans/miles*	Lionfish	Mar	Ex	1
Mollusk	*Corbicula fluminea*	Asiatic clam	FW-B	Ex	2
Mollusk	*Limnoperna fortunei*	Golden mussel	FW-B	Ex	2
Mollusk	*Mytilus edulis*	Common mussel	Mar	Ex	2
Mollusk	*Perna perna*	Brown mussel	FW-B	Ex	2
Mollusk	*Perna viridis*	Green mussel	FW-B	Ex	2
Mollusk	*Rapana venosa*	Veined rapa whelk	FW-B	Ex	2
Mammal	*Myocastor coypus*	Nutria	FW-B	Ex	3
Plant	*Phragmites australis*	Common Reed	FW_B	Ex	3
Plant	*Eichhornia crassipes*	Water Hyacinth	FW-B	Ex	1
Plant	*Hydrilla verticillata*	Hydrilla	FW-B	Ex	1
Plant	Landoltia punctata	Dotted duckweed	FW-B	Ex	3
Plant	Ludwigia hexapetala	Uruguayan waterprimrose	FW-B	Ex	3
Plant	*Myriophyllum aquaticum*	Parrotfeather	FW-B	Ex	3
Plant	*Myriophyllum spicatum*	Eurasian water-milfoil	FW-B	Ex	1
Plant	*Najas marina*	Spinyleaf naiad	FW-B	Ex	2
Plant	*Najas minor*	Brittle naiad	FW-B	Ex	3
Plant	*Oxycaryum cubense*	Cuban Bullrush	FW-B	Ex	3
Plant	*Pistia stratioties*	Water lettuce	FW-B	Ex	3
Plant	*Pluchea odorata*	Marsh fleabane	FW-B	NT	1
Plant	*Salvinia minima*	Common Salvinia	FW-B	Ex	3
Coel.-Scyph.	*Phyllorhiza punctata*	Australian spotted jellyfish	Mar	Ex	1
Crustacea	*Balanus amphitrite*	Striped barnacle	Mar	Ex	2
Crustacea	*Balanus eburneus*	Ivory barnacle	Mar	Ex	2
Crustacea	*Callinectes bocourti*	Red blue crab	FW-B	Ex	2
Crustacea	*Callinectes bocourti*	Bocourt swimming crab	Mar	Ex	1
Crustacea	*Carcinus maenas*	Green crab	FW-B	Ex	2
Crustacea	*Charybdis hellerii*	Portunid crab	FW-B	Ex	2

Source: USGS 2009k; Mobile Bay NEP 2009; ADWFF 2008

Notes: Coel.-Schyph.= Coelenterata-Schyphozoa; Mar = marine; FW-B = freshwater-brackish; FW-M = freshwater-marine; Ex = exotic; NT = native transplant.

Sensitive species are unique plants and animals that have been observed to be declining toward extinction. Using available scientific research, state, federal, and nongovernmental organizations have assigned conservation priority to many rare or declining species. The most significant protection for sensitive species is the ESA, passed in 1973 to address concerns about declining populations. The law offers two classes of protection for rare species—endangered and threatened. Endangered status is defined as a species that is in danger of extinction throughout all or a significant portion of its range. Threatened status indicates that a species is likely to become endangered within the foreseeable future. All species of plants and animals, except pest insects, are eligible for listing as federally endangered or threatened. All federal agencies are required to protect threatened and endangered species while carrying out projects and to preserve threatened and endangered species habitats on federal land (USFWS 2001).

Under the ESA it is illegal to *take* threatened and endangered species. As defined in the ESA, "the term *take* means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." The Secretary of the Interior, through regulations, defined the term *harm* in that passage as, "an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering." Because it is unlawful to hunt or collect threatened and endangered species, habitat degradation is the primary reason for population declines in listed species (USFWS 2001).

Critical habitat is defined in the ESA (16 U.S.C. 1531 et seq.). Species listed as threatened or endangered under the ESA are afforded protection within specific areas of their geographic range that offer physical or biological features essential in their conservation and that may require special management considerations. Habitat not used by the species may also be included if it is deemed necessary for recovery. Proposed designations and the final determination of critical habitat are published in the *Federal Register*.

2.5.4.1 Protected Mammal Species

There are three federally listed mammals in the ACT Basin that could be affected by changes in basin operations (Table 2.5-11).

2.5.4.1.1 Alabama Beach Mouse (*Peromyscus p. ammobates*)

Historic distribution of the Alabama beach mouse (federally listed as endangered) was along the coastal dunes of Baldwin County, Alabama, from the western tip of Fort Morgan Peninsula eastward to the Perdido Bay inlet, including Ono Island. The type locality was a sand bar immediately west of Perdido Key inlet. Type locality has been heavily developed and no longer exhibits natural characteristics. Because of extensive development throughout the Alabama Gulf Coast, the present-day distribution of the Alabama beach mouse is greatly reduced. Active populations are known to exist in areas of public ownership at Fort Morgan and within the Perdue Unit of the Bon Secour National Wildlife Refuge. Discontinuous occupation of dune and scrub habitat between these two sites also occurs. A population has been re-established at Gulf State Park. Trapping and visual surveys suggest extirpation from all areas east of Gulf State Park. Habitat for this species typically includes primary, secondary, and scrub dunes of the coastal strand community. Densities are often greatest in sparsely vegetated areas within the primary dune zone. Recent research indicates that scrub habitat is more important than previously thought (ADCNR 2014c).

Table 2.5-11.
Federally protected species potentially affected by water allocation in the ACT Basin

State	Common name	Scientific name	Endemic	Federal	AL	GA	Sub basin	Habitat
	Mammals							
AL	Alabama beach mouse	*Peromyscus p. ammobates*		E	SP		MB	Scrub dunes of the coastal strand community
AL	Perdido Key beach mouse	*P. p. trissyllepsis*		E	SP		MB	Scrub dunes of the coastal strand community
AL	West Indian manatee	*Trichechus manatus*		E	SP	E	MB	Open estuarine
	Birds							
AL/GA	Wood stork	*Mycteria americana*		E	SP	E	UCO, LCO, T, AL	Forested wetland/shallow water
AL/GA	Red-cockaded woodpecker	*Picoides borealis*		E	SP	E	AL	Mature southern pine forest; preference for longleaf
	Fish							
AL	Gulf sturgeon	*Acipenser oxyrinchus desotoi*		T	SP		AL	Riverine mainstem
AL/GA	Blue shiner	*Cyprinella caerulea*	Y	T	SP	E	LCO, UCO	Riverine/mainstream/large tributary/rocky
GA	Etowah darter	*Etheostoma etowahae*	Y	E		E	UCO	Riverine/mainstream/ tributary/riffle
GA	Cherokee darter	*E. scotti*	Y	T		T	UCO	Riverine/tributary small-medium streams
AL	Cahaba shiner	*Notropis cahabae*	Y	E	SP		AL	Riverine/mainstream/pool/ clear waters
GA	Amber darter	*Percina antesella*	Y	E		E	UCO	Riverine/mainstream/large tributary/riffle
AL/GA	Goldline darter	*P.aurolineata*	Y	T	SP	T	UCO, AL	Riverine/mainstream/riffles and runs
GA	Conasauga logperch	*P. jenkinsi*	Y	E		E	UCO	Riverine/mainstream/riffles and runs
AL	Alabama sturgeon	*Scaphirhynchus suttkusi*	Y	E	SP		AL	Riverine/mainstream/large tributary/sand and gravel substrates
	Insects							
AL	Mitchell's satyr butterfly	*Neonympha m. mitchellii*		E	SP			
	Mussels							
AL/GA	Upland combshell	*Epioblasma metastriata*		E	SP	E	UCO, AL	Riverine, stable gravel or sandy gravel substrates
AL/GA	Southern acornshell	*E. othcaloogensis*	Y	E	SP	E	LCO, AL, UCO	Riverine/rock and gravel substrates
AL	Southern combshell	*E. penita*		E	SP		AL	Riverine, stable gravel or sandy gravel substrates
AL	Orangenacre mucket	*Lampsilis perovalis*		E	SP		AL	Riverine, stable gravel or sandy gravel substrates
AL/GA	Finelined pocketbook	*L. altilis*		T	SP	T	AL, LCO, UCO, T	Riverine, stable gravel or sandy gravel substrates
AL	Alabama pearlshell	*Margaritifera marrianae*		C	SP		AL	Riverine/stable or sandy gravel substrate

Table 2.5-11. (continued)

State	Common name	Scientific name	Endemic	Federal	AL	GA	Sub basin	Habitat
	Mussels (continued)							
AL/GA	Alabama moccasinshell	*Medionidus acutissimus*		T	SP	T	UCO	Riverine/rivers and large creeks
AL/GA	Coosa moccasinshell	*Medionidus parvulus*		E	SP	E	UCO	Riverine, stable gravel or sandy gravel substrates
GA	Painted clubshell	*Pleurobema chattanoogaense*		C		E	UCO	Riverine/medium size rivers/stable gravel or sandy gravel substrate
AL/GA	Southern clubshell	*P. decisum*		E	SP	E	AL, T	Riverine/medium size rivers/stable substrate
AL/GA	Southern pigtoe	*P. georgianum*	Y	E	SP	E	UCO, LCO	Riverine, stable gravel or sandy gravel substrates
GA	Georgia pigtoe	*P. hanleyanum*	Y	E		E	UCO	Riverine/medium size rivers/stable gravel or sandy gravel substrate
AL/GA	Ovate clubshell	*P. perovatum*		T	SP	E	T	Riverine, stable gravel or sandy gravel substrates
AL	Heavy pigtoe	*P. taitianum*		E	SP		AL	Riverine/stable grave or sandy gravel substrates
AL	Inflated heelsplitter	*Potomilus inflatus*		T	SP		AL, LCO, UCO, T	Riverine/stable grave or sandy gravel substrates
AL/GA	Triangular kidneyshell	*Ptychobranchus greenii*		E	SP	E	UCO, AL, LCO	Riverine/high quality riffle-run
	Snails							
AL	Lacy elimia	*Elimia crenatella*	Y	T	SP		LCO	Riverine/mainstream/ tributary riffle
AL	Round rocksnail	*Leptoxis ampla*	Y	C	SP		AL	Riverine/mainstream/ tributary riffle
GA	Interrupted rocksnail	*L. foremani*		E		E	LCO, UCO	Riverine/mainstream/ tributary riffle
AL	Plicate rocksnail	*L. plicata*		T	SP			Riverine/mainstream/ tributary riffle
AL	Painted rocksnail	*L. taeniata*	Y	T	SP		LCO	Riverine/mainstream/ tributary riffle
AL	Flat pebblesnail	*Lepyrium showalteri*	Y	E	SP		AL	Riverine/mainstream/ tributary riffle
AL/GA	Cylindrical lioplax snail	*Lioplax cyclostomaformis*	Y	E	SP		AL	Riverine/mainstream/ tributary riffle
AL	Rough hornsnail	*Pleuroera foremani*	Y	E	SP		LCO	Riverine/mainstream/ tributary riffle
AL	Tulotoma snail	*Tulotoma magnifica*	Y	E	SP		AL, LCO	Riverine/mainstream/ tributary riffle
	Plants							
AL	Price's potato bean	*Apios priceana*		T			AL	Mesic soils in open areas along creeks
AL/GA	Georgia rockcress	*Arabis georgiana*		C		T	UCO	Dry, shallow soils on rocky bluffs & sandy loam soils on eroding river banks
AL/GA	Alabama leather flower	*Clematis socialis*		E		E	UCO	Mesic flats along intermittent creeks

Table 2.5-11. (continued)

State	Common name	Scientific name	Endemic	Federal	AL	GA	Sub basin	Habitat
	Plants (continued)							
AL	Whorled sunflower	*Helianthus verticillatus*		E			UCO	Relict praries, moist prarie-like openings along creeks
AL/GA	Mohr's Barbara's buttons	*Marshallia mohrii*		T		T	LCO, UCO	Palustrine/emergent/open water
AL/GA	White fringeless orchid	*Platanthera integrilabia*		C		T	T, UCO	Boggy areas at stream heads and seepage slopes
AL	Harperella	*Ptilimnium nodosum*		E			LCO, UCO	Palustrine/riverine
GA	Michaux's Sumac	*Rhus michauxii*		E		E	UCO	Sandy or rocky open woods on acidic soils
AL/GA	Kral's water-plantain	*Sagittaria secundifolia*		T			UCO	Riverine/tributary/riffle/run/ pool
AL/GA	Green pitcher-plant	*Sarracenia oreophila*		E		E	LCO, T, UCO	Palustrine/forested, bogs, streambanks
AL	AL canebrake pitcher plant	*Sarracenia rubra alabamensis*	Y	E			LCO, T	Palustrine, sandhills, seeps, bogs, and swamps
AL/GA	Georgia aster	*Symphyotrichum georgianum*		C		T	UCO	Post oak-savanna communities and relict praries
AL/GA	TN yellow-eyed grass	*Xyris tennesseensis*		E		E	LCO, UCO	Palustrine; margins in and along spring runs and wet meadows
	Reptiles and Amphibians							
AL	Eastern indigo snake	*Drymarchon corais couperi*		T	SP	T	AL	Flatwoods, tropical hammocks, dry glades and moist bogs
AL	Kemp's ridley sea turtle	*Lepidochelys kempii*		E	SP	E	MB	Open estuarine
AL	Red hills salamander	*Phaeognathus hubrichti*		T	SP		AL	Steep sloped ravines and bluffs dominated by hardwoods
AL	Black pine snake	*Pituophis melanoleucus lodingi*		C	SP		AL	Xeric, fire-maintained longleaf pine forest
AL	Alabama red-belly turtle	*Pseudemys alabamensis*		E	SP		AL	Rivering/mainstream/ palustrine/open estuarine/sub and intertidal

Notes:
E = listed as endangered; C = candidate species for listing; T = listed as threatened; SC = federal species of special concern; SP = species formally protected; R = rare, no legal status; Y = species is endemic to basin; s/a = protected because of similar appearance to the listed species; CO = Coosa; LCO = Lower Coosa; UCO = Upper Coosa; AL = Alabama; T = Tallapoosa; MB = Mobile Bay.

2.5.4.1.2 Perdido Key Beach Mouse (*Peromyscus p. trissyllepsis*)

The Perdido Key beach mouse (federally listed as endangered) is known only from Perdido Key, Baldwin County, Alabama. Storms and habitat destruction have reduced distribution from entire length of Perdido Key to a few remnant and reintroduced populations. Although there are distinct morphological and genetic differences, ecology and reproduction are similar to the Alabama beach mouse (ADCND 2014c).

2.5.4.1.3 West Indian Manatee (*Trichechus manatus*)

Range of the West Indian manatee (federally listed as endangered) encompasses rivers, estuaries, and coastal areas of subtropical and tropical areas of northern South America, West Indies/Caribbean region, Gulf of Mexico, and southeastern North America. U.S. populations occur primarily in Florida, where they are effectively isolated from other populations by the cooler waters of the northern Gulf of Mexico and the deeper waters of the Straits of Florida. In the southeastern United States, manatees are more or less

retricted to the vicinity of warm-water sites in peninsular Florida during the winter, although a few may remain year-round in Cumberland Sound, southeastern Georgia. Occasional manatees occur in summer from Texas to North Carolina (NatureServe 2014b).

2.5.4.2 Protected Bird Species

There are two federally listed birds in the ACT Basin that could be affected by changes in basin operations (Table 2.5-11).

2.5.4.2.1 Wood Stork (*Mycteria americana*)

Historically, the breeding range of wood stork (federally listed as endangered) spanned the southeastern states, extending from South Carolina to Texas (USFWS 1997). Today, breeding is limited to coastal areas of Florida, Georgia and South Carolina. Post-breeding storks generally disperse, occasionally occurring as far north as North Carolina and as far west as Alabama and Mississippi (USFWS 1997). In Alabama, the species is known to forage during summer and early fall in the western Inland Coastal Plain near the Tombigbee River and lakes in Hale, Marengo, and Perry counties; at ponds near Montgomery; and at Eufaula National Wildlife Refuge (ADCNR 2010b).

2.5.4.2.2 Red-Cockaded Woodpecker (*Picoides borealis*)

The red-cockaded woodpecker (federally listed as endangered) historically inhabited open pine forest from New Jersey, Maryland, and Virginia to Florida. Their range also extended west to Texas and north to parts of Oklahoma, Missouri, Tennessee, and Kentucky. Due to the drastic decline of the longleaf pine ecosystem, the red-cockaded woodpecker disappeared from much of its original range. The current range extends from Florida to Virginia and west to Oklahoma and eastern Texas. In Alabama, the majority of red-cockaded woodpeckers are found on the Oakmulgee, Talladega, and Conecuh National Forests (ACDNR 2014a).

2.5.4.3 Protected Fish Species

There are 41 protected fish species in the ACT Basin, of which 9 are federally protected species that could be affected by changes in basin operations (Table 2.5-11). That group consists of four threatened and five endangered species of darters, shiners, sturgeon, and logperch. One species included in the draft EIS was removed based on additional information. The pygmy sculpin is found only in Coldwater Spring and the spring run, well above, by several tributary watersheds, the Coosa River.

2.5.4.3.1 Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)

The historical range of Gulf sturgeon (federally listed as threatened) extended across the northern Gulf of Mexico from Tampa Bay in the east to the mouth of the Mississippi River in the west Bay (USFWS 1995; Wooley and Crateau 1985). During exceptionally cold winters, individuals have been encountered as far west as Texas and as far south as Florida. In the ACT Basin, Mettee et al. (2009) documented two Gulf sturgeon in Mobile Bay near Fairhope, AL and suggested that anecdotal records indicate the species inhabits riverine areas downstream of Claiborne Lock and Dam and Lake. In March 2003 critical habitat was established through the issuance of a final rule, designating 14 units comprising approximately 1,730 mi of riverine habitat and 2,333 square mi of estuarine and marine habitat; however, no units occur within the ACT Basin (USFWS 2003).

2.5.4.3.2 Blue Shiner (*Cyprinella caerulea*)

The blue shiner (federally listed as threatened) is endemic to the Mobile River drainage basin and was historically known from the Coosa and Cahaba river systems of Tennessee, Georgia, and Alabama (USFWS 1992a). Water quality and habitat degradation, primarily because of dam construction, are the primary threat to the species (USFWS 1995). It is restricted to the lower reaches of Little River, Weogufka Creek, and Choccolocco Creek in Alabama (ADCNR 2010b) and the upper Conasauga River system above the junction with Holly Creek in Georgia (USFWS 1995). Blue shiners prefer clear, medium or large streams and are found in shallow pools with slow currents or in backwaters over sand and gravel substrates. Spawning in the upper Coosa River system occurs from late April to late July (Mettee et al. 1996).

2.5.4.3.3 Etowah Darter (*Etheostoma etowahae*)

The Etowah darter (federally listed as endangered) is restricted to the Etowah River system of the upper Coosa River of Georgia, upstream of Allatoona Lake. Adults occur in small to medium sized streamswith cobble and gravel riffles and moderate to swift current. Because this species is newly described, little is known of its life history. Based on what is known of other species, spawning probably occurs from late April to early June, peaking in May (Mettee et al. 1996).

2.5.4.3.4 Cherokee Darter (*E. scotti*)

The Cherokee darter (federally listed as threatened) is endemic to upper portions of the middle Etowah River system in Georgia, upstream of Allatoona Lake. Cherokee darters are found in the Blue Ridge and Piedmont physiographic sections in this area with most populations occurring in the Northern Piedmont Upland. The Cherokee darter inhabits small to medium sized creeks with moderate gradient and rocky substrates. It occurs in runs above and below riffles, typically in waters one to two feet deep over large gravel, cobble, and small boulders. Little is known about the life history of this species, although it is assumed to be similar to the Coosa darter, which eats aquatic insects and spawns in the spring (Mettee et al. 1996).

2.5.4.3.5 Cahaba Shiner (*Notropis cahabae*)

The Cahaba shiner (federally listed as endangered) is endemic to the main channel of the Cahaba River of the Mobile basin. The historic range of the Cahaba shiner included about 76 river miles from Centreville upstream to Helena, but recent studies indicate that the species is now limited to about 15 river miles from Centreville upstream to Piper Bridge. In the Cahaba River it occurs sympatrically with the undescribed "Mobile mimic shiner." The preferred habitat of the Cahaba shiner is the main channel of the Cahaba River, in areas of shallow shoals up to 5 feet deep and downstream of riffles composed of clean sand or a sand-gravel mix. Individuals have also been observed in shallow waters flowing through beds of the emergent aquatic vegetation Fusticia. Spawning occurs from mid-May through early July, with peak activity in June (Mettee et al. 1996).

2.5.4.3.6 Amber Darter (*Percina antesella*)

The amber darter (federally listed as endangered) is endemic to the Conasauga and Etowah river systems in the upper Coosa River system. Individuals were observed in the Etowah River and Sharp Mountain Creek in 1990, and this species was recently rediscovered in Shoal Creek, Cherokee County, Georgia. The Conasauga population is limited to about 33 miles of the river in north Georgia and southeast Tennessee. The amber darter inhabits cool, clear, small rivers with moderate to swift currents over gravel and cobble substrates. Most individuals live in deep riffles with moderate current. Preferred habit is the

midsection or upstream end of low-gradient riffles, either over sand and gravel or among clumps of river weed in midsummer. Spawning occurs from late fall to early spring. Eggs are deposited in sand and gravel areas of riffles and shoals (Mettee et al. 1996).

2.5.4.3.7 Goldline Darter (*P. aurolineata*)

The goldline darter (federally listed as threatened) is endemic to the ACT Basin and has been found only in the Coosawattee River system in Georgia and the Cahaba River in Alabama (USFWS 2000). Goldline darters inhabit free-flowing mainstem rivers and large tributaries primarily in runs and riffles with swift currents. Water quality degradation, particularly sedimentation, is the primary threat to the species (USFWS 1992a).

2.5.4.3.8 Conasauga Logperch (*P. jenkinsi*)

The Conasauga logperch (federally listed as endangered) is one of the rarest darters in North America. It is endemic to the Mobile basin, its entire range limited to approximately 11 miles of the upper Conasauga River of the Coosa River system in Tenessee and Georgia. This rare species occurs in flowing pools over silt-free substrates of gravel and small rubble. Little is known of the Conasauga logperch's life history, although it is assumed to be similar to that of other logperches. Spawning probably extends from late March to May (Mettee et al. 1996).

2.5.4.3.9 Alabama Sturgeon (*Scaphirhynchus suttkusi*)

Alabama sturgeon (federally listed as endangered) historically occurred in the Mobile River Basin in Alabama and Mississippi (USACE, Mobile District 2003b). Recent collections indicate that the species persists in low numbers in portions of the Alabama River channel downstream of Millers Ferry Lock and Dam and Claiborne Lake (USFWS 2009a). In 2009, approximately 326 mi of critical habitat was designated along the Alabama River from its confluence with the Tombigbee River in Clarke and Baldwin counties, Alabama, upstream to Robert F. Henry Lock and Dam, Autauga and Lowndes counties, Alabama; and the Cahaba River from its confluence with the Alabama River upstream to U.S. Highway 82 near the Fall Line in Bibb County, Alabama Figure 2.5-2; USFWS 2009c).

USACE has worked closely with the USFWS, ADCNR, and others since the 1990s on studies and operational considerations related to protection of the Alabama sturgeon. On July 8, 2013, the USFWS published a recovery plan for the Alabama sturgeon. The overall strategy for the recovery program is "to prevent possible extinction of the Alabama Sturgeon by increasing numbers of the species through hatchery propagation and augmentation, protecting existing riverine habitat, and enhancing riverine flows at Claiborne and Millers Ferry (Locks and Dams) during the time periods most sensitive for spawning and larval drift." The plan contains numerous tasks to meet the recovery objectives. One of the recovery tasks specified in the plan is "to identify opportunities to enhance fish passage at Claiborne and Millers Ferry Locks and Dams by manipulating flows and modifying lock operations." One of the key recovery criteria in the plan necessary to consider eventual delisting of the species is to have "an agreement in place and completed with the U.S. Army Corps of Engineers and the Alabama Power Company to ensure adequate flows are being delivered down the Alabama River to allow for successful development of sturgeon larvae, and that fish are being successful being passed both upstream and downstream at dams on the Alabama River" (USFWS 2013). At the present time, such an agreement is not in place.

2.5.4.4 Protected Insect Species

There is one federally protected insect species that occurs in the ACT Basin that could be affected by changes in basin operations (Table 2.5-11).

2.5.4.4.1 Mitchell's Satyr Butterfly (*Neonympha mitchellii mitchellii*)

In the late 1990s and since, Mitchell's satyr butterfly populations were found in southwestern Virginia and in southeastern Alabama and Mississippi. The species is restricted to calcareous sedge wetlands, usually true fens, and sometimes sedge meadows in fen complexes (NatureServe 2014g).

2.5.4.5 Protected Mussel Species

Seventy-nine protected mussel species occur in the ACT Basin, 16 of which are federally protected (Table 2.5-11). The group comprises four threatened, ten endangered, and two candidate species.

2.5.4.5.1 Upland Combshell (*Epioblasma metastriata*)

The upland combshell (federally listed as endangered) is endemic to the Mobile River Basin and historically occurred in portions of the Black Warrior, Cahaba, middle Coosa and upper Coosa rivers, and their tributaries (USACE 2003). It is generally found in high-quality habitat in small to medium-sized rivers, where it is found on sand and gravel substrate in riffles (USACE, Mobile District 2003b). Today, its range is drastically diminished. Surveys have failed to relocate the species, except the Conasauga River in Georgia (USFWS 2000). Despite the absence of live specimens, critical habitat has been designated in seven units of the upland combshell's former range (Figure 2.5-2; USFWS 2004).

2.5.4.5.2 Southern Acornshell (*Epioblasma othcaloogensis*)

The range of the southern acornshell (federally listed as endangered) historically spanned the Coosa and Cahaba River systems above the fall line in Alabama, Georgia, and Tennessee (USFWS 2000). The species is presumed to be extirpated from the Tennessee portion of the Conasuaga River and appears restricted to the Coosa River drainage in Alabama and Georgia the (Parmalee and Bogan 1998; USFWS 1993). Critical habitat has been designated in seven units comprising 341 mi of streams in the Southern acornshell's former range (Figure 2.5-2; USFWS 2004).

2.5.4.5.3 Southern Combshell (*Epioblasma penita*)

Remnant populations of southern combshell (federally listed as endangered) are found in the Buttahatchee River. Southern combshell from the Alabama Aquatic Biodiversity Center were stocked into the Cahaba River on September 27, 2012. They have possibly distributed upstream into the Alabama River. This species is found in shoal habitats (ADCNR 2014b).

2.5.4.5.4 Orange-nacre Mucket (*Lampsilis perovalis*)

The orange-nacre mucket (federally listed as endangered) is endemic to the Mobile River Basin, historically occurring in the Alabama, Tombigbee, Black Warrior and Cahaba River systems (USFWS 2000). The species prefers high water quality streams and is generally found on sand, gravel, or cobble substrate in moderate to fast currents. In the ACT Basin the orange-nacre mucket persists in the Little Cahaba River, but it has not been reported from the Alabama River since its description. Three critical habitat units were designated in portions of the Cahaba River, Alabama River and Bogue Chitto Creek in 2004 (Figure 2.5-2; USFWS 2004).

2.5.4.5.5 Fine-lined Pocketbook (*Lampsilis altilis*)

The historical distribution of the fine-lined pocketbook (federally listed as threatened) included most of the Mobile River Basin, to which the species is endemic (USFWS 2000). Within the ACT Basin, it occurs in the

Little Cahaba River, the Tallapoosa River drainage, three tributaries of the middle Coosa River, and the Conasauga River (USACE, Mobile District 2003b; Williams and Hughes 1998). Twelve critical habitat units, all within the ACT Basin, have been established on approximately 546 mi of rivers and streams (Figure 2.5-2; USFWS 2007).

2.5.4.5.6 Alabama Pearlshell *(Margaritifera marrianae)*

The Alabama pearlshell (a candidate species) is endemic to small area of south-central Alabama. Most populations are found in the Conecuh River system in Butler, Conecuh, and Crenshaw Counties. In the Alabama River system, it is known from Limestone Creek in Monroe County. This species is found in small tributaries (ADCNR 2014j).

2.5.4.5.7 Alabama Moccasinshell (*Medionidus acutissimus*)

The Alabama moccasinshell (federally listed as threatened) historically occurred in the Mobile River basin in Alabama, Mississippi, Georgia, and Tennessee (USFWS 2000). It prefers moderate to strong currents in streams and small rivers and is often associated with shoal habitat and sand, gravel, or cobble substrate (USFWS 2000). In the ACT Basin, the Alabama moccasinshell is generally found in small, localized populations in the upper Conasauga River in Georgia and Tennessee and in portions of the Cahaba River system in Alabama. Critical habitat has been designated in portions of the Cahaba, Lower Coosa, and Oostanuala rivers, as well as Bogue Chitto Creek (Figure 2.5-2; USFWS 2004).

2.5.4.5.8 Coosa Moccasinshell (*Medionidus parvulus*)

Historically, the Coosa moccasinshell (federally listed as endangered) was known from tributaries of the middle and upper Coosa River drainage, including Choccolocco Creek, Chattooga River, Little River, Conasauga River, the Cahaba River, and Sipsey Fork in the Black Warrior River (USACE, Mobile District 2003b). The species prefers sand, gravel and cobble substrate in moderate to strong current along shoals of streams and small rivers (USFWS 2000). Recent collections have been made from the Little River in Alabama and the upper Conasauga in Georgia and Tennessee (USFWS 1993). Nine critical habitat units have been designated, only one (the Oostanaula complex) of which supports the species (Figure 2.5-2; USFWS 2004).

2.5.4.5.9 Painted Clubshell (*Pleurobema chattanoogaense*)

The painted clubshell (a candidate species) was historically found in the Conasauga River in Tennessee and Georgia, in the Chatooga, Coosa, and Oostanaula rivers and Armuchee Creek in Georgia, and throught the length of the Coosa River in Alabama. In the Coosa River basin in Georgia, it is known historically from the Coosa, Etowah, Oostanaula, and Conasauga River drainages but has not been collected there recently. Fresh dead shells were collected in the upper Conasauga River during a 1997 survey. The species is thought to persist in Alabama only in Weiss bypass of Coosa River, Cherokee County. In the Conasauga River, it inhabits riffle areas with substrates of coarse sand and gravel (NatureServe 2014a).

2.5.4.5.10 Southern Clubshell (*Pleurobema decisum*)

Historically, the southern clubshell (federally listed as endangered) was found throughout the Mobile River Basin, inhabiting sand, gravel or cobble shoals in large streams and small rivers (USFWS 2000). Its current distribution in the ACT Basin includes Bogue Chitto Creek in the Alabama River, the mainstem Alabama River, and Chewacla Creek in the lower Tallapoosa River (USACE, Mobile District 2003b). It

has been previously found in the lower Coosa River mainstem in the bypass reach downstream of Weiss Lake, but recent surveys failed to collect any live specimens. In 2004 critical habitat was designated as 19 units in Alabama, Georgia, Mississippi, and Tennessee (USFWS 2004). Within the ACT Basin, 10 units exist, encompassing approximately 467 mi of habitat (Figure 2.5-2).

2.5.4.5.11 Southern Pigtoe (*Pleurobema georgianum*)

The southern pigtoe (federally listed as endangered) is endemic to the ACT Basin, historically occurring in the Coosa River in Alabama, Georgia and Tennessee (USFWS 2000). It is generally found in small, restricted populations in high quality large streams and small rivers. The species prefers coarse substrate (sandy-gravel and gravel) in moderate flows and depths of less than 60cm (Parmalee and Bogan 1998). Its current distribution is restricted to the upper Conasauga River of Georgia and Tennessee and along the lower Coosawattee River mainstem, but only the Oostanaula complex supports a population (Figure 2.5-2; USFWS 2004).

2.5.4.5.12 Georgia Pigtoe (Pleurobema hanleyanum)

The Georgia pigtoe was historically present in large creeks and rivers of the Coosa River drainage of Alabama, Georgia, and Tennessee. It is found in shallow runs and riffles with strong to moderate current and coarse sandgravel-cobble bottoms. The Georgia pigtoe is currently known from a few isolated shoals in the Upper Conasauga River in Murray and Whitfield Counties, Georgia, and in Polk County, Tennessee. In November 2010, the Georgia pigtoe was listed as endangered, and critical habitat for the species was designated. Critical habitat was designated for the following areas: 52 miles of the upper Conasauga River upstream of US Highway 76 in Murray and Whitfield Counties; 15 miles of Terrapin Creek upstream of it confluence with the Coosa River and 11 miles of the Coosa River immediately below Weiss Dam in Cherokee County, Alabama; and 41 miles of Hatchet Creek in Clay and Coosa Counties, Alabama (USFWS 2010c).

2.5.4.5.13 Ovate Clubshell (*Pleurobema perovatum*)

The ovate clubshell (federally listed as threatened) was historically found throughout the Mobile River basin tributaries, including inhabiting large creeks and small to large rivers such as the Tombigbee, Black Warrior, Alabama, Cahaba, lower Tallapoosa and Coosa River systems (USFWS 2000). Within the ACT Basin, recent surveys indicate the species is only known from Chewacla Creek in the Uphapee Creek system in the lower Tallapoosa River drainage, Alabama, and from the upper Coosa River mainstem (bypass reach) near Weiss Lake in Alabama (USACE, Mobile District 2003b; USFWS 1993). Approximately 388 mi of critical habitat have been designated for the ovate clubshell, composing seven distinct units (Figure 2.5-2; USFWS 2004).

2.5.4.5.14 Heavy Pigtoe (*Pleurobema taitianum*)

The heavy pigtoe (federally listed as endangered) historically occurred along the mainstem of the Tombigbee and Alabama rivers, as well as some larger tributaries, including the East Fork Tombigbee, Buttahatchee, and Sipsey rivers in the Tombigbee drainage, and the Cahaba River in the Alabama River drainage (USFWS 2009b). Recent surveys indicate that the species has been largely extirpated from its historical range and is known to survive only within an area of a few hundred square yards at a single location in the Alabama River in Dallas County, Alabama (Hartfield and Garner 1998).

2.5.4.5.15 Inflated Heelsplitter (*Potamilus inflatus*)

The inflated heelsplitter (federally listed as threatened) occupies free-flowing habitats in small to large rivers. Its preferred habitat is soft, stable substrate in slow to moderate currents (USFWS 1992b). Until recently, the species had not been reported from the Coosa or Alabama rivers in 30 years. In 1998 fresh dead specimens of the inflated heelsplitter were collected in the Alabama River downstream of Claiborne Lock and Dam and Lake.

2.5.4.5.16 Triangular Kidneyshell (*Ptychobranchus greeni*)

The triangular kidneyshell (federally listed as endangered) is endemic to the Mobile River basin. It prefers sand, gravel, or cobble substrate in runs and shoals of large streams and small rivers with high-quality water (USFWS 2000). In the ACT Basin, the species is known to exist in the Upper Conasauga River, the Oostanaula River, and the Coosawattee River downstream of Carter's Dam in Georgia (USACE, Mobile District 2003b). In 2004 critical habitat was established in 13 units in Alabama, Georgia and Tennessee (USFWS 2004). Ten units, comprising 400 mi are in the ACT Basin (Figure 2.5-2).

2.5.4.6 Protected Snail Species

There are nine federally protected species of snail within the ACT Basin, consisting of three threatened, five endangered, and one candidate species (Table 2.5-11).

2.5.4.6.1 Lacy Elimia (*Elimia crenatella*)

The lacy elimia (federally listed as threatened) was historically abundant from St. Clair to Chilton County, Alabama, along the mainstem of the Coosa River. Several tributaries, including Big Will's Creek, Kelley's Creek, and Choccolocco and Tallaseehatchee creeks also supported populations (USFWS 2005a). Recent surveys, however, have found populations in just three Coosa River tributaries—Cheaha, Emauhee, and Weewoka creeks, Talladega County, Alabama. Because of its limited distribution and vulnerability to habitat and water quality degradation, the lacy elimia continues to maintain its threatened classification (USFWS 2006).

2.5.4.6.2 Round Rocksnail (*Leptoxis ampla*)

The round rocksnail (a candidate species) is endemic to the Mobile Basin. The species was historically found in the Coosa and Cahaba rivers and tributaries, and is known to still be found in some reaches of the Cahaba River and three tributaries. It is found in lotic habitats (ADCNR 2014d).

2.5.4.6.3 Interrupted Rocksnail (*Leptoxis foremani*)

The interrupted rocksnail was listed as an endangered species in November 2010 (UFSWS 20010c). Historically, it occurred in the Coosa River drainage in Alabama and Georgia. Surveys of the Oostanaula, Coosa, Coosawattee, Etowah, and Conasauga rivers since 1999, however, only have documented the species in about 7.5 mi of the Oostanaula River upstream of the Gordon-Floyd County line. Critical habitat was designated in November 2010 for the following areas: 7 miles of the Coosa River below Weiss Dam; 8 miles of the Coosa River below Jordan Dam; and 48 miles of the Oostanaula River downstream of its origin at the confluence of the Conasauga and Coosawattee rivers (USFWS 2010c).

2.5.4.6.4 Plicate Rocksnail (*Leptoxis plicata*)

The plicate rocksnail (federally listed as threatened) is endemic to the Black Warrior River system, historically, occurring from headwaters to near confluence with Tombigbee River, Greene County. It is now restricted to 15 shoals in a 30-kilometer (18.6-mile) reach of Locust Fork, Jefferson County, between Kimberly and Sayre. The species occurs in shoals, on silt-free bedrock, cobble, and boulders, in less than one meter (3 1/4 feet) of water. It is often found on undersides of large, flat boulders, and is more commonly found marginally than at mid-channel (ADCNR 2014e).

2.5.4.6.5 Painted Rocksnail (*Leptoxis taeniata*)

The painted rocksnail (federally listed as threatened) historically maintained the largest range of any rocksnail in the Mobile River Basin drainage, ranging from the Coosa River and its tributaries in St. Clair County, Alabama, downstream into the mainstem of the Alabama River to Claiborne, Monroe County, Alabama, and the Cahaba River downstream of the Fall Line in Perry and Dallas counties, Alabama (USFWS 2005a). Populations exist in only three Coosa River tributaries—Choccolocco Creek, Talladega County; Buxahatchee Creek, Shelby County; and Ohatchee Creek, Calhoun County, Alabama. Two of these systems, Choccolocco Creek and Buxahatchee Creek, have recently been identified on Alabama's draft listing of 303d impaired waterbodies for organic pollution and excessive nutrients, respectively (USFWS 2006).

2.5.4.6.6 Flat Pebblesnail (*Lepyrium showalteri*)

The flat pebblesnail (federally listed as endangered) was historically widespread in the Coosa, Cahaba, and Little Cahaba rivers. It is known to be extant at one site each in Cahaba and Little Cahaba rivers, and is restricted to shoal habitats (ADCNR 2014f).

2.5.4.6.7 Cylindrical Lioplax (*Lioplax cyclostomaformis*)

The cylindrical lioplax (federally listed as endangered) is endemic to the Mobile River basin, historically inhabiting the Alabama, Black Warrior, Coosa and Cahaba River systems (USFWS 2005a). It generally inhabits mud under large rocks in rapid currents in free-flowing riffles and shoals in mainstem rivers and in major tributaries (USFWS 1998). Recent surveys indicate, however, that the species is now known only from a 24-km reach of the Cahaba River in Shelby and Bibb counties, Alabama (USFWS 2005a). As a result, a 5-year review concluded that the cylindrical lioplax should retain its current endangered status (USFWS 2006).

2.5.4.6.8 Rough Hornsnail (*Pleurocera foremani*)

The rough hornsnail is endemic to the Coosa River and its tributaries in Alabama and is generally found on gravel, cobble, and bedrock substrate in areas of moderate currents. It is known to occur at only two locations: Lower Yellowleaf Creek in Shelby County, Alabama; and the Lower Coosa River downstream of Wetumpka Shoals in Elmore County, Alabama. In November 2010, the rough hornsnail was listed as endangered, and critical habitat for the species was designated. Critical habitat was designated for the following areas: 13 miles of the Coosa River from Jordan Dam to the confluence with the Tallapoosa River and 4 miles of Yellowleaf Creek in Shelby County, Alabama (USFWS 2010c).

2.5.4.6.9 Tulotoma Snail (*Tulotoma magnifica*)

The tulotoma snail (federally listed as endangered) inhabits cool, well-oxygenated, free-flowing waters in mainstem rivers and major tributaries. Historically, it occurred throughout the Coosa River drainage to the Alabama River (USFWS 2000). Recent studies suggest an increase in the abundance and distribution of the species, as it now occurs in eight populations in more than 10 percent of its former range (USFWS 2007). Minimum flow criteria established by APC have expanded the populations downstream of Jordan Dam and Lake. In 2006 a 5-year review recommended downlisting the Tulotoma snail to threatened status (USFWS 2007).

2.5.4.7 Protected Reptile and Amphibian Species

There are four federally protected reptile species (including two endangered, one threatened, and one candidate species), and one federally protected amphibian species (threatened) that occur in the ACT Basin that could be affected by changes in basin operations (Table 2.5-11). Three species included in the draft EIS were removed based on additional information. The reticulated flatwoods salamander (*Ambystoma bishopi*) is listed by FWS as occurring in several Florida panhandle and south Georgia counties (USFWS 2014b). The NatureServe Explorer website lists it also in Covington and Houston Counties in Alabama (NatureServe 2014c). None of these are in the ACT basin. It was also determined that the loggerhead sea turtle and the green sea turtle, which are found only in open estuarine habitat, will not be affected by changes in basin operations.

2.5.4.7.1 Eastern Indigo Snake (*Drymarchon corais couperi*)

The historical range of the eastern indigo snake (federally listed as threatened) was from the east coast of South Carolina down thru southern Georgia, Florida, into south Alabama and southwest Mississippi. Today it is known only to naturally occur in southern Georgia and Florida. In Alabama, the eastern indigo snake was studied and reintroduced in its historical range within the state. Research done in the 1980s included releases in Autuaga, Baldwin, Bullock, Covington, Escambia, Mobile and Washington counties. During the research study, reintroduced snakes were recaptured and known to be thriving on some of the restocked areas. In the northern portion of its range, including south Alabama, the indigo snake requires deep sand ridges and is often associated with the gopher tortoise. The Indigo Snake is dependent upon the deep burrows dug by the gopher tortoise and uses them as a refuge from the extreme hot and cold temperatures. This restricted habitat is even more isolated by the snakes' preference for the interspersion of wet lowlands like ty ty swamps and cypress ponds. These preferred areas are usually found where rivers and creeks run thru sandhills habitat (ADCNR 2014g).

2.5.4.7.2 Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)

Kemp's Riddley sea turtles (federally listed as endangered) occur throughout the Gulf of Mexico and along the Atlantic coast of the United States. They are normally associated with coastal and bay waters. Stranding data indicate occurrence in coastal and bay waters of Alabama, and historically, relatively large numbers were reported to inhabit those coastal waters. This species is well known for inhabiting and feeding in the coastal and estuarine waters of the entire Gulf of Mexico and Atlantic Coast of the United States. They primarily nest on a stretch of beach in Mexico, although a few nests are reported each year in the United States ranging from Texas to Florida. At least one nest has been documented in Alabama in recent years. Additionally, historical data suggest the bay waters of Alabama serve as foraging areas for juveniles during times of the year when blue crabs are abundant (ADCNR 2014i).

2.5.4.7.3 Red Hills Salamander (*Phaeognathus hubrichti*)

The Red Hills salamander (federally listed as threatened) is the only amphibian species endemic to Alabama, historically inhabiting portions of Monroe, Conecuh, Butler, Covington, and Crenshaw counties (Godwin 2008). Recent surveys by Bailey and Miller (2006) resulted in a single observation, extending its range to Wilcox County. Its distribution is almost entirely restricted to the Tallahatta and Hatchetigbee formation of the Red Hills in the Gulf Coastal Plain physiograhic province. The species is fossorial, inhabiting steep, north-facing slopes of ravines and bluffs dominated by hardwoods (USFWS 1983). Siltstone or claystone outcroppings are necessary to provide burrowing habitat within deep cracks and fissures. The Red Hills salamander is listed as federally threatened because of habitat loss and is in the process of a 5-year status review (USFWS 2006).

2.5.4.7.4 Black Pine Snake (*Pituophis melanoleucus lodingi*)

The black pine snake (a candidate species) inhabits the Coastal Plain from extreme southeastern Louisiana through southern Mississippi into southwestern Alabama. It has been recorded in Alabama from Mobile, Clarke, and Washington Counties, and probably occurs in southern Choctaw County. Habitat includes xeric, fire-maintained longleaf pine forest having sandy, well-drained soils preferred, usually on hilltops, ridges, and toward the tops of slopes, with open canopy, reduced midstory, and dense herbaceous understory. Riparian areas, hardwood forests, or other closed-canopy conditions are not regularly used (ADCNR 2014h).

2.5.4.7.5 Alabama Red-Belly Turtle (*Pseudemys alabamensis*)

The Alabama red belly turtle (federally listed as endangered) is restricted to the Mobile-Tensaw River Delta in Mobile and Baldwin counties (USFWS 1989). They are rarely found north of I-65. The species inhabits shallow vegetated backwaters of freshwater streams, rivers, bays, and bayous in or adjacent to Mobile Bay (Mirachi et al. 2004). They prefer soft-bottom habitat dominated by submergent aquatic macrophytes, including hydrilla, brushy pondweed, eel-grass, arrowhead, and mud plantain. The red-bellied turtle is listed as federally endangered because of habitat loss, predation, and over-harvesting (USFWS 1989). A 5-year review of the species status was initiated in 2007 (USFWS 2007).

2.5.4.8 Protected Plant Species

There are 13 federally protected plant species within the ACT Basin. This group of protected plants includes three threatened, seven endangered, and three candidate species (Table 2.5-11).

2.5.4.8.1 Price's Potato Bean (*Apios priceiana*)

Price's potato bean (federally listed as threatened) is herbaceous vine in the pea family and known from four states: Alabama, Kentucky, Mississippi and Tennessee. In Alabama, it occurs in four small, isolated populations with Autauga, Madison and Marshall counties (USFWS 1993). It prefers mesic soils and is often found in open, low areas near streams and rivers (USFWS 1993). A 5-year review of the species' status has been initiated but is not available (USFWS 2008b).

2.5.4.8.2 Georgia Rockcress (*Arabis georgiana*)

The Georgia rockcress (a candidate species) grows in various dry situations, including shallow soil accumulations on rocky bluffs, in ecotones of gently sloping rock outcrops, and in sandy loam along eroding riverbanks. Currently, 19 populations are known from four counties in Alabama (Bibb, Elmore, Russell, and Wilcox) and six counties in Georgia (Clay, Chattahoochee, Floyd, Gordon, Harris, and

Muscogee). In September 2013, USFWS proposed this candidate species for federal listing as threatened and for designation of critical habitat (USFWS 2013b). The listing and designation of critical habitat are pending.

2.5.4.8.3 Alabama Leather Flower (*Clematis socialis*)

The Alabama leather flower (federally listed as endangered) is only known from three locations in northeast Alabama with one population occurring in St. Clair County and two in Cherokee County (USFWS 1989). A 5-year review of the species is being conducted by USFWS (2005b).

2.5.4.8.4 Whorled Sunflower (*Helianthus verticillatus*)

The whorled sunflower (federally listed as endangered) is known only from Alabama (Cherokee Co.), Georgia (Floyd Co.), and Tennessee (Madison and McNairy Cos.). This species is a narrow habitat specialist occurring in remnant wet prairie areas and calcareous barrens, in moist, prairie-like openings in woodlands and along adjacent creeks (NatureServe 2014d).

2.5.4.8.5 Mohr's Barbara's Buttons (*Marshalla mohrii*)

Mohr's Barbara's buttons (federally listed as threatened) typically occurs in moist, prairie-like openings in woodlands and along shale-bedded streams (USACE, Mobile District 2003b). At the time of its listing it was known to exist at 15 sites in Alabama, all of which are within the ACT Basin (one population in Bibb County, four in Etowah County, and 10 in Cherokee County) (USFWS 1991b). The species is also known from Floyd County, Georgia (within the ACT Basin). In 2010 the USFWS initiated a 5-year status review of Mohr's Barbara's buttons (USFWS 2010b).

2.5.4.8.6 White Fringeless Orchid (*Platanthera integrilabia*)

White fringeless orchid (a candidate species) is documented from 53 extant locations within six states: Alabama, Georgia, Kentucky, Mississippi, South Carolina, and Tennessee. In the ACT basin, is found in the Etowah, Upper Coosa, Lower Coosa, and Upper Tallapoosa watersheds. This species is generally found in wet, flat, boggy areas at the head of streams or seepage slopes (NatureServe 2014e).

2.5.4.8.7 Harperella (*Ptilimnium nodosum*)

Harperella (federally listed as endangered) typically grows in two habitat types: (1) rocky or gravel shoals and margins of clear, swift-flowing stream sections and (2) edges of intermittent pineland ponds in the Coastal Plain. Two extant populations occur in Alabama. One consisting of several thousand individuals occurs along the Little River on the border of Cherokee and DeKalb counties (USFWS 1990). The other population has less than 100 plants and is on Town Creek in DeKalb County. More recent data for the species within the basin are unavailable, but a 5-year review is underway (USFWS 2008e).

2.5.4.8.8 Michaux's Sumac (*Rhus michauxii*)

Michaux's sumac (federally listed as endangered) is a species which was historically endemic to the Inner Coastal Plain and lower Piedmont of North Carolina, South Carolina, and Georgia. Extant populations occur in North Carolina, Virginia, and Georgia. In Georgia both extant and historical populations of this species occur on mafic/sub-mafic substrates and derivatives. This type of habitat in Georgia is extremely limited (NatureServe 2014f).

2.5.4.8.9 Kral's Water Plantain (*Sagittaria secundifolia*)

Kral's water plantain (federally listed as threatened) typically occurs on frequently exposed shoals or is rooted in quiet pools up to 3 ft deep. In the ACT Basin, the species has been collected from the Little River (Cherokee and DeKalb counties, Alabama and Chattooga County, Georgia), a tributary to the Coosa River; and from Town Creek (DeKalb County, Alabama), a tributary to the Tennessee River (USFWS 1991a). More recent data are unavailable; however, a 5-year review of the species is underway (USFWS 2008d).

2.5.4.8.10 Green Pitcher Plant (*Sarracenia oreophilia*)

The green pitcherplant (federally listed as endangered) occurs in a relatively wide variety of habitats, including mixed oak or pine flatwoods, seepage bogs, and stream banks (USFWS 1994b). It is found near seepage bogs in sandy clays or loams that contain abundant organic matter. On the basis of historic records, the species is most likely to occur in the ACT Basin in DeKalb, Etowah, and Cherokee counties, Alabama (USFWS 1994b).

2.5.4.8.11 Alabama Canebreak Pitcherplant (*Sarracenia rubra* ssp. *alabamensis)*

The Alabama canebrake pitcherplant (federally listed as endangered) is found in sandy and gravelly bogs; in damp, peaty soil around springheads or seeps; and in swamps. It grows in highly acidic sands and clays. Within the ACT Basin, the Alabama canebrake pitcherplant is restricted to 12 sites in three counties in central Alabama: 5 populations each in Autauga and Chilton counties, and 2 in Elmore County (USFWS 1992c). A 5-year review of the species has been initiated (USFWS 2008c).

2.5.4.8.12 Georgia Aster (*Symphyotrichum georgianum*)

The Georgia aster is a candidate species for federal listing (USFWS 2009d). It generally occurs in dry oak-pine flatwoods and uplands in the piedmont of North and South Carolina, Georgia, and Alabama. The species is presumed to be extirpated throughout much of its historic range, including Florida. It remains in 31 counties in 4 states (North Carolina, South Carolina, Alabama, and Georgia), 3 of which are in Alabama and 10 in Georgia (USACE, Mobile District 2003b; USFWS 2009d).

2.5.4.8.13 Tennessee Yellow-Eyed Grass (*Xyris tennesseensis*)

At the time of its listing as endangered, extant populations of Tennessee yellow-eyed grass occurred at 14 sites in the five areas: (1) Northwest Georgia (Bartow and Whitfield counties - one population each; (2) Northeast Alabama (Calhoun County - two populations); (3) Central Alabama (Bibb County - five populations); (4) Northwest Alabama (Franklin County - one population); and (5) South central Tennessee (Lewis County - four populations) (USFWS 1994a). Conditions of the sites generally feature nearly permanent (all-year) moisture regimes, open, sunny conditions, and calcareous bedrock (shale, limestone, dolomite) or thin calcareous soils (USACE, Mobile District 2003b). Recent survey data are not available in the ACT Basin; however, a 5-year review of the species is underway and should provide new information (USFWS 2008c).

2.5.5 Fish and Wildlife Management Facilities Affected Environment

Fish and wildlife management facilities include all fish hatcheries, wildlife refuges, and fish and wildlife management areas in the ACT Basin. At least six state or federal facilities in the ACT Basin use water in operations for fish and wildlife management. These facilities include fish hatcheries and a public fishing area. The facilities and their annual water use are listed below:

- William "Bill" Dannelly Lake in Camden, Alabama, operated by USACE with an average annual use of 0.02 mgd of surface water from the Alabama River
- Arrowhead Game Management Office in Armuchee, Georgia, operated by GADNR with an average annual use of 0.05 mgd of surface water from the Armuchee Creek
- Arrowhead Public Fishing Area in Armuchee, Georgia, operated by GADNR with an average annual use of 0.3 mgd of surface water from the Armuchee Creek
- Eastboga Fish Hatchery in Eastboga, Alabama, operated by ADCNR with an average annual use of 0.19 mgd of groundwater
- Alabama Aquatic Biodiversity Center in Marion, Alabama, operated by ADCNR with an average annual use of 0.35 mgd of groundwater
- Summerville Fish Hatchery in Summerville, Georgia, operated by GADNR with an average annual use of 2.19 mgd of groundwater

Average annual water use at those six facilities totals 3.1 mgd. Nearly 90 percent of current water supply is provided by groundwater. Water use peaks in the spring and is at its lowest level in the summer (USACE, Mobile District 1998a).

2.6 Socioeconomic Resources

2.6.1 Socioeconomic Resources Affected Environment

This section describes the affected environment, or the baseline conditions, for the economic resources in the ACT Basin. M&I water demands, navigation, power generation, agriculture, recreation, and flood risk management are discussed, as well as population, housing, income, employment, environmental justice, and protection of children.

The ACT Basin drains approximately 22,739 sq mi in parts of southeastern Tennessee, northwest Georgia, and a diagonal area across Alabama from the northeast to the southwest corner of the state. The major rivers of the ACT Basin are the Alabama, Coosa, and Tallapoosa rivers. About 76 percent of the ACT Basin is in Alabama; the remaining 23 percent is in Georgia, with a very small portion in southeast Tennessee. The basin extends approximately 320 mi from the Blue Ridge Mountains to the Gulf of Mexico and has an average width of approximately 75 mi. The basin covers 32 counties in Alabama, 18 counties in Georgia, and 2 counties in Tennessee.

The ACT Basin is a dynamic hydrologic system containing interactions between aquifers, streams, reservoirs, floodplains, estuaries, and adjacent river basins. Water resources in the ACT Basin have been managed to serve a variety of purposes, including navigation, hydropower, flood risk management, water supply, water quality, and recreation. Such water resources also provide important habitat for fish and wildlife conservation. The basin has 17 dams (6 federal and 11 non-USACE projects) (USACE, Mobile District 1998a) that have altered the natural streamflow. The interrelationship between dam operations and downstream river flows has resulted in a highly regulated system over much of the basin, with the exception of the Cahaba River, which remains naturally free-flowing.

USACE is responsible for flood risk management functions at Weiss, H. Neely Henry, Logan Martin, and R.L. Harris lakes. Two dams are on the Coosawattee River: Carters Lake and Carters Reregulation Dam, a peaking hydropower facility. The Oostanaula River flows south for approximately 47 mi where it joins the Etowah River and forms the Coosa River at Rome, Georgia. One dam is on the Etowah River—Allatoona Lake, about 48 mi above Rome near Cartersville, Georgia. The Coosa River flows 286 mi from

Rome, Georgia, to north of Montgomery, Alabama, where it joins the Tallapoosa River to form the Alabama River. Seven APC dams form continuous impoundments over nearly the entire length of the Coosa River, with each dam discharging to the upper end of the next downstream reservoir. The dams are Weiss Lake, H. Neely Henry Lake, Logan Martin Lake, Lay Lake, Mitchell Lake, Jordan Dam and Lake, and Bouldin Dam. The upper three APC projects operate as peaking facilities, with releases occurring several hours each weekday and with no releases on the weekends. The lower four projects generally operate as run-of-river projects for power production and to maintain stable flows from Jordan Dam and Lake over the weekends when the upstream peaking projects do not operate. Because the series of reservoirs provide continuous inundation from one dam to the next, the effects of the peaking operation are tempered and attenuated.

The Tallapoosa River begins in northwest Georgia at an elevation of 1,145 ft. The river flows 235 mi into Alabama to join the Coosa River near Montgomery. APC has constructed four dams across the Tallapoosa River. The upper two projects, R.L. Harris Lake and Lake Martin, are peaking projects that generate several hours on weekdays and normally do not generate on weekends. The two downstream projects, Yates and Thurlow lakes, operate as run-of-river facilities, slightly reregulating peak upstream releases and maintaining downstream minimum flows over the weekends when the upstream projects typically reduce discharges.

The Alabama River is formed by the confluence of the Coosa and Tallapoosa rivers about 14 mi north of Montgomery, Alabama. The river channel varies in width from 400 to 600 ft with banks 10 ft high (USACE, Mobile District 1998a). USACE has constructed three multipurpose dams on the Alabama River. Robert F. Henry Lock and Dam, about 30 mi above Selma, and Millers Ferry Lock and Dam, 73 mi downstream from Selma. Each has a navigation lock and a hydropower powerhouse. Claiborne Lock and Dam, 72 mi above the mouth has only a navigation lock, six spillway gates, and a fixed-crest spillway.

2.6.1.1 M&I Water Demands

A critical function of the rivers in the ACT Basin is water supply. Municipalities draw water from the rivers and reservoir pools for their water supplies. Industrial plants such as pulp and paper mills and poultry-processing operations use water in their production processes. Recreation-related businesses, such as country clubs, use water to irrigate golf courses. Various state and county parks use water for irrigation and water supply. In many ways, such water uses support local jobs and contribute to the economy. Water use and water use trends (municipal, industrial, agricultural, etc.) in the ACT Basin from the 1950's to the early 2000's is summarized in Section 2.1.1.2.3.5 and additional background information is available in the ACT Master WCM and individual project WCMs (EIS Appendix A).

The purpose of this section is to estimate water usage rates for the ACT Basin over a 20-year period from 2011 to 2031. This analysis represents the best estimates by USACE on the basis of data from Alabama, Georgia, federal agencies, and previously conducted studies.

2.6.1.1.1 Water Demand Methodology

The methodology used for this analysis identified, as accurately as possible, existing sources of available data from various local, state, and federal agencies and used that data to make an informed estimate of future M&I water demands for the ACT Basin. M&I demands include all water uses, both publicly supplied and self-supplied, described as residential, commercial, government/institutional, industrial/manufacturing, and other demands such as unaccounted (e.g., distribution system losses) water use. Data sources used for this analysis include (1) information from the Comprehensive Basin-wide reports conducted by the USACE, Mobile District on the ACT Basin in the 1990's (*Draft Environmental*

Impact Statement of Water Allocation for the Alabama-Coosa-Tallapoosa (ACT) River Basin, Alabama and Georgia, Main Report); (2) actual water use data provided by Alabama and Georgia; and (3) population data collected from the U.S. Census Bureau. Using those data, the analysis seeks to find a reasonable Compound Annual Growth Rate (CAGR) that can be applied to the latest available accurate year water usage data to estimate the future M&I needs for the ACT Basin. The steps are as follows:

1/ Net M&I Water Usage for a Given Year = Total Surface Water Withdrawals – Total Returns

2/ Net M&I Water Usage CAGR for a series of years = (((Ending Year Water Use / Beginning Year Water Use)) (1/n))-1) × 100, where n is equal to the number of years of growth.

3/ M&I Projection for a given Year = Net M&I for the previous year × CAGR

2.6.1.1.2 Data from 1990's Comprehensive Basin-Wide Reports

In the 1990s, USACE, Mobile District developed (in cooperation with 10 other federal agencies) draft EISs in light of an interstate water compact for the ACT and ACF river basins. The stated purposes of the compact were:

> "…promoting interstate comity, removing causes of present and future controversies, equitably apportioning the surface water of the ACT and ACF, engaging in water planning, and developing and sharing common databases."

Although the results of the draft Comprehensive Study EISs for the ACT and ACF river basins were never finalized, significant effort and coordination went into the development of growth rates for the two basins. Planning and Management Consultants, Ltd. (PMCL) was contracted to identify, analyze, and coordinate the M&I water demand needs for the basins among the various state and federal stakeholders. The results of the PMCL effort were based on extensive interviewing and surveying of the various counties and water utilities within the basins and were generally considered by all parties to be an accurate portrayal of the M&I water needs. Table 2.6-1 shows the PMCL analysis results for the ACT for various years.

Table 2.6-1.
Results of 1990's PMCL M&I water demand analysis from the Comprehensive Study EISs

Year	ACT
1995	618 mgd
2000	647 mgd
2005	683 mgd
Compound Annual Growth Rate, 1995-2005	1.01%
Compound Annual Growth Rate, 2000-2005	1.09%

2.6.1.1.3 Population Data

Population data for the various counties were collected for the ACT Basin from the U.S. Census Bureau. The Census Bureau conducts a full nationwide census every 10 years in years ending in zero. It also uses statistical analysis in between those years to estimate population trends. Table 2.6-2 shows the population data from 2000 to 2009 for the states in the ACT Basin.

Table 2.6-2.
2000 to 2009 population data for the ACT Basin

Year	AL	GA	ACT
2000	3,040,773	1,590,201	4,630,974
2001	3,065,935	1,643,716	4,709,651
2002	3,091,692	1,699,316	4,791,008
2003	3,118,063	1,757,089	4,875,153
2004	3,145,068	1,817,128	4,962,196
2005	3,172,726	1,879,528	5,052,253
2006	3,201,058	1,944,388	5,145,447
2007	3,230,087	2,011,815	5,241,902
2008	3,259,835	2,081,916	5,341,751
2009	3,290,326	2,154,806	5,445,132
Compound Annual Growth Rate, 2000–2009	0.79%	2.73%	1.63%

Source: U.S. Census Bureau 2000, 2009c

2.6.1.1.4 State Collected Water Usage Data

The Mobile District contacted the state agencies involved in the ACT/ACF River Basins Comprehensive Water Resources Study to provide all available water use data from 2001 through 2005. Alabama's Office of Water Resources, (OWR) Florida's Northwest Florida Water Management District (NWFWMD) and Georgia's EPD provided data in spreadsheet form. Water Use Data included municipal, industrial, and power withdrawals and returns. Water Use Data from 1995 through 2001 was provided to Mobile District in 2002 to support the update of the Unimpaired Flow Data set.

Upon weeks of review and communication with OWR, NWFWMD and EPD, missing data, duplicate data, erroneous data and other inconsistencies were discovered and corrected using professional judgment. Also, during the review many missing records had to be estimated.

Table 2.6-3 summarizes water usage data and the derived compound annual growth rates for the ACT Basin for the period 1995 through 2005. The data provided is in millions of gallons per day (mgd). Table 2.6-4 displays the annual per capita water use by dividing the water usage from Table 2.6-3 by the population data provided in Table 2.6-2. Since water used data was only available for the period 1995 through 2005 at the time the analysis was performed, Table 2.6-4 presents this period as well.

Table 2.6-3.
1995 to 2005 state water use data for the ACT Basin

ACT actual surface water usage (mgd)			
Year	**AL**	**GA**	**ACT**
1995	23.33	93.05	116.38
1996	19.36	171.04	190.40
1997	5.60	173.10	178.69
1998	-1.21	177.31	176.10
1999	14.95	201.68	216.63
2000	77.03	177.64	254.67
2001	108.38	164.91	273.29
2002	126.71	169.63	296.34
2003	124.36	151.88	276.24
2004	109.73	142.69	252.42
2005	153.03	150.05	303.08
Compound Annual Growth Rate 1995-2005	**20.69%**	**4.89%**	**10.04%**
Compound Annual Growth Rate 2000-2005	**14.71%**	**-3.32%**	**3.54%**

Table 2.6-4.
2000 to 2005 yearly per capita water use for the ACT Basin

ACT yearly per capita water use (gallons)			
Year	**AL**	**GA**	**ACT**
2000	37.78	113.83	70.76
2001	52.94	101.45	74.41
2002	61.74	101.47	79.57
2003	60.32	88.78	73.22
2004	52.97	81.46	66.02
2005	73.45	83.52	78.11
Compound Annual Growth Rate, 2000-2005	**14.22%**	**-6.01%**	**2.00%**

2.6.1.1.5 M&I Water Demand Projections

The CAGR derived from the water use data sets as provided by the states, although valuable for reporting, were determined not suitable for use in projecting future M&I needs for the basins for several reasons. First, Alabama did not receive consistent reporting from utilities until around the year 2000, as can be seen in the previous tables. Due to this fact, the 10-year compound growth rate (1995–2005) reported is higher than what it actually should be over the period. Second, the ACT Basin was in drought conditions in the early 2000's, skewing the 5-year growth rate (2000–2005) downward, a negative value for Georgia, representing the conservation efforts seen within the basin.

Because of those observations, the compound annual growth rates derived and carefully coordinated among stakeholders by the PMCL efforts for the 1990's Comprehensive Studies, identified previously in Table 2.6-1, were determined to be applicable for use in this analysis. A comparison of the PMCL water use compound annual growth rates to the population compound annual growth rates of the basin shown

above in Table 2.6-2 confirm that they are reasonable estimates of growth for the ACT Basin, assuming somewhat steady per capita use over the 20-year period of analysis. Table 2.6-5 displays the estimated M&I demand growth from 2011 to 2031 using a 10-year PMCL CAGR and Table 2.6-6 displays M&I growth over the same period using a 5-year PMCL CAGR, by applying the formula:

M&I Projection for a given Year = Net M&I for the previous year × CAGR.

These M&I water demand projections represent the best estimate of future basin needs at the time of this document's writing and given the available data for 2006 provided by Alabama and Georgia.

Table 2.6-5.
25-year M&I water demand projections based on 10-year PMCL compound annual growth rate 1.01 percent

	ACT water demand projection (mgd)		
Year	**AL**	**GA**	**ACT**
2006	145.9	181.9	327.8
2011	151.8	189.2	341.0
2012	153.4	191.1	344.4
2013	154.8	193.1	347.9
2014	156.4	195.0	351.4
2015	158.0	197.0	355.0
2016	159.6	199.0	358.6
2017	161.2	201.0	362.2
2018	162.9	203.1	365.9
2019	164.5	205.1	369.6
2020	166.2	207.2	373.4
2021	167.9	209.3	377.1
2022	169.6	211.4	381.0
2023	171.3	213.6	384.8
2024	173.0	215.7	388.7
2025	174.8	217.9	392.7
2026	176.5	220.1	396.6
2027	178.3	222.3	400.7
2028	180.1	224.6	404.7
2029	182.0	226.9	408.8
2030	183.8	229.2	413.0
2031	185.7	231.5	417.1

Source: Water use data collected from states.

Table 2.6-6.
25-year M&I water demand projections based on 5-year PMCL compound annual growth rate 1.09 percent

	ACT water demand projection (mgd)		
Year	**AL**	**GA**	**ACT**
2006	144.3	179.9	324.2
2011	152.3	190.0	342.3
2012	154.0	192.0	346.0
2013	155.7	194.1	349.8
2014	157.4	196.2	353.6
2015	159.1	198.4	357.5
2016	160.8	200.5	361.4
2017	162.6	202.7	365.3
2018	164.4	204.9	369.3
2019	166.2	207.2	373.3
2020	168.0	209.4	377.4
2021	169.8	211.7	381.5
2022	171.7	214.0	385.7
2023	173.5	216.4	389.9
2024	175.4	218.7	394.2
2025	177.3	221.1	398.5
2026	179.3	223.5	402.8
2027	181.2	226.0	407.2
2028	183.2	228.4	411.6
2029	185.2	230.9	416.1
2030	187.2	233.5	420.7
2031	189.3	236.0	425.3

Source: Water use data collected from states.

2.6.1.2 Navigation

The Alabama River is an authorized navigation project in southwest Alabama stretching 289 mi from its confluence with the Mobile River to Montgomery, Alabama. A 9-ft by 200-ft navigation channel is on the Alabama River from its junction with the Mobile River to Montgomery, Alabama, including three sets of locks and dams.

The Alabama River is a terminus on the inland waterway system. It is accessed by the Black Warrior Tombigbee Waterway and Mobile Harbor and the Gulf Intracoastal Waterway (GIWW). Its major value as a water transportation resource is its ability to carry traffic to and from inland waterway points in Mississippi, Louisiana, and Texas. Barge navigation is provided by a series of three locks and dams. Claiborne Lock and Dam is the lowermost structure at navigation mile 72.5, which is 117.5 above the Bankhead Tunnel, at Mobile, Alabama. It has a lift of 30 ft. Millers Ferry Lock and Dam is upstream of Claiborne Lock and Dam at navigation mile 178 and has a lift of 45 ft. Robert F. Henry Lock and Dam is upstream of Millers Ferry Lock and Dam at navigation mile 281.2. It has a lift of 45 ft. All three lock chambers have dimensions of 84 ft by 600 ft.

The Alabama River is bounded on all fronts by navigable waterways; the Tennessee River to the north, the ACF on the east, Mobile Harbor and the GIWW on the south and the Black Warrior–Tombigbee River to the west. It competes with other waterways and other modes of transportation. Cost disadvantages that arise when barges must be light-loaded for low water conditions plus the lack of backhaul cargoes limit the opportunity for sustained growth and diversification of Alabama's cargoes. The bulk of the traffic on the Alabama River is linked to resources originating along the river, which makes barge transportation essential and convenient for moving these resources.

Because of river bends and shoaling at the bends, typical tow size is a four-barge tow, except during very low water conditions when tow sizes can be reduced to two barges. Coast Guard regulations restrict tow widths to one-half of the 200-ft channel width. Those restrictions, however, would still allow most GIWW tows to navigate the Alabama River without breaking up tows. Tow widths generally do not exceed the width of locks on the system, which is 84 ft.

2.6.1.2.1 Facilities

Facilities along the Alabama River are numerous and strategically located. The Alabama State Docks maintains three public terminals, Claiborne, Selma, and Montgomery at RMs 74.4, 227.6, and 305.0, respectively, on the Alabama River. Table 2.6-7 and Table 2.6-8 display the private and public terminals.

Table 2.6-7.
Private terminals—Alabama River

Terminal	City	RM
Canton Oil & Gas Company	Carlton, Alabama	18.5
Alabama River Pulp	Claiborne, Alabama	67.5
International Paper	Millers Ferry, Alabama	121.9

Table 2.6-8.
Public terminals—Alabama docks—Alabama River

Terminal	Products handled	Storage	Barges handled	Operations	Connections
Claiborne	Grain	Concrete Elevator 427,000 bu.	1 worked, 2 held	As required	
Selma	General Cargo, Grain, Dry bulk	Open, unpaved elevator 302,000 bu.	1 worked, 2 held	As required	
Montgomery	General Cargo, Grain, Dry bulk	Open, unpaved elevator 594,000 bu.	1 worked, 2 held	As required	L&N Rail

2.6.1.2.2 Waterborne Commerce

Over the past 14 years, most of the commodity tonnage was from moving petroleum and related products along the waterway. Most of the lockages that pass through are recreational, not commercial. Waterborne commerce for 1998 through 2011, as reported by USACE Waterborne Commerce Statistics Center in New Orleans is listed in Table 2.6-9.

Table 2.6-9.
Waterborne commerce for Alabama and Coosa rivers 1998–2011

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Ton-miles x 1,000	61,468	44,654	6,719	13,873	9,168	6,044	9,383	7,032	4,697	22,585	14,420	20,765	724	0
Total, all commodities (tons x 1,000)	655	557	90	126	77	90	127	106	77	128	80	99	7	0
Coal (tons x 1,000)	0	0	0	0	4	0	0	0	0	0	0	0	0	0
Petroleum and petroleum products (tons x 1,000)	66	144	87	86	42	89	121	102	77	17	31	6	6	0
Chemicals and related products (tons x 1,000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude materials, inedible except fuels (tons x 1,000)	587	411	0	39	31	0	5	3	0	111	37	93	0	0
Primary manufactured goods (tons x 1,000)	2	0	4	0	0	0	0	0	0	0	0	0	0	0
Food and farm products (tons x 1,000)	0	2	0	0	0	0	0	0	0	0	0	0	0	0
All manufactured equipment, machinery and products (tons x 1,000)	0	0	0	1	0	0	0	0	0	0	12	0	2	0

Note: Section included: Mouth to Wetumpka, Alabama. Project depth: Mouth to Wetumpka, 9 ft. For 2011, no commerce was reported.

2.6.1.3 Hydropower Generation

The ACT Basin was heavily developed for hydropower generation by private power companies, municipalities, and USACE. The power resources serve residential, commercial, agricultural, and industrial users. Some of the agricultural and industrial users are dependent on economical power sources for continued operations.

2.6.1.3.1 ACT Basin Bulk Power System Overview

The ACT Basin is in the southeastern subregion (Figure 2.6-1) of the Southeastern Electrical Reliability Corporation (SERC, formerly the Southeastern Electrical Reliability Council) and the larger North American Electrical Reliability Council. The southeastern subregion of SERC consists of five smaller control areas that are each individually managed by Alabama Electric Cooperative, Oglethorpe Power Corporation, South Mississippi Electrical Power Association, Walton Electric Membership Corporation, and the Southern Company. APC is a division of the Southern Company and is the primary private operator in the ACT Basin.

SERC is responsible for improving the reliability related to the critical infrastructure of the bulk power system in the region. Since 1998, the southern sub-region has undergone a significant increase in natural gas capacity. Natural gas currently nearly matches coal in percentage of total system capacity at around 35 percent. Nuclear and hydropower energy make up the remaining bulk energy at 15 percent and 10 percent of total system capacity, respectively (Figure 2.6-2).

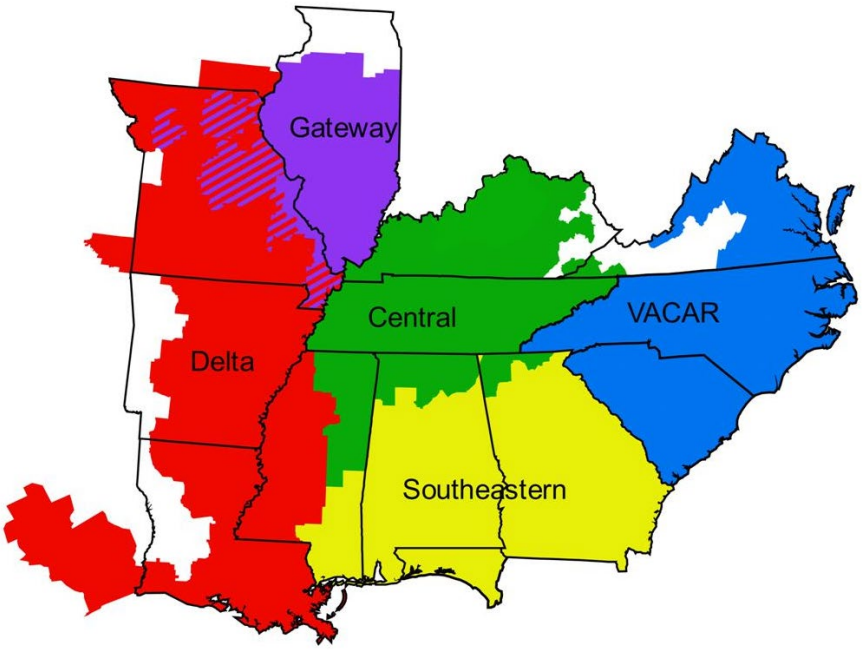


Figure 2.6-1. SERC subregions (SERC 2011).

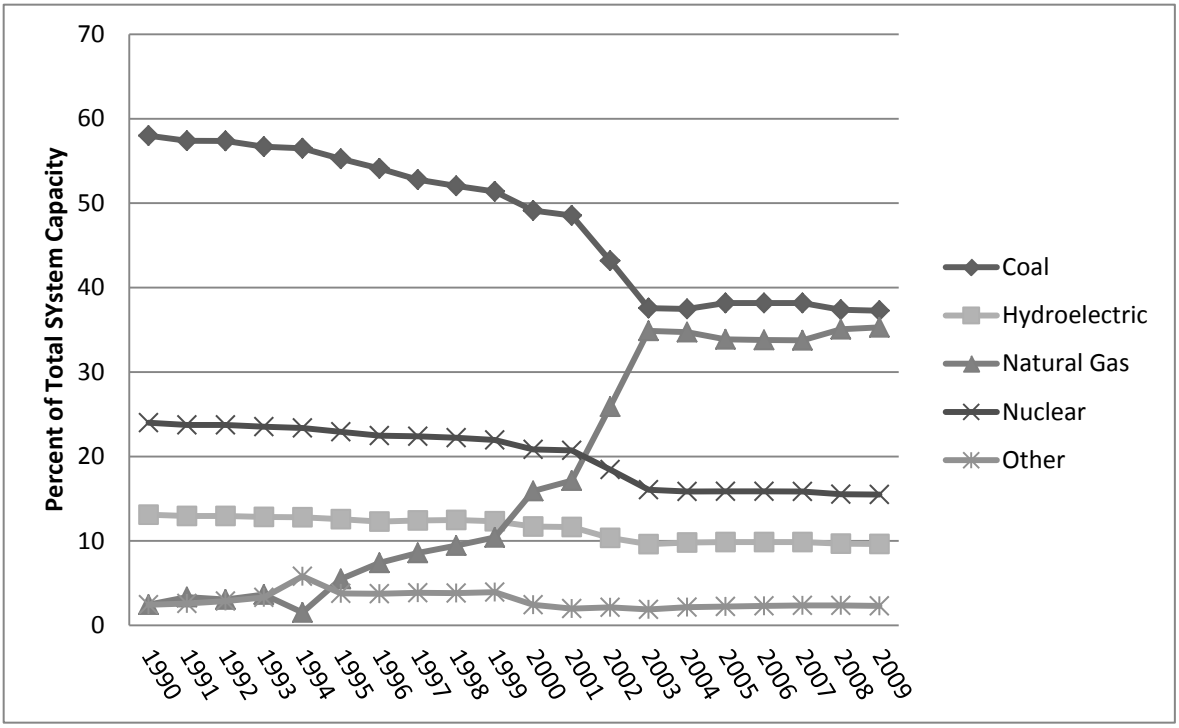


Figure 2.6-2. Historical trends for the percent of total system capacity for SERC's Southern sub-region.

According to the November release of 2008 data by Platts (an industry leader in providing price assessments in energy markets), SERC's electrical power resources are dominated by thermoelectric generation, a process of heating water into steam and using the steam to move turbines. Coal accounts for 59 percent of the region's total electrical generation. Additionally, nuclear power accounts for 27 percent of all generation in the area. Hydropower makes up a smaller share of regional energy production and generates only 2 percent of the total energy. Total estimated 2008 generation for the SERC region was 1,065,368 gigawatt hours. All thermoelectric energy in the region is generated at plants owned by private entities, while 50 percent of the hydropower energy is generated at federal plants (Platts 2008).

Coal and nuclear power are predominately run as baseload plants, facilities that produce constant rates of generation to meet the system's continuous regional demands. Natural gas and hydropower plants on the other hand are generally run as peaking plants, meeting the daily and seasonal peak loads throughout the system. This is important in conceptually understanding what alternative thermoelectric plants might be used to replace hydropower if changes in operations dictated such a need. As an illustrative example consider the 2009 generation pattern reported by the Energy Information Administration (EIA) for the southern sub-region (Figure 2.6-3). Increases (decreases) in percent of total generation for hydropower are matched by decreases (increases) in percent generation for natural gas. The same coupling of energy sources can be seen in the relationship between coal and nuclear power.

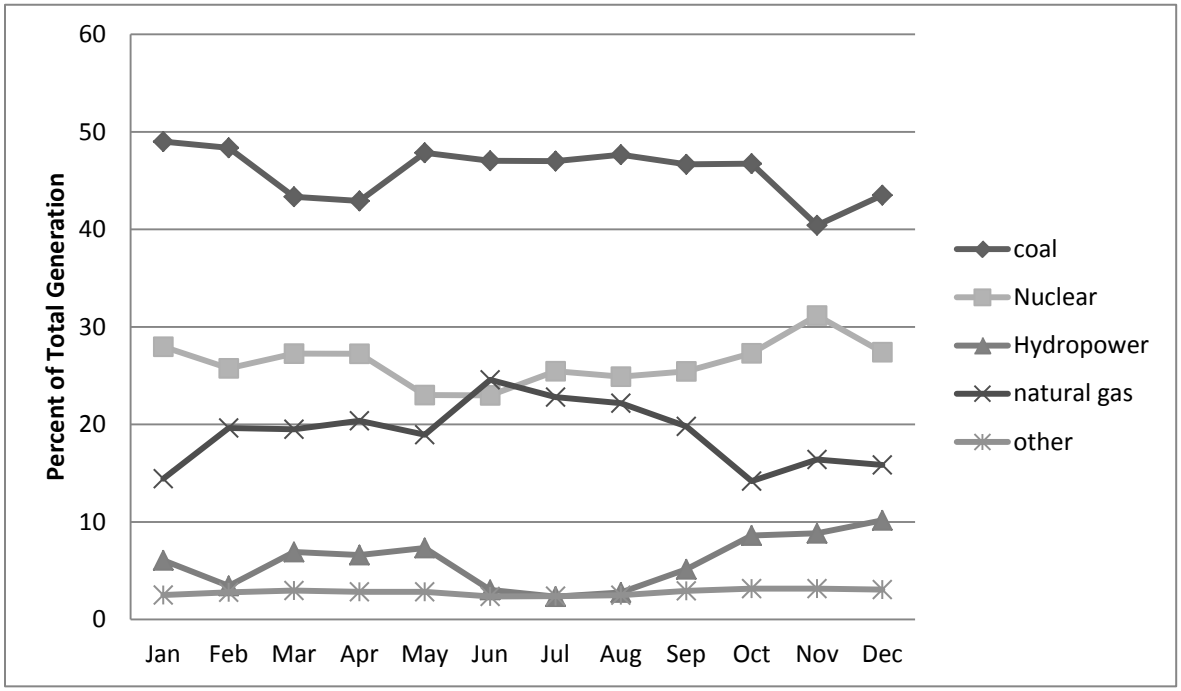


Figure 2.6-3. Percent of total generation by fuel type for SERC's Southern sub-region.

2.6.1.3.2 ACT Hydropower System

USACE operates four projects with hydropower capabilities in the ACT Basin. The Robert F. Henry Lock and Dam and Millers Ferry Lock and Dam are both on the Alabama River about 200 miles upstream of Mobile Bay. The two dams work together with a combined generating capacity of 172 MW in support of hydropower generation while serving other project purposes, including navigation, recreation, water quality, and fish and wildlife conservation. Allatoona Lake is northwest of Atlanta, Georgia, on the Etowah River. It is operated as a peaking plant with an installed generating capacity of 82.2 MW. The final USACE project, Carters Dam, is on the Coosawattee River in Georgia and is operated as a pump

storage plant. This plant consists of two pools, Carters Lake and Carters Reregulation Dam. During peak loading hours, water is released from Carters Lake to the reregulation pool generating energy. When demand is low, energy is purchased to pump water back into the Carters Lake from the reregulation pool. This plant has a total generating capacity of 600 MW.

Eleven non-USACE projects owned by APC are also included in the ACT hydropower system (Table 2.6-10). As a whole, APC owns a total of 14 peaking power plants making up 6 percent of the company's power generation. The 11 APC projects on the Tallapoosa and Coosa rivers have 1,403.5 MW of declared generating capacity.

Table 2.6-10.
Project hydropower generation characteristics for the ACT Basin

Project	Owner	No. of units	Installed capacity (MW)
Allatoona Dam	USACE	3	82.2
Carters Dam	USACE	4	600
Weiss Dam	APC	3	87.75
H. Neely Henry Dam	APC	3	72.9
Logan Martin Dam	APC	3	128.25
Lay Dam	APC	6	177
Mitchell Dam	APC	4	170
Jordan Dam	APC	4	100
Bouldin Dam	APC	3	225
R.L. Harris Dam	APC	2	135
Martin Dam	APC	4	182.5
Yates Dam	APC	2	44.25
Thurlow Dam	APC	3	81.35
Robert F. Henry Lock and Dam	USACE	4	82
Millers Ferry Lock and Dam	USACE	3	90
Total			2,257.7

Table 2.6-11 below displays generation over the past several years at federal projects.

Table 2.6-11.
ACT federal project power generation (MWh) by fiscal year (FY)

	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011
Alabama River Power Projects	465,864	627,148	571,701	826,003	708,004	885,777	633,618	464,458	444,314	645,867	660,838	506,146
Allatoona Dam	80,418	116,857	76,417	203,245	120,092	223,257	92,795	71,453	50,541	100,222	174,927	86,790
Carters Dam	413,225	387,964	385,928	380,276	481,001	434,571	434,088	484,652	535,959	577,565	610,566	544,692

SERC collects monthly peak hour demand data and the net energy for the southern subregion. Each utility's peak hour demand and net energy were aggregated for each month. Then, a summer and winter peak hour demand were identified by the month with the highest peak in each season.

Platts projects that SERC's energy and peak demand will have an annual average increase of 1.5 percent over the next 20 years. The projected increase reflects both a shift in the SERC region along with an

increase in consumption. To meet that demand, 7,100 MW are projected to be added to the region's capacity, 4,800 MW of which will be from coal. With the additional increase in capacity, the region's power generation is still projected to be thermoelectric driven with coal and nuclear energy making up almost 81 percent, and hydropower still providing 2 percent of the total generation (Platts 2008).

2.6.1.4 Agricultural Water Supply

Agriculture is a vital component of the regional economy; therefore, the availability of adequate water supplies for the agricultural purposes is important. According to the U.S. Census in 2000 approximately 37,310 people in Alabama were employed in the agriculture, forestry, and fisheries industries; in Georgia it was 53,201 people (U.S. Census Bureau 2009a). Potential shortages in meeting agricultural water demands could result in significant economic effects on portions of the ACT Basin.

As part of the ACT/ACF Comprehensive Study, in 1995 the NRCS completed the Agricultural Water Demand element of the study. In performing this element of the study, the NRCS evaluated the agricultural water demand in the ACT Basin for five broad agricultural categories: crops and orchards, turf farms, nurseries, aquaculture, and livestock and poultry. Approximately 79 percent of the water used for agricultural purposes in the ACT Basin is for the irrigation of crops and orchards. The NRCS found that in the ACT Basin, surface water supplied the majority of the water used for agricultural irrigation. The primary sources of surface water for agricultural use in the ACT Basin are smaller tributaries to the Alabama, Coosa, and Tallapoosa rivers or from farm ponds constructed for that purpose.

Surface water and groundwater withdrawals within the ACT Basin for agricultural water supply are summarized in Sections 2.1.1.2.3.1 and 2.1.1.2.3.2. Additional information on agriculture is available in the ACT Master WCM and individual project WCMs (EIS Appendix A).

2.6.1.5 Flood Risk Management

Flood risk management has long been an important USACE focus for the reservoirs it operates. In the ACT Basin, Allatoona Lake provides important flood-control storage, with spillway capacities sufficient to discharge floods with return intervals of 500 years. The 500-year floodplain downstream of the dam extends through Bartow and Floyd counties. The floodplain begins at Allatoona Dam and concludes on the Coosa River downstream of the Etowah River's confluence with the Oostanaula River.

The majority of the floodplain structures are in the Cities of Cartersville, Euharlee, and Rome, Georgia. According to the 1998 draft EIS (USACE Mobile District 1998a), the floodplain downstream of Allatoona Lake consists of 1,132 residential structures, 9 public structures, and 189 commercial structures. Tax assessor-appraised residential structure values range from a $5,000 trailer to several $450,000 homes, with a floodplain residential structure value of over $65.8 million. Residential structure content values are estimated to total $29.1 million. Public structures in the floodplain have a total value of $847,000. The structures range in value from a $35,000 storage building to a $150,000 sewage treatment facility. Public structure inventory and equipment values total $168,000 and $741,000, respectively. The floodplain tax-appraised commercial structures value from a $10,000 office building to a $119 million industrial plant, with a floodplain total commercial value of $213.6 million. Commercial structure inventory and equipment values total $25 million and $54.3 million, respectively. The total land value in the floodplain downstream of Allatoona Dam is approximately $389.6 million.

USACE developed an *Annual Damage Reduction Summary*, which reports the estimates the flood damages prevented by two projects in the ACT Basin: Allatoona Lake and Carters Lake. The cumulative flood damages prevented by Allatoona Lake through 2007 are estimated to be $90,528,398. It was estimated that Carters Lake prevented cumulative damages of approximately $645,991 through 2007

(USACE, Mobile District, Water Management Office 2008). On the basis of provisional data, a preliminary analysis indicates estimated damages prevented by Allatoona Dam and Carters Dam as of September 2009 exceeded $33 million (USACE, Mobile District 2009f).

Other lakes in the basin—such as Weiss, H. Neely Henry, Logan Martin, and R.L. Harris lakes—also provide flood risk management, but their protection has not been calculated.

2.6.1.6 Recreation

The reservoirs, rivers, and streams of the ACT Basin are heavily used for recreation. The reservoirs and rivers provide important recreation opportunities for residents in northern Georgia and a majority of Alabama. Northern Georgia and Alabama have several national forests, national and state parks, and resort communities that are favorite weekend and vacation destinations. The Georgia portion of the Coosa River Basin is in the Chattahoochee National Forest. The Cahaba and Coosa rivers run through the Talladega National Forest, south of Birmingham and Anniston, Alabama. South of Auburn-Opelika, Alabama, a tributary to the Tallapoosa River runs through Tuskegee National Forest. The developed sites provide a range of primitive to modern facilities. Dispersed activities include hunting, fishing, boating, hiking, and off-road vehicle riding.

Two popular national parks are in the ACT Basin. Horseshoe Bend National Military Park is on a peninsula formed by the horseshoe-shaped bend of the Tallapoosa River. It commemorates the final battle of the Creek War of 1813–1814. The 2,040-ac park preserves the site of the battle and has a visitor center and walking trails. Water-related recreation facilities are not available at the park, but the flow level of the Tallapoosa River is considered integral to experiencing the historic park. Little River Canyon National Preserve, another popular National Park Service site in the ACT Basin, is a tributary to the Coosa River draining into Weiss Lake from the north. Sightseeing, picnicking, hiking, wading, advanced white water paddling, canoeing, mountain biking, horseback riding and rock climbing are popular activities at the 816-ac area. Hunting, fishing, and trapping are permitted in designated areas.

There are no federally designated Wild and Scenic Rivers within the ACT Basin.

Downstream from Claiborne Lock and Dam, the Alabama River joins the Tombigbee River and flows south to Mobile Bay. The Tombigbee, an important commercial waterway, also provides riverine recreation opportunities including fishing and boating. The Mobile Bay area also provides recreation opportunities, including deep-sea fishing, freshwater fishing in the bays and bayous, and water sports.

Of the reservoirs on the mainstem rivers in the ACT Basin, 15 provide recreation opportunities and receive varying amounts of usage. Six of the reservoirs are on the Coosa River, four are on the Tallapoosa River, three are on the Alabama River, and one each are on the Coosawatee and Etowah rivers. Facilities on the reservoirs provide a range of opportunities for recreation. Table 2.6-12 below details recreations facilities on each reservoir.

Table 2.6-13 below display visitor days at USACE projects from FY 2003 through FY 2011. Allatoona Lake has the highest number of visitor days each year.

2.6.1.7 Population

According to the U.S. Census Bureau, the population in the ACT Basin in 2010 was 5,275,006 people. The population has more than doubled in the region over the past 50 years. Table 2.6-14 and Table 2.6-15 below show the populations and growth rates over the past 40 years of the basin as a whole, and the Alabama and Georgia portions of the ACT Basin separated out. As shown in Table 2.6-14, about 62 percent of the population in the ACT Basin resides in Alabama with the remainder in Georgia. While

the overall percentage of population is larger in Alabama, the compound annual growth rate over the past 40 years averages about three percent for the Georgia portion of the basin compared to less than one percent for the Alabama portion (Table 2.6-15). The overall growth rate for the ACT Basin is 1.26 percent for 1960 through 2010 (Table 2.6-15).

Table 2.6-12.
Reservoir recreation facilities

Reservoir/ surface area	No. of parks	Campsites	No. of picnic sites	Boat ramps	Public docks & fishing piers	Comment
Carters Lake/ 3,275 ac	8	147	94	6	8	Public boat ramps, marina, two barrier-free fishing decks, day-use recreation areas containing picnic shelters are available. The lake is considered one of the best spotted bass fisheries in Georgia.
Allatoona Lake/ 11,862 ac	45	662	427	21	8	Camping, picnicking, hunting, fishing, boating, tennis courts and swimming facilities are available. Red Top Mountain State Park has recreational facilities; the lodge ceased operation in June 2010, but all other facilities remain open.
Weiss Lake/ 30,027 ac		1,480	384	38	12	World-renowned for crappie fishing
H. Neely Henry Lake/11 ,200 ac		108	214	28	11	Gadsden is on the shores of the lake.
Logan Martin Lake/15,269 ac		79	7	30	28	Pell City is on the shores of lake.
Lay Lake/11,795 ac		18	22	21	15	
Mitchell Lake/ 5,855 ac		26	44	11	2	
Jordan Dam and Lake/5,890 ac			22	11		The lake is just north of Montgomery.
R.L. Harris Lake/10,660 ac	11	105	78	11	9	
Lake Martin/ 39,210 ac	57	883	1,066	50	32	About 40 mi northeast of Montgomery; 57 facilities/parks that provide public access; 14 marinas and 12 swimming areas on the lake (APC 2008).
Yates and Thurlow lakes/2,004 ac and 570 ac			10	3		
Alabama River lakes/13,500 ac, 18,528 ac, and 6,290 ac	35	505	387	33	8	There are 35 day-use recreation areas offering tennis courts, playing fields, basketball courts, fishing piers, boat ramps, swimming areas, nature trails, and picnic shelters.

Source: USACE, Mobile District 1998a

Table 2.6-13.
ACT USACE project visits

	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011
Alabama River lakes	3,758,863	3,121,828	3,160,605	3,251,704	3,107,910	3,094,869	3,502,623	3,455,705	3,487,877
Allatoona Lake	5,942,789	5,650,029	5,663,215	6,129,733	6,431,973	6,929,550	5,281,347	6,245,913	6,004,769
Carters Lake	566,310	536,863	561,237	547,745	538,337	431,529	622,962	598,878	700,251

Table 2.6-14.
Population estimates

	2010	2000	1990	1980	1970	1960
ACT (AL)	3,255,514	3,042,112	2,766,512	2,688,651	2,379,925	2,330,066
ACT (GA)	2,019,492	1,594,408	1,153,046	854,126	636,681	484,100
ACT Basin	5,275,006	4,636,520	3,919,558	3,542,777	3,016,606	2,814,166

Source: U.S. Census Bureau 2009a, 2009b, 2009c, 2014a.

Table 2.6-15.
Population annual growth rates

	Total	60–70	70–80	80–90	90–00	00–10
ACT (AL)	0.67%	0.21%	1.23%	0.29%	0.95%	0.68%
ACT (GA)	2.90%	2.78%	2.98%	3.05%	3.27%	2.39%
ACT Basin	1.26%	0.70%	1.62%	1.02%	1.68%	1.30%

In Table 2.6-16 below, the population densities are given for the entire basin, with the Georgia and Alabama portions broken out and the corresponding annual growth rates between 1980 and 2010. The data were gathered from the 1980, 1990, 2000, and 2010 U.S. censuses. The growth rates for the population density similarly mirror the annual growth of the population as a whole. The Georgia portion of the basin has suburban areas of metro Atlanta. When the Alabama and Georgia portions are separated, note that from 1980 to 2010, the population density for the Georgia portion more than doubled, versus an increase of roughly 23 percent in the Alabama portion.

Table 2.6-16.
Population density

	Population per sq mi				Population density annual growth rate			
	2010	2000	1990	1980	1980–2000	1980–1990	1990–2000	2000-2010
ACT (AL)	95.7	88.6	80.2	77.6	0.70%	0.32%	1.00%	0.77%
ACT (GA)	298.0	234.2	168.2	125.1	2.94%	3.00%	3.37%	2.44%
ACT Basin	165.3	138.7	110.5	94.0	1.90%	1.63%	2.30%	1.77%

Source: U.S. Census Bureau 2009a, 2009b, 2014a

Population growth in the ACT Basin is projected to increase at an average of about 1.6 percent per year through 2060. The projections are presented in Table 2.6-17 below.

Table 2.6-17.
Population projections

	2000	2030	2060
ACT (AL)	3,040,773	4,197,614	5,601,733
ACT (GA)	1,590,201	4,643,786	6,197,150
ACT Basin	4,630,974	8,841,400	11,798,883

Source: USACE 2011 (created from historic population census data)

2.6.1.8 Housing

Housing statistics were gathered for the ACT Basin over the past 60 years. Housing counts include single family residential, mobile homes, and multi-family residential. For the year 2006 the total housing was an estimate based in the American Community Survey which is given by the U.S. Census Bureau on years that it does not conduct a census. Table 2.6-18 and Table 2.6-19 below show the housing counts and the corresponding growth rates for the entire basin as well as the Alabama and Georgia portions broken out. In 2010 there were a total of 2,349,269 housing units in the ACT Basin of those roughly two-thirds are in Alabama and the remainder are in Georgia (Table 2.6-18). The annual growth rate for housing for the ACT Basin between 1940 and 2010 was 2.03 percent (Table 2.6-19). However, housing has grown much faster in the Georgia portion (3.26 percent) of the ACT Basin than that of Alabama portion (1.65 percent) (Table 2.6-19).

Table 2.6-18.
Total housing units

	2010	2000	1990	1980	1970	1960	1950	1940
ACT (AL)	1,530,108	1,336,384	1,141,341	1,010,899	773,949	691,644	598,041	487,000
ACT (GA)	819,161	627,987	471,315	318,845	204,074	144,153	112,995	86,556
ACT Basin	2,349,269	1,964,371	1,612,656	1,329,744	978,023	835,797	711,036	573,556

Source: U.S. Census Bureau 2009a, 2009b, 2009c, 2014a

Table 2.6-19.
Housing annual growth rates

	1940–2010	’10–’00	’00–’90	’90–’80	’80–’70	’70–’60	’60–’50	’50–’40
ACT (AL)	1.65%	1.36%	1.59%	1.22%	2.71%	1.13%	1.46%	2.08%
ACT (GA)	3.26%	2.69%	2.91%	3.99%	4.56%	3.54%	2.47%	2.70%
ACT Basin	2.03%	1.81%	1.99%	1.95%	3.12%	1.58%	1.63%	2.17%

Table 2.6-20 below shows the housing counts for mobile homes between 1990 and 2000 in the ACT Basin and the corresponding growth rate. There were a total of 268,395 mobile homes in the ACT Basin in the 2000; 199,445 were in the Alabama portion of the basin and the remaining 68,950 were in the Georgia portion. Mobile homes did grow at a faster rate in the Alabama portion of the ACT Basin which had an annual growth rate of 4.31 percent compared to 2.85 percent for the Georgia portion. This data was not gathered during the 2010 U.S. Census.

Table 2.6-20.
Mobile home housing units

	Housing units mobile homes		Annual growth rate
	2000	1990	1990–2000
ACT(Al)	199,445	130,784	4.31%
ACT(GA)	68,950	52,064	2.85%
ACT Basin	268,395	182,848	3.91%

Source: U.S. Census Bureau 2009a, 2009b

2.6.1.9 Income

Per capita income statistics were gathered for the ACT over the past 50 years, and a summary is presented below in Table 2.6-21. According to the U.S. Census for 2010 (2009 income year), the average per capita income within the ACT Basin was $20,679. The average per capita income for the Georgia portion of the ACT was $22,174, whereas in Alabama, the per capita income was $19,895. Table 2.6-21 gives a snapshot of per capita income in the ACT Basin over the past 50 years. It also includes the annual growth rates for the region and the state portions of the basin. In general, both the Georgia and Alabama portions of the ACT Basin bordering metropolitan areas (including Atlanta, Birmingham, Montgomery, and Mobile) had considerably higher per capita income than rural areas.

Table 2.6-21.
Per capita income statistics

	Personal income per capita						Annual growth rate					
	2009	1999	1989	1979	1969	1959	59–09	09-99	99–89	89–79	79–69	69–59
ACT(AL)	$19,895	$15,738	$9,779	$8,514	$6,046	$3,824	3.35%	2.37%	4.87%	1.40%	3.48%	4.69%
ACT(GA)	$22,174	$18,841	$11,709	$9,544	$7,234	$4,362	3.31%	1.64%	4.87%	2.07%	2.81%	5.19%
ACT Basin	$20,679	$16,806	$10,444	$8,868	$6,455	$4,009	3.34%	2.10%	4.87%	1.65%	3.23%	4.88%

Source: U.S. Census Bureau 2009a, 2009b, 2014a

2.6.1.10 Employment

Employment statistics were gathered for the year 2010 from the 2010 U.S. Census Bureau report. Table 2.6-22 below provides details of employment statistics for the ACT Basin. In 2010, 2,589,279 people were in the labor force in the basin, 63 percent of whom were in the Alabama portion; the remainder were in the Georgia portion. Also, 11,350 people served in the military. In the ACT Basin, 1,528,972 people were not in the work force, of whom 67 percent were in the Alabama portion, and 33 percent were in the Georgia portion. The average unemployment rate for the basin was 10.19 percent. The average unemployment rate for the Georgia portion of the basin was slightly lower at 9.83 percent. Several counties in the Alabama portion of the basin had unemployment rates over 10 percent. Those areas tended to be more rural.

Table 2.6-22.
Employment statistics (2010)

	Civilian labor force					
	Total	Employed	Unemployed	Percent unemployed	Armed Forces	Not in labor force
ACT(AL)	1,541,971	1,381,025	160,946	10.44%	9,047	1,026,849
ACT(GA)	1,047,308	944,308	103,000	9.83%	2,303	502,123
ACT Basin	2,589,279	2,325,333	263,946	10.19%	11,350	1,528,972

Source: U.S. Census Bureau 2009a, 2014a

2.6.1.11 Environmental Justice

On February 11, 1994, President Clinton issued EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*. The order requires that federal agencies identify and address, as appropriate, disproportionately high and adverse human-health or environmental effects of its programs, policies, and activities on minority and low-income populations. By the memorandum of February 11, 1994, the President directed USEPA to ensure that agencies analyze environmental effects on minority and low-income communities, including human-health, social, and economic effects.

The term *minority population* includes persons who identify themselves in the U.S. Census as African-American, Asian, or Pacific Islander; Native American or Alaskan Native; or Hispanic (CEQ 1997). A minority population exists if the percentage of minorities in an affected area either exceeds 50 percent or is meaningfully greater than in the general population of the larger surrounding area (CEQ 1997). A minority community can be geographically dispersed/transient set of individuals (such as migrant workers or Native Americans). Either type of group experiences common conditions of environmental exposure or effect. A selected appropriate unit of geographic analysis can be a governing body's jurisdiction, a neighborhood, a census tract, or another similar unit with no artificial dilution or inflation of the affected minority population. A minority population also exists if there is more than one minority group, and the aggregate minority percentage meets one of the above-stated thresholds.

Table 2.6-23 shows the demographic characteristics of the basin. Analysis of demographic data for the ACT Basin shows that the population is almost 72 percent white. African-Americans represent the next largest ethnic group, composing more than 24.2 percent of the basin's population. For Alabama, the proportion of minority persons living in the ACT Basin (36.2 percent) is higher than for the state as a whole (30 percent). However, in Georgia, the proportion of minority persons living in the basin (13.1 percent) is much smaller than the proportion for the state as a whole (37.2 percent). Other minority groups are represented in similar proportions in the basin and in surrounding states.

The extent of low-income population in the ACT Basin was determined from the 2010 U.S. statistical poverty threshold, which is based on income and family size. The Bureau of the Census defines a poverty area as having 20 percent or more of the residents with incomes below the poverty threshold. Overall, 19.6 percent of the basin's population (including persons of all ages) is below the poverty level (Table 2.6-24). In the basin, the proportion of persons below the poverty level is much higher in Alabama (21.6 percent) than in Georgia (16.6 percent). The percent of low-income residents in the Alabama portion of the basin (21.6 percent) is also higher than in the ACT Basin as a whole (19.6 percent) and higher than Alabama's poverty rate (18.1 percent). In the Georgia portion of the ACT Basin, 16.6 percent of the population is classified as low income compared to 19.6 percent for the entire ACT Basin and 17.4 percent for the entire state of Georgia. The national rate, based on 2010 data, is 14.9 percent.

Table 2.6-23.
ACT Basin demographics

	Total population	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and other Pacific Islander	Two or more races	Hispanic or Latino	White alone, not Hispanic or Latino
Alabama	4,817,528	70.0%	26.5%	0.7%	1.2%	0.1%	1.5%	4.1%	66.6%
Georgia	9,992,167	62.8%	31.2%	0.5%	3.5%	0.1%	1.8%	9.2%	55.1%
ACT (AL)	3,375,525	63.8%	33.1%	0.6%	0.7%	0.0%	1.2%	2.9%	61.8%
ACT (GA)	2,009,838	86.9%	7.1%	0.4%	1.2%	0.0%	1.7%	7.9%	82.2%
ACT Basin	5,385,363	71.7%	24.2%	0.6%	0.8%	0.0%	1.3%	4.6%	68.8%

Source: U.S. Census Bureau 2009a, 2014a

Table 2.6-24.
ACT Basin poverty status

		Population for whom poverty status is determined Income in last 12 months below poverty level (see note below)							
		All ages		Age 18 years and under		Age 18–64 years		Age 65 years and over	
Area	Total population	No.	%	No.	%	No.	%	No.	%
ACT (AL)	3,291,621	590,343	21.1	204,410	30.5	339,389	19.1	46,544	13.7
ACT (GA)	1,994,810	264,932	16.6	91,027	22.7	154,188	15.5	19,717	11.4
ACT Basin	5,286,431	855,275	19.6	295,437	27.8	493,577	17.9	66,261	12.9

Source: U.S. Census Bureau 2014b (Populations based on the estimated average between 2008 and 2012 from the American Community Survey 5 year Estimates. Thus, total population numbers differ slightly from Table 2.6-24.)

2.6.1.12 Protection of Children

On April 21, 1997, the President issued EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, which recognizes that a growing body of scientific knowledge demonstrates that children might suffer disproportionately from environmental health and safety risks. This EO requires federal agencies, to the extent permitted by law and mission, to identify and assess such environmental health and safety risks.

While EO 13045 does not provide guidance on what age children are to be protected, the Federal Interagency Forum on Child and Family Statistics, which was founded in 1994 and formally established by the EO, focuses on those aged 17 and under (Federal Interagency Forum on Child and Family Statistics 1997). In the ACT Basin, 1,334,414 children 17 and under were identified in the 2008-2012 American Community Survey. That represents more than 24 percent of the basin-wide population. More than 60 percent of the children in the basin were residents of Alabama (806,525). The Georgia portion of the ACT Basin had 527,889 children (26.4 percent) (U.S. Census Bureau 2014b).

2.7 Aesthetic Resources

Scenic views and vistas within the river and stream corridors of ACT Basin encompass a wide range of river, stream, and reservoir settings, including: cascading streams rising from the upper reaches of the Coosa River watershed in the mountains and foothills of the Southern Appalachian highlands; rivers and streams in the Piedmont Province and along the Fall Line in the lower Coosa River and Tallapoosa River watersheds; the large Alabama River below Montgomery, Alabama that meanders through the coastal plain toward the Mobile River delta and Gulf of Mexico. Interspersed along the rivers and primary stream

throughout ACT Basin are both federal and non-federal reservoirs, as discussed in Section 2.1.1.1.4. The streams, rivers, and lakes of the ACT Basin provide valued aesthetic resources to the residents and tourists in the region that are associated with a variety of the water-based recreational pursuits.

These aesthetic values are institutionally recognized as reflected by establishment many public access points, public use areas, national, state, and local parks within the basin, etc. There are no formally designated National Wild and Scenic Rivers within the ACT Basin. Nevertheless, several river corridors within the ACT Basin, such as the Cartecay and Conasauga rivers in Georgia and Little River in Alabama, are publicly recognized within their states and the region as scenic and minimally impacted by man's activities. The Alabama and Coosa rivers are an integral part the blueway known as the Alabama Scenic River Trail (http://www.alabamascenicrivertrail.com/).

2.8 Air Quality and General Conformity

2.8.1 Air Quality and General Conformity Affected Environment

USEPA Region 4 and ADEM regulate air quality in Alabama; and USEPA Region 4 and GADNR regulate air quality in Georgia.

The Clean Air Act (CAA) (42 U.S.C. 7401–7671q), as amended, gives USEPA the responsibility to establish the primary and secondary National Ambient Air Quality Standards (NAAQS) (40 CFR Part 50) that set acceptable concentration levels for six criteria pollutants: particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), carbon monoxide (CO), nitrous oxides (NO_x), ozone (O_3), and lead. Short-term NAAQS (1-, 8-, and 24-hour periods) have been established for pollutants contributing to acute health effects, while long-term NAAQS (annual averages) have been established for pollutants contributing to chronic health effects. Each state has the authority to adopt standards stricter than those established under the federal program; however, both Alabama and Georgia accept the federal standards.

Federal regulations designate Air-Quality Control Regions (AQCRs) in violation of the NAAQS as *nonattainment* areas. Federal regulations designate AQCRs with levels below the NAAQS as *attainment* areas. According to the severity of the pollution problem, nonattainment areas can be categorized as marginal, moderate, serious, severe, or extreme. USEPA has designated 12 out of the 64 counties in the ACT Basin as nonattainment areas for at least one criteria pollutant (Table 2.8-1).

Table 2.8-1.
Counties in the ACT Basin designated as nonattainment areas

State	Counties	Nonattainment pollutant
Georgia	Floyd, Walker	$PM_{2.5}$
	Carroll, Bartow, Cherokee, Cobb, Forsyth, Fulton, Heard, Paulding	$PM_{2.5}$ and O_3
Alabama	Jefferson, Shelby	$PM_{2.5}$

Source: USEPA 2010

USEPA, ADEM, and GADNR, have established general conformity rules specifically to ensure that the actions taken by federal agencies in nonattainment areas do not affect a region's ability to meet the NAAQS. The conformity regulations play an important role in helping states and tribal regions improve air quality in those areas that do not meet the NAAQS and federally supported activities that take place in the 12 nonattainment counties in the ACT Basin. The updates to the WCM are not expected to result in any reasonably foreseeable direct or indirect emissions. Such types of federal activities are specifically exempt from the general conformity regulations. The requirements of the general conformity rule would not apply to the WCM updates because the proposed activities would result in no emissions increase

[40 CFR 93.153(c)(2)], or the emissions are not reasonably foreseeable, such as electric power marketing activities that involve the acquisition, sale, and transmission of electric energy [40 CFR 93.153(c)(3)(ii)]. A Record of Non-Applicability to the general conformity rule has been prepared and is provided in Appendix E of this EIS.

Although regional air quality and air emissions are partially functions of population and land use, for the purposes of this EIS, population and land use throughout the basin are not expected to change appreciably because of the proposed updates. As a result, it is assumed that any changes in air quality would have occurred under the No Action Alternative. It is for those reasons that air quality is not analyzed in detail in this EIS.

2.9 Noise

2.9.1 Noise Affected Environment

Noise is defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise intrusive. Human response to noise varies according to the type and characteristics of the noise, distance between the noise source and the receptor, receptor sensitivity, and time of day. Noise is often generated by activities that are part of everyday life, such as construction or vehicular traffic.

Sound varies by both intensity and frequency. Sound pressure level, described in decibels (dB), is used to quantify sound intensity. The dB is a logarithmic unit that expresses the ratio of a sound pressure level to a standard reference level. Hertz are used to quantify sound frequency. The human ear responds differently to different frequencies. *A-weighing*, described in a-weighted decibels (dBA), approximates that frequency response to express accurately the perception of sound by humans. Sounds encountered in daily life and their approximate levels in dBA are provided in Table 2.9-1.

Table 2.9-1.
Common sounds and levels

Outdoor	Sound level (dBA)	Indoor
Snowmobile	100	Subway train
Tractor	90	Garbage disposal
Noisy restaurant	85	Blender
Downtown (large city)	80	Ringing telephone
Freeway traffic	70	TV audio
Normal conversation	60	Sewing machine
Rainfall	50	Refrigerator
Quiet residential area	40	Library

Source: Harris 1998

The dBA noise metric describes steady noise levels. Very few noises are, in fact, constant; therefore, a noise metric, Day-night Sound Level (DNL) has been developed. DNL is defined as the average sound energy in a 24-hour period with a 10-dB penalty added to the nighttime levels (10 p.m. to 7 a.m.). DNL is a useful descriptor for noise because (1) it averages ongoing, yet intermittent noise, and (2) it measures total sound energy over a 24-hour period. In addition, Equivalent Sound Level (L_{eq}) is often used to describe the overall noise environment. L_{eq} is the average sound level in dB.

The Noise Control Act of 1972 (P.L. 92-574) directs federal agencies to comply with applicable federal, state, and local noise control regulations. In 1974 USEPA provided information suggesting that continuous and long-term noise levels in excess of DNL 65 dBA are normally unacceptable for noise-sensitive land uses such as residences, schools, churches, and hospitals. Alabama and Georgia have not implemented noise regulations at the state level. Many counties in the ACT Basin maintain nuisance noise regulations. However, most do not outline specific, not-to-exceed noise levels. The vast majority of county and city-based noise ordinances exempt construction noise during the daytime hours.

Existing noise levels (L_{eq} and DNL) were estimated for the areas internal to, and on the perimeter of the ACT Basin, according to the techniques specified in the *American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound Part 3: Short-term measurements with an observer present*, and are provided in Table 2.9-2 (ANSI 2003). Individuals residing in urban areas in the ACT Basin have outdoor DNL values ranging from 45 to 65 dBA. The levels shown are the lowest provided by the American National Standards Institute (ANSI) standard, and noise levels in remote areas could be substantially less. Very rural and remote areas are estimated to have DNL values ranging from 20 to 45 dBA.

Table 2.9-2.
Estimated noise levels for varying land use intensities

Example land use category	Average residential intensity (people per ac)	DNL (dba)	L_{eq} (dba)	
			Daytime	Nighttime
Noisy Urban Residential	80	65	64	57
Quiet Commercial, Industrial, and Normal Urban Residential	25	60	58	52
Quiet Urban Residential	8	55	53	47
Quiet Suburban Residential	3	50	48	42
Rural Residential	1	45	43	37

Source: ANSI 2003

The updates to the WCM are not expected to result in any appreciable changes in the noise environment. No new noise from man-made sources would be introduced as a result of implementing the proposed updates. Small changes in the natural soundscape associated with water movement, and animal movement and vocalizations in and around the projects could occur. Although noise is partially a function of population and land use throughout the basin, for the purposes of this EIS, it is not expected to change appreciably because of the proposed updates. As a result, it is assumed that any changes in noise levels would have occurred under the No Action Alternative. It is for those reasons that noise is not analyzed in detail in this EIS.

2.10 Traffic and Transportation (Non-navigation and non-recreation)

2.10.1 Traffic and Transportation Affected Environment

This section summarizes the existing traffic resources in the areas immediately adjacent to USACE' projects, which include vehicles to support varying land uses including the operation and maintenance of USACE-managed facilities, personal operating vehicles for residence, recreational vehicles and tourist. Notably, the proposed action to manage pool levels and flow requirements would not be expected to affect the traffic resources immediately adjacent to the dams and lakes, such as limited development for shoreline and lake access, recreation (marinas, parks, and picnic areas), protected areas, and prohibited access areas. It is for those reasons that traffic and transportation are not analyzed in detail in this EIS.

Existing recreational activities are discussed in Section 2.6.1.6 Recreation, and navigational activities are discussed in Section 2.6.1.2 Navigation.

2.11 Cultural Resources

2.11.1 Cultural Resources Affected Environment

A review of the state archaeological site files from Alabama and Georgia and archaeological studies in the ACT Basin was conducted to establish a framework for the existing condition of cultural resources. The following discussion is based on the results of the *Cultural Resources Investigations for the Alabama-Coosa-Tallapoosa (ACT) River Basin Water Control Manual and EIS* (Brockington 2010). Sites within one-quarter mile of government property, or their jurisdiction at lakes and along river boundaries, were considered. A review of the *Integrated Cultural Resources Management Plan* for each of the USACE lakes was conducted. Sites having potential significance in terms of the National Historic Preservation Act and the Native American Graves Protection and Repatriation Act were identified. That information, along with background research and context statements from previous studies conducted in the ACT Basin was used to assess the existing condition of sites in the basin. Finally, the regional historic context included a review of the prehistoric and historic periods; Native American presence and movements in the ACT Basin and river trade. Industrial development occurred along the riverine corridor from the mid-1800s. The river was used for textile and grist mills to the early 1900s, followed by a period of hydropower and control of the water resources in the basin through congressional legislation and subsequent construction of federal projects for flood risk management, hydropower generation, and navigation.

The National Park Service conducted a study on the impact of inundation from reservoirs on archeological sites. Originally authored by Lenihan et al. (1981), *The Final Report of the National Reservoir Inundation Study, Volume I*, provides a framework for categorizing effects on archaeological sites in reservoir settings. The National Park Service identifies four categories of processes affecting archeological sites: (1) mechanical—relating to physical erosion and deposition such as wave action, fluctuating shorelines, siltation, and saturation; (2) biochemical—alteration of site soils and degradation of archaeological contexts associated with changing ecosystems; (3) human factors—consisting of artificial impacts such as borrow pits, construction, and increased wave action from boat traffic; and (4) miscellaneous factors—inundation, submergence, or changes in floral and faunal components (Lenihan et al. 1981).

Mechanical and biochemical processes can displace or bury artifacts, or features. The process of displacement is generally defined by *erosion*, where the soil matrix supporting the site is removed, exposing archaeological material to other adverse effects. The process of burying sites refers to *deposition.* Deposition alters the known context of sites or features preventing access to, or knowledge of, them. *Access* is defined as the relative ability for the site to fall subject to human processes of vandalism or artifact collection (including knowledge of sites as previously mentioned), which can destroy contexts or deplete significant materials. The existing condition of archaeological sites in the ACT Basin can be undergoing, or have undergone, any or all three sets of effects. The effects can be adverse or beneficial. For example, deposition can protect an archaeological site from erosion induced by human activities; however, the deposition can accelerate decay of significant materials at the site.

In addition to a review of state archaeological sites and site investigations, geomorphic studies were used to assess existing conditions. Site visits to 15 lakeshore and riverine sites were conducted to understand the existing condition of archaeological sites (Table 2.11-1). It is not possible to simulate local conditions such as visitation, land use and land cover, water surface elevation, inundation, and erosion from overland

runoff at each site in the basin. However, sampling 15 sites was intended to be representative of conditions in the basin.

Table 2.11-1.
2009 Sampled lakeshore and riverine cultural resource sites

Lake/river	Site no./name	Cultural affiliation	Site type	Effect categories	NRHP status[a]
Claiborne Lake	1 EE8 (Fort Toulouse/ Fort Jackson)	Archaic, Woodland, Mississippian	Artifact scatter features	Inundated deposition	Undetermined
Claiborne Lake/ Alabama River	1EE1 Taskigi	Archaic, Woodland, Mississippian	Artifact scatter features, midden	Erosion, deposition, access	Potentially eligible
William "Bill" Dannelly Lake	1MN1 (Lee)	Late Woodland	Artifact scatter	Access	Potentially eligible
William "Bill" Dannelly Lake/ Alabama River	1MN4 (Shell Fill)	Mississippian	Artifact scatter	Erosion, deposition, access	Potentially eligible
R.E. "Bob" Woodruff Lake	1WX69	Archaic, Woodland, Mississippian	Habitation	Erosion, access	Recommended ineligible
R.E. "Bob" Woodruff Lake/ Alabama River	1WX228	Mississippian	Artifact scatter	Erosion, access	Recommended ineligible
Coosa River	1LO28	18th c. Colonial, 19th c. American	Historic fort	Erosion, access	Listed NHL[b]
Coosa River	1LO133	Mississippian, Creek Indian	Mound site	Erosion, access	Eligible
Allatoona Lake	9BR253 Etowah (Coopers Furnace Community)	19th c., Aboriginal	Features artifact scatter, home site	Erosion, access	Potentially eligible
Allatoona Lake	9BR248	19th c.	Cemetery	Access	Potentially eligible
Allatoona Lake	9BR245	19th c.	Home site, features (terraces, well, cellar)Iron furnace	Access	Potentially eligible
Allatoona Lake/ Etowah River	9BR585	19th c.	Iron furnace	Access	Potentially eligible
Carters Lake/ Coosawattee River	9MU8	Woodland	Habitation	Erosion, access	Potentially eligible
Carters Lake/ Coosawattee River	9MU56	19th c.	Home site, plantation	Access	Recommended ineligible
Carters Lake	9MU103 (Potts Tract)	Woodland Mississippian	Village	Inundated deposition, access	Potentially eligible

a. NRHP = National Register of Historic Places
b. NHL = National Historic Landmark

Sites at each USACE reservoir and in the riverine corridor were selected for investigation. The exact location of the sites is not included in this report to maintain site integrity. The site descriptions provided here focus on the existing condition of known sites and to help reviewers understand the changes that have occurred (i.e., its integrity, observed ongoing effects, and indications of past effects).

The most common adverse effect at archaeological sites in the ACT Basin is access (see Table 2.11-1). Of the 15 sampled sites, 14 have the potential to be accessed because of exposed cultural deposits or the possibility of being exposed. However, few sites had evidence of active looting or vandalism. Looters generally target known eligible sites more frequently. The sites sampled in this study may represent a higher percentage of the eligible sites in the basin and therefore have a greater chance for looting.

Solutions to the adverse effects of access to sites in the ACT Basin are currently being explored. These solutions include combining GIS site location data with the recorded water level data controlled by USACE water management strategies to create a low cost management tool. This tool includes a real-time remote access map available for District Archaeologists illustrating culturally sensitive areas and the effects of USACE water management practices. Additionally, email alerts can be configured to notify District Archaeologists when water level factors contribute to the adverse effect of site access. This notification will allow the District Archaeologists to notify local resource offices to the exposure and increase monitoring.

The effects of deposition were the least common, found at only four of the 15 sites. At four sites, artifacts and archaeological contexts are being buried at varying rates. At all the sites where soil is depositing on artifacts and archaeological contexts, erosion is also occurring. It is likely that soil is eroded from one area and depositing on another area of the site. The ability to interpret the content of a site is the greatest loss that can occur from deposition. Deposition can reverse temporal deposits, change preservation states, or chemically alter radiocarbon samples.

Evidence of erosion was recorded at eight of the sites, two along the banks of reservoirs. Sites experiencing the greatest erosion are downstream of reservoirs and are in the Coastal Plain. In some cases, measures have been taken to decrease the impact of erosion.

It appears that significant erosion is most common at riverine sites, especially those that are on lower terraces of the dam and outside river bends near confluences. Those areas are more likely to experience changes in water levels and high flows. Areas of the Coastal Plain that are dominated by sandy soils are the most vulnerable to erosion. In some locations along the river, channel routing and construction of facilities associated with dams had minimized the impact of erosion from variations in flow. At sites adjacent to the river in the upper basin and more than 2 mi downstream of dams, cultural sites are typically on high terraces where they would not be affected by water management activities.

A small number of lakeshore sites were noted to have experienced erosion. Those sites are generally on exposed peninsulas and along steep shorelines near the dam. Lakeshore sites further upstream are generally more protected from wave action because of more shallow slopes and their sinuous nature. Those upstream sites along the lakeshore are also farther from recreational areas where wave action is the most pronounced. In recent years, residential housing has increased in upland areas draining to those sites.

2.11.1.1 Alabama River Basin

Six sites were investigated in the Alabama River Basin: downstream of Claiborne Lock and Dam, along the lakeshore of Claiborne Lake, downstream of Millers Ferry Lock and Dam, along the lakeshore of William “Bill” Dannelly Lake, downstream of Robert F. Henry Lock and Dam, and along the lakeshore of R.E. “Bob” Woodruff Lake.

Both locations near Claiborne Lock and Dam and Lake have experienced deposition. The lakeshore site is experiencing deposition because of inundation. That is the only location in the ACT Basin investigated where access was not a concern. The site downstream of the Claiborne Lock and Dam is also experiencing the effects of erosion (Brockington 2010).

The site downstream of the Millers Ferry Lock and Dam is also likely to have eroded material deposited on-site. The lakeshore site investigated at William “Bill” Dannelly Lake is expected to be influenced by vandalism and looting because of the location in or near a public access point (Brockington 2010).

The Robert F. Henry Lock and Dam and R.E. “Bob” Woodruff Lake locations are both also experiencing erosion (Brockington 2010).

2.11.1.2 Coosa River Basin

Two sites were examined in river sections of the Coosa River Basin downstream of dams. One of the sites is the NHL, Fort Toulouse/Fort Jackson. Both the sites investigated in the Coosa River Basin were being affected by erosion and access. As known sites, they are often the target of looting and vandalism. Erosion at the sites is because of their location adjacent to the river and exposure to high volumes of water.

2.11.1.3 Etowah River and Allatoona Lake

Potentially eligible sites in the Etowah River Basin are along the lakeshore of Allatoona Lake (three sites), with one downstream of the dam. All those sites are being affected by access, three are in or near public access points, making them more venerable to looting and vandalism. One of the lakeshore sites is also experiencing erosion (Brockington 2010).

2.11.1.4 Carters Lake and Coosawattee River

Two sites were investigated in the Coosawattee River downstream of the Carters Reregulation Dam and one is adjacent to the Carters Reregulation Dam. Those three sites might be affected by access. One of the downstream sites is near a public access point. The lakeshore site has been inundated and is experiencing deposition but becomes exposed when water levels are drawn down (Brockington 2010).

2.12 Hazardous and Toxic Materials

Operating and maintaining USACE projects typically requires the use of hazardous and toxic materials. The use of materials such as pesticides, paints, solvents, and petroleum products would be expected during the operation and maintenance of USACE-managed facilities, shoreline, vehicles, and equipment. The use of petroleum products would also be expected from the operation of marinas and from recreational vehicle use. The handling, use, storage, and disposal of such materials must be in accordance with label recommendations, USACE regulations, and local, state, and federal regulatory guidelines.

There are no known hazardous, toxic, or radioactive waste sites in the vicinity of the USACE reservoirs in the ACT Basin that would likely be vulnerable to increased risk of exposure or release as a result of existing reservoir water management operations or potential changes associated with updates to the WCMs. Existing conditions with respect to bank stability and erosion rates are not expected to change as a result of potential modifications to water management practices.

Water management practices in the ACT Basin are not expected to have an effect on hazardous and toxic materials use, storage, or disposal of hazardous, toxic, and radioactive waste sites, and therefore are not discussed further in Section 6 *Environmental Consequences*.

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3 Framework for Decision Making

3.1 Description of Projects in the ACT Basin

The ACT Basin has 17 large dams on the mainstem rivers. USACE owns and operates six dams; the remaining 11 are privately-owned and operated (APC). USACE is responsible for flood risk management operations at four of the APC projects: Weiss Lake, H. Neely Henry Lake, Logan Martin Lake, and R.L. Harris Lake projects. Section 2 of the River and Harbor Act of 1945 (P.L. 79-14) authorized the initial and ultimate development of the Alabama and Coosa Rivers for navigation, flood risk management, power development, and other purposes. The following paragraphs provide a brief description of the projects and a more detailed discussion is in Section 2.1.1.1.4. Table 3.1-1 provides an overview of the dams on the mainstem rivers (USACE and non-USACE) within the ACT Basin. Figure 2.0-1 depicts the general location of these projects in the basin.

3.1.1 Carters Lake and Carters Reregulation Dam

The USACE Carters Lake and Carters Reregulation Dam on the Coosawattee River is a multipurpose project for flood risk management, hydropower, navigation, water supply, water quality, fish and wildlife conservation, and recreation. The Carters project is a pumped-storage peaking facility. Water is released from Carters Lake, flows through the penstock, and generates power as it is discharged to the reregulation dam pool. USACE generates power at Carters Lake only a few hours each weekday, when demand for electricity is greatest. When demand for electricity is low, usually during the night or on weekends, two of the four generating units can be reversed to pump water back up from the reregulation pool to Carters Lake. Water is then available again for hydropower generation in the next peak use period, and Carters Lake is maintained at its optimal power generation level. The reregulation dam serves two purposes: as a lower pool for the pumped storage operation and to reregulate peaking flows from Carters Lake to provide a more stable downstream flow.

Carters Lake has a total storage capacity of 472,756 ac-ft at elevation 1,099 ft (see Figure 3.1-1). Of that, 141,402 ac-ft are usable for power generation, 89,191 ac-ft are reserved for flood risk management, and 242,163 ac-ft are inactive storage. The minimum conservation pool elevation is 1,022 ft, and the maximum conservation pool elevation is 1,074 ft in the summer and 1,072 ft in the winter. Carters Lake has a surface area of 3,275 ac at elevation 1,074 ft. The normal year-round operating range for the reregulation pool is 674 to 698 ft. The Carters Reregulation Dam provides a minimum continuous flow of 240 cfs to the Coosawattee River. The total generating capacity of the project is 600 MW. As expected with a peaking/pumped storage operation, both Carters Lake and the reregulation pool experience frequent elevation changes. Typically, water levels in Carters Lake vary no more than 1 to 2 ft per day. The reregulation pool will likely reach both the maximum (698 ft) and the minimum level (674 ft) at least once during the course of the week. Levels can rise more than that during flooding events, however, as the lake captures and retains flood flows.

Table 3.1-1.
Major projects on the mainstem rivers in the ACT Basin

Basin/river/project name	Owner/state/year initially completed	Drainage area (sq mi) [a]	Reservoir size at full pool (ac) [b]	Total storage at full pool (ac-ft) [b]	Conservation storage (ac-ft) [b]	Declared power capacity (MW)	Full pool (summer) elev. (ft) [b]	Authorized purposes for USACE-owned projects [c]
Coosawattee River		862						
Carters Lake	USACE/GA/1974	374	3,275	383,565	141,402	600 [d]	1,074	FRM, HP, REC, NAV, WS, WQ, FW
Carters Reregulation Dam	USACE/GA/1974	520	870	17,500	16,000	None	698	
Etowah River		*1,861*						
Allatoona Lake	USACE/GA/1949	1,122	11,862	367,471	284,580	82.2 [d]	840	FRM, HP, NAV, REC, WQ, WS, FW
Coosa River		*10,156*						
Weiss Lake	APC/AL/1961	5,270	30,027	306,655	263,417	87.75 [e]	564	
H. Neely Henry Lake	APC/AL/1966	6,596	11,235	120,853	118,210	72.9 [e]	508	
Logan Martin Lake	APC/AL/1964	7,743	15,269	273,467	144,383	128.25 [e]	465	
Lay Lake	APC/AL/1914	9,053	11,795	262,887	92,352	177 [e]	396	
Mitchell Lake	APC/AL/1923	9,778	5,855	170,783	51,577	170 [e]	312	
Jordan Dam and Lake [f]	APC/AL/1929	10,102	5,890	236,130 [f]	19,057 [f]	100 [e]	252	
Bouldin Dam and Lake [f]	APC/AL/1967	10,102	734	---- [f]	---- [f]	225 [e]	252	
Tallapoosa River		*4,687*						
R.L. Harris Lake	APC/AL/1982	1,454	10,660	425,721	207,317	135 [b]	793	
Lake Martin	APC/AL/1927	2,984	39,210	1,628,303	1,202,340	182.5 [b]	491 [g]	
Yates Lake	APC/AL/1928	3,293	2,004	53,908	6,928	44.25 [b]	345 [g]	
Thurlow Lake	APC/AL/1930	3,308	570	17,976	None	81.35 [b]	289 [g]	
Alabama River		*22,739*						
Robert F. Henry Lock and Dam/R.E. "Bob" Woodruff Lake	USACE/AL/1972	16,233	13,500	247,210	36,450	82 [d]	126 [h]	NAV, REC, HP, WQ, FW
Millers Ferry Lock and Dam/William "Bill" Dannelly Lake	USACE/AL/1969	20,637	18,528	346,254	46,704	90 [d]	80.8 [h]	NAV, REC, HP, WQ, FW
Claiborne Lock and Dam and Lake	USACE/AL/1969	21,473	6,290	102,480	None	None	36 [h]	NAV, REC, WQ, FW

a. Source: USGS HUC units and stream gage data (Subregion 0315).

b. Source: USACE projects – verified by USACE (June 2014); APC projects – values verified by USACE coordination with APC via email (June 2014).

c. As used in this table, the term *authorized purposes* includes purposes expressly identified in the project authorizing documents, incidental benefits recognized in project authorizations, and objectives that result from other authorities contained in congressional legislation for which USACE operates each listed project. FRM = flood risk management; HP = hydropower; NAV = navigation; REC = recreation; WQ = water quality; WS = water supply; FW = fish and wildlife conservation.

d. Declared Power Capacity is defined as the plant's operational capacity declared on a weekly basis to the power marketing agency. The value may vary slightly from week to week depending on factors such as head and cooling capabilities; values shown are the nominal values reported.

e. Source: FERC 2009

f. Jordan and Bouldin Dams both impound the same reservoir and share the same reservoir storage.

g. Subtract one (1.0) ft to convert from ft NGVD29 elevation to Martin datum.

h. Represents the upper limit of the normal operating range for these projects.

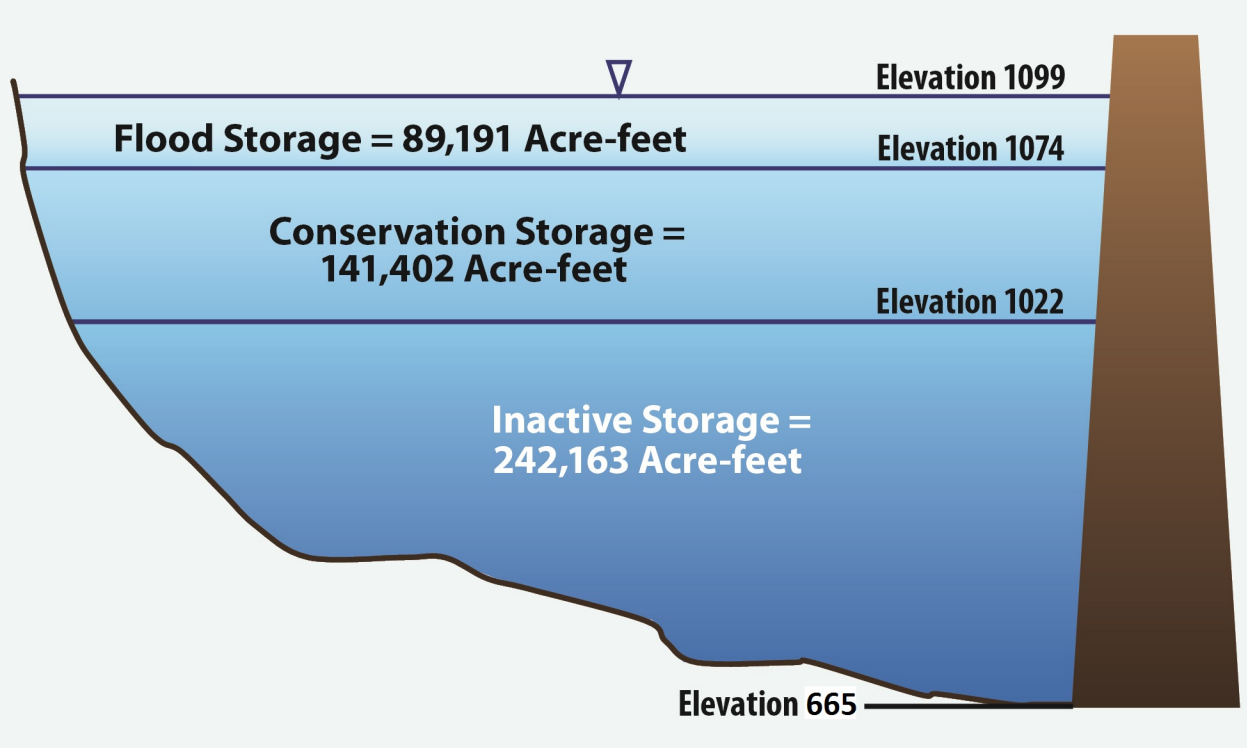


Figure 3.1-1. Storage in Carters Lake.

3.1.2 Allatoona Lake

The USACE Allatoona Dam on the Etowah River creates the 11,862-ac Allatoona Lake. Authorized by the Flood Control Act of 1941 (P.L. 77-228, 55 Stat 638), Allatoona Lake is a multipurpose project for flood risk management, navigation, hydropower, recreation, water supply, water quality, and fish and wildlife conservation. In 2008 nearly 7 million visitors were reported at Allatoona Lake (Table 2.6-13). As depicted in Figure 3.1-2, the lake has a flood risk management storage capacity of 302,576 ac-ft and conservation storage of 284,580 ac-ft. A minimum flow of 240 cfs is continuously released through a service unit, which generates power while providing a constant flow to the Etowah River downstream. Allatoona Lake typically operates in a peaking mode, generating power between 2 and 6 hours during normal operations each weekday. Weekend generation can occur if required to meet customer needs. The period of power generation is related to the stage of conservation pool drawdown.

3.1.3 Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake

The R.E. "Bob" Woodruff Lake is created by the Robert F. Henry Lock and Dam, 281 mi upstream of Mobile Bay. R.E. "Bob" Woodruff Lake extends from the Robert F. Henry Lock and Dam upstream to the Walter Bouldin Dam. In addition to hydropower and navigation, R.E. "Bob" Woodruff Lake provides recreation and fish and wildlife conservation.

R.E. "Bob" Woodruff Lake is 77 mi long and averages 1,300 ft wide. It has a surface area of 12,510 ac and a storage capacity of 247,210 ac-ft at a normal pool elevation of 126 ft. A 9-ft-deep by 200-ft-wide navigation channel exists over the entire length of the lake. The hydropower generating capacity of the project is 82 MW. Lake levels are typically fairly stable with minimal fluctuation. The lake is a popular recreation destination, receiving up to 2 million visitors annually.

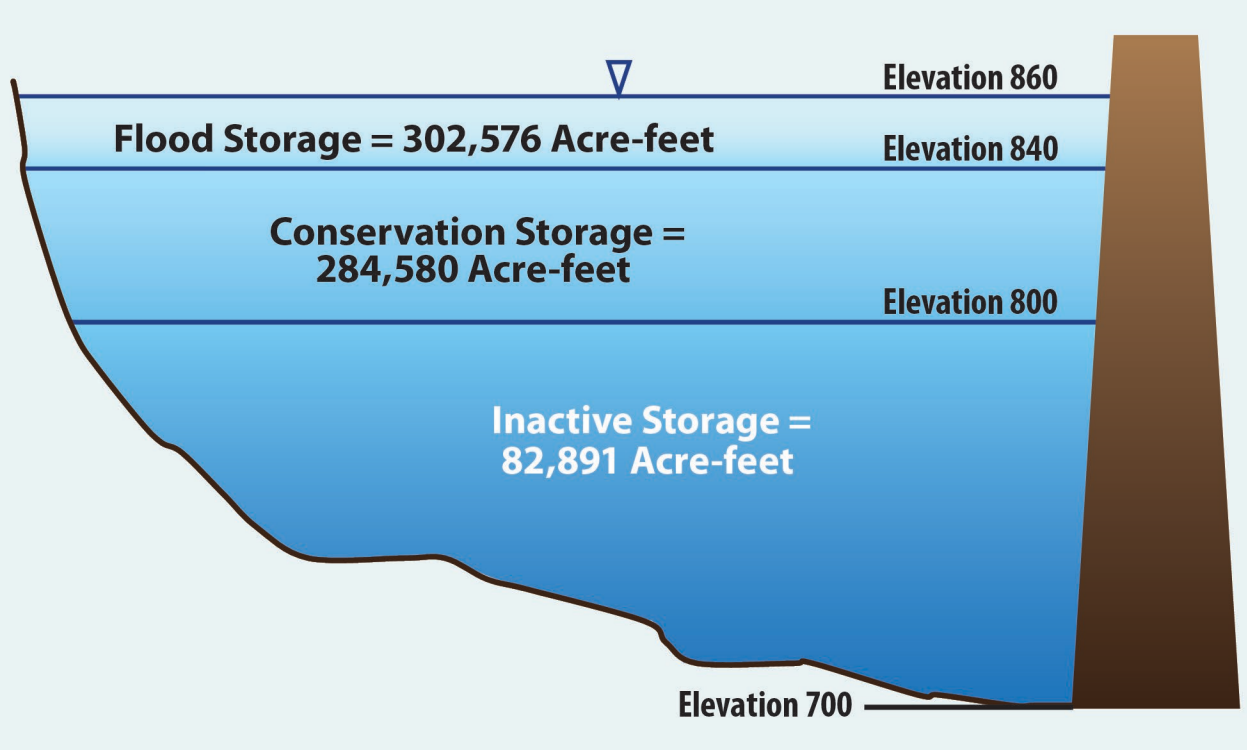


Figure 3.1-2. Storage in Allatoona Lake.

3.1.4 Millers Ferry Lock and Dam and William "Bill" Dannelly Lake

The William "Bill" Dannelly Lake is created by the Millers Ferry Lock and Dam on the Alabama River, 178 mi upstream of Mobile Bay. William "Bill" Dannelly Lake is 103 mi long and averages almost 1,400 ft wide. The reservoir partially inundates several tributary streams. The Cahaba River flows into the upper reaches of William "Bill" Dannelly Lake.

William "Bill" Dannelly Lake has a storage capacity of 346,254 ac-ft at a normal pool elevation of 80.8 ft. It has a surface area of 18,528 ac. A 9-ft-deep by 200-ft-wide navigation channel extends the entire length of the reservoir. The facility is a multipurpose reservoir constructed by USACE for both navigation and hydropower. Project purposes also include recreation and fish and wildlife conservation. The hydropower generating capacity of the project is 90 MW. Lake levels remain fairly stable on a day-to-day basis, but they rise slightly, up to one-half ft, in wet weather. The reservoir provides ample recreation opportunities. Recreation visitors number 3 million annually.

3.1.5 Claiborne Lock and Dam and Lake

Claiborne Lake is created by the Claiborne Lock and Dam on the Alabama River about 118 mi upstream of Mobile Bay. The lake is similar to a wide river, averaging about 800 ft wide, with a surface area of 6,290 ac. Claiborne Lake extends 60 mi upstream to the Millers Ferry Lock and Dam. Storage capacity in the lake is 102,480 ac-ft at a normal pool elevation of 36 ft. The lake has a 9-ft-deep, 200-ft-wide navigation channel extending its entire length. The primary purpose of the project is navigation. No hydropower generating capability exists at the project. Project purposes also include recreation and fish and wildlife conservation. Claiborne Lake, together with R.E. "Bob" Woodruff Lake and William "Bill" Dannelly Lake, are collectively referred to as the Alabama River Lakes. Claiborne Lake is the most primitive of the three. It remains mostly within its original river banks and is surrounded by a rustic

atmosphere. USACE is allowing the shoreline to revert to its natural state, providing important wildlife habitat. Recreation visitors number more than one million annually.

Downstream of Claiborne Lock and Dam, the Alabama River flows about 72 miles farther to its confluence with the Tombigbee River to form the Mobile River. The federally authorized 9-ft-deep, 200-ft-wide navigation channel extends through this reach of the Alabama River. The navigation channel is sustained by a combination of flows from Claiborne Lock and Dam, maintenance dredging, and training works.

3.1.6 APC Projects

WCMs are required for the four APC projects having flood risk management responsibilities. In 1954 Congress suspended the authorization under the River and Harbor Act of March 2, 1945, insofar as it concerned federal electric power development of the Coosa River, thereby allowing development of electric power by private interests under a license to be issued by the Federal Power Commission (now FERC) (P.L. 83-436). The law stipulates that the license must require the provision of flood risk management storage and further states that the projects will be operated for flood risk management and navigation in accordance with reasonable rules and regulations of the Secretary of the Army. Additionally, in the River and Harbor Act of 1966 (P.L. 89-789), Congress suspended the authorization under the River and Harbor Act of March 2, 1945, insofar as it concerned federal electric power development of the Crooked Creek site on the Tallapoosa River in Randolph County, Alabama, thereby allowing development of a reach Tallapoosa River (not more than 15 mi downstream of the confluence of the Tallapoosa and Little Tallapoosa Rivers) for electric power under a license to be issued by the Federal Power Commission (now FERC) (P.L. 83-436). The four APC projects subject to those provisions and, thus, requiring WCMs, are Weiss Lake, H. Neely Henry Lake, and Logan Martin Lake on the Coosa River, and R.L. Harris Lake on the Tallapoosa River.

Weiss Lake. The Weiss Lake is on the Coosa River at RM 225.7, about 50 mi upstream from Gadsden, Alabama, and about one mi southeast of the town of Leesburg, Alabama. The reservoir, extending from the dam about 52 mi upstream to Mayo's Bar, Georgia, is in Cherokee County, Alabama, and Floyd County, Georgia. Weiss Lake is a multiple purpose project. APC built it principally for hydropower production and to provide flood risk management and navigation benefits. The reservoir is a source of water supply for domestic, agricultural, municipal, and industrial uses. The lake creates a large recreational area providing opportunities for fishing, boating, and other water sports.

H. Neely Henry Lake. The H. Neely Henry Lake is on the Coosa River at RM 148.0, about 27 mi downstream from Gadsden, Alabama. The reservoir, extending upstream 77.7 mi to Weiss Lake, is in St. Clair, Calhoun, Etowah, and Cherokee counties. H. Neely Henry Lake is a multiple purpose project. APC built the dam principally for hydropower production. The reservoir is a source of water supply for domestic, agricultural, municipal, and industrial uses. The lake creates a large recreational area providing opportunities for fishing, boating, and other water sports.

Logan Martin Lake. The Logan Martin Lake is on the Coosa River at RM 99.5, about 13 mi upstream from Childersburg, Alabama. The reservoir, extending upstream 48.5 mi to the H. Neely Henry Lake, is in Talladega, St. Clair and Calhoun counties. Logan Martin Lake is a multipurpose project. APC built it principally for hydropower production and to provide flood risk management and navigation benefits. The reservoir is a water supply for domestic, agricultural, municipal, and industrial uses. The lake creates a large recreational area providing opportunities for fishing, boating, and other water sports.

R.L. Harris Lake. R.L. Harris Lake (locally known as Lake Wedowee) is on the Tallapoosa River at RM 139.1 in Randolph County, Alabama. The 29-mi-long reservoir extends up both the Tallapoosa and Little Tallapoosa Rivers and is in Randolph and Clay counties. Crooked Creek is just downstream of the dam. The dam is about midway between Montgomery, Alabama, and Atlanta, Georgia. The R.L. Harris Lake project provides for hydropower generation, flood risk management, recreation, and fish and wildlife conservation. The project provides for minimum continuous downstream releases for water quality and fish and wildlife conservation purposes.

3.1.7 Applicable USACE Guidance

The following USACE guidance publications apply to operation of the ACT Basin projects and management by use of WCMs. The directives are at http://www.publications.usace.army.mil/.

- ER 1110-2-240, *Water Control Management* (October 8, 1982). This regulation prescribes policies and procedures to be followed by USACE in carrying out water control management activities, including establishment of water control plans for USACE and non-USACE projects, as required by federal laws and directives.
- ER 1110-2-241, *Use of Storage Allocated for Flood Control and Navigation at Non-Corps Projects* (May 24, 1990). This regulation prescribes the responsibilities and general procedures for regulating reservoir projects for flood risk management or navigation and the use of storage allocated for such purposes. Excepted projects are those owned and operated by USACE; the International Boundary and Water Commission, United States and Mexico; and those under the jurisdiction of the International Joint Commission, United States and Canada, and the Columbia River Treaty. The intent of this regulation is to establish an understanding among project owners, operating agencies, and USACE.
- ER 1110-2-1150, *Engineering and Design for Civil Works Projects* (August 31, 1999). This regulation defines engineering responsibilities, requirements, and procedures during the planning, design, construction, and operations phases of civil works projects. The regulation provides guidance for developing and documenting quality engineering analyses and designs for projects and products on time and in accordance with project management policy for civil works activities.
- ER 1110-2-1941, *Drought Contingency Plans* (September 15, 1981). This regulation provides policy and guidance for preparing drought contingency plans as part of the USACE overall water control management activities. This directive states the policy that water control managers will continually review and, when appropriate, adjust water control plans in response to changing public needs.
- ER 1110-2-8154, *Water Quality and Environmental Management for Corps Civil Works Projects* (May 31, 1995). This regulation establishes a policy for the water quality management program at USACE civil works projects.
- ER 1110-2-8156, *Preparation of Water Control Manuals* (August 31, 1995). This regulation standardizes the procedures to be followed when preparing WCMs.
- EM 1110-2-3600, *Management of Water Control Systems* (November 30, 1987). This manual provides guidance to field offices for managing water control projects or systems authorized by Congress and constructed and operated by USACE. It also applies to certain water control projects constructed by other agencies or entities.

The Mobile District continually reviews the WCM as needed to ensure that the best use is made of available water resources. At a minimum, the District reviews the manual every 5 years to determine whether updates are needed (USACE 2010a).

In addition to the above guidance, USACE established Environmental Operating Principles (EOP) in 2002 to guide and ensure that USACE mission activities include totally integrated sustainable environmental practices (USACE 2012). The EOP are applicable to the ACT WCM update. These seven principles were reviewed, updated, and reissued in August 2012. The seven EOP are as follows:

1. Foster sustainability as a way of life throughout the organization.
2. Proactively consider environmental consequences of all Corps activities and act accordingly.
3. Create mutually supporting economic and environmentally sustainable solutions.
4. Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the USACE which may impact human and natural environments.
5. Consider the environment in employing a risk management and systems approach throughout life cycles of projects and programs.
6. Leverage scientific, economic, and social knowledge to understand the environmental context and effects of Corps actions in a collaborative manner.
7. Employ an open, transparent process that respects views of individuals and groups interested in Corps activities.

Application of the EOP to the ACT WCM update process is summarized at the beginning of Section 6.

3.1.8 Authorized Project Purposes

The following subsections describe the various purposes for which USACE operates projects in the ACT Basin. Those purposes include specifically authorized project purposes (e.g. flood risk management, hydropower generation, and navigation). In addition, USACE projects can provide important, incidental benefits that result from operation of a project for its authorized purposes. Other operational objectives derive from authorities that generally apply to all USACE reservoirs, such as fish and wildlife conservation (Fish and Wildlife Coordination Act of 1958 [P.L. 85-624] and ESA of 1973 [P.L. 93-205]), recreation (Flood Control Act of 1944 [P.L. 78-534]), water quality (Water Pollution Control Act Amendments of 1972 [P.L. 92-500]), and water supply (Water Supply Act of 1958 [P.L. 85-500]).

The following describes the various purposes for which USACE operates projects in the ACT Basin.

Flood Risk Management. Heavy rains can raise a lake level several feet overnight. When the rain event subsides, it is important to properly manage flood storage capacity in anticipation of the next event. When a potential flood event is occurring, releases from the dam are curtailed or minimized until downstream conditions allow, or until the lake reaches its capacity to hold flood waters. When conditions allow, USACE releases water to evacuate the flood waters as quickly as possible, avoiding downstream flood effects to the extent possible to prepare for the next potential flood event. Flood storage is also increased by lowering normal pool elevations during the rainy season. Therefore, pool elevations fluctuate on an annual basis between minimum winter and maximum summer pool elevations.

Not all USACE projects are designed for flood risk management, and no dam can prevent every flood. Some major floods will eventually exceed the flood capacity of a dam. Typically, in a major flood, the dam will help reduce the peak flow of a flood and help reduce the amount of damages that might have occurred if the dam was not there. In the ACT Basin, Allatoona Lake and Carters Lake were authorized

specifically for flood risk management. In addition, four APC projects (Weiss Lake, H. Neely Henry Lake, Logan Martin Lake, and R.L. Harris Lake) were developed for flood risk management.

Navigation. Navigation was one of the earliest uses of our southeastern rivers. Native Americans and early settlers used the rivers for transportation and commerce. Keeping our rivers clear for navigation was one of the first missions for USACE. Today's commercial barge lines still use rivers to move significant quantities of bulk materials by barge.

In the ACT Basin, the Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake, Millers Ferry Lock and Dam and William "Bill" Dannelly Lake, and Claiborne Lock and Dam and Lake projects were authorized specifically for navigation. The lower Alabama River requires flow in addition to dredging and channel training dikes to assure adequate depths for navigation. A minimum flow is needed, which will assure useable depths. In drier months, water is taken (released) from reservoirs to augment natural river flow. That can often result in the decline in reservoir levels. Releases from the Allatoona and Carters projects during routine operations incidentally support flow conditions necessary for downstream navigation. However, these projects are not operated to provide specific releases to support downstream navigation.

Hydropower. Water power still plays an important part in giving reliable and relatively inexpensive energy for homes, stores, and factories. Most hydropower generation is peaking power. The generators are turned on when there is the most, or peak, demand for power. Hydropower can start quickly, making it an important safety feature of an electric system.

In the ACT Basin, the Allatoona Lake, Carters Lake, Robert F. Henry Lock and Dam, and Millers Ferry Lock and Dam federal projects were authorized specifically for hydropower. Under the provisions of section 5 of the Flood Control Act of 1944 (P.L. 78-534) and other acts, power generated at USACE projects, which is surplus to project needs is turned over to the Secretary of Energy for marketing. Hydropower from USACE lakes in the ACT Basin is sold by SEPA to a number of cooperatives and municipal retail suppliers of power, referred to as *preference customers*.

Recreation. Recreation at USACE lakes has become a very important resource with a large economic expansion based on local and interstate tourism. A wide variety of recreational opportunities is provided at the sites including boating, fishing, picnicking, camping, skiing, and sightseeing. In response to meeting other water requirements at the projects, lake levels might decline during prime recreation periods. Large reservoir drawdowns are detrimental to recreational use because access to the water for boaters and swimmers is inhibited, safety hazards result from large trees left in the water for fishery protection, and exposed banks and lake bottoms appear unsightly. Therefore, USACE seeks to maintain a steady, full pool, when possible.

To maximize the potential recreational use of all the projects, USACE operates the reservoirs in the ACT Basin as a system, keeping the drawdown levels and rates balanced among the reservoirs. USACE gives such considerations greater attention during the primary recreation season of May through early September.

Water Supply. Much of the water supply in the ACT Basin comes from surface water in streams, rivers, and reservoirs. In the past, streams and rivers provided sufficient flow, even in the worst droughts, to accommodate domestic, municipal, and industrial water supply needs. However, cities and industries have grown and become more dependent on the use of reservoir storage to assure a dependable water supply. The Water Supply Act of 1958 authorizes USACE to participate and cooperate with States and local interests to include storage in USACE reservoirs for water supply. Pursuant to this authority, USACE has entered into water supply storage agreements with three entities at two USACE reservoirs in the ACT system.

The city of Chatsworth, Georgia, has a water supply storage agreement with USACE for 818 ac-ft of storage in Carters Lake. The city of Cartersville, Georgia, and CCMWA have water supply storage agreements with USACE for 6,371 ac-ft and 13,140 ac-ft, respectively, of storage in Allatoona Lake (a total of 19,511 ac-ft). More specific information on these water supply storage agreements is detailed in Section 4.2.6.

Water Quality. USACE water quality management authority is founded on the Federal Water Pollution Control Act (FWPCA) of 1948 and its amendments including the CWA of 1972 and 1977 and the Water Quality Act of 1987. Federal projects operate to sustain or improve water quality conditions, consistent with other specifically authorized project purposes. Two of the dams in the ACT Basin currently have minimum release obligations for environmental protection: Allatoona Lake and Carters Lake. These minimum flow releases from dams help to ensure healthy aquatic life, even when treated or used waters are added at downstream points. The operation of the projects can influence water quality as it relates to temperature, DO, and nutrients and can help benefit water quality purposes on downstream lakes and river reaches.

Fish and Wildlife Conservation. Fish and wildlife conservation is an authorized project purpose at USACE reservoir projects. USACE recognizes the importance of keeping a healthy population of fish in lakes. Each year in coordination with the USFWS and state fishery agencies, USACE works to hold lake levels at Allatoona Lake stable during the spring fish spawning period.

All USACE reservoirs in the ACT Basin support important fisheries and are operated accordingly, consistent with other project purposes. In addition to fishery management, such operations include aquatic plant control and waterfowl management activities. The various projects in the basin have specific operations for fish and wildlife conservation, which are described in the individual reservoir regulation manuals for the projects.

USACE SADR PDS-O-1 (May 31, 2010) and Mobile District Draft SOP 1130-2-9 (February 2005) were developed to address lake regulation and coordination for fish spawn management purposes. The draft District SOP was developed in response to an earlier version of the SADR (2001). The SADR and SOP specifically apply to the Allatoona Lake project. They identify principal fish spawning periods and provide general guidance for management of lake levels during the annual fish spawning period between March and May, primarily targeted at largemouth bass. The major goal of the operation is to not lower the lake level more than 6 inches during the reproduction period to prevent stranding or exposing fish eggs.

3.1.9 WCMs

WCMs are guidance documents that help federal water managers operate individual and multiple, interdependent, federal and non-USACE reservoirs on the same river system. They provide technical, historical, hydrological, geographic, demographic, policy, coordination, and other information that guide the proper management of reservoirs during times of high water, low water, and normal conditions. The manuals contain water control plans for each of the reservoirs in the basin system and specify how the various reservoir projects will be operated as a balanced system. As mentioned previously, USACE is also responsible for the review and approval of the flood risk management plans, navigation, and Reservoir Regulation Manuals for some of the APC projects on the Coosa and Tallapoosa Rivers.

The manuals also contain drought plans and storage zones to help federal water managers know when to reduce or increase reservoir releases and conserve storage in USACE reservoirs and how to provide for proper water control regulation and coordination to ensure the safety of dams during extreme conditions such as floods. The authority and guidance for USACE to prepare and update the manuals is in section 7 of the 1944 Flood Control Act and the following USACE regulations: ER 1110-2-240, ER 1110-2-241, ER 1110-2-1941 and ER 1110-2-8156.

The *Alabama-Coosa River Basin Reservoir Regulation Manual* (Master Manual) was completed in 1951. Individual WCMs for each of the nine projects have been prepared as appendices to the master WCM. The following identifies the appendices to the master WCM and their year of completion or most recent year of revision.

- Appendix A—Allatoona Reservoir, 1993
- Appendix B—Weiss Reservoir, 1965 (APC project)
- Appendix C—H. Neely Henry Reservoir, 1979 (APC project)
- Appendix D—Logan Martin Reservoir, 1968 (APC project)
- Appendix E—Millers Ferry Lock and Dam, 1990
- Appendix F—Claiborne Lock and Dam, 1993
- Appendix G—Robert F. Henry Lock and Dam, 1999
- Appendix H—Carters Reservoir, 1979
- Appendix I—R.L. Harris Reservoir, 2003 (APC project)

The proposed new manuals would replace any current ones and will address the basin-wide management of those water resources. During development of the WCM updates, USACE determined that APC had obtained flood easements to support flood risk management operations up to 473.5' at Logan Martin and 572' at Weiss pursuant to their original FERC license for those projects. These easement elevations are below the maximum surcharge elevations contained in the current license and Water Control Manuals. APC has proposed new flood operations that would ensure that surcharge operations do not exceed these elevations, which will require a flood study that exceeds the scope of this proposed action. Therefore, updates of the Logan Martin and Weiss WCMs will be deferred pending the completion of the necessary studies to determine if the revised flood risk management protocols are acceptable. There are no proposed changes to flood operations at H. Neely Henry Lake, and R.L. Harris Lake. Therefore, WCM updates for those projects are included in this proposed action.

3.1.10 Negotiations and Litigation

In 1989 proposals by USACE to reallocate storage to M&I water supply at Carters Lake and Allatoona Lake in the ACT Basin and Lake Lanier in the ACF Rivers Basin, and by Georgia to develop a regional reservoir in the Tallapoosa River Basin near the Alabama state line (West Georgia Regional Reservoir) caused controversy among water user groups, Alabama and Florida, and various federal agencies. A *draft Reallocation and Post-Authorization Report and draft Environmental Assessment* were prepared for the Lake Lanier proposal. A draft *Apalachicola-Chattahoochee-Flint Basin Water Control Plan,* dated October 1989, was included as an appendix to the post-authorization change report. A *Final Water Supply Reallocation Report and final Environmental Assessment* were also prepared for the Carters Lake and Allatoona Lake proposals and submitted to the South Atlantic Division for approval in May 1990. Alabama filed a lawsuit against USACE in June 1990 to halt those proposed actions. As a result of the litigation, the proposed revisions to the ACF Basin WCM were deferred while the parties negotiated.

After a period of negotiation, the governors of Alabama, Florida, and Georgia and the Assistant Secretary of the Army for Civil Works (ASA(CW)) addressed the issues of concern by signing a Memorandum of Agreement (MOA) on January 3, 1992. The MOA specified that a comprehensive study of the water resources of the basins would be conducted, in partnership among the states and USACE, to develop the needed water resources data and to investigate the feasibility of implementing an interstate coordination mechanism (compacts) for resolving water resources issues in the ACT and ACF Basins. The MOA contained a *live and let live* provision for water use in the basins while the ACT/ACF comprehensive study and negotiations were conducted. That approach permitted existing water users to reasonably increase water withdrawal amounts for the period necessary to negotiate a solution to the water issues. The MOA also specified that USACE would operate USACE reservoirs in the ACT and ACF Basins,

within its statutory and contractual obligations, to maximize water resource benefits to the basins as a whole while taking into account the needs of existing water users and the need to maintain the historic flow regime in the rivers within the basins. Further, the MOA specified that USACE would withdraw the 1990 *Water Supply Reallocation Report and final Environmental Assessment for Carters Lake and Lake Allatoona*, but that USACE could proceed with appropriate evaluations and documentation related to the use of storage space in Allatoona Lake to meet the identified water supply needs of the City of Cartersville through 1995 and Carters Lake to meet the identified water supply needs of the City of Chatsworth through 1995. That report was completed and submitted to the South Atlantic Division for approval in August 1991.

Subsequent supplemental MOAs extended the term of those agreements and continue to include the live and let live provisions. The comprehensive study partners recommended river basin compacts among the states as the mechanism for negotiating water allocation formulas and managing the basins. The live and let live provisions were incorporated into the Interstate River Basin Compacts for each basin, signed into law by the President in November 1997; the MOAs were allowed to expire in September 1998.

It was envisioned that the comprehensive study would recommend, among other things, a conceptual plan for managing water resources in the ACT and ACF Basins, including managing USACE and non-USACE reservoirs in the basins; assessing existing and future water resource needs; the extent of water resources available in the basins to serve such needs; and an appropriate mechanism to implement management of the basins. Although much useful data on water resource needs and availability were generated and assessment and modeling tools were developed to assist in resource assessment and management of the basins, the comprehensive study was never completed.

Compact negotiations began in early 1998, with a December 31, 1998, deadline for reaching agreement on the water allocation formulas. By mutual agreement and in accordance with the provisions of the compacts, the states extended the deadline numerous times. Nevertheless, the state commissioners (governors of each state) were unable to reach an agreement on an equitable apportionment of the waters in either basin, and the compacts were allowed to expire in August 2003 (ACF Basin) and in July 2004 (ACT Basin). Upon expiration of the ACT and ACF compacts, Alabama and Florida reactivated their previous litigation and filed new litigation, resulting in a stay of any action by USACE related to implementation of any new water supply contracts or changes in reservoir storage or water control operations. The states asserted in the litigation that water control operations in the ACF Basin are not being conducted in accordance with approved water control plans, USACE regulations, and federal law.

Court-ordered mediation among the parties was initiated in March 2006 for both the ACT and ACF litigations. The order expired in March 2007 for the ACF Basin. In March 2007 the ACF claims were consolidated as Multiple District Litigation to be heard by one judge, with proceedings to be held in the U.S. District Court for the Middle District of Florida.

ACT claims remained with the U.S. District Court for the Northern District of Alabama. The court-ordered mediation order for the ACT Basin expired in September 2007.[3] In October 2007, the Secretary of the Army directed USACE to proceed with updating the water control plans for the ACT Basin. On November 9, 2007, USACE, Mobile District published in the *Federal Register* the NOI to prepare an EIS for the ACT WCM update.

[3] On November 1, 2007, the governors of Alabama, Florida, and Georgia met with Executive branch leaders (Secretary of the Department of the Interior, Chairman of the CEQ, Chief of Engineers) to discuss strategies for developing solutions to the decades-long dispute among the three states and the associated litigation. The resulting discussions focused primarily on the ACF system and the need for the states to agree on a drought water management plan. The mutually agreed-upon deadline was March 1, 2008. The parties did not reach an agreement, and negotiations ended on the deadline.

The ACT Complaints included a claim that NEPA evaluation performed by the US Army Corps of Engineers, Savannah District, for the permitting of the Hickory Log Creek Reservoir was inadequate. Hickory Log Creek Reservoir was permitted by the Savannah District in 2004 as a water supply reservoir for the Cobb County Marietta Water Authority (CCMWA) and city of Canton, and it is located on a tributary to the Etowah River upstream of Allatoona Lake. Alabama was concerned that Hickory Log Creek Reservoir would serve as a vehicle to allow CCMWA to withdraw more water from Allatoona Lake than its current water supply storage agreement allows.

The ACF litigation was divided into two phases to address separate distinct legal issues. Phase I addressed the USACE authority to operate Lanier for water supply and reallocate storage under the Water Supply Act of 1958 (WSA 1958), as well as claims raised under NEPA and other statutes. The Phase I summary judgment hearing was held on May 11, 2009. On July, 17, 2009, Judge Magnuson issued a ruling that found that USACE operations in support of water supply had "seriously affected the project purposes for which the Buford project was originally authorized" and that "the Corps is therefore in violation of the WSA."

The United States appealed the Phase I ruling. On June 28, 2011, the Eleventh Circuit Court issued a ruling that reversed the findings of the District Court. The court found that water supply was an authorized project purpose of Buford Dam under the River and Harbors Act of 1946 (RHA) and the WSA 1958. As to the merits, the court held that the majority of Plaintiffs' claims in the ACF were not final agency actions and therefore not subject to judicial review.

Phase II of the ACF litigation concerned USACE compliance with the Endangered Species Act (ESA), as well as claims raised under NEPA. The Phase II summary judgment hearing was held on June 8, 2010. Judge Magnuson issued a ruling on Phase II in the summer of 2010. In his ruling, he determined that USACE and the USFWS had complied with the ESA, but that USACE had not properly complied with its NEPA requirements. The appropriate remedy would be for USACE to conduct new NEPA on the WCM; however, because USACE had already agreed to develop an EIS as part of the WCM update Judge Magnuson determined Florida's claims were moot. Florida appealed the Phase II ruling to the Eleventh Circuit. After the appeal was filed new information on the endangered species caused the USFWS to request USACE to reinitiate consultation. All parties agreed to stay the appeal while USACE and the USFWS conducted additional studies. On January 24, 2013, the district court vacated its phase two ruling on the grounds that the USACE and the USFWS reinitiated consultation while the appeal was pending, thus rendering the appeal moot and making it proper to vacate the underlying order. Accordingly, there is no active litigation regarding the USACE operation of the ACF Basin.

After the Eleventh Circuit's opinion holding that the majority of Plaintiffs' claims in the ACF were not final agency actions and therefore not subject to judicial review, the Northern District of Alabama requested all parties file briefs on whether the ACT claims are final agency actions based on the rationale contained in the Eleventh Circuit's decision in the ACF litigation. The Court scheduled hearing on the motions to dismiss took place on June 29, 2012. On July 3, 2012, Judge Bowdre dismissed nine of the ten claims because no final agency action had been taken. On October 19, 2012, the Plaintiffs agreed to dismiss the last remaining claim, the permitting of Hickory Log Creek Reservoir, with prejudice.

3.1.11 Other Relevant Statutes and Executive Orders

A decision on whether to proceed with the proposed action rests on numerous factors such as mission requirements, schedule, availability of funding, and environmental considerations. In addressing environmental considerations, the Army is guided by relevant statutes (and their implementing regulations) and EOs that establish standards and provide guidance on environmental and natural resources management and planning. Table 3.1-2 provides a brief list of applicable laws and EOs.

Those authorities are addressed in various sections throughout this EIS when relevant to particular environmental resources and conditions. The full text of the laws, regulations, and EOs is on the DoD Environment, Safety and Occupational Health Network and Information Exchange (DENIX) web site at http://www.denix.osd.mil.

Table 3.1-2.
Applicable laws and EOs

Applicable authority	Summary
Federal laws	
Archeological and Historical Preservation Act, 16 U.S.C. 469	Requires federal agencies to identify and recover data from archeological sites threatened by their actions.
Archeological Resources Protection Act, 16 U.S.C. 470aa-470ll	Requires permits and provides for civil and criminal penalties for persons disturbing archeological resources on federal and tribal land without a permit.
The CWA, 33 U.S.C. 1344 *et seq.*; also known as the Federal Water Pollution Control Act of 1972	Protects, restores, and enhances the quality of the nation's waters. Prohibits discharges without a permit for any actions affecting "waters of the United States," including wetlands, and has strict liability for discharges of petroleum.
CAA, 42 U.S.C. 7401	Requires agencies to comply with state air quality standards set in State Implementation Plans.
Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9601-9675	Requires reporting of releases and cleanup of releases of hazardous substances; also assigns liability for cleanup.
Emergency Wetlands Resources Act of 1986, 16 U.S.C. 3901-3932	Promotes the conservation of wetlands to maintain the public benefits they provide and to fulfill international obligations contained in various migratory bird treaties and conventions.
ESA, 16 U.S.C. 1531	Requires consultation with the USFWS to ensure that actions do not jeopardize threatened or endangered species or their critical habitat.
Fish and Wildlife Coordination Act	Requires consultation with the USFWS on actions affecting stream modifications.
Fish and Wildlife Conservation Act, 16 U.S.C. 2901	Encourages all federal departments and agencies to use their statutory and administrative authority, to the maximum extent practicable and consistent with each agency's statutory responsibilities, to conserve and promote conservation of nongame fish and wildlife and their habitats.
Federal Land Policy and Management Act of 1976, 43 U.S.C. 1701-1784	Provides for the management of public lands that will protect the quality of scientific, scenic, historic, ecologic, environmental, air and atmospheric, water resource, and archeological values, that, where appropriate, will preserve and protect certain public lands in their natural condition.
Magnuson-Stevens Fishery Conservation Management Act, as amended by the Sustainable Fisheries Act of 1996 (P.L. 104-267; 16 U.S.C. 1801	Establishes exclusive U.S. management authority over all fishing within the exclusive economic zone, all anadromous fish throughout their migratory range except when in a foreign nation's waters and all fish on the Continental Shelf. Foreign fishing within those areas is prohibited unless conducted pursuant to a governing international fishery agreement and permit and only if the foreign nation extends reciprocity to U.S. fishing vessels. The act also establishes eight Regional Fishery Management Councils responsible for the preparation of FMPs to achieve the optimum yield from U.S. fisheries in their regions.
Marine Protection, Research, and Sanctuaries Act of 1972 33 U.S.C. 1401-1445, 16 U.S.C. 1431 *et seq*. and 33 U.S.C. 1271	Regulates the dumping of materials into ocean waters. It prevents, or restricts, dumping of materials that would degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities. The act provides for a permitting process to control the ocean dumping of dredged material. It also establishes the marine sanctuaries program, which designates certain areas of the ocean waters as sanctuaries to preserve or restore those areas for their conservation, recreational, ecological, or aesthetic values.

Table 3.1-2 (continued)

Applicable authority	Summary
Federal laws	
Migratory Bird Treaty Act, 16 U.S.C. 701-719c	Decreed that all migratory birds and their parts (including eggs, nests, and feathers) are fully protected.
NEPA, P.L. 91-190	Requires agencies to consider impacts on the human environment from proposed actions and document environmental impacts during project planning.
The National Historic Preservation Act, 16 U.S.C. 470 *et seq.*	Requires agencies to identify historic properties subject to effect by their actions and to consult with the State Historic Preservation Officer and others about alternatives and mitigation.
Noise Control Act of 1972 as amended, 42 U.S.C. 4901 *et seq*.	Establishes a national policy to promote an environment for all Americans free from noise that jeopardizes their health and welfare. The act also serves to (1) establish a means for effective coordination of federal research and activities in noise control; (2) authorize the establishment of federal noise emission standards for products distributed in commerce; and (3) provide information to the public respecting the noise emission and noise reduction characteristics of such products.
North American Wetlands Conservation Act, 16 U.S.C. 4401 *et seq*.	Implements the North American Waterfowl Management Plan and the Tripartite Agreement on wetlands between Canada, Mexico and the U.S. It establishes a North American Wetlands Conservation Council, the purpose of which is to recommend wetlands conservation projects to the Migratory Bird Conservation Commission.
Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901-6992k	Regulates the collection, storage, transport, and disposal of hazardous and solid waste and regulates underground storage tanks.
Safe Drinking Water Act as amended, 42 U.S.C. 300f *et seq*, 6939b and 15 U.S.C. 1261 *et seq*.	Authorizes USEPA to establish minimum standards to protect tap water and requires all owners or operators of public water systems to comply with these primary (health-related) standards. The 1996 amendments to SDWA require that USEPA consider a detailed risk and cost assessment, and best available peer-reviewed science, when developing the standards. Under the act, USEPA also establishes minimum standards for state programs to protect underground sources of drinking water from endangerment by underground injection of fluids.
Toxic Substances Control Act of 1976, 15 U.S.C. 2601	Requires that manufacturers and processors of a chemical conduct certain toxicological tests when there is little data on the chemical and it "may present an unreasonable risk of injury to health or the environment" or when large quantities of the substance will be produced and many people will be exposed to it.
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001	Provides for cooperation with state and local constituents for the purpose of preventing erosion, floodwater, and sediment damages in the watersheds of the rivers and streams of the United States and furthering the conservation, development, utilization, and disposal of water and the conservation and utilization of land thereby preserving, protecting, and improving the nation's land and water resources and the quality of the environment.
Water Pollution Control Act Amendments of 1961, P.L. 87-88	Requires federal agencies to consider, during the planning for any reservoir, storage to regulate streamflow for the purpose of water quality control.
EOs	
EO 11988: Floodplain Management	Directs all federal agencies to avoid, if possible, development and other activities in the 100-year base floodplain. Where the base floodplain cannot be avoided, special considerations and studies for new facilities and structures are needed. Design and siting are to be based on scientific, engineering, and architectural studies; consideration of human life, natural processes, and cultural resources; and the planned lifespan of the project. Federal agencies are required to reduce the risk of flood loss; minimize the impact of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains in carrying out agency responsibility.

Table 3.1-2 (continued)

Applicable authority	Summary
EOs	
EO 11990: Protection of Wetlands	Directs all federal agencies to avoid, if possible, adverse effects on wetlands and to preserve and enhance the natural and beneficial values of wetlands. Each agency must avoid undertaking or assisting in wetland construction projects unless the head of the agency determines that there is no practicable alternative to such construction and that the proposed action includes measures to minimize harm.
EO 12088: Federal Compliance with Pollution Control Standards	Delegates responsibility to the head of each executive agency for ensuring that all necessary actions are taken for the prevention, control, and abatement of environmental pollution. The order gives USEPA authority to conduct reviews and inspections to monitor federal facility compliance with pollution control standards.
EO 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	Requires each federal agency to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.
EO 13045: Protection of Children from Environmental Health Risks and Safety Risks	Requires each federal agency to make it a high priority to identify and assess environmental health risks and safety risks that might disproportionately affect children and ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks.
EO 13061 American Heritage Rivers	Directs federal agencies to establish and implement an initiative supporting community-led efforts relating to rivers that spur economic revitalization, protect natural resources and the environment, and preserve historic and cultural heritage.
EO 13175: Consultation and Coordination with Indian Tribal Governments	In formulating or implementing policies that have tribal implications, requires agencies to consult with tribal officials regarding the need for federal standards and any alternatives that would limit the scope of federal standards or otherwise preserve the prerogatives and authority of Indian tribes.
EO 13186 Responsibilities of Federal Agencies to Protect Migratory Birds	Directs executive departments and agencies to take certain actions to further implement the Migratory Bird Treaty Act
EO 13423: Strengthening Federal Environmental, Energy, and Transportation Management (replaced EOs 13101, 13123, and 13148)	Directs Federal agencies to conduct their environmental, transportation, and energy-related activities under the law in support of their respective missions in an environmentally, economically and fiscally sound, integrated, continuously improving, efficient, and sustainable manner.

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4 Water Management Alternative Formulation

The WCM update has been prepared in compliance with ER 1110-2-240 and all other applicable USACE regulations and policies. The following paragraphs briefly describe the methodology employed by USACE in developing the update to the Master Manual for the ACT Basin.

As noted in previous sections, USACE has been operating under the 1951 Master Manual and Reservoir Regulation Manuals for Allatoona Lake, Carters Lake, R.E. "Bob" Woodruff Lake (R.F. Henry Lock and Dam), William "Bill" Dannelly Lake (Millers Ferry Lock and Dam), Claiborne Lake (Claiborne Lock and Dam), as well as for the APC projects with authorized flood risk management functions (Weiss Lake, H. Neely Henry Lake, Logan Martin Lake, and R.L. Harris Lake. In addition to updating the draft 1951 Master Water Control Plan to include a drought contingency plan, USACE has considered making minor revisions to water management procedures at the projects to improve overall performance of the ACT Basin. In updating the Master Manual within the context of the purpose and need statement (Section 1.2), USACE used a six-step planning process described in the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources* (U.S. Water Resources Council 1983) and in ER 1105-2-100. The process is a structured approach to problem solving that provides a rational framework for sound decision making. Even though specifically required for planning studies, the process was well suited for this Master Manual update and is consistent with the CEQ's regulations for implementing NEPA (40 CFR 1500-1508). The six steps are

- Step 1. Identify problems (challenges) and define objectives (includes scoping as required by 40 CFR 1501.7)
- Step 2. Inventory and forecast critical resources (physical, environmental, economic, and demographic) and develop the No Action Alternative
- Step 3. Formulate alternative plans
- Step 4. Evaluate alternative plans
- Step 5. Compare alternative plans
- Step 6. Select a plan

The six steps, although presented and discussed in a sequential manner for ease of understanding, usually occur iteratively and sometimes concurrently. Iterations of steps were conducted as necessary to formulate efficient, effective, complete and acceptable plans. The process is illustrated in Figure 4.0-1.

Problems and challenges were identified by the scoping process (stakeholder comments) and by an internal review by USACE Water Management staff with experience gained operating under the draft 1951 Master WCM. On the basis of the results of those efforts, the following challenges were identified:

- The flow requirements from the upstream APC projects to provide for navigation on the Alabama River downstream of Claiborne Lock and Dam have not been well defined. Recent experience operating in drought conditions revealed that attempting to provide navigation flows during drought conditions over-taxes APC projects.
- Current water management documents do not provide a basin-wide drought management plan as required by USACE regulations (ER 1110-2-240 and ER 1110-2-1941). Further, recent experience operating in drought conditions identified a number of circumstances where the lack of flexibility in existing water control plans led to placing unreasonable demands on APC projects.

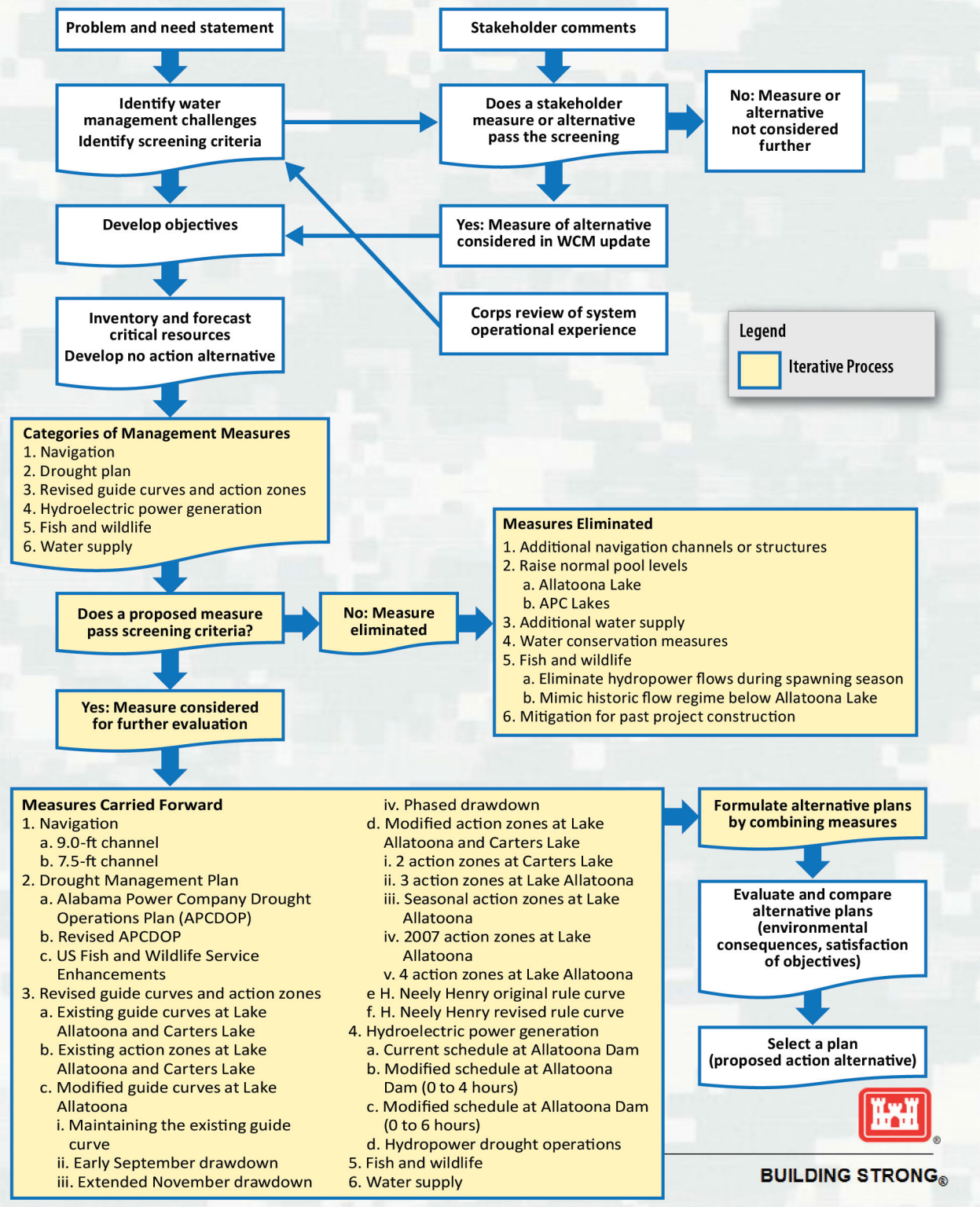


Figure 4.0-1. Water management planning process.

- Coordination with USFWS, beginning in 2003, has yielded recommendations to modify releases at multiple ACT projects to mimic a more natural flow regime and to improve downstream flow conditions for the benefit of fish and other aquatic resources. As summarized in Section 4.1 below, modification of releases at ACT projects was evaluated and determined to be viable only below the Carters reregulation dam.
- Sustained hydropower operations at Allatoona Lake during drought have an adverse effect on USACE ability to balance project purposes.
- APC is relicensing its Coosa River project and making some changes in its operations. USACE WCMs must be updated to incorporate appropriate changes in APC project operations.

From those challenges, several objectives for the WCM update were developed. In the context of this EIS, an *objective* is a statement of what USACE should try to achieve with the updated WCM. Accordingly, the following objectives have been developed:

- More accurately define flow requirements for APC projects to support navigation on the Alabama River downstream of Claiborne Lock and Dam
- Develop a drought management plan as required by USACE regulations
- Improve conditions downstream of Carters Reregulation Dam for fish and wildlife conservation, including threatened and endangered species
- Improve system performance to achieve congressionally authorized project purposes
- Incorporate appropriate changes in APC project operations into the updated WCM

On the basis of the foregoing operational challenges and extensive stakeholder input during scoping, USACE identified numerous management measures for possible consideration in the updated WCM. A *management measure* can be defined as a feature or activity that can be implemented at a specific geographic site to address one or more of the objectives. The measures considered in updating the WCM included variations for revising reservoir guide curves and conservation storage action zones; revising hydropower generation plans for water control regulation; revising drought procedures and environmental flows; and developing navigation-specific operations.

USACE used an iterative process to identify the various measures that would be further developed, analyzed, and refined toward the goal of developing an updated WCM. The process relied extensively on modeling using the latest software application (HEC-ResSim version 3.1) in the early stages of the process. HEC-ResSim version 3.2 was used for the final simulations (see Section 6.1). USACE HEC developed the software that is now the standard for USACE reservoir operations modeling. The software incorporates characteristics of the basin and individual reservoirs including physical constraints (spillway capacities, area-discharge curves, flows associated with hydropower generation, and such) and operational procedures (action zones, balancing, and the like). USACE selected HEC-ResSim as the tool most capable of replicating Mobile District water management practices at the culmination of a 3-year model development and verification process. In 2006 the Mobile District began working with HEC to create HEC-ResSim watershed models of its established HEC-5 models simulating 1977, 1995, and 2006 physical and operational conditions. The three HEC-5 models hold significance as the tools *of record* for analyses concerning the previous EIS and the 1990's Comprehensive Study. After ensuring that the corresponding HEC-ResSim models could effectively reproduce the HEC-5 results, the Mobile District and HEC created another HEC-ResSim model that captured the most significant operations as of 2008.

The model was presented to stakeholders in October 2008 and is generally accepted as a promising improvement to ACT reservoir system modeling. As the HEC-ResSim model for the ACT Basin was further refined and initial baseline model runs were conducted, USACE conducted a second stakeholder

workshop in May 2011. Participants in these workshops included representatives of the states of Alabama and Georgia, U.S. Geological Survey, Alabama Power Company, local water utilities in the basin, and several consultants.

Using HEC-ResSim, USACE modeled the effects of changing individual and multiple operational measures (for instance, revising hydropower generation per action zone or reshaping action zones) at individual reservoirs and across the entire ACT Basin. The software provided data outputs (hydropower generation, reservoir levels, river flows and stages, and others) across the entire hydrologic period of record (initially 1939–2008 and subsequently extended to 2011), which were then evaluated in terms of project and watershed criteria (channel availability, generation and capacity, reservoir recreation impact levels, and other authorized purposes, intended benefits, and existing uses in the system). The iterative process is illustrated in Figure 4.0-2.

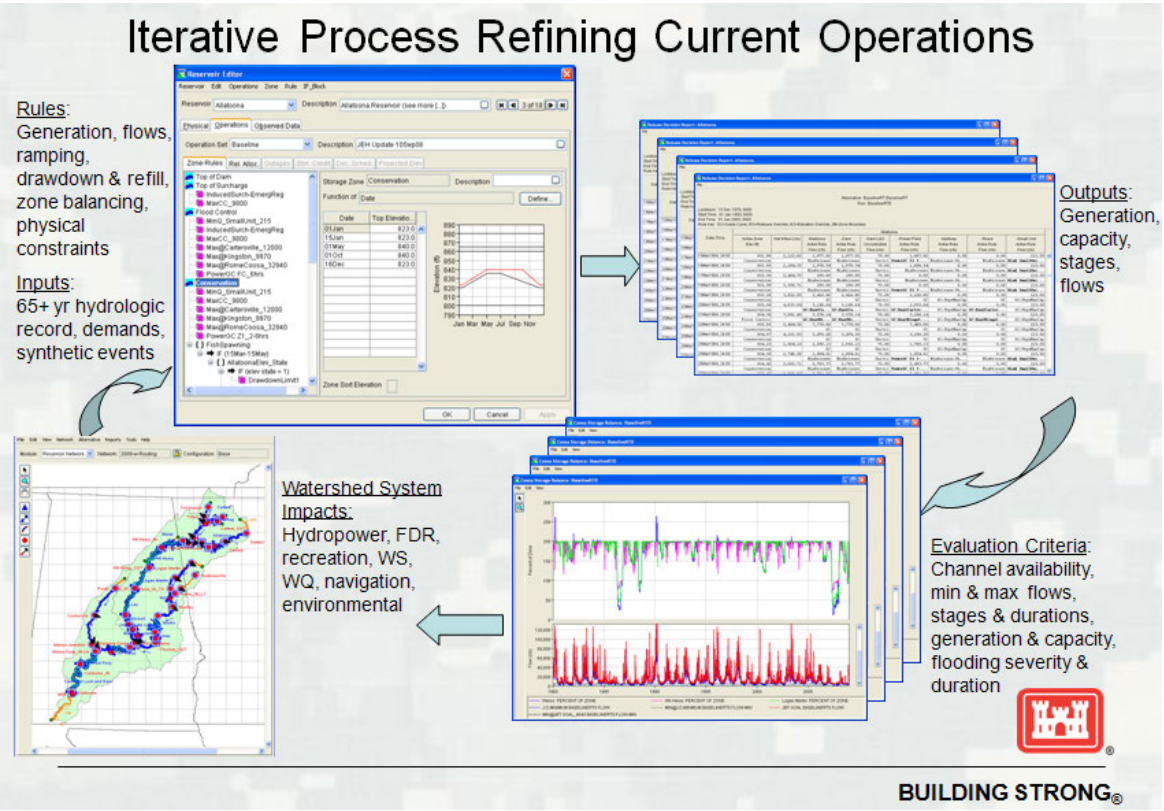


Figure 4.0-2. Process of refining current operations.

USACE considered each measure individually and determined whether it passed the screening criteria listed in section 1.4.4. Measures failing to pass the screening criteria were eliminated from further consideration. Measures carried forward for further evaluation were refined, if required, and then combined to form basin-wide alternative plans. HEC-ResSim was then used to model the effects of the alternative plans providing data outputs (hydropower generation, reservoir levels, river flows and stages, and others) across the entire hydrologic period of record (1939–2011), which were then evaluated in terms of project and watershed criteria (channel availability, generation and capacity, reservoir recreation impact levels, and other authorized purposes, intended benefits, and existing uses in the system). Ultimately, the updated WCM will reflect the recommended plan or Preferred Alternative with the combination of water management measures that would be expected to meet the objectives and best balance system operations.

The sections to follow outline operational revisions considered in updating WCMs for the ACT Basin.

4.1 Management Measures Eliminated from Consideration

Management measures eliminated from consideration were those that do not pass the screening criteria presented in Section 1.4.4. Further, in the scoping comments received, a number of specific management measures (or alternatives) were identified that were found to be outside the scope of this EIS. Specific management measures (or alternatives) identified in scoping that were eliminated from consideration for further evaluation are presented in detail in Section 1.4.4. A brief description of some examples of management measures eliminated from further consideration follows in this section.

USACE does not prioritize project purposes, with the exception of flood risk management during a flood event as explained in Section 5.1.1. Therefore, any measure proposed during public scoping that recommended prioritization of project purposes was not carried forward for further consideration.

Navigation is one of the congressionally authorized purposes in the ACT Basin; however, recommendations to add channel buoys in the vicinity of Gadsden, construct additional training works in the Alabama River, or maintain tributaries to the Alabama River exceed the scope and authority for water control management of existing reservoir projects and the development/update of water control plans for water control regulation. Consequently, these measures were not considered further.

Management measures that suggest use of flood storage for purposes other than flood storage were not considered. Accordingly, management measures to raise Allatoona Lake 2 ft to a conservation pool elevation 842 ft or to raise the winter pool level above 823 ft were eliminated from consideration. As described in Section 1.4.4.1, USACE authority to consider raising the pool at Allatoona Lake would reduce the available flood risk management storage and require a reallocation of that storage to some other purpose. USACE is not pursuing exercise of that discretionary authority as part of this WCM update. This update is being conducted to determine how the federal projects in the ACT Basin should be operated for their authorized purposes, in light of current conditions and applicable law.

A number of scoping comments, previously discussed in Chapter 1, suggest various means of addressing water supply needs in the ACT Basin. USACE did not carry forward for further consideration management measures, such as additional reallocation of storage in Allatoona Lake, rainfall recycling, eliminating interbasin transfer, increasing the yield of Allatoona Lake by dredging or other means, and desalination, which would address the future water supply needs for the Atlanta region. Additionally, scoping comments suggesting that USACE establish broad-based water conservation measures, impose surcharges on water supply storage used to supply needs outside the ACT Basin, or limit growth in the Atlanta area are outside USACE authority to implement and were not carried forward for further consideration. While USACE recognizes the water needs of entities downstream of its reservoirs, the authorized purposes of the federal ACT system do not include making specific releases to satisfy those needs.

USACE also did not carry forward for further consideration management measures that change minimum releases or minimum flows to ensure other entities meet their federal clean water compliance requirements in the future. USACE does recognize existing minimum flow requirements but is not authorized to operate projects to ensure compliance by others; the use of Allatoona Lake releases to ensure discharges by municipalities and industries comply with the CWA are also not within USACE authority. States have the regulatory authority to ensure that discharges to surface water meet permitted standards. Setting minimum flow targets to ensure compliance with water quality standards is the responsibility of states, not USACE. Further, controlling development on private property around its lakes through zoning is not an authorized USACE activity.

Some scoping comments suggested significant revisions to hydropower operations such as reducing peak flows for hydropower and provide windows of no peak flows during the spawning season; considering dam operations at Allatoona Lake that would more closely mimic the natural flow regime; or minimizing the amount of water being released from Allatoona Lake during droughts. Hydropower is one of the congressionally authorized purposes in the ACT Basin. Hydropower facilities at USACE projects in the ACT Basin are operated to meet daily peak electric power demands during periods of high use, The number of hours of peaking operations on any given day at any specific project may vary as necessary to balance with meeting other authorized project purposes. Recommended measures for off-peak hydropower operations to achieve other objectives or benefits were determined to be inconsistent with the authorized hydropower purpose. Consequently, recommended measures that would dictate non-peak hydropower operations or would otherwise have a significant adverse effect on the hydropower function were not carried forward for detailed consideration.

Management measures that suggest mitigating for project construction, operations or restoring degraded habitat were not considered further. The update of the ACT WCMs and plans is not the appropriate authority to evaluate alternatives for mitigating the construction of the Carters Lake project, for considering construction of structural measures to improve the water quality of releases, or for recommending restoration of habitat for federally listed species. Accordingly, such measures were not carried forward for detailed consideration. Separate authorities that may be pursued to improve or restore degraded environmental conditions from past project-related activities include: Section 216 of the River and Harbor and Flood Control Act of 1970 (Review of Completed Projects); Section 1135 of WRDA 1986, as amended (Project Modifications for Improvement of the Environment); and Section 206 of WRDA 1996, as amended (Small Aquatic Ecosystem Restoration Projects). The latter two authorities have specific limits on Federal funds that can be expended on each project ($10,000,000).

Several scoping comments suggest taking actions regarding APC projects on the Coosa and Tallapoosa Rivers, such as operating the winter pool level for Lake Martin at or above elevation 479 ft, making other operational changes to APC projects, or addressing erosion problems on APC projects. Such measures are beyond USACE authority to address.

4.2 Management Measures Considered for Further Evaluation

The management measures considered in updating the WCM are described in the subsections to follow. Those measures considered in the formulation of alternatives were those that passed the screening criteria presented in Section 1.4.4. This section provides a general description of the measures considered. Each measure was considered individually and refined iteratively as described in Section 4.3.

4.2.1 Navigation

Allatoona Lake and Carters Lake, while authorized for navigation, are not regulated specifically for navigation which occurs only on the Alabama River downstream of Montgomery, Alabama, the *head of navigation.* Those projects contribute flows which aids APC's support of navigation on the Alabama River as explained below. In accordance with federal law and USACE regulation, APC operates Jordan Dam and Lake and Bouldin Dam, along with the other FERC-licensed projects on the Coosa and Tallapoosa Rivers, to supply water for navigation on the Alabama River. The required flow is the combined release from Jordan-Bouldin-Thurlow Dams (JBT). R.E. "Bob" Woodruff, William "Bill" Dannelly, and Claiborne Lakes are operated to maintain stable pool levels, coupled with the necessary channel maintenance dredging, to support sustained use of the authorized navigation channel. Releases by APC together with local inflows downstream of the Coosa and Tallapoosa Rivers' confluence are expected to provide the required flow in the Alabama River downstream of Claiborne Lock and Dam. The volume of APC releases necessary to sustain navigation in the Alabama River at any given time has been

a matter of disagreement between APC and USACE for some time. During the 2007 drought, APC made the determination that it could not meet the flow target and made cuts in releases that impeded navigation.

USACE considered several factors in developing options to support navigation on the ACT Basin. First, it reviewed historic channel availability, flow depth patterns, and the relationship between basin inflows and storage usage to determine flow levels necessary to support navigation on the system. To accomplish that, USACE also considered dredging impacts (timing and extent) during low- and high-flow periods. Dredging typically occurs in the summer and fall months, after which less flow would be required during those periods to provide the necessary channel depths. As dredging proceeds, more flow is required to produce the 9-ft channel over shoals until the shoals are removed. USACE also examined storage relationships between USACE and APC projects, taking into account such factors as drainage areas, storage volumes, and historic contributions to flows. As an example of that analysis, Figure 4.2-1 below shows the effect of dredging on flow requirements for different navigation channel depths during normal hydrologic conditions (1992–1994).

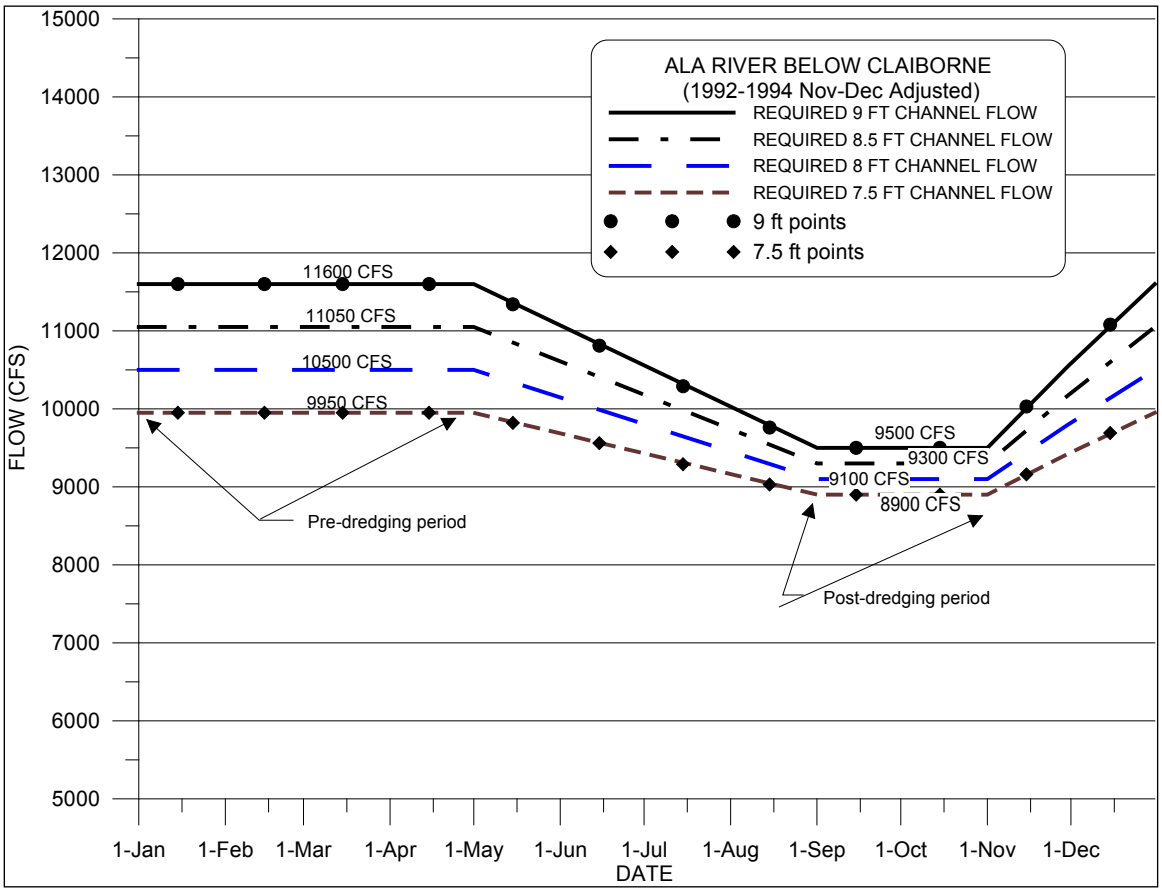


Figure 4.2-1. Flow-depth pattern (navigation template) from 1992–1994 data (revised Nov 2013).

USACE selected the Navigation Template from 1992 to 1994 as the basis for determining navigation flow targets for the Alabama River downstream of Claiborne Lock and Dam. Monthly flow targets for a 9.0-ft and 7.5-ft channel were incorporated into the alternatives to represent the system navigation demand. When a 9.0-ft channel cannot be met, the shallower 7.5-ft channel would still allow for light loaded barges moving through the navigation system. During the discussions and development of navigation flow support concept drought plan with APC, USACE and APC agreed to transition to a navigation

channel depth less than 9.0-ft before complete suspension during drought operation. The designated navigation template provided estimated flow requirements for channel depths ranging from 7.5-ft to 9.0-ft at half foot increments. The agencies decided to use the lowest available channel depth flows for transition navigation channel. There is enough flexibility in the navigation plan to support shallower channel depth if required flow data are provided. In short, USACE and APC agreed to a navigation plan that provides necessary navigable channel flows. The actual channel depth will vary with USACE ability to dredge.

During and after the coordination of the draft EIS, USACE reviewed additional data addressing the "annual depth of available channel at design low water elevation." The navigation (1992-1994) template initially used in the modeling to support the ACT WCM update indicated a rapid channel refill in the month of November. The available additional information revealed a different response depending on flow conditions. Channel refill appeared to be considerably slower during low flow and high flow years (low flow in 2007, 2008, and 2010; high flow in 2005). During normal flow years (e.g., 2004 and 2009), the fill-in rate is slightly higher, However, in all cases reviewed, the navigation channel in the Alabama River did not fill in as abruptly as in the initial navigation template used in the modeling. Figure 4.2-1 above reflects revisions to the navigation template based on the review of the additional information described above.

Historically, navigation has been supported by releases from storage in the ACT Basin. Therefore, another critical component in developing the navigation operation would involve using an amount of storage similar to that which has historically been used, but in a more efficient manner. In developing the proposed navigation operations, USACE did not include flow requirements from Allatoona Lake and Carters Lake because, as explained earlier, they are not regulated specifically for navigation. Further, because they are subject to congressional action, federal projects are more likely to experience future changes in storage usage than are the APC projects. Linking the basin inflow to an expected storage usage from federal projects could require a reciprocating change in storage usage from APC projects. In other words, if the navigation target remains the same and there is a reduction in releases from the federal projects, there could be an expected increase in storage usage required from APC projects.

After completing this storage and flow/stage/channel depth analyses, USACE, in coordination with APC, developed a navigation operation on the basis of basin inflows and average storage usage by APC (e.g., navigation operations would not be predicated on use of additional storage) during normal hydrologic conditions. Under that concept, USACE and APC make releases that support navigation when basin inflows meet or exceed seasonal targets for either the 9.0-ft or 7.5-ft channel templates. Triggers are also identified (e.g., when basin inflow are less than required natural flows) to change operational goals between the 9.0-ft and 7.5-ft channels. Similarly, basin inflow triggers are identified when releases for navigation would be suspended and only releases from JBT of 4,640 cfs (weekly average) would occur. The basin inflow is the total flow above the APC projects excluding inflow into Allatoona Lake and Carters Lake; however, it does include releases from Allatoona and Carters. During drought operations, releases to support navigation would be suspended until system recovery occurs as defined in the basin Drought Management Plan (Section 4.2.2).

Monthly navigation flow targets downstream of Claiborne Lock and Dam are depicted in Table 4.2-1.

Table 4.2-1
Monthly navigation flow target in cfs (revised November 2013)

Month	9.0-ft target downstream of Claiborne Lock and Dam (cfs)	9.0-ft JBT goal (cfs)	7.5-ft target downstream of Claiborne Lock and Dam (cfs)	7.5-ft JBT goal (cfs)
Jan	11,600	9,280	9,950	7,960
Feb	11,600	9,280	9,950	7,960
Mar	11,600	9,280	9,950	7,960
Apr	11,600	9,280	9,950	7,960
May	11,340	9,072	9,820	7,856
Jun	10,810	8,648	9,560	7,648
Jul	10,290	8,232	9,290	7,432
Aug	9,760	7,808	9,030	7,224
Sep	9,500	7,600	8,900	7,120
Oct	9,500	7,600	8,900	7,120
Nov	10,030	8,024	9,160	7,328
Dec	11,080	8,864	9,690	7,752

To achieve the 9.0-ft and 7.5-ft flow targets downstream of Claiborne Lock and Dam requires flows from JBT as defined in Table 4.2-1. The JBT goal values were computed using the drainage area ratio between Claiborne Lock and Dam site and total area above JBT dam sites, a factor of 0.8. The difference in flow between targets downstream of Claiborne Lock and Dam and the JBT goal would come in flows downstream of JBT from rainfall and overland flow.

Table 4.2-2 and Figure 4.2-2 show the required basin inflow for a 9.0-ft channel; Table 4.2-3 and Figure 4.2-3 show the required basin inflow for a 7.5-ft channel. The required basin inflow to support navigation is a function of the navigation flow target for 9.0-ft and 7.5-ft channel depths and the monthly historic use of storage from the APC projects. The derivation of the required monthly basin inflow levels is described in detail in Section 4 of the HEC-ResSim Modeling Report for the ACT Master WCM updates (Appendix C of this EIS). On the basis of observed monthly average flows, those figures indicate that the required navigation flow target could be met entirely by basin inflow or rainfall in some months (January through May) with the excess inflow above the required target available to replenish storage in the APC reservoirs. In June through December, basin inflow or rainfall is typically not sufficient to provide the required navigation flow target and releases from JBT must be made to supplement the natural flow. The assumptions made about water releases and holding water are consistent with seasonal management where water is released from reservoirs in the fall to reduce flooding during months of high rainfall (January through April).

Table 4.2-2.
Basin inflow (cfs) above APC projects required to meet a 9.0-ft navigation channel (revised November 2013)

Month	APC Navigation Target	Monthly Historic Storage Usage	Required Basin Inflow
Jan	9,280	-994	**10,274**
Feb	9,280	-1,894	**11,174**
Mar	9,280	-3,028	**12,308**
Apr	9,280	-3,786	**13,066**
May	9,072	-499	**9,571**
Jun	8,648	412	**8,236**
Jul	8,232	749	**7,483**
Aug	7,808	1,441	**6,367**
Sep	7,600	1,025	**6,575**
Oct	7,600	2,118	**5,482**
Nov	8,024	2,263	**5,761**
Dec	8,864	1,789	**7,075**

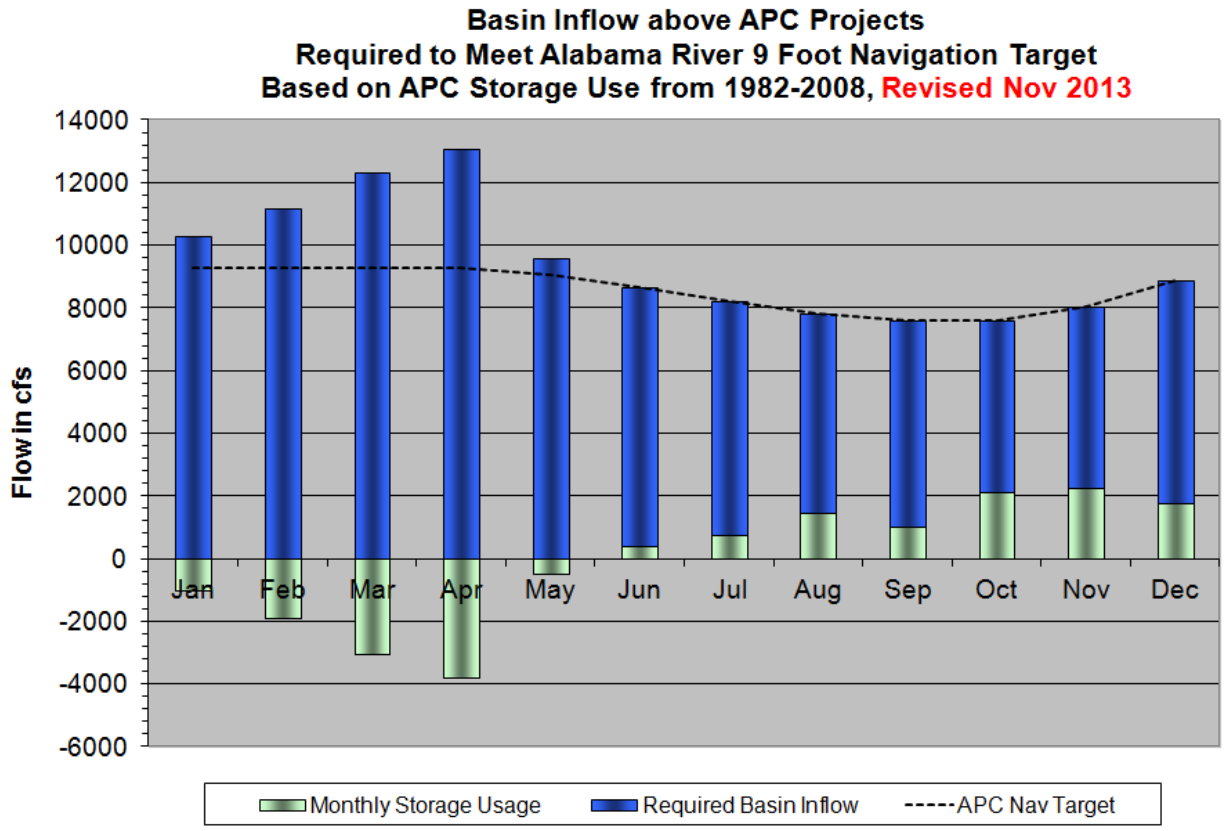


Figure 4.2-2. Flow requirements from rainfall (or natural sources) and reservoir storage to achieve the JBT goal for navigation flows for a 9-ft channel (revised November 2013).

Table 4.2-3.
Basin inflow (cfs) above APC projects required to meet a 7.5-ft navigation channel (revised November 2013)

Month	APC Navigation Target	Monthly Historic Storage Usage	Required Basin Inflow
Jan	7,960	-994	**8,954**
Feb	7,960	-1,894	**9,854**
Mar	7,960	-3,028	**10,988**
Apr	7,960	-3,786	**11,746**
May	7,856	-499	**8,355**
Jun	7,648	412	**7,236**
Jul	7,432	749	**6,683**
Aug	7,224	1,441	**5,783**
Sep	7,120	1,025	**6,095**
Oct	7,120	2,118	**5,002**
Nov	7,328	2,263	**5,065**
Dec	7,752	1,789	**5,963**

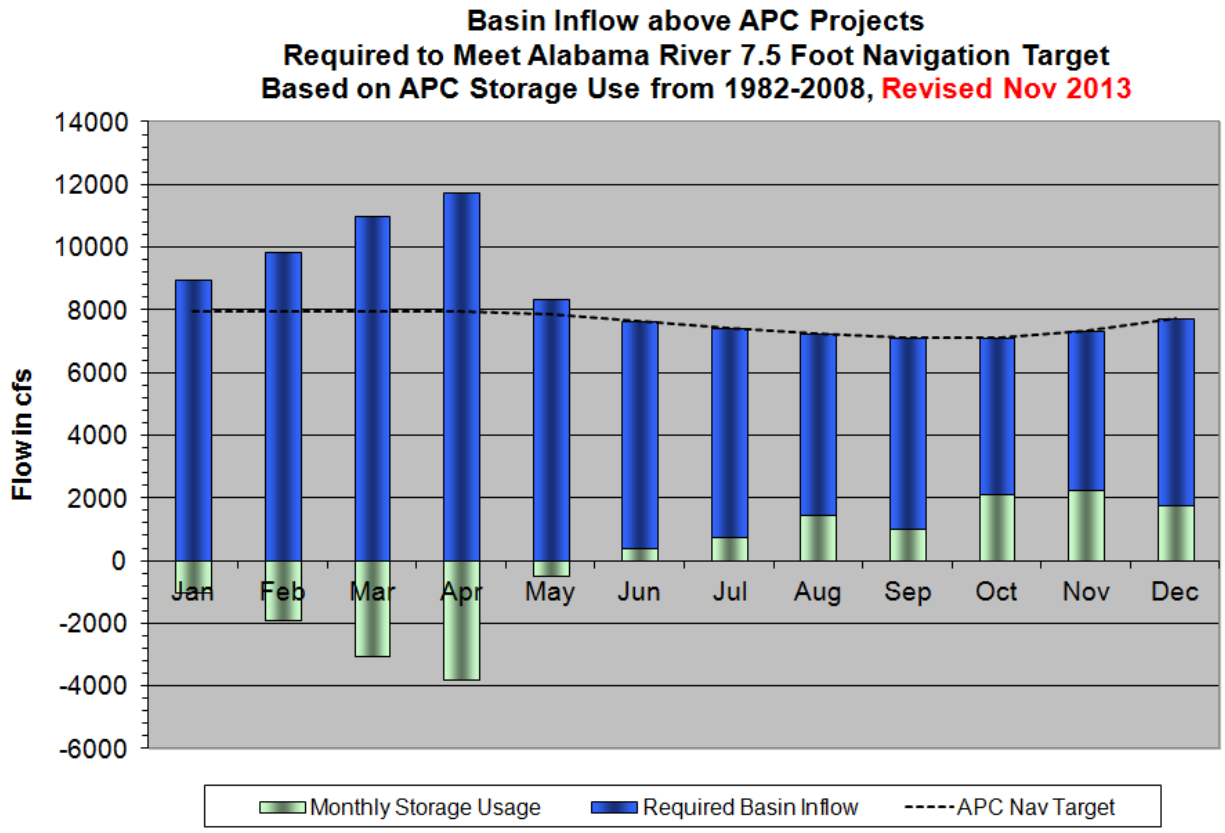


Figure 4.2-3. Flow requirements from rainfall (or natural sources) and reservoir storage to achieve the JBT goal for navigation flows for a 7.5-ft channel (revised November 2013).

In conclusion, management measures for navigation included consideration of a 9.0-ft or 7.5-ft channel and assumed dredging would occur each year from May through August. Under the management measure to support navigation, USACE and APC would make releases for navigation when basin inflows meet or exceed seasonal targets for either the 9.0-ft or 7.5-ft channel template. Modeling effort for the WCM update process assumed the navigation template or channel condition remains the same for each calendar year because required dredging occurs. In actual operation channel conditions may vary, because required dredging may not occur. For this situation, the flow required to support the 7.5 foot and 9.0 foot channel will be determined from the latest channel survey and will consequently define the temporary navigation template. From this information, the required basin inflow to support navigation will be recomputed. The monthly historic storage usage from the APC projects would remain the same. In summary, if the temporary navigation template requires a higher flow for the 9 foot and 7.5 foot channels, then the basin inflow required to support navigation will increase. Conversely the required basin inflow will also decrease if the navigation flow decreases. In all situations the expected use of storage to support navigation from the APC projects would remain the same.

Triggers were also identified to change operations between the 9.0-ft and 7.5-ft channel. Similarly, basin inflow triggers were identified when releases for navigation would be suspended. In such cases, the JBT releases would provide only a flow of 4,640 cfs, which with inflows downstream of JBT would be sufficient to provide for a 7Q10 flow (the lowest stream flow for 7 consecutive days that would be expected to occur once in 10 years) downstream of Claiborne Lock and Dam. During drought operations (discussed below), releases to support navigation would be suspended until system recovery occurs as defined in the drought management plan.

4.2.2 Drought Management Plan

As indicated in Section 2.1.1.2.5, both Alabama and Georgia have general statewide drought plans. Management measures to establish a drought management plan for the ACT basin were considered to meet the objectives to *develop a drought management plan as required by USACE regulations* and to *incorporate changes made at APC projects into operations of the ACT Basin in the updated WCM.* APC manages about 78 percent of the water stored in the ACT Basin.

During the drought of 2006–2008, USACE did not have a drought plan applicable across the entire ACT Basin. USACE generally responded to drought conditions by reducing hydropower generation at Allatoona Lake and Carters Lake as the reservoir pools dropped throughout the summer and fall. During previous droughts, USACE coordinated frequently with APC, the states, and affected stakeholders—and the drought of 2006–2008 was no exception. During the drought, USACE conducted biweekly water management conference calls with stakeholders from across the basin to gather information to better inform water management decision making. USACE also supported, to a limited extent, an APC request to reduce the 4,640-cfs JBT flow target near Montgomery by 20 percent (to 3,700 cfs).

In response to the 2006–2008 drought, APC worked closely with Alabama to develop the APC draft *Alabama Drought Operations Plan* that specified operations at APC projects on the Coosa and Tallapoosa Rivers. (For the purpose of this EIS, that will be referred to as the APC Drought Operations Plan or APCDOP.) That plan included the use of composite system storage, state line flows, and basin inflow as triggers to drive drought response actions. Similarly, in response to the 2006–2008 drought, USACE recognized that a basin-wide drought plan must incorporate variable hydropower generation requirements from its headwater projects in Georgia (Allatoona Lake and Carters Lake), a reduction in the level of navigation service provided on the Alabama River as storage across the basin declines, and that environmental flow requirements must still be met to the maximum extent practicable.

Building on the APCDOP and APC experience applying it to project operations, USACE sought, in cooperation with APC, to develop a basin-wide drought plan composed of three components—headwater operations at Allatoona Lake and Carters Lake in Georgia; operations at APC projects on the Coosa and Tallapoosa Rivers; and downstream operations at USACE projects downstream of Montgomery. The concept is graphically depicted in Figure 4.2-4 below.

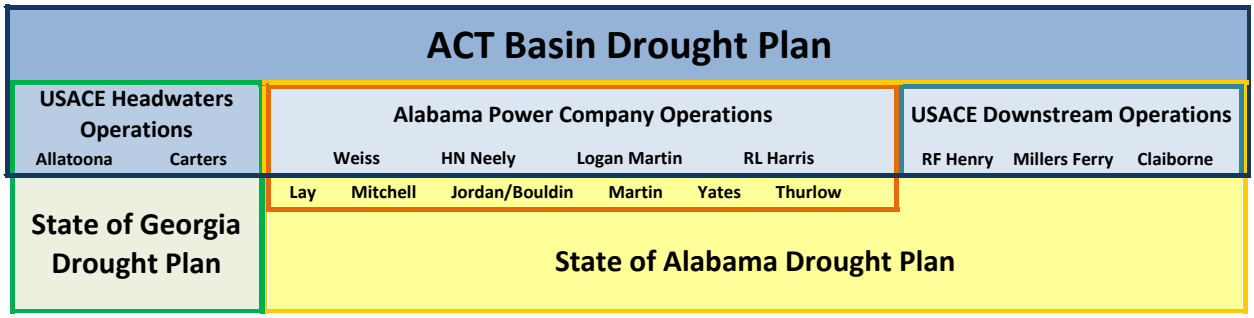


Figure 4.2-4. Schematic of the ACT Basin drought plan.

4.2.2.1 Headwater Operations for Drought at Allatoona Lake and Carters Lake

Drought operations at Allatoona Dam and Lake would consist of progressively reduced hydropower generation as pool levels decline. For instance, when Allatoona Lake is operating in normal conditions (Zone 1 operations), hydropower generation might be 0 to 4 hours per day. However, as the pool drops to lower action zones during drought conditions, generation could be reduced to 0 to 2 hours per day. As Carters Lake pool level might drop into a newly created Zone 2, minimum target flows would be reduced from seasonal varying values to 240 cfs. Sections 4.2.3 and 4.2.4 describe in more detail potential revisions to operations at those projects to create more flexibility during drought.

4.2.2.2 Operations at APC Projects on the Coosa, Tallapoosa, and Alabama Rivers

Under current operations, APC provides a combined minimum release of 4,640 cfs (7-day average) from JBT projects, which are located just above the confluence of the Coosa and Tallapoosa Rivers (forming the Alabama River) near Montgomery. Section 2.1.1.1.4.13 describes in detail how the combined minimum JBT releases were determined. This JBT minimum release target was established based on the premise that if APC provided 4,640 cfs, USACE operations at downstream projects and intervening basin inflow would be able to meet the minimum flow target of 6,600 cfs downstream of Claiborne Lock and Dam (the 7Q10 flow at that location). As dry conditions continued in 2007, water managers understood that, if the basin inflows from rainfall were insufficient, the minimum flow target would not likely be achievable. With that understanding, USACE considered updating drought operations in coordination with APC.

The APCDOP, described in the following paragraphs, served as the initial template for developing proposed drought operations for the ACT Basin. APCDOP operational guidelines for the Coosa, Tallapoosa, and Alabama Rivers have been defined in a matrix, on the basis of a Drought Intensity Level (DIL). The DIL is a drought indicator, ranging from zero to three. The DIL is determined on the basis of three basin drought criteria (or triggers). A DIL=0 indicates normal operations, while a DIL from 1 to 3 indicates some level of drought conditions. The DIL increases as more of the drought indicator thresholds (or triggers) are met. The APCDOP matrix defines monthly minimum flow requirements for the Coosa, Tallapoosa, and Alabama Rivers as function of DIL and time of year. Such flow requirements are modeled as daily averages.

The combined occurrences of the drought triggers determine the DIL. Three intensity levels for drought operations are applicable to APC projects.

DIL

- DIL0—(normal operation) no triggers met
- DIL1—(moderate drought) 1 of 3 triggers met
- DIL2—(severe drought) 2 of 3 triggers met
- DIL3—(exceptional drought) all 3 triggers met

The indicators used in the APCDOP to determine drought intensity include the following:

1. Low basin inflow
2. Low composite conservation storage
3. Low state line flow

Each of those indicators is described in detail in Sections 4.2.2.3 through 4.2.2.5

The DIL would be computed on the 1st and 3rd Tuesday of each month. Once a drought operation is triggered, the DIL can only recover from drought condition at a rate of one level per period. For example, as the system begins to recover from an exceptional drought with DIL=3, the DIL must be stepped incrementally back to zero to resume normal operations. In that case, even if the system triggers return to normal quickly, it will still take at least a month before normal operations can resume—conditions can improve only to DIL=2 for the next 15 days, then DIL=1 for the next 15 days, before finally returning to DIL=0.

For DIL=0, the matrix shows a Coosa River flow between 2,000 cfs and 4,000 cfs with peaking periods up to 8,000 cfs occurring. The required flow on the Tallapoosa River is a constant 1,200 cfs throughout the year. The navigation flows on the Alabama River are applied to the APC projects. The required navigation depth on the Alabama River is subject to the basin inflow.

For DIL=1, the Coosa River flow varies from 2,000 cfs to 4,000 cfs. On the Tallapoosa River, part of the year, the required flow is the greater of one-half of the inflow into Yates Lake and twice the Heflin USGS gage. For the remainder of the year, the required flow is one-half of Yates Lake inflow. The required flows on the Alabama River are reduced from the amounts when DIL=0. The requirement on the Alabama River is between 4,200 and 4,640 cfs.

For DIL=2, the Coosa River flow varies from 1,800 cfs to 2,500 cfs. On the Tallapoosa River, the minimum is 350 cfs for part of the year and one-half of Yates Lake inflow for the remainder of the year. The requirement on the Alabama River is between 3,700 cfs and 4,200 cfs.

For DIL=3, the flows on the Coosa River range from 1,600 cfs to 2,000 cfs. A constant flow of 350 cfs on the Tallapoosa River is required. It is assumed an additional 50 cfs will occur between Thurlow Lake and the City of Montgomery water supply intake. Required flows on the Alabama River range from 2,000 cfs to 4,200 cfs

In addition to the APCDOP, the DIL affects the navigation operations. When the DIL is equal to zero, APC projects are operated to meet navigation flow target or 4,640 cfs as defined in the navigation measure section. Once DIL is greater than zero, drought operations will occur, and releases to support commercial navigation operations are suspended.

The above features of the APCDOP are depicted later in Section 4.2.2.7 in a tabular format (Table 4.2-6), along with three variations of the APCDOP that were used in formulating water management alternatives for the ACT Basin.

4.2.2.3 Low Basin Inflow Trigger

The total basin inflow needed to meet the JBT release target is the sum of the total filling volume plus 4,640 cfs. Table 4.2-4 lists the monthly low basin inflow criteria. All numbers are in cfs-days. The basin inflow value is computed daily and checked on the 1st and 3rd Tuesday of each month. If computed basin inflow is less than the value required, the low basin inflow indicator is triggered.

Table 4.2-4.
Low basin inflow guide (in cfs-days) (revised November 2013)

Month	Coosa filling volume	Tallapoosa filling volume	Total filling volume	JBT Release Target	Required basin inflow
Jan	628	0	628	4,640	5,268
Feb	626	1,968	2,594	4,640	7,234
Mar	603	2,900	3,503	4,640	8,143
Apr	1,683	2,585	4,269	4,640	8,909
May	248	0	248	4,640	4,888
Jun			0	4,640	4,640
Jul			0	4,640	4,640
Aug			0	4,640	4,640
Sep	–612	–1,304	–1,916	4,640	2,724
Oct	–1,371	–2,132	–3,503	4,640	1,137
Nov	–920	–2,748	–3,667	4,640	973
Dec	–821	–1,126	–1,946	4,640	2,694

The basin inflow is total flow above the APC projects excluding flow into Allatoona Lake and Carters Lake. It is the sum of local flows, minus lake evaporation and diversions. Figure 4.2-5 illustrates the local inflows to the Coosa and Tallapoosa basin. The basin inflow computation differs from the navigation basin inflow, because it does not include releases from Allatoona Lake and Carters Lake. The intent is to capture the hydrologic condition across APC projects in the Coosa and Tallapoosa basins.

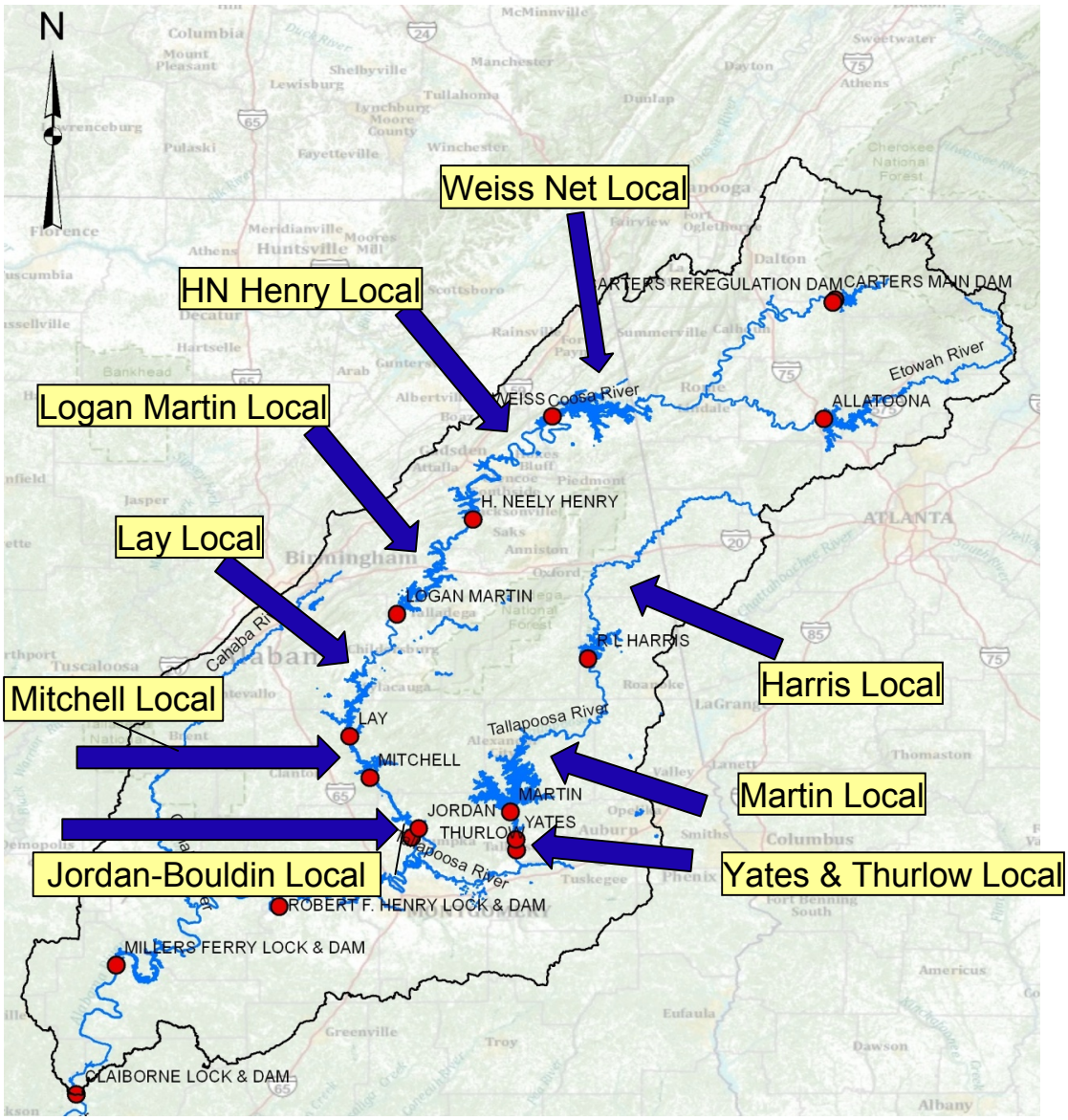


Figure 4.2-5. ACT Basin inflows.

4.2.2.4 State Line Flow Trigger

A low state line flow trigger occurs when the Mayo's Bar USGS gage measures a flow below the monthly historical 7Q10 flow. The 7Q10 flow is defined as the lowest flow over a 7-day period that would occur once in 10 years.

Table 4.2-5 lists the Mayo's Bar 7Q10 value for each month. The lowest 7-day average flow over the past 14 days is computed and checked at the 1st and 3rd Tuesdays of the month. If the lowest 7-day average value is less than the Mayo's Bar 7Q10 value, the low state line flow indicator is triggered. If the result is greater than or equal to the trigger value from Table 4.2-5, the flow is considered normal, and the state line flow indicator is not triggered.

The term *state line flow* is used in developing the drought management plan because of the proximity of the Mayo's Bar gage to the Alabama-Georgia state line and because it relates to flow data upstream of the Alabama-based APC reservoirs. State line flow is used only as a source of observed data for one of the three triggers and does not imply that *targets* exist at that geographic location. The APCDOP does not include or imply any USACE operation that would result in water management decisions at Carters Lake or Allatoona Lake.

Table 4.2-5.
State line flow trigger

Month	Mayo's Bar (7Q10 in cfs)
Jan	2,544
Feb	2,982
Mar	3,258
Apr	2,911
May	2,497
Jun	2,153
Jul	1,693
Aug	1,601
Sep	1,406
Oct	1,325
Nov	1,608
Dec	2,043

Note: Based on USGS Coosa River at Rome Gage (Mayo's Bar, USGS 02397000) observed flow from 1949 to 2006

4.2.2.5 Low Composite Conservation Storage in APC projects

Low composite conservation storage occurs when the APC projects' composite conservation storage is less than or equal to the storage available within the drought contingency curves for the APC reservoirs. Composite conservation storage is the sum of the amounts of storage available at the current elevation for each reservoir down to the drought contingency curve at each APC major storage project. The reservoirs considered for the trigger are R.L. Harris Lake, H. Neely Henry Lake, Logan Martin Lake, Lake Martin, and Weiss Lake. Figure 4.2-6 plots the APC composite zones. Figure 4.2-7 plots the APC low composite conservation storage trigger.

If the actual active composite conservation storage is less than or equal to the active composite drought zone storage, the low composite conservation storage indicator is triggered. That computation is performed on the 1st and 3rd Tuesday of each month, and is compared to the low state line flow trigger and basin inflow trigger.

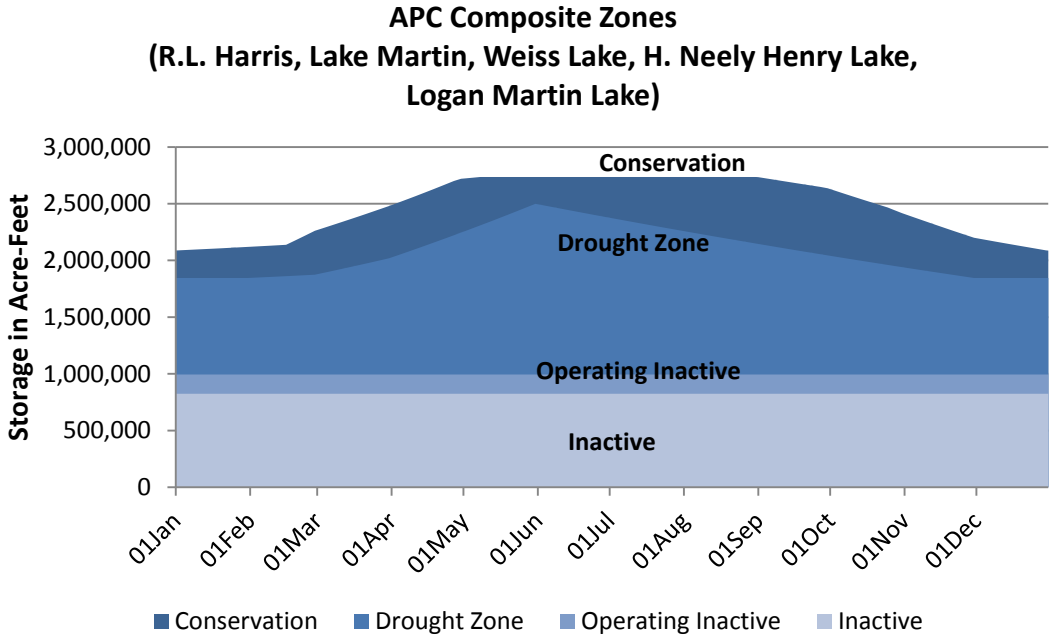


Figure 4.2-6. APC composite zones.

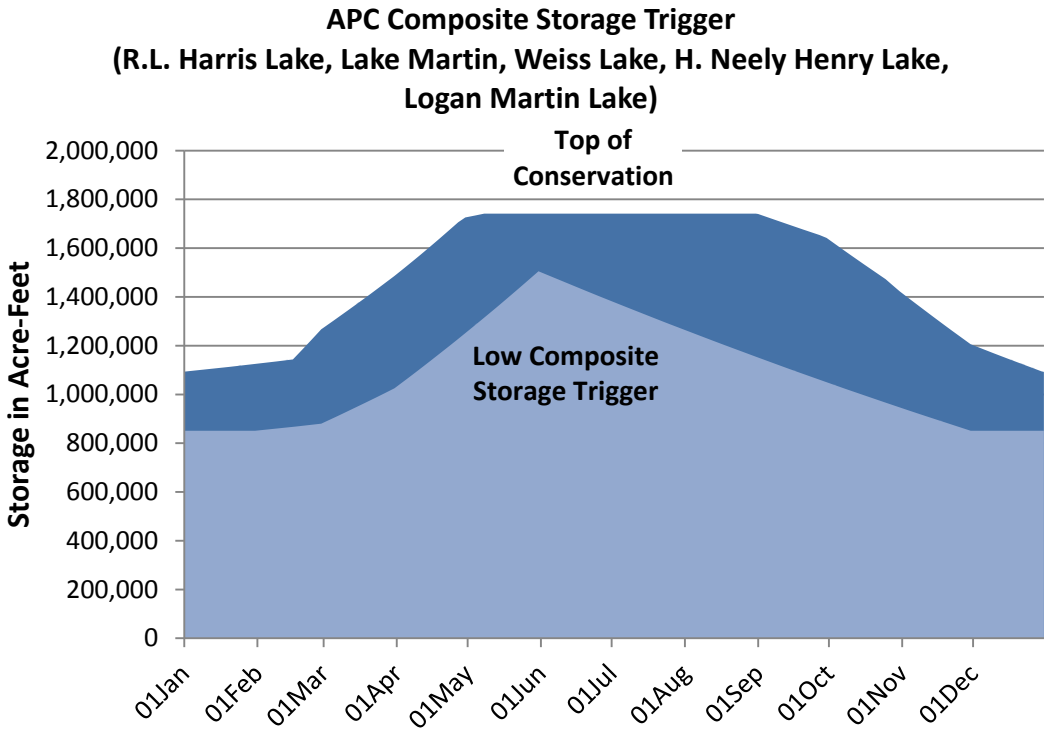


Figure 4.2-7. APC low composite conservation storage drought trigger.

4.2.2.6 Operations for USACE Projects Downstream of Montgomery

Drought operations of the USACE Alabama River projects (R.E. "Bob" Woodruff Lake [Robert F. Henry Lock and Dam], and William "Bill" Dannelly Lake [Millers Ferry Lock and Dam]) will respond to drought operation of the APC projects. When combined releases from APC's JBT projects are reduced to 4,640 cfs, the USACE Alabama River projects will operate to maintain a minimum flow of 6,600 cfs downstream of Claiborne Lock and Dam. This flow at Claiborne Lock and Dam is a non-mandatory minimum flow target or guide, representing the 7Q10 flow level at that point. Under drought conditions, that flow level cannot be met in all circumstances. When the APCDOP requires flows less than 4,640 cfs, the minimum flow downstream of Claiborne Lock and Dam is equal to the inflow into Millers Ferry Lock and Dam. There is inadequate storage in the Alabama River projects to sustain 6,600 cfs, when combined releases from the APC projects are less than 4,640 cfs.

4.2.2.7 Summary of Potential Drought Management Measures

Potential management measures developed for ACT Basin-wide drought operations consisted of three major components:

- Headwater operations at Allatoona Lake and Carters Lake in Georgia
- Operations at APC projects on the Coosa and Tallapoosa rivers
- Operations at USACE projects downstream of Montgomery

The headwater operations component would include potential changes to action zones and hydropower generation as discussed in sections to follow. Operation of APC projects will be in accordance with Table 4.2-6 in which the drought response will be triggered by one or more of three indicators—state line flows, basin inflow, or composite conservation storage. USACE operation of its projects downstream of Montgomery will respond to drought operations of the APC projects upstream.

After coordination with APC and USFWS, USACE considered several variations of the drought plan matrix for APC projects. The four different options considered were as follows:

- APCDOP (Table 4.2-6)
- Revised Drought Plan (Table 4.2-7)
    - Revisions made by USACE (to APCDOP) in developing the updated WCMs to consider the minimum JBT release target near Montgomery and to recalculate inflows at Montgomery. The recalculation of minimum JBT releases changed from 3,900 cfs for DIL 3 in May and June to 3,700 cfs.
- APCDOP with USFWS Enhancement (Table 4.2-8)
    - The USFWS expressed concern about water temperatures during October and November. The USFWS recommended that the Coosa River flow under DIL3 increase from 1,600 to 1,800 cfs downstream of Jordan Dam and Lake in October and November. To offset the higher releases, the USFWS recommended lowering the spring Jordan Dam and Lake minimum flow under DIL2 from 3,000 cfs to 2,500 cfs in April through mid-June. Through coordination with the APC and USFWS, flows in April and May were lowered under DIL 2 scenarios (Table 4.2-8).
- Revised Drought Plan with USFWS Enhancement (Table 4.2-9)
    - This includes revisions made by USACE in developing the updated WCM and USFWS enhancements. USACE revisions were recalculated minimum JBT releases of 3,900 cfs for DIL 3 in May and June to 3,700 cfs. The USFWS enhancements include changes to flows in the Coosa River under DIL 3 from 1,600 to 1,800 cfs downstream of Jordan Dam and Lake in October and November. To offset the higher releases, the USFWS recommended lowering the spring Jordan Dam and Lake minimum flow under DIL 2 from 3,000 cfs to 2,500 cfs in April through mid-June.

Table 4.2-6.
APCDOP

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Drought Level Response[a]	DIL 0 - Normal Operations											
	DIL 1: Low Basin Inflows or Low Composite or Low State Line Flow											
	DIL 2: DIL 1 criteria + (Low Basin Inflows or Low Composite or Low State Line Flow)											
	DIL 3: Low Basin Inflows + Low Composite + Low State Line Flow											
Coosa River Flow[b]	Normal Operation: 2000 cfs			4000 (8000) cfs		4000 – 2000 cfs	Normal Operation: 2000 cfs					
	Jordan 2,000 +/-cfs			4,000 +/- cfs		6/15 Linear Ramp down	Jordan 2,000 +/-cfs			Jordan 2,000 +/-cfs		
	Jordan 1,600 to 2,000 +/-cfs			3,000 +/- cfs		6/15 Linear Ramp down	Jordan 2,000 +/-cfs			Jordan 1,600 to 2,000 +/-cfs		
	Jordan 1,600 +/-cfs			Jordan 1,600 to 2,000 +/-cfs			Jordan 2,000 +/-cfs			Jordan 1,600 +/-cfs		
Tallapoosa River Flow[c]	Normal Operations: 1200 cfs											
	Greater of: 1/2 Yates Inflow or 2 x Heflin Gage(Thurlow Lake releases > 350 cfs)				1/2 Yates Inflow					1/2 Yates Inflow		
	Thurlow Lake 350 cfs				1/2 Yates Inflow					Thurlow Lake 350 cfs		
	Maintain 400 cfs at Montgomery WTP (Thurlow Lake release 350 cfs)						Thurlow Lake 350 cfs			Maintain 400 cfs at Montgomery WTP (Thurlow Lake release 350 cfs)		
Alabama River Flow[d]	Normal Operation: Navigation flow (4,640 cfs)											
	4,200 cfs (10% Cut) - Montgomery				Full Navigation - Montgomery (4640 cfs)					Reduce: Full – 4,200 cfs		
	3,900 cfs (20% Cut) - Montgomery				4,200 cfs (10% Cut) - Montgomery					Reduce: 4,200 cfs-> 3,900 cfs Montgomery		
	2,000 cfs Montgomery				3,900 cfs Montgomery		4,200 cfs (10% Cut) - Montgomery			Reduce: 4,200 cfs -> 2,000 cfs Montgomery (ramp thru October)		
Guide Curve Elevation	Normal Operations: Elevations follow Guide Curves as prescribed in License (Measured in Feet)											
	USACE Variances: As Needed; FERC Variance for Lake Martin											
	USACE Variances: As Needed; FERC Variance for Lake Martin											
	USACE Variances: As Needed; FERC Variance for Lake Martin											

a. Note: These are based on flows that will be exceeded when possible.
b. Jordan flows are based on a continuous +/- 5% of target flow.
c. Thurlow Lake flows are based on continuous +/- 5% of target flow: flows are reset on noon each Tuesday based on the prior day's daily average at Heflin or Yates.
d. Alabama River flows are 7-Day Average Flow.

Table 4.2-7.
Revised APCDOP

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Drought Level Response[a]	DIL 0 - Normal Operations											
	DIL 1: Low Basin Inflows or Low Composite or Low State Line Flow											
	DIL 2: DIL 1 criteria + (Low Basin Inflows or Low Composite or Low State Line Flow)											
	DIL 3: Low Basin Inflows + Low Composite + Low State Line Flow											
Coosa River Flow[b]	Normal Operation: 2,000 cfs			4,000 (8000) cfs		4,000 – 2,000 cfs	Normal Operation: 2,000 cfs					
	Jordan 2,000 +/-cfs			4,000 +/- cfs		6/15 Linear Ramp down	Jordan 2,000 +/-cfs			Jordan 2,000 +/-cfs		
	Jordan 1,600 to 2,000 +/-cfs			3,000 +/- cfs		6/15 Linear Ramp down	Jordan 2,000 +/-cfs			Jordan 1,600 to 2,000 +/-cfs		
	Jordan 1,600 +/-cfs			Jordan 1,600 to 2,000 +/-cfs			Jordan 2,000 +/-cfs			Jordan 1,600 +/-cfs		
Tallapoosa River Flow[c]	Normal Operations: 1200 cfs											
	Greater of: 1/2 Yates Inflow or 2 x Heflin Gage(Thurlow Lake releases > 350 cfs)				1/2 Yates Inflow					1/2 Yates Inflow		
	Thurlow Lake 350 cfs				1/2 Yates Inflow					Thurlow Lake 350 cfs		
	Maintain 400 cfs at Montgomery WTP (Thurlow Lake release 350 cfs)						Thurlow Lake 350 cfs			Maintain 400 cfs at Montgomery WTP (Thurlow Lake release 350 cfs)		
Alabama River Flow[d]	Normal Operation: Navigation or 4,640 cfs flow											
	4,200 cfs (10% Cut) - Montgomery				4,640 cfs - Montgomery					Reduce: Full – 4,200 cfs		
	3,700 cfs (20% Cut) - Montgomery				4,200 cfs (10% Cut) – Montgomery					Reduce: 4,200 cfs-> 3,700 cfs Montgomery		
	2,000 cfs Montgomery				3,700 cfs Montgomery		4,200 cfs (10% Cut) – Montgomery			Reduce: 4,200 cfs -> 2,000 cfs Montgomery (ramp thru October)		
Guide Curve Elevation	Normal Operations: Elevations follow Guide Curves as prescribed in License (Measured in Feet)											
	USACE Variances: As Needed; FERC Variance for Lake Martin											
	USACE Variances: As Needed; FERC Variance for Lake Martin											
	USACE Variances: As Needed; FERC Variance for Lake Martin											

a. Note: These are based on flows that will be exceeded when possible.
b. Jordan flows are based on a continuous +/- 5% of target flow.
c. Thurlow Lake flows are based on continuous +/- 5% of target flow: flows are reset on noon each Tuesday based on the prior day's daily average at Heflin or Yates.
d. Alabama River flows are 7-Day Average Flow.

Table 4.2-8.
APCDOP with USFWS enhancements

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Drought Level Response[a]	DIL 0 - Normal Operations											
	DIL 1: Low Basin Inflows or Low Composite or Low State Line Flow											
	DIL 2: DIL 1 criteria + (Low Basin Inflows or Low Composite or Low State Line Flow)											
	DIL 3: Low Basin Inflows + Low Composite + Low State Line Flow											
Coosa River Flow[b]	Normal Operation: 2,000 cfs			4,000 (8,000) cfs		4,000 – 2,000 cfs	Normal Operation: 2,000 cfs					
	Jordan 2,000 +/-cfs			4,000 +/- cfs		6/15 Linear Ramp down	Jordan 2,000 +/-cfs			Jordan 2,000 +/-cfs		
	Jordan 1,600 to 2,000 +/-cfs			2,500 +/- cfs		6/15 Linear Ramp down	Jordan 2,000 +/-cfs			Jordan 1,600 to 2,000 +/-cfs		
	Jordan 1,600 +/-cfs			Jordan 1,600 to 2,000 +/-cfs			Jordan 2,000 +/-cfs			Jordan 1,600 to 2,000 +/-cfs		Jordan 1,600 +/-cfs
Tallapoosa River Flow[c]	Normal Operations: 1200 cfs											
	Greater of: 1/2 Yates Inflow or 2 x Heflin Gage(Thurlow Lake releases > 350 cfs)				1/2 Yates Inflow					1/2 Yates Inflow		
	Thurlow Lake 350 cfs				1/2 Yates Inflow					Thurlow Lake 350 cfs		
	Maintain 400 cfs at Montgomery WTP (Thurlow Lake release 350 cfs)						Thurlow Lake 350 cfs			Maintain 400 cfs at Montgomery WTP (Thurlow Lake release 350 cfs)		
Alabama River Flow[d]	Normal Operation: Navigation flow (4,640 cfs)											
	4,200 cfs (10% Cut) - Montgomery				Full Navigation - Montgomery (4,640 cfs)					Reduce: Full – 4,200 cfs		
	3,900 cfs (20% Cut) - Montgomery				4,200 cfs (10% Cut) – Montgomery					Reduce: 4,200 cfs-> 3,900 cfs Montgomery		
	2,000 cfs Montgomery				3,900 cfs Montgomery		4,200 cfs (10% Cut) - Montgomery			Reduce: 4,200 cfs -> 2,000 cfs Montgomery (ramp thru October)		
Guide Curve Elevation	Normal Operations: Elevations follow Guide Curves as prescribed in License (Measured in Feet)											
	USACE Variances: As Needed; FERC Variance for Lake Martin											
	USACE Variances: As Needed; FERC Variance for Lake Martin											
	USACE Variances: As Needed; FERC Variance for Lake Martin											

a. Note: These are based on flows that will be exceeded when possible.
b .Jordan flows are based on a continuous +/- 5% of target flow.
c. Thurlow Lake flows are based on continuous +/- 5% of target flow: flows are reset on noon each Tuesday based on the prior day's daily average at Heflin or Yates.
d. Alabama River flows are 7-Day Average Flow.

Table 4.2-9.
Revised APCDOP with USFWS enhancements

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Drought Level Response[a]	DIL 0 - Normal Operations											
	DIL 1: Low Basin Inflows or Low Composite or Low State Line Flow											
	DIL 2: DIL 1 criteria + (Low Basin Inflows or Low Composite or Low State Line Flow)											
	DIL 3: Low Basin Inflows + Low Composite + Low State Line Flow											
Coosa River Flow[b]	Normal Operation: 2,000 cfs			4,000 (8,000) cfs		4,000 – 2,000 cfs	Normal Operation: 2,000 cfs					
	Jordan 2,000 +/-cfs			4,000 +/- cfs		6/15 Linear Ramp down	Jordan 2,000 +/-cfs			Jordan 2,000 +/-cfs		
	Jordan 1,600 to 2,000 +/-cfs			2,500 +/- cfs		6/15 Linear Ramp down	Jordan 2,000 +/-cfs			Jordan 1,600 to 2,000 +/-cfs		
	Jordan 1,600 +/-cfs			Jordan 1,600 to 2,000 +/-cfs			Jordan 2,000 +/-cfs			Jordan 1,600 to 2,000 +/-cfs		Jordan 1,600 +/-cfs
Tallapoosa River Flow[c]	Normal Operations: 1200 cfs											
	Greater of: 1/2 Yates Inflow or 2 x Heflin Gage(Thurlow Lake releases > 350 cfs)				1/2 Yates Inflow					1/2 Yates Inflow		
	Thurlow Lake 350 cfs				1/2 Yates Inflow					Thurlow Lake 350 cfs		
	Maintain 400 cfs at Montgomery WTP (Thurlow Lake release 350 cfs)						Thurlow Lake 350 cfs			Maintain 400 cfs at Montgomery WTP (Thurlow Lake release 350 cfs)		
Alabama River Flow[d]	Normal Operation: Navigation or 4,640 cfs flow											
	4,200 cfs (10% Cut) - Montgomery				4,640 cfs - Montgomery					Reduce: Full – 4,200 cfs		
	3,700 cfs (20% Cut) - Montgomery					4,200 cfs (10% Cut) - Montgomery				Reduce: 4,200 cfs-> 3,700 cfs Montgomery (1 week ramp)		
	2,000 cfs Montgomery				3,700 cfs Montgomery		4,200 cfs (10% Cut) - Montgomery			Reduce: 4,200 cfs -> 2,000 cfs Montgomery (1 month ramp)		
Guide Curve Elevation	Normal Operations: Elevations follow Guide Curves as prescribed in License (Measured in Feet)											
	USACE Variances: As Needed; FERC Variance for Lake Martin											
	USACE Variances: As Needed; FERC Variance for Lake Martin											
	USACE Variances: As Needed; FERC Variance for Lake Martin											

a. Note: These are based on flows that will be exceeded when possible.
b .Jordan flows are based on a continuous +/- 5% of target flow.
c. Thurlow Lake flows are based on continuous +/- 5% of target flow: flows are reset on noon each Tuesday based on the prior day's daily average at Heflin or Yates.
d. Alabama River flows are 7-Day Average Flow.

4.2.3 Revised Guide Curves and Action Zones

USACE considered redefining guide curves and action zones at USACE projects in the ACT Basin to meet the objective of *improved system performance to achieve congressionally authorized project purposes*. Specific management measures included the following:

a. Maintaining existing guide curves at Allatoona Lake and Carters Lake
b. Maintaining existing action zones at Allatoona Lake and Carters Lake
c. Modified guide curves at Allatoona Lake
d. Modified action zones at Allatoona Lake and Carters Lake

Additionally, the following guide curve options at APC projects with federally authorized flood risk management functions were carried forward for detailed consideration:

a. H. Neely Henry Lake original guide curve
b. H. Neely Henry Lake revised guide curve

All those potential management measures are described in detail in the following paragraphs.

Maintaining existing guide curves and action zones would maintain current operating conditions at the projects. Modifying the guide curve at Allatoona Lake and the action zones at Allatoona Lake and Carters Lake were considered to enhance operations at each federal project. Action zone modifications at Carters Lake were considered to establish variable seasonal releases from the reregulation dam.

Carters Lake. No changes to guide curve were considered at Carters Lake. The top of conservation pool is at elevation 1,074 ft from May through September, transitioning to 1,072 ft from mid-October through mid-April. Under current conditions, water management operations at Carters Lake occur without action zones. In 2000, 2003, and in the Planning Aid Letter for this EIS (USFWS 2010a), the USFWS recommended establishing seasonal minimum flow targets for releases from Carters Reregulation Dam in lieu of a constant minimum flow requirement of 240 cfs. Refinements at Carters Lake to consider the USFWS recommendation would include an action zone beginning at 1,066 ft in January, moving up to 1,070.5 ft in May, then moving down to 1,070 ft by October when the action zone would drop to 1,066 ft for the remainder of the year (Figure 4.2-8). That would create two action zones. In action Zone 1, minimum flow releases at Carters Reregulation Dam would be equal to the seasonal minimum flow. If Carters Lake were in action Zone 2, minimum flow releases from the Carters Reregulation Dam would be 240 cfs. Seasonal minimum flow by month when in Zone 1 is shown at the bottom of Figure 4.2-8.

Allatoona Lake. Modifications to the guide curve and action zones were considered at Allatoona Lake on the basis of past water management experiences. The recommended management measures at Allatoona Lake do not consider any particular downstream flow requirement whether at the state line or other downstream location. Management measures to improve performance of operations at Allatoona were first considered in changes to the guide curve that would not require reallocation of storage in the reservoir but would sustain higher water levels after Labor Day.

Four specific management measures were considered in drawing down Allatoona Lake (Figure 4.2-9):

a. Maintaining the existing guide curve
b. Early September drawdown
c. Extended November drawdown
d. Phased drawdown

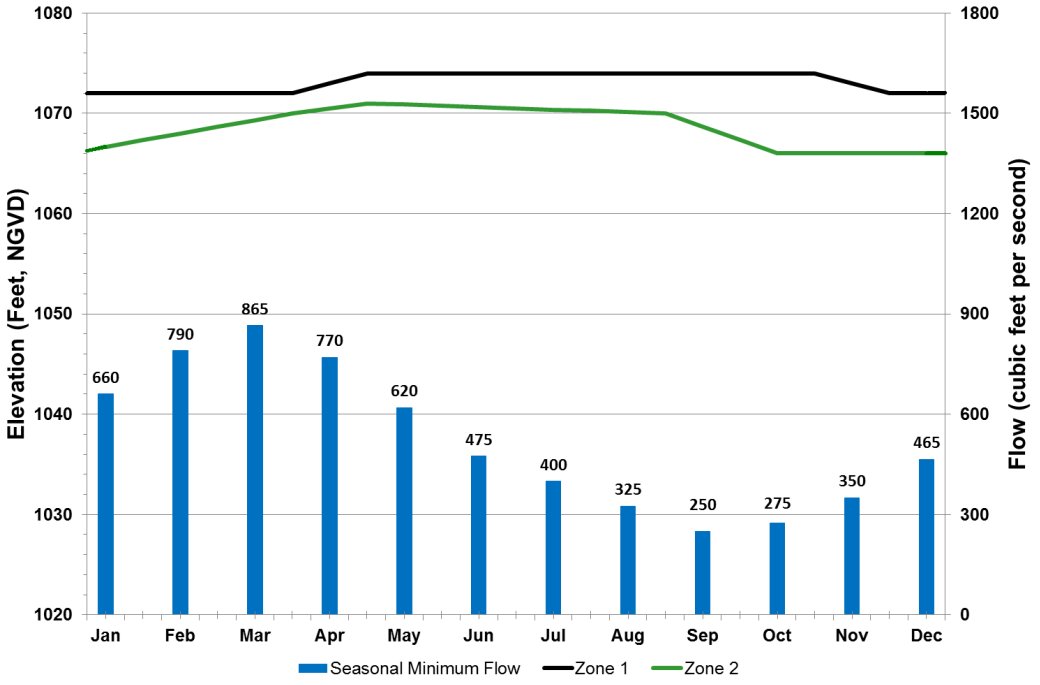


Figure 4.2-8. Carters Lake modified action zones.

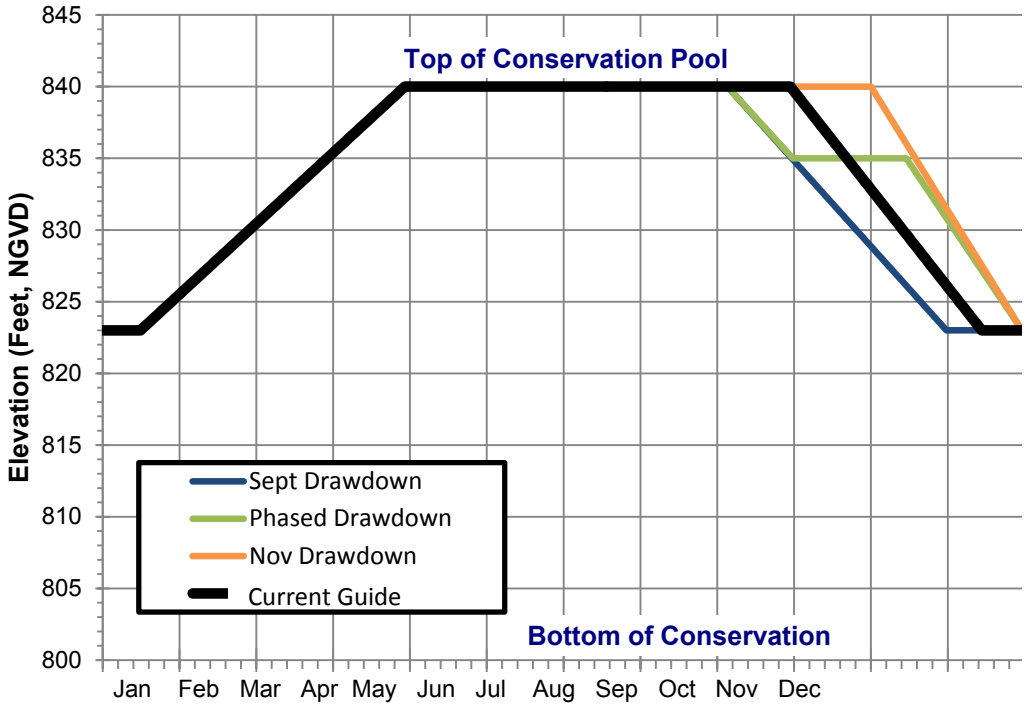


Figure 4.2-9. Management measures considered to drawdown Allatoona Lake.

Procedures to develop combined regulated flood frequency curves were used to determine flows downstream of Allatoona Lake considering each drawdown. For the analysis, hypothetical hydrographs were developed and used for the historic events of December 1961, March 1979, and March 1990. Those

flood events had distinctively different storm patterns in the upper ACT Basin. Using the hypothetical hydrographs maintaining the existing guide curve and the three alternative management measures, a series of simulations were created in HEC-ResSim to determine monthly regulated hypothetical hydrographs. For each month, the peak discharges of the 0.2, 0.5, 1.0, 2.0, and 5.0 percent regulated hydrographs at Kingston and Rome-Coosa define the regulated flood frequency curves for maintaining the existing guide curve (Existing), September drawdown, November drawdown, and Phased drawdown. Table 4.2-10 through Table 4.2-15 show the combined regulated flood frequency flows in cfs at the Kingston and Rome-Coosa sites for the three hydrographs for the 0.2, 0.5, 1.0, 2.0, and 5.0 percent flood flows. Table 4.2-16 and Table 4.2-17 show the percent change of the alternative operation compared to the baseline.

Table 4.2-10.
Combined regulated flood frequency flows in cfs at Kingston based on 1961 hydrograph shapes

Exceedance Probability (%))	Existing	September drawdown	November drawdown	Phased drawdown
0.2	15,874	15,874	15,874	15,874
0.5	14,520	14,520	14,520	14,520
1.0	13,471	13,471	13,471	13,471
2.0	12,412	12,412	12,412	12,412
5.0	10,976	10,976	10,976	10,976

Table 4.2-11.
Combined regulated flood frequency flows in cfs at Kingston based on 1979 hydrograph shapes

Exceedance Probability (%)	Existing	September drawdown	November drawdown	Phased drawdown
0.2	38,136	37,895	38,386	37,885
0.5	34,579	34,450	34,713	34,445
1.0	31,896	31,844	31,949	31,842
2.0	29,238	29,238	29,238	29,238
5.0	25,774	25,774	25,774	25,774

Table 4.2-12.
Combined regulated flood frequency flows in cfs at Kingston based on 1990 hydrograph shapes

Exceedance Probability (%)	Existing	September drawdown	November drawdown	Phased drawdown
0.2	25,114	25,114	25,114	25,114
0.5	23,124	23,124	23,124	23,124
1.0	21,601	21,601	21,601	21,601
2.0	20,051	20,051	20,051	20,051
5.0	17,526	17,526	17,526	17,526

Table 4.2-13.
Combined regulated flood frequency flows in cfs at Rome-Coosa based on 1961 hydrograph shapes

Exceedance Probability (%)	Existing	September drawdown	November drawdown	Phased drawdown
0.2	82,878	82,878	82,878	82,878
0.5	75,812	75,812	75,812	75,812
1.0	70,336	70,336	70,336	70,336
2.0	64,786	64,786	64,786	64,786
5.0	57,256	57,256	57,256	57,256

Table 4.2-14.
Combined regulated flood frequency flows in cfs at Rome-Coosa based on 1979 hydrograph shapes

Exceedance Probability (%)	Existing	September drawdown	November drawdown	Phased drawdown
0.2	79,909	79,583	80,645	79,643
0.5	71,958	71,830	72,222	71,846
1.0	66,660	66,591	66,801	66,599
2.0	61,315	61,302	61,342	61,304
5.0	54,540	54,540	54,540	54,540

Table 4.2-15.
Combined regulated flood frequency flows in cfs at Rome-Coosa based on 1990 hydrograph shapes

Exceedance Probability (%)	Existing	September drawdown	November drawdown	Phased drawdown
0.2	80,362	80,311	80,514	80,311
0.5	73,429	73,429	73,449	73,429
1.0	68,229	68,229	68,241	68,229
2.0	62,968	62,968	62,972	62,968
5.0	55,230	55,230	55,230	55,230

Table 4.2-16.
Change in percent from existing at Kingston

Exceedance Probability (%)	1961 Hydrograph shape			1979 Hydrograph shape			1990 Hydrograph shape		
	September	November	Phased	September	November	Phased	September	November	Phased
0.2	0.000	0.000	0.000	-0.631	0.657	-0.656	0.000	0.000	0.000
0.5	0.000	0.000	0.000	-0.374	0.388	-0.389	0.000	0.000	0.000
1.0	0.000	0.000	0.000	-0.162	0.167	-0.168	0.000	0.000	0.000
2.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 4.2-17.
Change in percent from existing at Rome-Coosa

Exceedance Probability (%)	1961 Hydrograph shape			1979 Hydrograph shape			1990 Hydrograph shape		
	September	November	Phased	September	November	Phased	September	November	Phased
0.2	0.000	0.000	0.000	-0.408	0.921	-0.333	-0.063	0.190	-0.063
0.5	0.000	0.000	0.000	-0.178	0.367	-0.156	0.000	0.027	0.000
1.0	0.000	0.000	0.000	-0.103	0.212	-0.090	0.000	0.017	0.000
2.0	0.000	0.000	0.000	-0.021	0.044	-0.019	0.000	0.007	0.000
5.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

The results indicate that the September drawdown operation and the Phased drawdown operation would be expected to have no impact on flood frequency flows at Kingston for the 1961 and 1990 hydrograph shapes and would slightly reduce the flood frequency flows at Kingston for the 1979 hydrograph shape. The September drawdown operation and the Phased drawdown operation would have no impact on flood frequency flows at Rome-Coosa for the 1961 hydrograph shape and would slightly reduce the flood frequency flows at Rome-Coosa for the 1979 and 1990 hydrograph shapes. The November drawdown operation would have no impact on flood frequency flows at Kingston for the 1961 and 1990 hydrograph shapes and would slightly increase the flood frequency flows at Kingston for the 1979 hydrograph shape. The November drawdown operation would have no impact on flood frequency flows at Rome-Coosa for the 1961 hydrograph shape and would slightly increase the flood frequency flows at Rome-Coosa for the 1979 and 1990 hydrograph shapes.

In creating the management measures for modifying action zones, USACE considered the total number of action zones and the shape of action zones. Three variations of action zones were considered. The first, Figure 4.2-10, includes four action zones derived from historic hydropower demands. Historically, the highest hydropower demand occurs in June through August. The shape of Zone 2 was revised to have a similar shape to the average historic pool elevation allowing for greater hydropower generation during above normal conditions. The shape of Zone 3 was established to provide reliable hydropower without depleting storage. Zone 4 represents a drought level zone where only minimum flows would be released. Figure 4.2-10 represents seasonal action zones.

The second modification to action zones (Figure 4.2-11) assumes three action zones, where the first two zones mimic current actions, and the new Zone 3 represents a drought level where only minimum flows would be released. Zone 3 is shaped to mimic conditions observed in the 2007 drought.

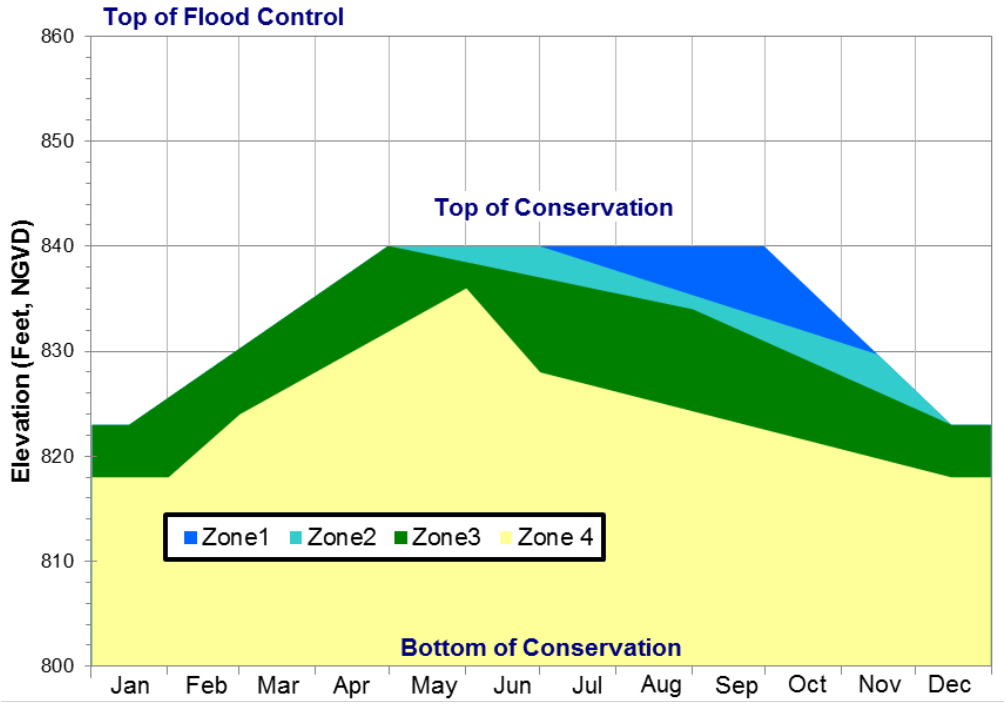


Figure 4.2-10. Seasonal action zones.

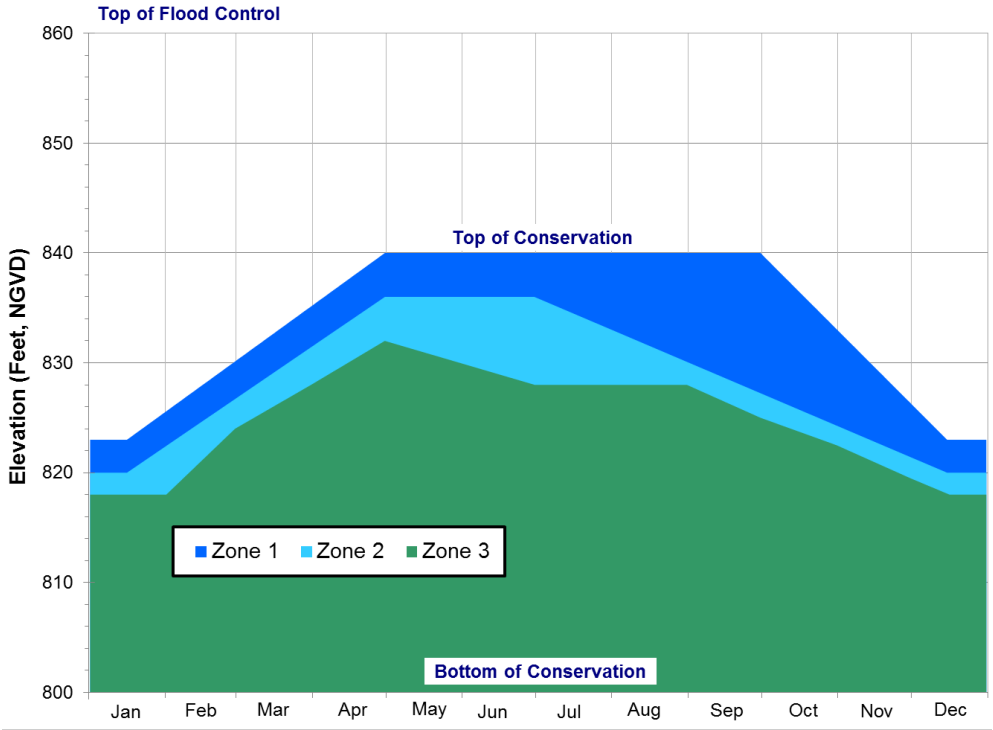


Figure 4.2-11. Three action zones shaped to mimic current actions and 2007 operations.

Finally, the third modification of action zones at Allatoona Lake, Figure 4.2-12, also assumes three action zones. The action Zones 1 and 2 are shaped as they currently exist. Zone 3 is shaped to mimic the existing action zones with a linear increase from January to a single peak in May and a linear decrease to December.

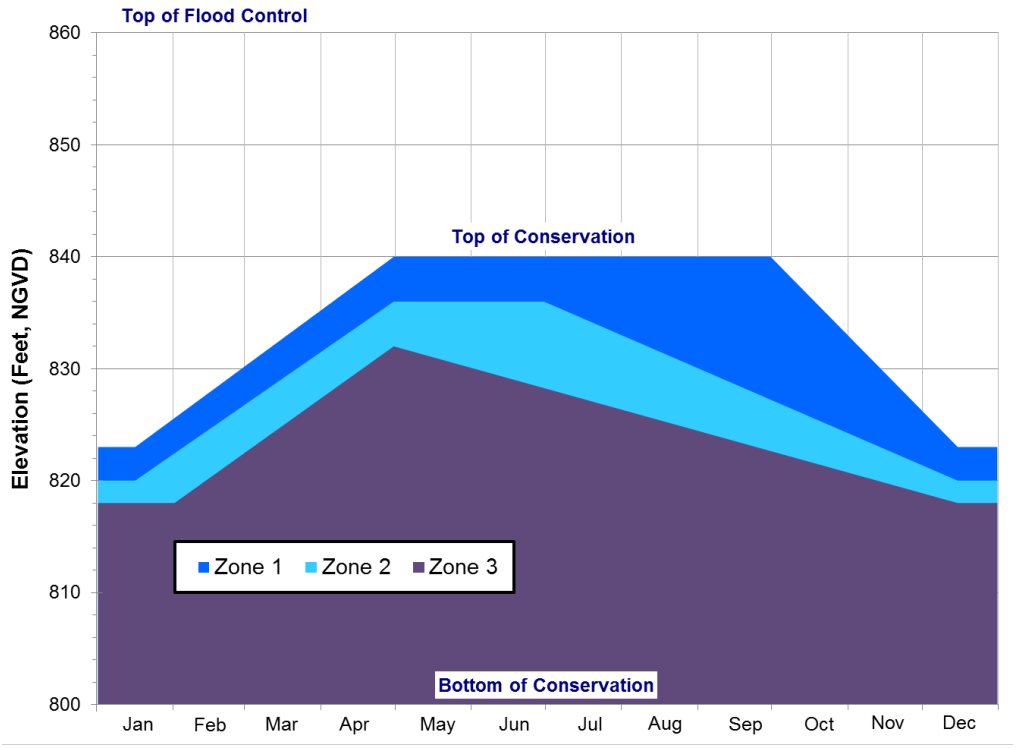


Figure 4.2-12. Three action zones shaped to mimics current action zones.

H. Neely Henry Lake. As described in Section 2.1.1.1.4.4, in June 1999 APC requested a temporary 3-year variance to H. Neely Henry Lake's guide curve. The goal of the variance, granted by FERC in February 2001, was to maintain higher water levels during the winter (i.e., increase the winter pool level by 2 ft from 505 ft to 507 ft). On March 18, 2004, FERC issued an extension to operate using the variance until a decision on APC's application for a new license is issued. FERC and USACE prepared a joint EA addressing the effects of the proposed extension (FERC 2009). APC has proposed that the interim operating plan be included in any new license that might be issued. USACE has concurred with the proposal for the interim operating plan with the revised guide curve to be included in the new FERC license. Accordingly, the revised guide curve at H. Neely Henry Lake is a management measure considered further. [NOTE: On June 20, 2013, following public review of the draft EIS for the ACT WCM update, FERC issued a new license for the APC projects on the Coosa River (No. 2146), which included the revised guide curve for H. Neely Henry Lake.]

4.2.4 Hydropower Generation

Four specific measures were considered for operations of hydropower generation:

a. Current schedule at Allatoona Lake
b. Modified schedule at Allatoona Lake (0 to 4 hours)
c. Modified schedule at Allatoona Lake (0 to 6 hours)
d. Hydropower drought operations

USACE generates hydropower at Allatoona Lake on a fixed schedule. For instance, when Allatoona Lake is in Zone 1, 6 hours of generation would be made available. USACE considered varying the amount of generation it would plan to provide for each action zone at Allatoona Lake (e.g., 0 to 4 hours or 0 to 6 hours would be made available when in Zone 1). Similarly, USACE considered reducing the amount of generation that would be made available when operating under drought protocols. The goal of the modified generation schedule at Allatoona Lake was to provide greater operational flexibility to meet power demands in the system while conserving storage as variable climate conditions might dictate. Therefore, consideration was also given to reduced generation during the fall drawdown.

The Carters Reregulation Dam allows for more consistent generation to meet hydropower demands. Therefore, there was no appreciable benefit to modifying the generation schedule at Carters Reregulation Dam.

4.2.5 Fish and Wildlife Conservation

Management measures considered for fish and wildlife conservation operations were based on recommendations provided by the USFWS in its Planning Aid Letter (PAL) of May 2010, Draft Fish and Wildlife Coordination Act Report (FWCAR) of December 2012, Final FWCAR of April 2014, previous discussions with the USFWS, and current USACE operations. The principal management measure considered by USACE from the USFWS coordination was seasonally varying flows from Carters Reregulation Dam. The USFWS also recommended changes in releases under the drought plan for the Tulotoma snail downstream of the APC Jordan Dam and Lake, as described in Section 4.2.2. That recommendation was considered and addressed by APC and USFWS in coordination with USACE and was ultimately incorporated into the FERC license (issued June 2013) for continued operation of the APC Coosa River projects. The USFWS PAL (USFWS 2010a) and FWCARs (USFWS 2012 and 2014) included recommendations for developing alternatives and mitigation, hydrologic modeling, and methods used to evaluate the effects of USACE alternatives. These documents are included in Appendix B of the EIS. USACE considered USFWS recommendations in updating the WCM.

USACE would continue to manage fish spawning operations at Allatoona Lake, as outlined in SADR PDS-O-1 (May 31,2010) and draft Mobile District SOP 1130-2-9, (February 2005). During the largemouth bass spawning period, from March 15 to May 15, USACE seeks to maintain generally stable or rising reservoir levels at Allatoona Lake. Generally stable or rising levels are defined as not lowering the reservoir levels by more than 6 inches, with the base elevation generally adjusted upward as levels rise from increased inflows or refilling of the reservoir.

USACE also would continue to operate fish passage lockages at Claiborne Lock and Dam and Millers Ferry Lock and Dam. During each spring since 2009, from February through May, USACE has operated the locks at Claiborne Lock and Dam and Millers Ferry Lock and Dam to facilitate the upstream passage of migratory fishes. USACE cooperated with The Nature Conservancy, USFWS, ADCNR, Auburn University, and the Geological Survey of Alabama to develop a schedule to most effectively implement the operation. There are slight differences in the locking schedule each year, and alterations can occur depending on local hydrologic conditions, especially flooding which can prevent lock operation, and staffing schedules for the project site. During the spring since 2009, two fish locking cycles have been performed each day. The operation consists of opening the lower lock gate and allowing fish to enter. The lock is allowed to remain open for 4 to 6 hours. The lock is then filled to the lake elevation, the upper gate is opened, and fish are allowed to freely enter and exit the lake for the next 4 to 6 hours, after which the cycle is repeated. Vessel passage, maintenance, safety, and other operational requirements continue unaffected by the fish passage schedule. Studies are ongoing to determine the success and most appropriate techniques to employ to provide maximum benefit to fish populations.

4.2.6 Water Supply

The measures for water supply operations reflect current water supply use, basin-wide and at USACE reservoirs, in the latter case, pursuant to existing water supply storage agreements. Water supply withdrawals vary on both a daily and annual average basis, but for modeling purposes, it was necessary to identify a fixed demand, to allow for effective comparison of alternatives. The highest levels of water supply withdrawals basin-wide occurred in 2006, during the 2006-2008 drought. Although withdrawals since 2006 have been lower overall, 2006 was selected as representative of "current" demand, because using the highest recent figure provides the most conservative estimate of the storage available for all purposes, assuming the greatest amount of reasonably forecasted water supply demand, including during times of drought. The withdrawal figures utilized do not necessarily reflect the maximum withdrawals that could be made at any given time, nor does the USACE analysis guarantee that the modeling withdrawals can actually be made at all times. Actual withdrawals may be affected by a range of factors, including, potentially, future changes to USACE policies or procedures regarding storage accounting, or external factors beyond USACE control. The withdrawal figures utilized in this analysis reflect reasoned judgment about what is most likely to occur under the circumstances assumed for each evaluated alternative, including the no action alternative.

For the no action alternative, which reflects actual water use reported throughout the basin in 2006, modeling includes the water supply withdrawals that actually were made from Carters Lake and Allatoona Lake. The 2006 actual withdrawal amounts are the highest levels of water supply withdrawal reported basin-wide. For the remaining alternatives, the USACE modeling includes the same level of demand, constrained at times, however, by the amount of available storage for water supply pursuant to storage agreements at Carters Lake and Allatoona Lake. At these reservoirs, USACE has entered into water supply agreements with municipalities contemplating the use of the following amounts of storage: 6,371 ac-ft of storage for the City of Cartersville at Allatoona Lake; 13,140 ac-ft for CCMWA at Allatoona Lake; and 818 ac-ft for the City of Chatsworth at Carters Lake. The amounts of storage stated in these contracts were estimated, at the time the contracts were executed, to yield 16.76 mgd, 34.5 mgd, and 2.0 mgd, respectively, during the critical drought, i.e., during the worst drought on record at the time the agreements were executed. The severity and frequency of droughts change over time, however, and more recent storage-yield analysis by USACE has indicated that the estimated yield of ACT reservoir storage has decreased. For the purpose of managing storage in these reservoirs, the Mobile District has employed a storage accounting methodology that tracks multiple storage accounts, applying a proportion of inflows and losses, as well as direct withdrawals by specific users, to each account. The use of the 2006 demand and, for alternatives other than no action, storage limitations indicated by storage accounting, for modeling purposes is not intended to identify maximum amounts that can be withdrawn on a daily basis,

or on an average daily basis, under the respective water supply agreements.[4] Nor do these figures represent any guarantee by USACE that these amounts will be available for withdrawal at all times.[5] Rather, these figures reflect the estimated maximum water supply demand that may reasonably be expected to exist, based on past use, and the extent to which existing water supply storage would support those withdrawals, under the circumstances assumed for each evaluated alternative, including the no action alternative. The amount of water that may actually be withdrawn is ultimately dependent on the amount of water available in storage, which will naturally change over time.

As a result of the USACE analysis, consideration of public comments from the State of Alabama and others on the draft EIS, and a formal request from the Governor of Georgia for storage for additional withdrawals from Allatoona Lake, USACE recognizes that projected water supply needs of CCMWA exceed the 34.5 mgd average withdrawals contemplated in 1963, the actual withdrawals that occurred in 2006, and the amount of storage currently allocated to water supply under the existing contract with CCMWA, according to the present USACE method of accounting for storage use at Allatoona Lake. USACE has authority to evaluate and potentially to grant Georgia's request for additional storage in Allatoona Lake, but consideration of including additional storage in Allatoona Lake for water supply exceeds the scope of this water control manual update and EIS. Any reallocation of storage to water supply would require a separate analysis and a separate final agency action.

4.3 Basin-wide Alternatives Evaluated

Management measures defined in previous sections were combined to achieve objectives developed for water management of the ACT Basin. As defined in Section 4, those objectives consist of the following:

- More accurately define flow requirements for APC projects to support navigation on the Alabama River downstream of Claiborne Lock and Dam
- Develop a drought management plan as required by USACE regulations
- Improve conditions downstream of Carters Reregulation Dam for fish and wildlife conservation, including threatened and endangered species
- Improve system performance to achieve congressionally authorized project purposes
- Incorporate appropriate changes in APC project operations into updated WCM

[4] The water supply storage agreements for the City of Cartersville and the City of Chatsworth both expressly recognize that during periods of normal or greater streamflow, the storage space will yield greater quantities than the amount that was expected to be available throughout the drought of record. See Contract No. DACW01-9-91-120 (October 18, 1991) (City of Cartersville), Art. 1.b(1) & Ex. B at 1; Contract No. DACW01-9-91-481 (November 15, 1991) (City of Chatsworth), Art. 1.b(1) & Ex. B at 1. The CCMWA agreement does not contain those express statements, but Exhibit 1, providing the basis for the storage calculation, references an average daily mgd of 34.5 mgd (equivalent to the yield during the critical drought), as well as a maximum daily requirement of 58 mgd (which would not be available on a daily basis during the critical drought). See Contract No. DA-01-076-CIVENG-64-116 (Oct. 31, 1963) (Cobb County-Marietta Water Authority), Ex. 1 at 1.

[5] The water supply storage agreements for the City of Cartersville and the City of Chatsworth both expressly state that the contracts provide storage space only, and that USACE "makes no representations with respect to the . . . availability of water." See Contract No. DACW01-9-91-120 (Oct. 18, 1991), Art. 1.d; Contract No. DACW01-9-91-481 (Nov. 15, 1991), Art. 1.d. Those agreements also expressly recognize that less water would be available for withdrawal during more severe drought periods. See Contract No. DACW01-9-91-120 (Oct. 18, 1991), Art. 1.b(1) & Ex. B at 1; Contract No. DACW01-9-91-481 (Nov. 15, 1991), Art. 1.b(1) & Ex. B at 1. The CCMWA agreement does not contain those express statements, but does make clear that CCMWA's ability to withdraw water is dependent on the availability of water in storage. See Contract No. DA-01-076-CIVENG-64-116 (Oct. 31, 1963), art. 1.

Table 4.3-1 presents the basin-wide water management alternatives developed to address the objectives and ensure that flood operations would not be compromised. The formulation strategy employed to develop alternatives involved starting with the No Action Alternative and adding one measure at a time, determining the operation for that measure that might best satisfy the objectives, and then developing another alternative by adding another measure or, in some instances, considering a variation of the last added management measure. Accordingly, the alternatives build one on another, ultimately establishing the recommended plan for water management in the ACT Basin. The Burkett and Drago (A & B) alternatives represent early iterations of water management alternative development that incorporate concepts advanced by two long-standing water management leaders on the Mobile District staff. During evaluation of those alternatives, HEC-ResSim modeling was conducted to determine if each alternative met the objectives and did not increase basin flooding. The sections to follow further detail each alternative and describe the rationale for which alternatives were carried forward for detailed impacts analysis. A summary of the alternatives carried forward for detailed impacts analysis is presented in Section 5, Description of the Proposed Action and Alternatives.

4.3.1 No Action Alternative

The No Action Alternative reflects operational practices on the ACT Basin as described in the following documents: *Alabama-Coosa River Basin Reservoir Regulation Manual* (Master Manual) December 1951 and project-specific WCMs. For USACE, those manuals and their dates are as follows: Allatoona Reservoir (1993), Carters Reservoir (1979), Robert F. Henry Lock and Dam (1999), Millers Ferry Lock and Dam (1990), and Claiborne Lock and Dam (1993). For APC projects, the following manuals reflect operations consistent with APCs current FERC license: Weiss Reservoir (1965), H. Neely Henry Reservoir (1979), Logan Martin Reservoir (1968), and R.L. Harris Reservoir (2003).

The No Action Alternative represents no change from the current management direction or level of management intensity. The alternative represents continuation of the current water control operations at each of the federal projects in the ACT Basin. Basin-wide management of all seven project purposes (flood risk management, hydropower, navigation, fish and wildlife conservation, recreation, water quality, and water supply) is also considered in this alternative.

The CEQ regulations require analysis of the No Action Alternative (40 CFR.1502.14); therefore the alternative was carried forward for further evaluation and is defined in detail in Section 5.1.

Table 4.3-1.
Summary of alternative management measures

Alternative	Current WCMs	USACE and APC supported navigation	APC projects			APCDOP				Carters Lake		
			APC current FERC license	H. Neely Henry Lake original guide curve	H. Neely Henry Lake new guide curve	APCDOP	Revised APCDOP	APCDOP with USFWS Enhancement	Revised APCDOP with USFWS Enhancement	240 cfs minimum flow	Seasonal flow	Action zones
No Action Alternative	XX		XX	XX						XX		
Drought Plan	XX	XX	XX	XX		XX				XX		
Burkett		XX	XX	XX		XX					XX	XX
Drago A		XX	XX	XX		XX					XX	XX
Drago B		XX	XX	XX		XX						
Plan A		XX	XX		XX	XX					XX	XX
Plan B		XX	XX		XX			XX			XX	XX
Plan C		XX	XX		XX		XX				XX	XX
Plan D		XX	XX		XX				XX		XX	XX
Plan E		XX	XX		XX		XX				XX	XX
Plan F		XX	XX		XX				XX		XX	XX
Plan G (Proposed Action Alternative)		XX	XX		XX				XX		XX	XX

Table 4.3-1. (continued)

Alternative	Allatoona Lake										
	240 cfs minimum flow	Current guide curve	Phased guide curve	Current action zones	3 action zones that mimic current zones	3 action zones that mimic 2007 conditions	4 action zones	Seasonal action zone shape	Hydropower Range - 0 to 6 hours	Hydropower Range - 0 to 4 hours	Drawdown hydropower reduced
No Action Alternative	XX	XX		XX							
Drought Plan	XX	XX		XX							
Burkett	XX	XX					XX	XX	XX		
Drago A	XX	XX				XX			XX		
Drago B	XX	XX		XX	XX				XX		
Plan A	XX	XX					XX	XX		XX	
Plan B	XX	XX					XX	XX		XX	
Plan C	XX	XX					XX	XX		XX	
Plan D	XX	XX					XX	XX		XX	
Plan E	XX		XX				XX	XX		XX	
Plan F	XX		XX				XX	XX		XX	
Plan G (Proposed Action Alternative)	XX		XX				XX	XX		XX	XX

4.3.2 Drought Plan

4.3.2.1 Plan Components

The Drought Plan includes the current water control operations, updated by the following management measures or coordinated actions by APC or both:

- Incorporate specific navigation operations protocols to support 9.0-ft or 7.5-ft navigation channel depths on the Alabama River, as described in Section 4.2.1, subject to flow conditions and constraints triggered by drought operations. The protocols establish criteria and flow targets that define the circumstances under which a 9.0-ft or 7.5-ft navigation channel can be maintained and those under which a viable navigation channel cannot be maintained because of drought conditions in the basin.
- Implement the basic (original) APCDOP reflected in Table 4.2-6. The plan focuses on variable releases at APC Jordan Dam and Lake and Bouldin Dam projects (Coosa River), releases at APC Thurlow Lake (Tallapoosa River), and combined JBT release targets downstream of these projects (Alabama River), with three drought levels based on specific hydrologic triggers in the ACT Basin, as discussed in Section 4.2.2.
- Continued operations by APC under the current FERC licenses for APC projects in the Coosa and Tallapoosa basins (as discussed in Sections 4.2.2 and 2.1.1.1.4.4).
- Maintain 240 cfs continuous minimum flow downstream of Carters Reregulation Dam.
- Maintain current guide curve at Carters Lake (Section 4.2.3).
- Maintain 240 cfs continuous minimum flow downstream of Allatoona Dam.
- Maintain the current guide curve and action zones at Allatoona Lake (Figure 4.3-1).

4.3.2.2 Relationship to Water Management Objectives and Project Purposes

The proposed measures in the Drought Plan alternative would address the basic objective to develop a drought management plan. The Drought Plan alternative represents no change from the current management direction or level of management intensity during wet or normal rainfall conditions. The alternative would represent incorporation of the 2007 APCDOP. Those changes would largely focus on management of the Coosa River Basin. A continuation of the current water control operations would be expected at each of the federal projects in the ACT Basin. Basin-wide management of all seven project purposes (flood risk management, hydropower, navigation, fish and wildlife conservation, recreation, water quality, and water supply) would be similar to the No Action Alternative.

4.3.2.3 Conclusions

The Drought Plan alternative was not carried forward for detailed consideration. The plan includes the basic (original) APCDOP. That version of the drought plan addresses the basic objective to develop a drought plan for the WCM update, but it does not consider management measures that consider other objectives in updating the WCMs. Thus, the plan was not carried forward because it would not address additional benefits to federal project purposes that would be realized under other plans.

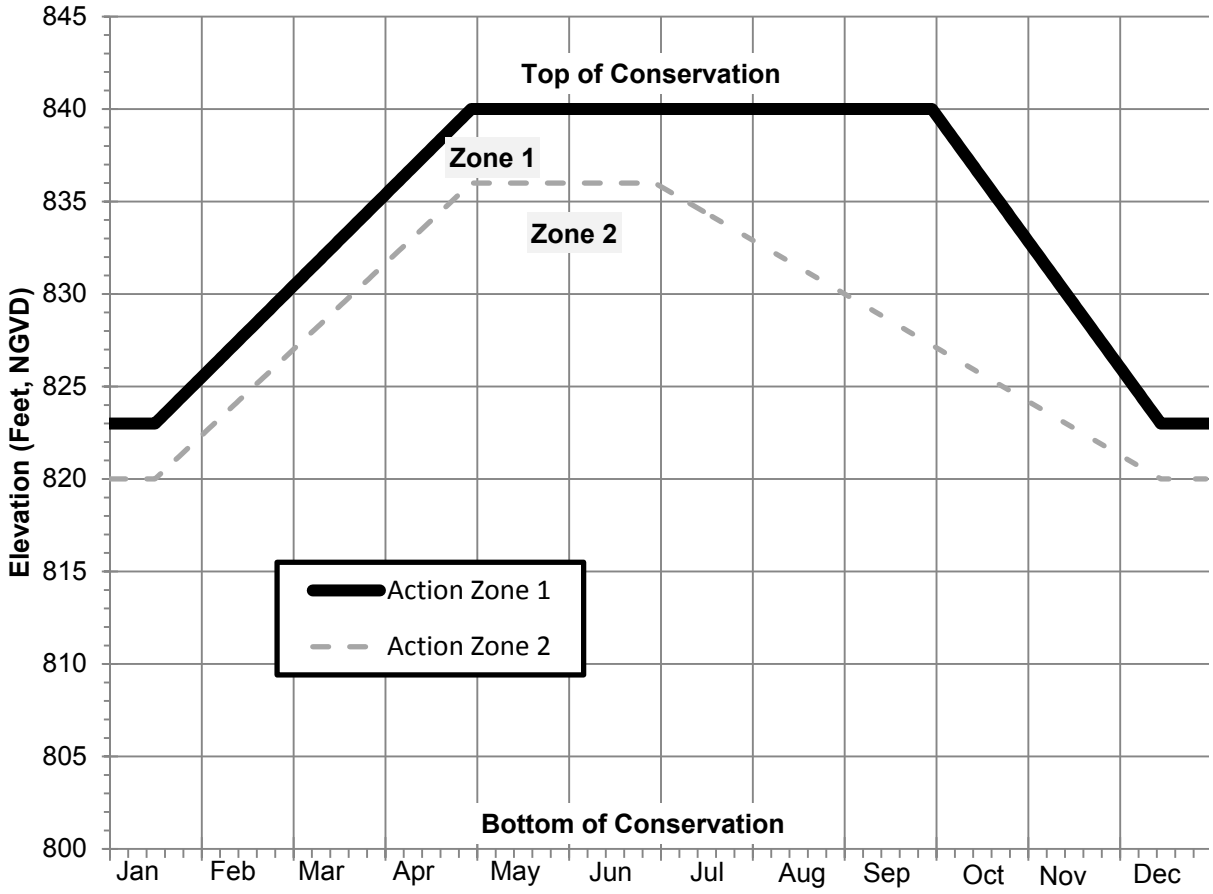


Figure 4.3-1. Current guide curve at Allatoona Lake.

4.3.3 Burkett

The Burkett alternative includes the current water control operations, updated by the following management measures or coordinated actions by APC or both:

- Incorporate specific navigation operations protocols to support 9.0-ft or 7.5-ft navigation channel depths on the Alabama River, as described in Section 4.2.1, subject to flow conditions and constraints triggered by drought operations. The protocols establish criteria and flow targets that define the circumstances under which a 9.0-ft or 7.5-ft navigation channel can be maintained and those under which a viable navigation channel cannot be maintained because of drought conditions in the basin.
- Implement the basic (original) APCDOP reflected in Table 4.2-6. The plan focuses on variable releases at APC Jordan Dam and Lake and Bouldin Dam projects (Coosa River), releases at APC Thurlow Lake (Tallapoosa River), and combined JBT downstream release targets (Alabama River), with three drought levels based on specific hydrologic triggers in the ACT Basin, as discussed in Section 4.2.2.
- Continued operations by APC under the current FERC licenses for APC projects in the Coosa and Tallapoosa basins.

- Establish seasonal continuous minimum flows (ranging from 240 to 865 cfs) from the Carters Reregulation Dam (Section 4.2.3).
- Define an additional action zone at Carters Lake.
- Maintain current guide curve at Carters Lake (Section 4.2.3).
- Maintain 240 cfs continuous minimum flow downstream of Allatoona Dam.
- Maintain the current guide curve at Allatoona Lake (Figure 3.1-2).
- Expand action zones at Allatoona Lake from two to four as depicted in Figure 4.2-10.
- Reshape action zones at Allatoona Lake on the basis of seasonal hydropower demand, as presented in Figure 4.2-10 and Section 4.2.3.
- Modify the daily hydropower generation range Allatoona Lake from a minimum of 0 hours/day (all zones) to a maximum of 6 hours/day (Zone 1).

4.3.3.1 Relationship to Water Management Objectives and Project Purposes

The proposed measures in the Burkett alternative would address the basic objectives established to guide the WCM update process, consisting of the following: define a navigation operations support protocol; develop a drought management plan; improve fish and wildlife conservation conditions downstream of Carters Reregulation Dam; improve overall system performance relative to authorized project purposes; and incorporate appropriate changes in APC projects into the updated WCM. However, some of the measures included in this plan might be less effective in meeting the WCM update objectives than alternative measures included in some of the other plans, as summarized below.

The proposed measures in Burkett would have the following effects or implications relative to the authorized purposes of federal projects in the ACT Basin:

- Flood Risk Management—The Burkett alternative would not improve on or adversely affect flood risk management operations at USACE and pertinent APC projects in the ACT Basin.
- Hydropower—For the Burkett alternative, Carters Lake hydropower needs would be slightly reduced from the No Action Alternative. Proposed management measures at Allatoona Lake (two to four action zones, seasonal action zone shaping, and daily hydropower generation range modification) would provide greater flexibility and capacity to better meet peak hydropower demands when most needed, generally June through August. Proposed modifications to the top of Zone 2 would allow for greater generation when storage is above Zone 2 under normal conditions. Storage in Zone 3 would enable production of reliable power without excessively depleting storage, and Zone 4 would represent the drought zone where hydropower operations would be curtailed. However, generating hydropower for up to 6 hours would be expected to lower water levels in Allatoona Lake faster than acceptable to meet operational objectives basin-wide.
- Navigation—The Burkett alternative would be expected to support navigation operations on the Alabama River.
- Fish and Wildlife Conservation—Providing seasonally based minimum flows downstream of Carters Reregulation Dam would be likely to improve conditions in the Coosawattee River for fish and wildlife conservation, including species protected under the ESA.
- Recreation—The measures in the Burkett alternative would not likely have an appreciable effect on recreational use of Carters Lake. However, the proposed establishment of four action zones, reshaping the action zones on the basis of seasonal hydropower demand, and adjustments in the

range of power generation hours per day up to 6 hours at Allatoona Lake would be expected to lower lake levels from July through October, increasing the likelihood of negatively affecting recreational use of the lake. The drought plan measures in Burkett would likely provide for improved conditions in APC lakes and downstream USACE projects under drought conditions that would benefit recreational users during those occurrences.

- Water Quality—Water quality would be expected to be as it is with the No Action Alternative.
- Water Supply—The Burkett alternative would not affect existing storage contracts at Allatoona Lake (Cartersville, CCMWA) or Carters Lake (Chatsworth) and would not likely have adverse effects on other water supply uses within the ACT Basin.

4.3.3.2 Conclusions

The Burkett alternative was not carried forward for detailed consideration. The alternatives described in following sections better meet the basic objectives established to guide the WCM update process. The management measures considered in the Burkett alternative would not improve overall system performance relative to authorized project purposes to the same extent as other alternatives.

4.3.4 Drago A

The Drago A alternative includes the current water control operations, updated by the following management measures or coordinated actions by APC or both:

- Incorporate specific navigation operations protocols to support 9.0-ft or 7.5-ft navigation channel depths on the Alabama River, as described in Section 4.2.1, subject to flow conditions and constraints triggered by drought operations. The protocols establish criteria and flow targets that define the circumstances under which a 9.0-ft or 7.5-ft navigation channel can be maintained and those under which a viable navigation channel cannot be maintained because of drought conditions in the basin.
- Implement the basic (original) APCDOP reflected in Table 4.2-6.
- Continued operations by APC under the current FERC licenses for APC projects in the Coosa and Tallapoosa basins.
- Establish seasonal continuous minimum flows (ranging from 240 to 865 cfs) from the Carters Reregulation Dam (Section 4.2.3).
- Maintain current guide curve at Carters Lake (Section 4.2.3).
- Define an additional action zone at Carters Lake (Section 4.2.3).
- Maintain 240 cfs continuous minimum flow downstream of Allatoona Dam.
- Maintain the current guide curve at Allatoona Lake (Figure 3.1-2).
- Expand action zones at Allatoona Lake from two to three as depicted in Figure 4.2-11.
- Keep action zones 1 and 2 at Allatoona Lake on the basis of their current shape and add Zone 3 to mimic 2007 operations, as presented in Figure 4.2-11 and Section 4.2.3.
- Modify the daily hydropower generation range Allatoona Lake from a minimum of 0 hours/day to a maximum of 6 hours/day (Zone 1).

4.3.4.1 Relationship to Water Management Objectives and Project Purposes

The proposed measures in the Drago A alternative would address the basic objectives established to guide the WCM update process, including developing a drought management plan and current operations at APC projects into the updated WCM. However, the proposed measures in the Drago A alternative would have the effects similar to Burkett. Hydropower generation at Carters Lake would be slightly reduced. Although, water levels in Allatoona Lake would be expected to be similar to the No Action Alternative.

4.3.4.2 Conclusions

Drago A was not carried forward for detailed consideration. Management measures in the alternative address the basic objective to develop a drought plan for the WCM update, and the plan would improve conditions downstream of Carters Reregulation Dam for fish and wildlife conservation. However, it would not improve system performance to achieve congressionally authorized project purposes to the same extent as other alternatives.

4.3.5 Drago B

Drago B includes the current water control operations, updated by the following management measures or coordinated actions by APC or both:

- Incorporate specific navigation operations protocols to support 9.0-ft or 7.5-ft navigation channel depths on the Alabama River, as described in Section 4.2.1, subject to flow conditions and constraints triggered by drought operations. The protocols establish criteria and flow targets that define the circumstances under which a 9.0-ft or 7.5-ft navigation channel can be maintained and those under which a viable navigation channel cannot be maintained because of drought conditions in the basin.
- Implement the basic (original) APCDOP reflected in Table 4.2-6.
- Continued operations by APC under the current FERC licenses for APC projects in the Coosa and Tallapoosa basins.
- Establish seasonal continuous minimum flows (ranging from 240 to 865 cfs) from the Carters Reregulation Dam (Section 4.2.3).
- Maintain current guide curve at Carters Lake (Section 4.2.3).
- Define an additional action zone at Carters Lake.
- Maintain 240 cfs continuous minimum flow downstream of Allatoona Dam.
- Maintain the current guide curve at Allatoona Lake (Figure 4.3-1).
- Expand action zones at Allatoona Lake from two to three as depicted in Figure 4.2-12.
- Keep action zones 1 and 2 at Allatoona Lake on the basis of their current shape and add Zone 3 wherein only minimum flow requirements are released, as presented in Figure 4.2-12 and Section 4.2.3. The shape of Zone 3 is similar to Zone 2.
- Modify the daily hydropower generation range Allatoona Lake from a minimum of 0 hours/day to a maximum of 6 hours/day (Zone 1).

4.3.5.1 Relationship to Water Management Objectives and Project Purposes

The proposed measures in Drago B are very similar to those in Drago A. The effects of Drago B on project purposes would be similar to Drago A. Hydropower generation at Carters Lake would be slightly reduced, conditions for fish and wildlife conservation would be the same, and conditions at Allatoona Lake would be similar to the No Action Alternative.

4.3.5.2 Conclusions

Management measures in Drago B again do not address the objective to improve system performance to achieve congressionally authorized project purposes to the same extent as other alternatives. The alternatives described in sections to follow combine management measures in such a way to improve system performance throughout the ACT Basin. Therefore, Drago B was not carried forward for detailed consideration.

4.3.6 Alternative Plan A

4.3.6.1 Plan Components

Plan A includes the current water control operations, updated by the following management measures or coordinated actions by APC or both:

- Incorporate specific navigation operations protocols to support 9.0-ft or 7.5-ft navigation channel depths on the Alabama River, as described in Section 4.2.1, subject to flow conditions and constraints triggered by drought operations. The protocols establish criteria and flow targets that define the circumstances under which a 9.0-ft or 7.5-ft navigation channel can be maintained and those under which a viable navigation channel cannot be maintained because of drought conditions in the basin.
- Implement the basic (original) APCDOP reflected in Table 4.2-6.
- Continued operations by APC under the current FERC licenses for APC projects in the Coosa and Tallapoosa basins, with the exception that the H. Neely Henry Lake project guide curve variance (as discussed in Sections 4.2.2 and 2.1.1.1.4.4) would become a feature of the new FERC license. [NOTE: The new FERC license for APC Coosa River projects issued on June 20, 2013, after public review of the draft EIS, included the revised guide curve.]
- Establish seasonal continuous minimum flows (ranging from 240 to 865 cfs) from the Carters Reregulation Dam (Section 4.2.3).
- Maintain current guide curve but establish two action zones within the conservation pool at Carters Lake (Section 4.2.3).
- Maintain 240 cfs continuous minimum flow downstream of Allatoona Dam.
- Maintain the current guide curve at Allatoona Lake (Figure 4.3-1).
- Expand action zones at Allatoona Lake from two to four as depicted in Figure 4.2-10.
- Reshape action zones at Allatoona Lake on the basis of seasonal hydropower demand, as presented in Figure 4.2-10 and Section 4.2.3.
- Modify the daily hydropower generation range Allatoona Lake from a minimum of 0 hours/day (all zones) to a maximum of 4 hours/day (Zone 1).

4.3.6.2 Relationship to Water Management Objectives and Project Purposes

The proposed measures in Plan A would address the basic objectives established to guide the WCM update process, consisting of the following: define a navigation operations support protocol; develop a drought management plan; improve fish and wildlife conservation conditions downstream of Carters Reregulation Dam; improve overall system performance relative to authorized project purposes; and incorporate appropriate changes in APC projects into the updated WCM. However, some of the measures included in this plan might be less effective in meeting the WCM update objectives than alternative measures included in some of the other plans, as summarized below.

The proposed measures in Plan A would have the following effects or implications relative to the authorized purposes of federal projects in the ACT Basin:

- Flood Risk Management—Plan A would not improve on or adversely affect flood risk management operations at USACE and pertinent APC projects in the ACT Basin.
- Hydropower—For Plan A, establishing actions zones at Carters Lake would provide guidance for meeting minimum hydropower needs at the project while better accommodating objectives for water quality and environmental flows. Proposed management measures at Allatoona Lake (two to four action zones, seasonal action zone shaping, and daily hydropower generation range modification) would provide greater flexibility and capacity to better meet peak hydropower demands when most needed, generally June through August. Proposed modifications to the top of Zone 2 would allow for greater generation when storage is above Zone 2 under normal conditions. Storage in Zone 3 would enable production of reliable power without excessively depleting storage, and Zone 4 would represent the drought zone where hydropower operations would be curtailed. Plan A would not be expected to adversely affect hydropower generation operations at APC or other USACE projects in the ACT Basin.
- Navigation—Plan A includes features to support navigation operations on the Alabama River. The specific navigation operations support protocol should provide improved information on current channel conditions and for forecasting future conditions for commercial navigation interests. The plan would likely result in improved navigation channel reliability.
- Fish and Wildlife Conservation—Providing seasonally based minimum flows downstream of Carters Reregulation Dam under Plan A would be likely to improve conditions in the Coosawattee River for fish and wildlife conservation, including species protected under the ESA.
- Recreation—The measures in Plan A would not likely have an appreciable effect on recreational use of Carters Lake. The proposed establishment of four action zones, reshaping the action zones on the basis of seasonal hydropower demand, and adjustments in the range of power generation hours per day at Allatoona Lake would provide for more effective management of conservation storage and would likely provide for an overall improvement in lake levels, particularly under drier conditions, and an overall benefit to recreational use of the lake. The drought plan measures in Plan A would likely provide for improved conditions in APC lakes and downstream USACE projects under drought conditions that would benefit recreational users during those occurrences.
- Water Quality—Seasonally based minimum flows downstream of the Carters Reregulation Dam could provide for improved water quality conditions in the Coosawattee River. No conflicts with other project related water quality objectives would likely be encountered.
- Water Supply—Plan A would not affect existing storage contracts at Allatoona Lake (Cartersville, CCMWA) or Carters Lake (Chatsworth) and would not likely have adverse effects on other water supply uses within the ACT Basin.

4.3.6.3 Conclusions

Plan A was not carried forward for detailed consideration. The plan includes the basic (original) APCDOP. This version of the drought plan addresses the basic objective to develop a drought plan for the WCM update, but it does not perform as well in the model simulations as the revised APCDOP (see in other plans discussed below) in meeting the multiple objectives for the water control plan update. In addition, the Plan A does not include enhancements to the basic APCDOP as recommended by the USFWS; thus, foregoing the additional benefits to fish and wildlife conservation resources that would be realized under other plans.

4.3.7 Alternative Plan B

4.3.7.1 Plan Components

Plan B includes the components of Plan A as described in Section 4.3.6.1 with the following modification: implement the basic (original) APCDOP with enhancements recommended by the USFWS (as discussed in Section 4.2.2 and depicted in Table 4.2-8).

4.3.7.2 Relationship to Water Management Objectives and Project Purposes

The proposed measures in Plan B would address the basic objectives established to guide the WCM update process, consisting of the following: define a navigation operations support protocol; develop a drought management plan; improve fish and wildlife conservation conditions downstream of Carters Reregulation Dam; improve overall system performance relative to authorized project purposes; and incorporate appropriate changes in APC projects into the updated WCM. However, some of the measures included in this plan might be less effective in meeting the WCM update objectives than alternative measures included in some of the other plans, as summarized below.

The proposed measures in Plan B would have the following effects or implications relative to the authorized purposes of federal projects in the ACT Basin:

- Flood Risk Management—Plan B would not improve on or adversely affect flood risk management operations at USACE and pertinent APC projects in the ACT Basin.
- Hydropower—For Plan B, water management measures that would be implemented at Carters Lake and Allatoona Lake would be expected to provide the same improvements for hydropower generation as described for Plan A in Section 4.3.6.2. Plan B would not be expected to adversely affect hydropower generation operations at APC or other USACE projects in the ACT Basin.
- Navigation—Plan B includes features to support navigation operations on the Alabama River. The specific navigation operations support protocol should provide improved information on current channel conditions and for forecasting future conditions for commercial navigation interests. The plan would likely result in improved navigation channel reliability.
- Fish and Wildlife Conservation—Seasonally based minimum flows downstream of Carters Reregulation Dam under Plan B would likely improve conditions in the Coosawattee River for fish and wildlife conservation, including protected species. Further, drought plan enhancements as recommended by the USFWS would be beneficial to fish and wildlife conservation resources in the Alabama River.
- Recreation—The measures in Plan B would not be likely to have an appreciable effect on recreational use of Carters Lake. Proposed measures for Allatoona Lake operations would provide for more effective management of conservation storage and would likely provide for an

overall improvement in lake levels, particularly under drier conditions, thus benefitting recreational use of the lake. The drought plan measures in Plan B would likely provide for improved conditions in APC lakes and downstream USACE projects under drought conditions that would benefit recreational users during those occurrences.

- Water Quality—Seasonally based minimum flows downstream of the Carters Reregulation Dam might provide for improved water quality conditions in the Coosawattee River. No conflicts with other project related water quality objectives would likely be encountered.
- Water Supply—Plan B would not affect existing storage contracts at Allatoona Lake or Carters Lake and would not likely have adverse effects on other water supply uses within the ACT Basin.

4.3.7.3 Conclusions

Plan B was not carried forward for detailed consideration. The plan includes the basic (original) APCDOP. This version of the drought plan addresses the basic objective to develop a drought plan for the WCM update, but it does not perform as well in the model simulations as the revised APCDOP (see other plans discussed below) in meeting the multiple objectives for the water control plan update.

4.3.8 Alternative Plan C

4.3.8.1 Plan Components

Plan C includes the components of Plan A as described in Section 4.3.6.1 with the following modification: implement a revised APCDOP (as discussed in Section 4.2.2 and depicted in Table 4.2-7).

4.3.8.2 Relationship to Water Management Objectives and Project Purposes

The proposed measures in Plan C would address the basic objectives established to guide the WCM update process, consisting of the following: define a navigation operations support protocol; develop a drought management plan; improve fish and wildlife conservation conditions downstream of Carters Reregulation Dam; improve overall system performance relative to authorized project purposes; and incorporate appropriate changes in APC projects into the updated WCM. However, some of the measures included in this plan might be less effective in meeting the WCM update objectives than alternative measures included in some of the other plans, as summarized below.

The proposed measures in Plan C would have the following effects or implications relative to the authorized purposes of federal projects in the ACT Basin:

- Flood Risk Management—Plan C would not improve on or adversely affect flood risk management operations at USACE and pertinent APC projects in the ACT Basin.
- Hydropower—For Plan C, water management measures that would be implemented at Carters Lake and Allatoona Lake would be expected to provide the same improvements for hydropower generation as described for Plan A in Section 4.3.6.2. Plan C would not be expected to adversely affect hydropower generation operations at APC or other USACE projects in the ACT Basin.
- Navigation—Plan C includes features to support navigation operations on the Alabama River. The specific navigation operations support protocol should provide improved information on current channel conditions and for forecasting future conditions for commercial navigation interests. The plan would likely result in improved navigation channel reliability.

- Fish and Wildlife Conservation—Seasonally based minimum flows downstream of Carters Reregulation Dam under Plan C would likely improve conditions in the Coosawattee River for fish and wildlife conservation, including protected species.
- Recreation—The measures in Plan C would not be likely to have an appreciable effect on recreational use of Carters Lake. Proposed measures for Allatoona Lake operations would provide for more effective management of conservation storage and would likely provide for an overall improvement in lake levels, particularly under drier conditions, thus benefitting recreational use of the lake. The drought plan measures in Plan C would likely provide for improved conditions in APC lakes and downstream USACE projects under drought conditions that would benefit recreational users during those occurrences.
- Water Quality—Seasonally based minimum flows downstream of the Carters Reregulation Dam might provide for improved water quality conditions in the Coosawattee River. No conflicts with other project related water quality objectives would likely be encountered.
- Water Supply—Plan C would not affect existing storage contracts at Allatoona Lake or Carters Lake and would not likely have adverse effects on other water supply uses within the ACT Basin.

4.3.8.3 Conclusions

Plan C was not carried forward for detailed consideration. The plan represents an improvement over Plans A and B in that it incorporates the revised APCDOP. However, Plan C does not include enhancements to the revised APCDOP as recommended by the USFWS. Thus, Plan C would forego the additional benefits to fish and wildlife conservation resources that would be realized under other plans (discussed below) composed of similar measures, including the USFWS recommendations on the revised APCDOP.

4.3.9 Alternative Plan D

4.3.9.1 Plan Components

Plan D includes the components of Plan A as described in Section 4.3.6.1 with the following modification: implement a revised APCDOP with enhancements recommended by the USFWS, as discussed in Section 4.2.2. The revised APCDOP with USFWS enhancement is depicted in Table 4.2-9.

4.3.9.2 Relationship to Water Management Objectives and Project Purposes

The proposed measures in Plan D would address the basic objectives established to guide the WCM update process, consisting of the following: define a navigation operations support protocol; develop a drought management plan; improve fish and wildlife conservation conditions downstream of Carters Reregulation Dam; improve overall system performance relative to authorized project purposes; and incorporate appropriate changes in APC projects into the updated WCM.

The proposed measures in Plan D would have the following effects or implications relative to the authorized purposes of federal projects in the ACT Basin:

- Flood Risk Management—Plan D would not improve on or adversely affect flood risk management operations at USACE and pertinent APC projects in the ACT Basin.
- Hydropower—For Plan D, water management measures that would be implemented at Carters Lake and Allatoona Lake would be expected to provide the same improvements for hydropower generation as described for Plan A in Section 4.3.6.2. Plan D would not be expected to adversely affect hydropower generation operations at APC or other USACE projects in the ACT Basin.

- Navigation—Plan D includes features to support navigation operations on the Alabama River. The specific navigation operations support protocol should provide improved information on current channel conditions and for forecasting future conditions for commercial navigation interests. The plan would likely result in improved navigation channel reliability.
- Fish and Wildlife Conservation—Seasonally based minimum flows downstream of Carters Reregulation Dam under Plan D would likely improve conditions in the Coosawattee River for fish and wildlife conservation, including protected species. Drought plan enhancements recommended by the USFWS would be beneficial to fish and wildlife conservation resources in the Alabama River.
- Recreation—The measures in Plan D would not be likely to have an appreciable effect on recreational use of Carters Lake. Proposed measures for Allatoona Lake operations would provide for more effective management of conservation storage and would likely provide for an overall improvement in lake levels, particularly under drier conditions, thus benefitting recreational use of the lake. The drought plan measures in Plan D would likely provide for improved conditions in APC lakes and downstream USACE projects under drought conditions that would benefit recreational users during those occurrences.
- Water Quality—Seasonally based minimum flows downstream of the Carters Reregulation Dam might provide for improved water quality conditions in the Coosawattee River. No conflicts with other project related water quality objectives would likely be encountered.
- Water Supply—Plan D would not affect existing storage contracts at Allatoona Lake or Carters Lake and would not likely have adverse effects on other water supply uses within the ACT Basin.

4.3.9.3 Conclusions

Plan D addresses the stated objectives for the update of the ACT WCM. The plan supports and, in a number of cases, improves on project and system-wide operations to meet authorized purposes. Specifically, Plan D would be likely to provide improvements with respect to hydropower generation, navigation, fish and wildlife conservation, recreation, and water quality. None of the proposed measures would likely be in conflict with authorized project purposes. Therefore Plan D was carried forward for detailed consideration (Section 5.2).

4.3.10 Alternative Plan E

4.3.10.1 Plan Components

Plan E includes the components of Plan A as described in Section 4.3.6.1 with the following modifications:

- Implement a revised APCDOP (as discussed in Section 4.2.2 and depicted in Table 4.2-7).
- Implement a phased guide curve at Allatoona Lake (Figure 4.3-2). The phased guide curve would have a top of conservation pool elevation of 823 from January 1 to 15, transitioning to 840 ft by May 1 and remaining at 840 ft through Labor Day (early September), then transitioning down to 835 ft by October 1 and remaining at 835 ft until mid-November, thereafter transitioning down to elevation 823 ft by December 31.

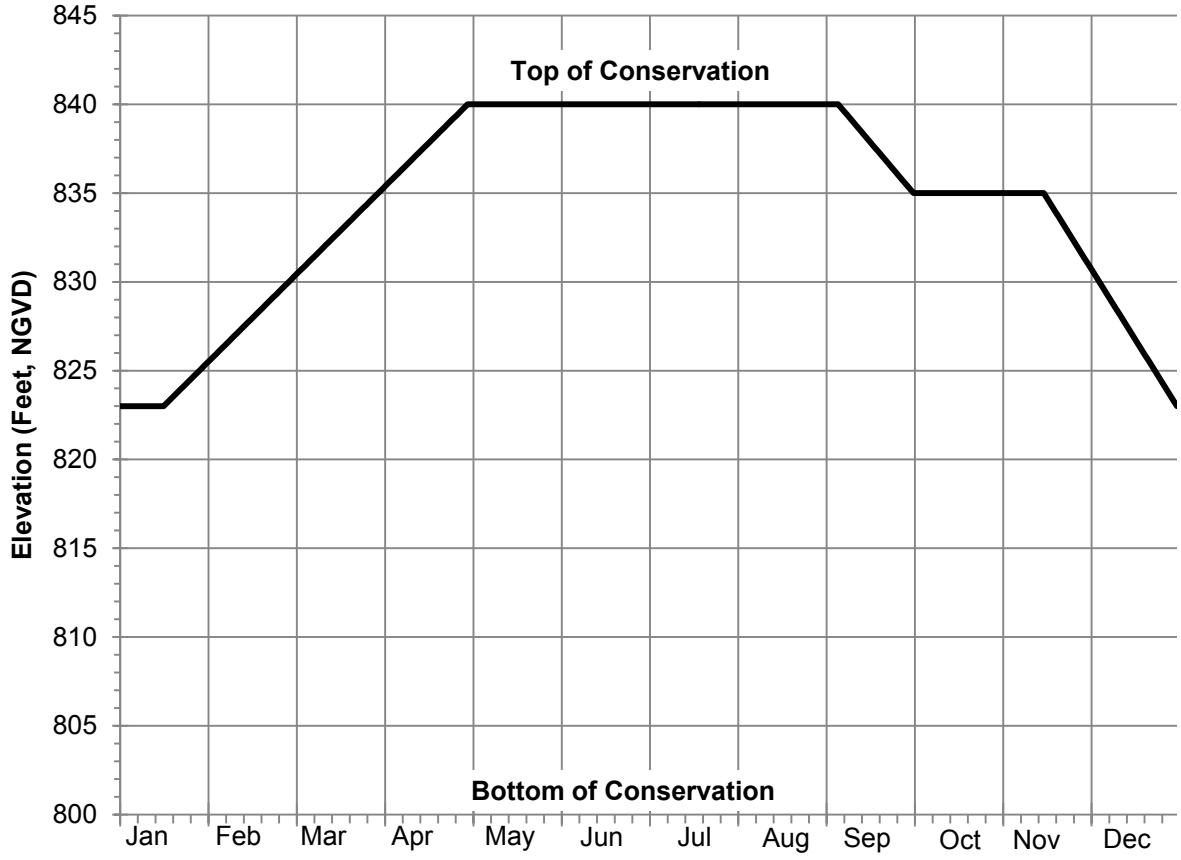


Figure 4.3-2. Phased guide curve at Allatoona Lake.

4.3.10.2 Relationship to Water Management Objectives and Project Purposes

The proposed measures in Plan E would address the basic objectives established to guide the WCM update process, consisting of the following: define a navigation operations support protocol; develop a drought management plan; improve fish and wildlife conservation conditions downstream of Carters Reregulation Dam; improve overall system performance relative to authorized project purposes; and incorporate appropriate changes in APC projects into the updated WCM. However, some of the measures included in this plan might be less effective in meeting the WCM update objectives than alternative measures included in other plans, as summarized below.

The proposed measures in Plan E would have the following effects or implications relative to the authorized purposes of federal projects in the ACT Basin:

- Flood Risk Management—Under Plan E, the phased drawdown feature in the fall season for the Allatoona Lake guide curve would likely result in improved flood risk management operations at Allatoona Lake. Flood risk management functions for other pertinent projects in the ACT Basin would not be appreciably improved or adversely affected by implementing Plan E.
- Hydropower—For Plan E, water management measures that would be implemented at Carters Lake and Allatoona Lake would be expected to provide similar improvements for hydropower generation as described for Plan A in Section 4.3.6.2. The phased fall drawdown guide curve would provide additional benefit for hydropower generation compared to the current guide curve,

while flood risk management and recreation would also benefit. Plan E would not be expected to adversely affect hydropower generation operations at APC and other USACE projects in the ACT Basin.

- Navigation—Plan E includes features to support navigation operations on the Alabama River. The specific navigation operations support protocol should provide improved information on current channel conditions and for forecasting future conditions for commercial navigation interests. The plan would likely result in improved navigation channel reliability.
- Fish and Wildlife Conservation—Seasonally based minimum flows downstream of Carters Reregulation Dam under Plan E would likely improve conditions in the Coosawattee River for fish and wildlife conservation, including protected species.
- Recreation—The measures in Plan E would not be likely to have an appreciable effect on recreational use of Carters Lake. Proposed measures for Allatoona Lake operations would provide for more effective management of conservation storage and would likely provide for an overall improvement in lake levels, particularly under drier conditions, thus benefitting recreational use of the lake. The proposed phased guide curve revision in the fall would further benefit recreational use at Allatoona Lake extending the fall lake drawdown over a longer period, sustaining the lake at a higher level through mid-November than the current guide curve. The drought plan measures in Plan E would likely provide for improved conditions in APC lakes and downstream USACE projects under drought conditions that would benefit recreational users during those occurrences.
- Water Quality—Seasonally based minimum flows downstream of the Carters Reregulation Dam might provide for improved water quality conditions in the Coosawattee River. No conflicts with other project related water quality objectives would likely be encountered.
- Water Supply—Plan E would not affect existing storage contracts at Allatoona Lake or Carters Lake and would not likely have adverse effects on other water supply uses within the ACT Basin.

4.3.10.3 Conclusions

Plan E incorporates the revised APCDOP. However, it does not include enhancements to the revised APCDOP as recommended by the USFWS. Plan E also includes the beneficial aspects of the phased guide curve for fall drawdown. Because the phased guide curve features are included in other plans that also incorporate the UFWS recommendations, Plan E was not carried forward for detailed consideration.

4.3.11 Alternative Plan F

4.3.11.1 Plan Components

Plan F includes the components of Plan A as described in Section 4.3.6.1 with the following modifications:

- Implement a revised APCDOP with enhancements recommended by the USFWS, as discussed in Section 4.2.2. The revised APCDOP with USFWS enhancement is depicted in Table 4.2-9.
- Implement a phased guide curve at Allatoona Lake (Figure 4.3-2).

4.3.11.2 Relationship to Water Management Objectives and Project Purposes

The proposed measures in Plan F would address the basic objectives established to guide the WCM update process, consisting of the following: define a navigation operations support protocol; develop a drought management plan; improve fish and wildlife conservation conditions downstream of Carters Reregulation Dam; improve overall system performance relative to authorized project purposes; and incorporate appropriate changes in APC projects into the updated WCM.

The proposed measures in Plan F would have the following effects or implications relative to the authorized purposes of federal projects in the ACT Basin:

- Flood Risk Management—Under Plan F, the phased drawdown feature in the fall season for the Allatoona Lake guide curve would likely result in improved flood risk management operations at Allatoona Lake. Flood risk management functions for other pertinent projects in the ACT Basin would not be appreciably improved or adversely affected by implementing Plan F.
- Hydropower—For Plan F, water management measures that would be implemented at Carters Lake and Allatoona Lake would be expected to provide similar improvements for hydropower generation as described for Plan A in Section 4.3.6.2. The phased fall drawdown guide curve would provide additional benefit for hydropower generation compared to the current guide curve, while flood risk management and recreation would also benefit. Plan F would not be expected to adversely affect hydropower generation operations at APC and other USACE projects in the ACT Basin.
- Navigation—Plan F includes features to support navigation operations on the Alabama River. The specific navigation operations support protocol should provide improved information on current channel conditions and for forecasting future conditions for commercial navigation interests. The plan would likely result in improved navigation channel reliability.
- Fish and Wildlife Conservation—Seasonally based minimum flows downstream of Carters Reregulation Dam under Plan F would likely improve conditions in the Coosawattee River for fish and wildlife conservation, including protected species. Drought plan enhancements recommended by the USFWS would be beneficial to fish and wildlife conservation resources in the Alabama River.
- Recreation—The measures in Plan F would not be likely to have an appreciable effect on recreational use of Carters Lake. Proposed measures for Allatoona Lake operations would provide for more effective management of conservation storage and would likely provide for an overall improvement in lake levels, particularly under drier conditions, thus benefitting recreational use of the lake. The proposed phased guide curve revision in the fall would further benefit recreational use at Allatoona Lake extending the fall lake drawdown over a longer period, sustaining the lake at a higher level through mid-November than the current guide curve. The drought plan measures in Plan F would likely provide for improved conditions in APC lakes and downstream USACE projects under drought conditions that would benefit recreational users during those occurrences.
- Water Quality—Seasonally based minimum flows downstream of the Carters Reregulation Dam might provide for improved water quality conditions in the Coosawattee River. No conflicts with other project related water quality objectives would likely be encountered.
- Water Supply—Plan F would not affect existing storage contracts at Allatoona Lake or Carters Lake and would not likely have adverse effects on other water supply uses within the ACT Basin.

4.3.11.3 Conclusions

Plan F addresses the stated objectives for the update of the ACT WCM. The plan supports and, in a number of cases, improves on project and system-wide operations to meet authorized purposes. Specifically, Plan F would be likely to provide improvements with respect to flood risk management, hydropower generation, navigation, fish and wildlife conservation, recreation, and water quality. None of the proposed measures would likely be in conflict with authorized project purposes. Therefore, Plan F was carried forward for detailed consideration (Section 5.3).

4.3.12 Alternative Plan G (Proposed Action Alternative)

4.3.12.1 Plan Components

Plan G includes the components of Plan A as described in Section 4.3.6.1 with the following modifications:

- Implement a revised APCDOP with enhancements recommended by the USFWS, as discussed in Section 4.2.2. The revised APCDOP with USFWS enhancement is depicted in Table 4.2-9.
- Implement a phased guide curve at Allatoona Lake (Figure 4.3-2).
- While retaining the range of typical daily hydropower generation range for Allatoona Lake, hydropower production at the project would be reduced during September through November to facilitate implementation of the fall phased down guide curve.

Plan G is the same as Plan F except for the additional measure to reduce hydropower generation during September through November to facilitate fall phased down guide curve implementation.

4.3.12.2 Relationship to Water Management Objectives and Project Purposes

The proposed measures in Plan G would address the basic objectives established to guide the WCM update process, consisting of the following: define a navigation operations support protocol; develop a drought management plan; improve fish and wildlife conservation conditions downstream of Carters Reregulation Dam; improve overall system performance relative to authorized project purposes; and incorporate appropriate changes in APC projects into the updated WCM.

The proposed measures in Plan G would have the following effects or implications relative to the authorized purposes of federal projects in the ACT Basin:

- Flood Risk Management—Under Plan G, the phased drawdown feature in the fall season for the Allatoona Lake guide curve would likely result in improved flood risk management operations at Allatoona Lake. Flood risk management functions for other pertinent projects in the ACT Basin would not be appreciably improved or adversely affected by implementing Plan G.
- Hydropower—For Plan G water management measures that would be implemented at Carters Lake and Allatoona Lake would be expected to provide similar improvements for hydropower generation as described for Plan A in Section 4.3.6.2. The phased fall drawdown guide curve would provide additional benefit for hydropower generation compared to the current guide curve, while flood risk management and recreation would also benefit. Plan G would not be expected to adversely affect hydropower generation operations at APC and other USACE projects in the ACT Basin.

- Navigation—Plan G includes features to support navigation operations on the Alabama River. The specific navigation operations support protocol should provide improved information on current channel conditions and for forecasting future conditions for commercial navigation interests. The plan would likely result in improved navigation channel reliability.
- Fish and Wildlife Conservation—Seasonally based minimum flows downstream of Carters Reregulation Dam under Plan G would likely improve conditions in the Coosawattee River for fish and wildlife conservation, including protected species. Drought plan enhancements recommended by the USFWS would be beneficial to fish and wildlife conservation resources in the Alabama River.
- Recreation—The measures in Plan G would not be likely to have an appreciable effect on recreational use of Carters Lake. Proposed measures for Allatoona Lake operations would provide for more effective management of conservation storage and would likely provide for an overall improvement in lake levels, particularly under drier conditions, thus benefitting recreational use of the lake. The proposed phased guide curve revision in the fall would further benefit recreational use at Allatoona Lake by extending the fall lake drawdown over a longer period, sustaining the lake at a higher level through mid-November than the current guide curve. The additional measure to reduce hydropower production for September through November to facilitate implementation of the fall phased drawdown would likely provide additional improvement to fall lake levels. The drought plan measures in Plan G would likely provide for improved conditions in APC lakes and downstream USACE projects under drought conditions that would benefit recreational users during those occurrences.
- Water Quality—Seasonally based minimum flows downstream of the Carters Reregulation Dam might provide for improved water quality conditions in the Coosawattee River. No conflicts with other project related water quality objectives would likely be encountered.
- Water Supply—Plan G would not affect existing storage contracts at Allatoona Lake or Carters Lake and would not likely have adverse effects on other water supply uses within the ACT Basin.

4.3.12.3 Conclusions

Plan G addresses the stated objectives for the update of the ACT WCM. The plan supports and, in a number of cases, improves on project and system-wide operations to meet authorized purposes. Specifically, Plan G would be likely to provide improvements with respect to flood risk management, hydropower generation, navigation, fish and wildlife conservation, recreation, and water quality. The additional measure in Plan G to reduce hydropower production during September through November to facilitate implementation of the phased fall guide curve drawdown would likely provide additional benefits with respect to recreation and overall hydropower production compared to Plan F. None of the proposed measures would likely conflict with authorized project purposes. Therefore, Plan G, referred to as the Proposed Action Alternative, was carried forward for detailed consideration. The plan is presented in more detail in Section 5.4.

5 Description of the Proposed Action and Alternatives

USACE proposes to prepare an updated master WCM for the ACT Basin. The component parts of the master WCM would be seven project-level WCMs, presented as appendices as identified in Section 3.1.9. As discussed in detail in Section 3.1.9, only two of the four APC projects in the basin with USACE WCMs will be included in this WCM update. Updates of the Logan Martin and Weiss Lake WCM will be deferred pending the completion of the necessary studies to determine if the revised flood risk management protocols are acceptable.

WCMs contain drought plans and action zones to assist USACE in knowing when to reduce or increase reservoir releases and conserve storage in USACE reservoirs. The individual manuals typically outline the regulation schedules for each project, including operating criteria, guidelines, and guide curves, and specifications for storage and releases from the reservoirs. The WCMs also outline the coordination protocol and data collection, management, and dissemination associated with routine and specific water management activities (such as flood-control operations or drought contingency operations). Operational flexibility and discretion are necessary to balance the water management needs for the numerous (and often competing) authorized project purposes at each individual project. In addition, there is a need to balance basin-wide water resource needs. Project operations also must be able to adapt to seasonal and yearly variations in flow and climatic conditions.

The following sections present the No Action Alternative and alternatives carried forward for further evaluation—Plan D, Plan F, and Plan G. Plan G, presented in Section 5.4, is the proposed action and USACE Preferred Alternative.

5.1 No Action Alternative

The CEQ regulations require analysis of the No Action Alternative 40 CFR.1502.14. Inclusion of the No Action Alternative in this EIS is prescribed by CEQ regulations and serves as a benchmark against which federal actions can be evaluated. On the basis of the nature of the proposed action, the No Action Alternative represents no change from the current management direction or level of management intensity. The alternative would represent continuation of the current water control operations at each of the federal projects in the ACT Basin. USACE operations have changed incrementally since completion of the 1951 ACT Master Manual. Except in very general terms, it is not possible to describe a single set of reservoir operations that apply to the entire period since completion of the 1951 ACT Master Manual.

Current operations under the No Action Alternative include the following.

- Operations consistent with the Master Manual of 1951 and project-specific WCMs. For USACE, those manuals and their dates are Allatoona Lake (1993), Carters Lake and Carters Reregulation Dam (1975), Robert F. Henry Lock and Dam (1999), Millers Ferry Lock and Dam (1990), and Claiborne Lake (1993). For APC projects, the applicable manuals and their dates are Weiss Lake (1965), H. Neely Henry Lake, (1979), Logan Martin Lake (1968), and R.L. Harris Lake (2003). USACE recognizes that APC operates 11 dams (10 reservoirs) under six FERC licenses, each one having specific operational requirements: (1) the Coosa River Project (FERC Project No. 2146), which includes the Weiss Lake, H. Neely Henry Lake, Logan Martin Lake, Lay Lake, and Bouldin Dam developments; (2) the Mitchell Lake Project (FERC Project No. 82); (3) the Jordan Dam and Lake Project (FERC Project No. 618); (4) Lake Martin Project (FERC Project No. 349) (5) Yates Lake-Thurlow Lake (FERC Project No. 2407); and (6) R.L. Harris Lake Project, referred to as Crooked Creek Hydroelectric Project (FERC Project No. 2628). The FERC license for the Coosa River Project was issued in 1957. The FERC license for the Mitchell Lake Project

was issued in 1975, and the FERC license for the Jordan Dam and Lake Project was issued in 1980. The licenses for those three projects expired on August 31, 2007. On July 28, 2005, APC applied for one new operating license that would combine all those projects as Project No. 2146. The FERC licenses could be amended in light of APC's request to modify winter pool levels at the Weiss Lake and Logan Martin Lake projects; however, the No Action Alternative does not include these APC-proposed modified pool levels. [NOTE: On June 20, 2013, following public review of the draft EIS for the ACT WCM update, FERC issued a new license for the APC projects on the Coosa River (No. 2146). The new license did not include the proposed modifications to winter pool levels at Weiss and Logan Martin Lakes.]

- H. Neely Henry Lake, which operates under a revised guide curve (per a temporary variance initially granted by FERC in 2001 and effective pending relicensing of Project No. 2146), would return to operation under its original guide curve under the current FERC license. [NOTE: On June 20, 2013, following public review of the draft EIS for the ACT WCM update, FERC issued a new license for the APC projects on the Coosa River (No. 2146), which included the revised guide curve for H. Neely Henry Lake.]
- Specified flow requirements apply to several projects. Allatoona Lake and Carters Lake must provide for a 240-cfs minimum flow. USACE has a flow target of 6,600 cfs from Claiborne Lock and Dam where the actual ability to meet the target depends on releases provided by APC and intervening flows from the Cahaba River and other tributaries. In accordance with a 1972 Letter Agreement between USACE and APC, APC ensures a combined minimum release of 4,640-cfs from JBT near Montgomery during normal conditions.
- Two entities, the City of Cartersville, Georgia and CCMWA, have entered into water supply agreements for the use of 6,371 ac-ft and 13,140 ac-ft, respectively, of storage in Allatoona Lake for water supply. The modeling for the No Action Alternative includes the water supply withdrawals that actually were made by these entities in 2006. It also includes the returns that were made in that year. This year was chosen to represent "current" operations because it was the year of highest net withdrawals in the ACT Basin and greatest stress on the system from withdrawals.
- The city of Chatsworth has entered into a water supply agreement for the use of 818 ac-ft of storage in Carters Lake for water supply. As described above, the modeling for the No Action Alternative includes the water supply withdrawals (and returns) that actually were made in 2006.
- USACE would continue to manage fish spawning operations at Allatoona Lake, as outlined in SADR PDS-O-1 (May 31, 2010) and draft Mobile District SOP 1130-2-9 (February 2005). During the largemouth bass spawning period, from March 15 to May 15, USACE seeks to maintain generally stable or rising reservoir levels at Allatoona Lake. Generally stable or rising levels are defined as not lowering the reservoir levels by more than 6 inches, with the base elevation generally adjusted upward as levels rise from increased inflows or refilling of the reservoir.
- USACE would continue to operate fish passage lockages to facilitate the upstream passage of migratory fishes at Claiborne Lock and Dam and Millers Ferry Lock and Dam. The operation is conducted each spring from February through May and consists of opening the lower lock gate for 4 to 6 hours and allowing fish to enter. The lock is then filled to the lake elevation, the upper gate is opened, and fish are allowed to freely enter and exit the lake for the next 4 to 6 hours, after which the cycle is repeated. During the spring since 2009, two fish locking cycles have been performed each day; however, there are slight differences in the locking schedule each year, and alterations can occur depending on local hydrologic conditions, especially flooding, which can prevent lock operation, and staffing schedules for the project site. Under the No Action Alternative, it is assumed that current fish passage operation would remain unchanged.

The following subsections describe key operational elements that apply to evaluating the No Action Alternative.

5.1.1 General System Operations

USACE operates its reservoirs in the ACT Basin to provide for the authorized purposes of flood risk management, navigation, hydropower, recreation, water supply, water quality, and fish and wildlife conservation. USACE considers each of those authorized project purposes when making operational decisions, and those decisions affect how water is stored and released from the projects. In general, to provide the authorized project purposes, flow must be stored during wetter times of each year and released from storage during drier periods of each year. Traditionally, that means that water is stored in the lakes during the spring and released for authorized project purposes in the summer and fall months. In contrast, some authorized project purposes such as lakeside recreation, water supply, and lake fish spawning are achieved by retaining water in the lakes, either throughout the year or during specified periods of each year. The flood risk management purposes at certain reservoirs requires drawing down reservoirs in the fall through winter months to store possible flood waters and refilling pools in the spring months to be used for multiple project purposes throughout the remainder of the year.

Certain APC projects (Weiss Lake, H. Neely Henry Lake, Logan Martin Lake, and R.L. Harris Lake) are also required to operate for flood risk management and navigation as described in Section 2.4.1.2.2. WCMs developed for the APC projects are used to guide operations for flood risk management and navigation.

The competing water demands require that the system be operated in a balanced manner to meet all authorized purposes, while continuously monitoring the total system water availability to ensure that minimum project purposes can be achieved during critical drought periods. The balanced water management strategy for USACE reservoirs in the ACT Basin does not prioritize any project purpose but seeks to balance all project authorized purposes. The intent is to maintain a balanced use of conservation storage among all the reservoirs in the system, rather than to maintain the pools at or above certain predetermined elevations. However, flood risk management during a flood event does clearly govern the operation of projects that have a flood risk management purpose, and an operation at all projects to support public health and safety governs during an extreme drought period. At all times, the USACE seeks to conserve the water resources entrusted to its regulation authority.

The last major evaluations of the environmental consequences of the individual USACE reservoirs in the ACT Basin were included in project operations EISs completed in the 1970s. Since then, incremental changes in project operations have occurred because of changes in hydropower contracts and operating schedules, changes in navigation flow requirements, and other changes related to water quality, environment, or other uses of the system. Historical records maintained by USACE illustrate the observed impacts of changes in operations or seasonal variations over time on pool levels and flow releases from USACE reservoirs. Comparing historic operations conditions with existing operations conditions provides a complete picture of the impacts related to changes in water demand and water resources management in the basin as well as a perspective on existing flows to plan for future changes.

5.1.2 Guide Curves and Action Zones

The guide curve for each federal project defines the top of conservation storage water surface elevation. Water management regulation decisions strive to maintain the pool elevation at the top of conservation elevation or at the highest elevation possible while meeting project purposes. Under the No Action Alternative, guide curves would remain as currently defined. Action zones are used to manage the lakes at the highest level possible within the conservation storage pool while balancing the needs of all authorized purposes with water conservation as a national priority used as a guideline. In accordance with ER 1110-

2- 241 *Use of Storage Allocated for Flood Control and Navigation at Non-Corps Projects*, USACE is responsible for the review and approval of the flood risk management plans and Reservoir Regulation Manuals for the APC storage projects Weiss, H. Neely Henry, and Logan Martin Lakes on the Coosa River and R.L. Harris Lake on the Tallapoosa River. The purpose of the reservoir manuals is to define a plan of operation at the reservoirs during the occurrence or threatened occurrence of damaging flood conditions at downstream stations, when such conditions can be alleviated or partially alleviated by the operation of the dam and power plant in the interest of flood risk management. In addition, in the 1960s USACE and APC developed MOUs to clarify the responsibilities of the two entities with regard to operation of the projects for flood risk management and other purposes and to provide for the orderly exchange of hydrologic data.

Guide curves have been defined for two USACE projects (Carters Lake and Allatoona Lake) and the four APC projects (Weiss, H. Neely Henry, Logan Martin, and R.L. Harris Lakes). No guide curves exist for Claiborne Lake (Claiborne Lock and Dam), William "Bill" Dannelly Lake (Millers Ferry Lock and Dam), or R.E. "Bob" Woodruff Lake (Robert F. Henry Lock and Dam). Additionally, action zones have been defined at Allatoona Lake. The zones are used to manage the lake at the highest level practicable while balancing the needs of all the authorized purposes. Action Zone 1 is the highest in each lake and defines a reservoir condition where all authorized project purposes should be met. The lake level at the top of Zone 1 is the normal pool level or top of conservation pool (or the guide curve). As lake levels decline, Zone 2 defines increasingly critical system water shortages, and prescribes reductions in reservoir releases as pool levels drop as a result of drier than normal or drought conditions. The action zones also provide guidance on meeting minimum hydropower needs at each project as well as determining the minimum releases for downstream purposes. More detailed information on action zones is in section 2.4.1.1.4. Under the No Action Alternative, the current guide curves at Allatoona and Carters lakes and current action zones at Allatoona Lake would continue to serve as the basis for USACE management of these reservoirs.

Figure 5.1-1 through Figure 5.1-6 show the annual guide curves and action zones for pertinent USACE and APC projects. Each of the figures for the APC projects (Figure 5.1-3 through Figure 5.1-6) depicts the guide curve (upper curve) and a drought curve (lower curve). The drought curves have been established by APC for their drought operations under their APCDOP, discussed in Section 4.2.2.

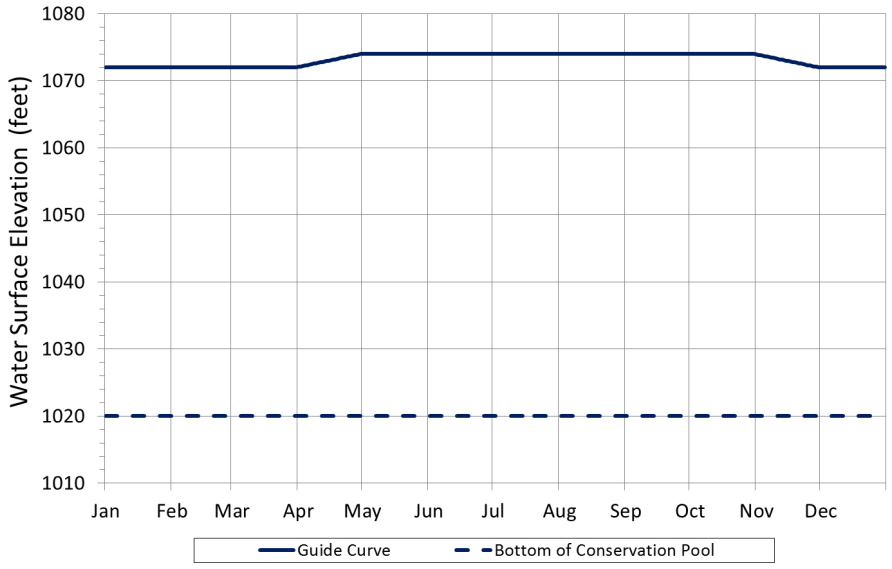


Figure 5.1-1. Carters Lake guide curve.

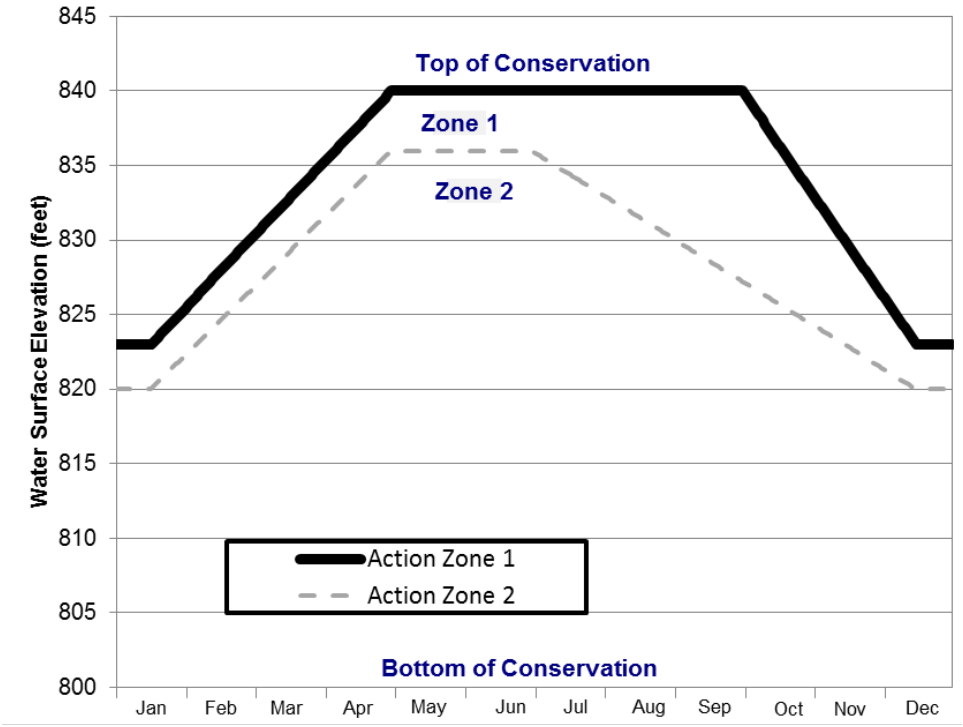


Figure 5.1-2. Allatoona Lake guide curve and action zones.

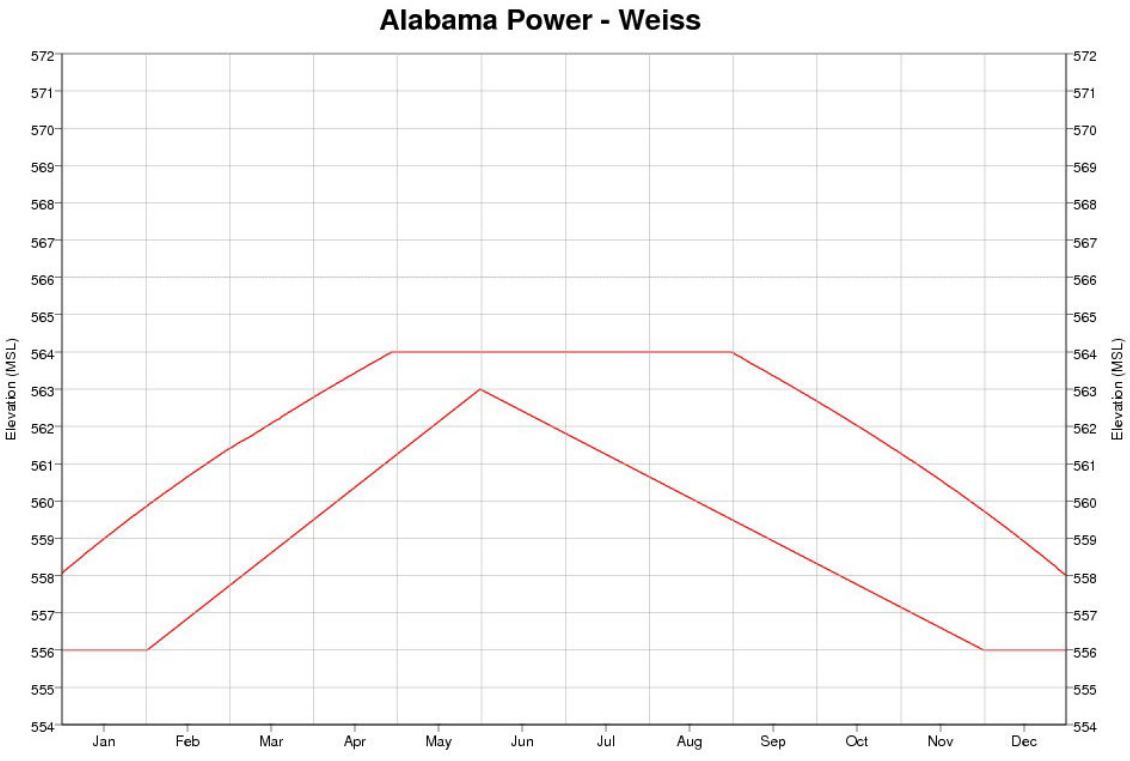


Figure 5.1-3. Weiss Lake guide curve (upper) and APC drought curve (lower).

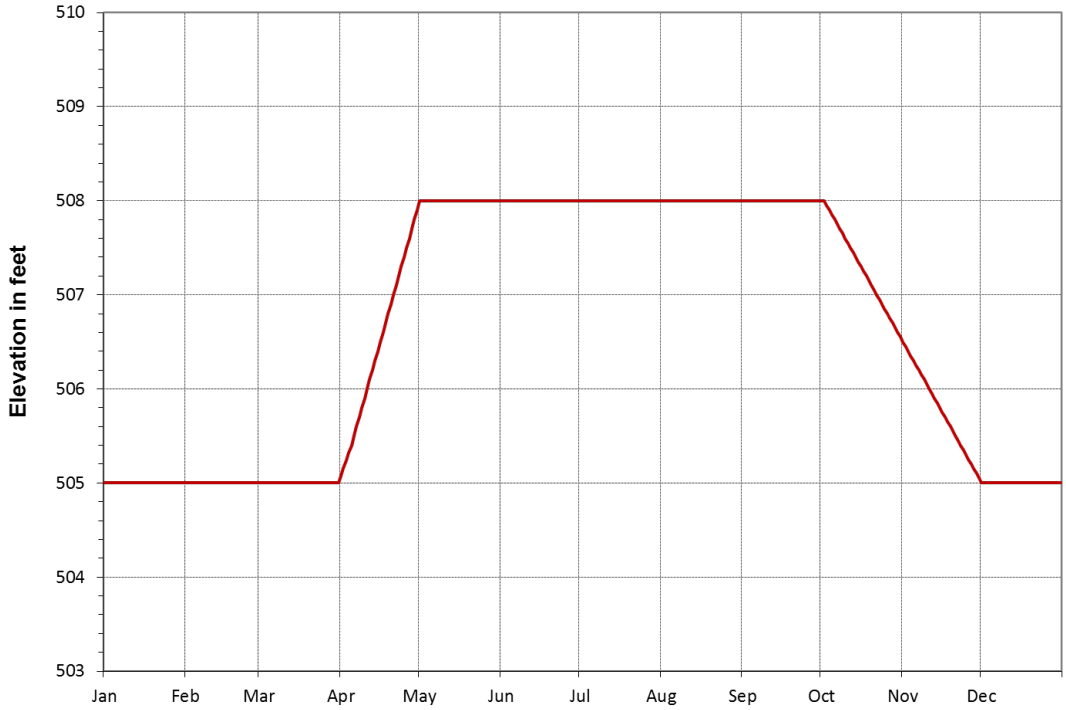


Figure 5.1-4. H. Neely Henry Lake guide curve (pre-FERC variance).

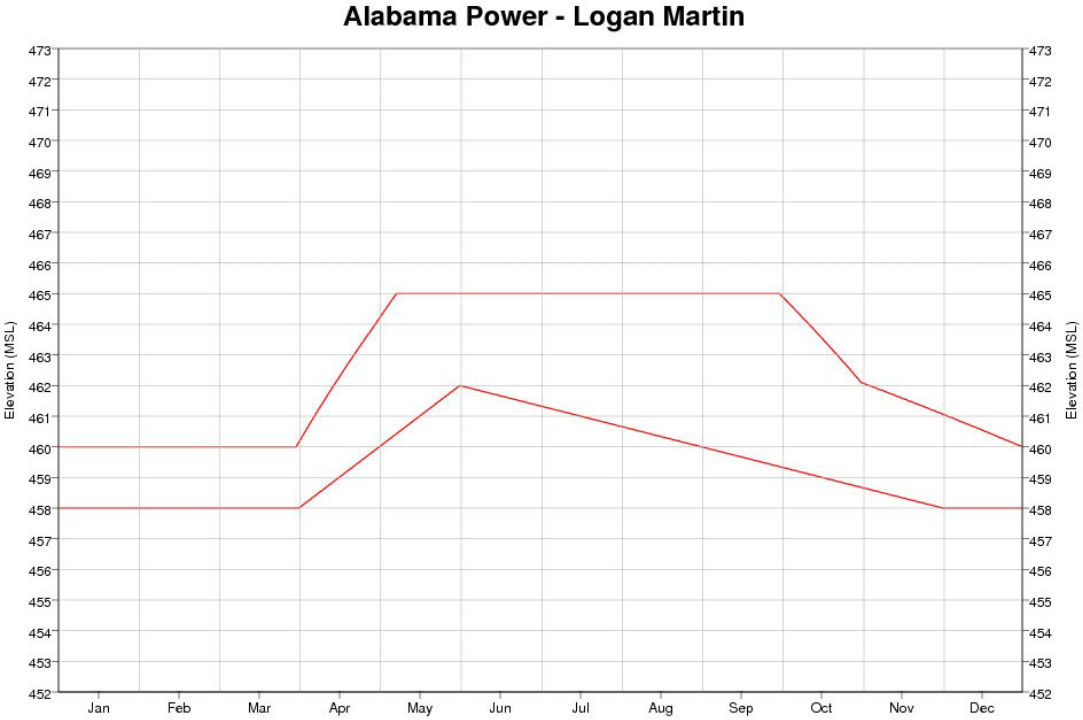


Figure 5.1-5. Logan Martin Lake guide curve (upper) and APC drought curve (lower).

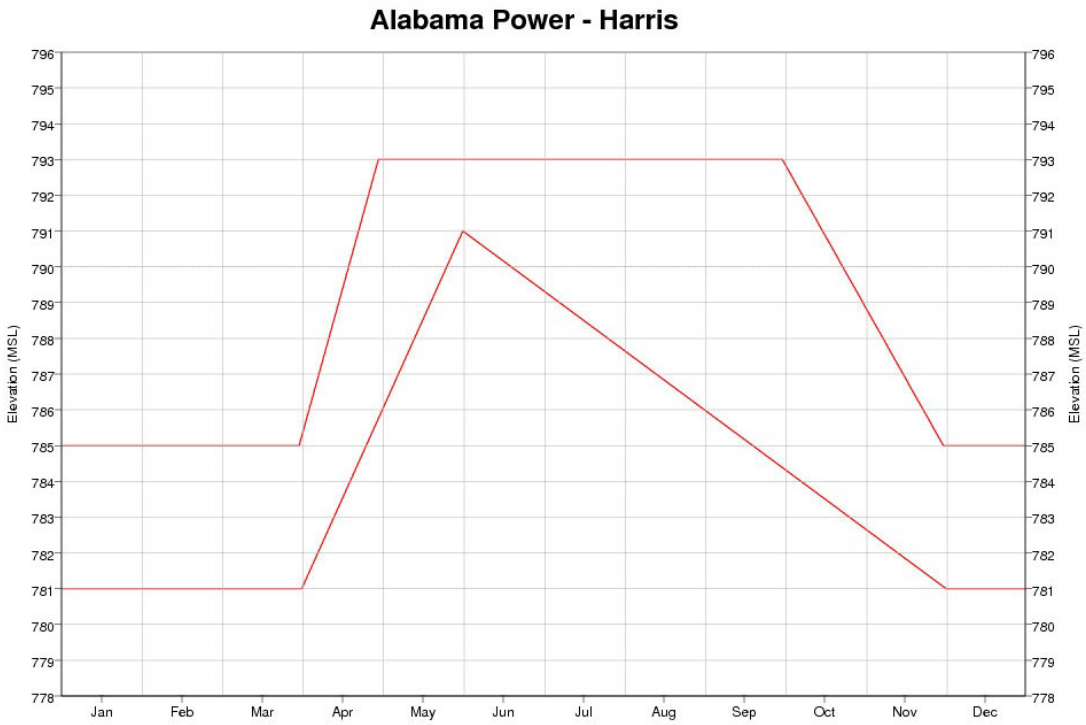


Figure 5.1-6. R.L. Harris Lake guide curve (upper) and APC drought curve (lower).

5.2 Alternative Plan D

Operations under Plan D would include the following:

- Implement the revised APCDOP with enhancements recommended by the USFWS, as discussed in Section 4.2.2. The revised APCDOP with USFWS enhancement is depicted in Table 4.2-9.
- Provide for seasonal navigation releases, coupled with seasonal maintenance dredging, to support commercial navigation in the Alabama River for a 9.0-ft or 7.5-ft channel depth as long as sufficient basin inflow above the APC projects is available, as described in Section 4.2.1. Available navigation channel depths in the Alabama River at any given time would be governed by the level of flow that could be delivered through the APC projects. When sufficient basin inflows are not available to support at least a 7.5-ft navigation channel, flow augmentation from the APC projects to support navigation would be suspended and combined releases from JBT near Montgomery would be reduced to 4,640 cfs or lower if one or more of the drought operations triggers (low basin inflows, low composite conservation storage, or low state line flows) are met.
- APC projects on the Coosa and Tallapoosa Rivers would continue to operate under their current FERC licenses with specific operational requirements. FERC relicensing actions are underway for the Coosa River projects, and APC has requested to modify winter pool levels at the Weiss Lake and Logan Martin Lake projects. Plan D does not include these APC-proposed modified winter pool levels. [NOTE: The new FERC license for APC Coosa River projects, issued on June 20, 2013, following public review of the draft EIS for the ACT WCM update, did not include the proposed modifications to winter pool levels at Weiss and Logan Martin Lakes.]

- The APC project, H. Neely Henry Lake (Coosa River), which operates with a revised guide curve under a FERC license variance (with USACE concurrence), would continue to operate under its revised guide curve (Figure 5.2-1). [NOTE: The new FERC license for APC Coosa River projects issued on June 20, 2013 included the revised guide curve for H. Neely Henry Lake.]

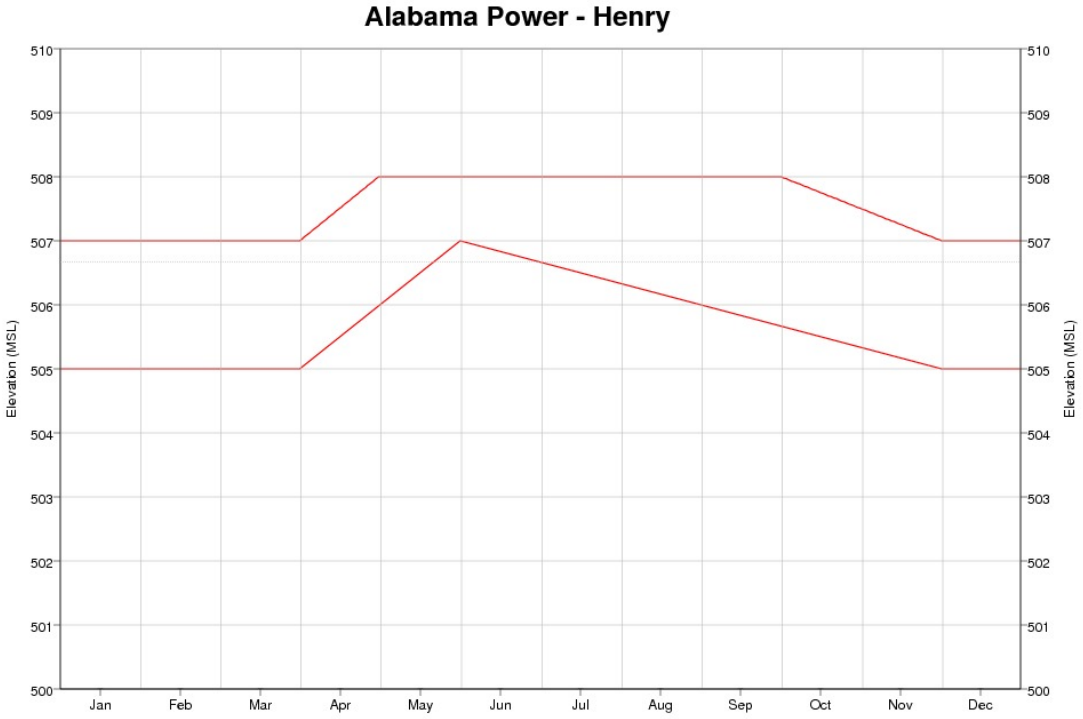


Figure 5.2-1. H. Neely Henry Lake revised guide curve (upper) and APC drought curve (lower).

- Specified flow requirements at Allatoona Lake would continue to provide for a 240-cfs minimum flow.
- The existing guide curve at Allatoona Lake would not change. However, refined operations at Allatoona Lake would include use of four action zones shaped to mimic the seasonal demands for hydropower (Figure 5.2-2). Modifications to the hydropower schedule would be put in place to provide greater operational flexibility to meet power demands while conserving storage.

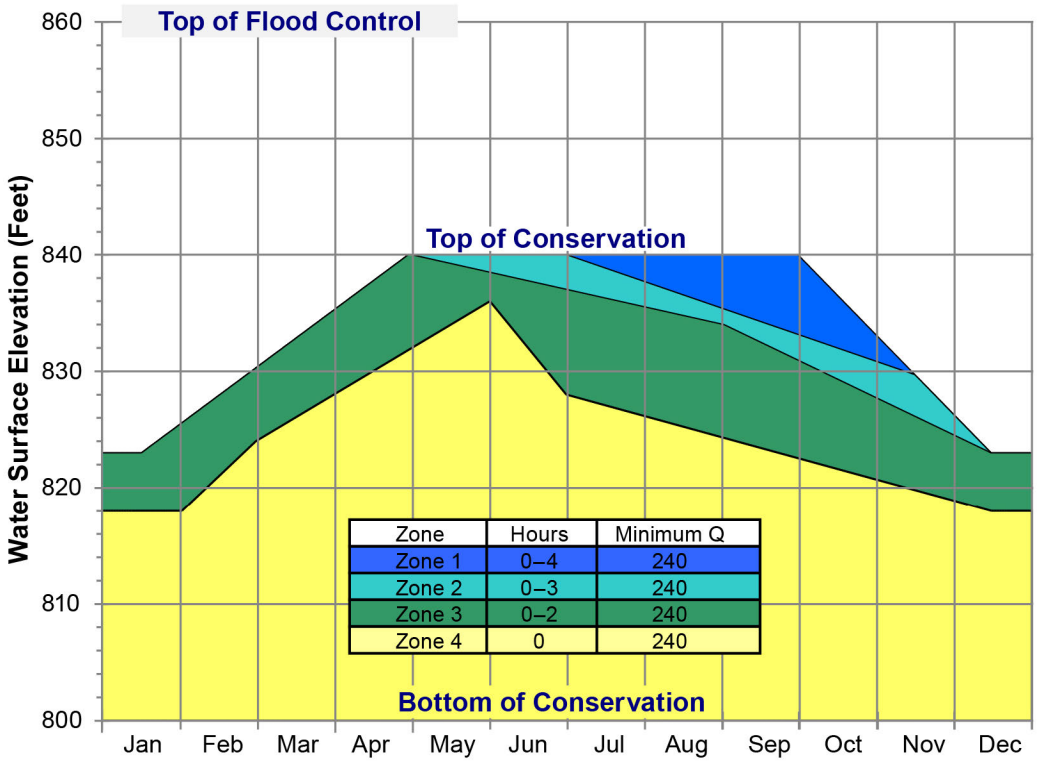


Figure 5.2-2. Operations under Plan D at Allatoona Lake.

- The minimum flow requirement would remain at 240 cfs from Carters Reregulation Dam. Refined operations at Carters Lake would include the use of two action zones to manage downstream releases. The top of the new Zone 2 begins at elevation 1,066 ft in January, increasing to 1,070.5 ft in May, dropping to 1,070 ft by October, and returning to elevation 1,066 ft through December (Figure 4.2-8). When Carters Lake is in Zone 1, minimum flow releases at Carters Reregulation Dam would be equal to the seasonal minimum flow. Those minimum flow releases are based on the mean monthly flow upstream of Carters Lake. If Carters Lake elevation drops into Zone 2, minimum flow releases from the Carters Reregulation Dam would be 240 cfs.
- Two entities, the city of Cartersville, Georgia and CCMWA, have entered into water supply agreements for the use of 6,371 ac-ft and 13,140 ac-ft of storage, respectively, in Allatoona Lake for water supply. Total storage allocated to water supply in Allatoona Lake is 19,511 ac-ft.
- The city of Chatsworth has entered into a water supply agreement for the use of 818 ac-ft of storage in Carters Lake for water supply.
- USACE would continue to manage fish spawning operations at Allatoona Lake as outlined in SADR PDS-O-1 and draft Mobile District SOP 1130-2-9. During the largemouth bass spawning period, from March 15 to May 15, USACE seeks to maintain generally stable or rising reservoir levels at Allatoona Lake. Generally stable or rising levels are defined as not lowering the reservoir levels by more than 6 inches, with the base elevation generally adjusted upward as levels rise from increased inflows or refilling of the reservoir.
- USACE would continue migratory fish passage operations at Claiborne Lock and Dam and Millers Ferry Lock and Dam, as stated under the No Action Alternative.

5.3 Alternative Plan F

Operations under Plan F would include the following:

- Implement the revised APCDOP with enhancements recommended by the USFWS, as discussed in Section 4.2.2. The revised APCDOP with USFWS enhancement is depicted in Table 4.2-9.
- Provide for seasonal navigation releases, coupled with seasonal maintenance dredging, to support commercial navigation in the Alabama River for a 9.0-ft or 7.5-ft channel depth as long as sufficient basin inflow above the APC projects is available, as described in Section 4.2.1. Available navigation channel depths in the Alabama River at any given time would be governed by the level of flow that could be delivered through the APC projects. When sufficient basin inflows are not available to support at least a 7.5-ft navigation channel, flow augmentation from the APC projects to support navigation would be suspended, and combined releases from JBT near Montgomery would be reduced to 4,640 cfs or lower if one or more of the drought operations triggers (low basin inflows, low composite conservation storage, or low state line flows) are met.
- APC projects on the Coosa and Tallapoosa Rivers would continue to operate under their current FERC licenses with specific operational requirements. FERC relicensing actions are underway for the Coosa River projects, and APC has requested to modify winter pool levels at the Weiss Lake and Logan Martin Lake projects. Plan F does not include these APC-proposed modified winter pool levels. [NOTE: The new FERC license, issued on June 20, 2013, following public review of the draft EIS for the ACT WCM update, did not include the proposed modifications to winter pool levels at Weiss and Logan Martin Lakes.]
- The APC project, H. Neely Henry Lake (Coosa River), which operates with a revised guide curve under a FERC license variance (with USACE concurrence) would continue to operate under its revised guide curve (Figure 5.2-1). [NOTE: The new FERC license for APC Coosa River projects issued on June 20, 2013 included the revised guide curve for H. Neely Henry Lake.]
- Specified flow requirements at Allatoona Lake would continue to provide for a 240-cfs minimum flow.
- The existing guide curve at Allatoona Lake would be revised to implement a phased fall drawdown period from early September through December (Figure 5.3-1). Refined operations at Allatoona Lake would include use of four action zones shaped to mimic the seasonal demands for hydropower (Figure 5.3-1). Modifications to the hydropower schedule would be put in place to provide greater operational flexibility to meet power demands while conserving storage. In Plan F, hydropower generation would not be reduced during annual drawdown in the fall. The WCM would define a range of hours for generation in each action zone but would not include the option to reduce production during fall drawdown when the demand is reduced.

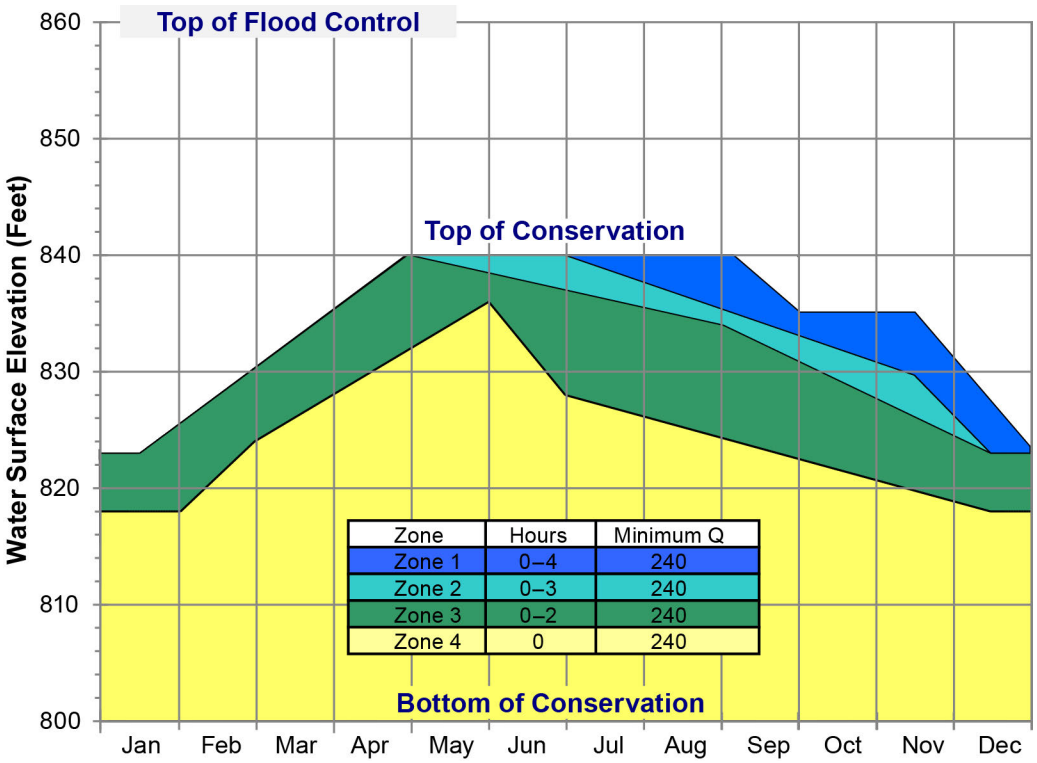


Figure 5.3-1. Operations under the Plan F at Allatoona Lake.

- The minimum flow requirement would remain at 240 cfs from Carters Reregulation Dam. Refined operations at Carters Lake would include the use of two action zones to manage downstream releases. The top of the new Zone 2 begins at elevation 1,066 ft in January, increasing to 1,070.5 ft in May, dropping to 1,070 ft by October, and returning to elevation 1,066 ft through December (Figure 4.2-8). When Carters Lake is in Zone 1, minimum flow releases at Carters Reregulation Dam would be equal to the seasonal minimum flow. Those minimum flow releases are based on the mean monthly flow upstream of Carters Lake. If Carters Lake elevation drops into Zone 2, minimum flow releases from the Carters Reregulation Dam would be 240 cfs.
- Two entities, the city of Cartersville, Georgia and CCMWA, have entered into water supply agreements for the use of 6,371 ac-ft and 13,140 ac-ft of storage, respectively, in Allatoona Lake for water supply. Total storage allocated to water supply in Allatoona Lake is 19,511 ac-ft.
- The city of Chatsworth has entered into a water supply agreement for the use of 818 ac-ft of storage in Carters Lake for water supply.
- USACE would continue to manage fish spawning operations at Allatoona Lake as outlined in SADR PDS-O-1 and draft Mobile District SOP 1130-2-9. During the largemouth bass spawning period, from March 15 to May 15, USACE seeks to maintain generally stable or rising reservoir levels at Allatoona Lake. Generally stable or rising levels are defined as not lowering the reservoir levels by more than 6 inches, with the base elevation generally adjusted upward as levels rise from increased inflows or refilling of the reservoir.
- USACE would continue migratory fish passage operations at Claiborne Lock and Dam and Millers Ferry Lock and Dam, as stated under the No Action Alternative.

5.4 Alternative Plan G (Proposed Action Alternative)

Under the Proposed Action Alternative, USACE would continue to operate federal projects in the ACT Basin in a balanced manner to achieve all authorized project purposes. Operations under the Proposed Action Alternative include the following.

- Implement a revised APCDOP with enhancements recommended by the USFWS, as discussed in Section 4.2.2. The revised APCDOP with USFWS enhancement is depicted in Table 4.2-9.
- Provide for seasonal navigation releases, coupled with seasonal maintenance dredging, to support commercial navigation in the Alabama River for a 9.0-ft or 7.5-ft channel depth as long as sufficient basin inflow above the APC projects is available, as described in Section 4.2.1. Available navigation channel depths in the Alabama River at any given time would be governed by the level of flow that could be delivered through the APC projects. When sufficient basin inflows are not available to support at least a 7.5-ft navigation channel, flow augmentation from the APC projects to support navigation would be suspended, and combined releases from JBT near Montgomery would be reduced to 4,640 cfs or lower if one or more of the drought operations triggers (low basin inflows, low composite conservation storage, or low state line flows) are met.
- APC projects on the Coosa and Tallapoosa Rivers would continue to operate under their current FERC licenses with specific operational requirements. FERC relicensing actions are underway for the Coosa River projects, and APC has requested to modify winter pool levels at the Weiss Lake and Logan Martin Lake projects. Plan G (the Proposed Action Alternative) does not include these APC-proposed modified winter pool levels. [NOTE: The new FERC license, issued on June 20, 2013, following public review of the draft EIS for the ACT WCM update, did not include the proposed modifications to winter pool levels at Weiss and Logan Martin Lakes.]
- The APC project, H. Neely Henry Lake (Coosa River), which operates with a revised guide curve under a FERC license variance (with USACE concurrence) would continue to operate under its revised guide curve (Figure 5.2-1). [NOTE: The new FERC license for APC Coosa River projects issued on June 20, 2013 included the revised guide curve for H. Neely Henry Lake.]
- Specified flow requirements at Allatoona Lake would continue to provide for a 240-cfs minimum flow.
- The existing guide curve at Allatoona Lake would be revised to implement a phased fall drawdown period from early September through December (Figure 5.4-1). Refined operations at Allatoona Lake would include use of four action zones shaped to mimic the seasonal demands for hydropower (Figure 5.4-1). Modifications to the hydropower schedule would be put in place to provide greater operational flexibility to meet power demands while conserving storage. Specifically, under the Plan G (the Proposed Action Alternative), hydropower generation would be reduced during annual drawdown in the fall (September through November). The additional water management measure for Allatoona Lake is described in more detail in Section 4.2.4.

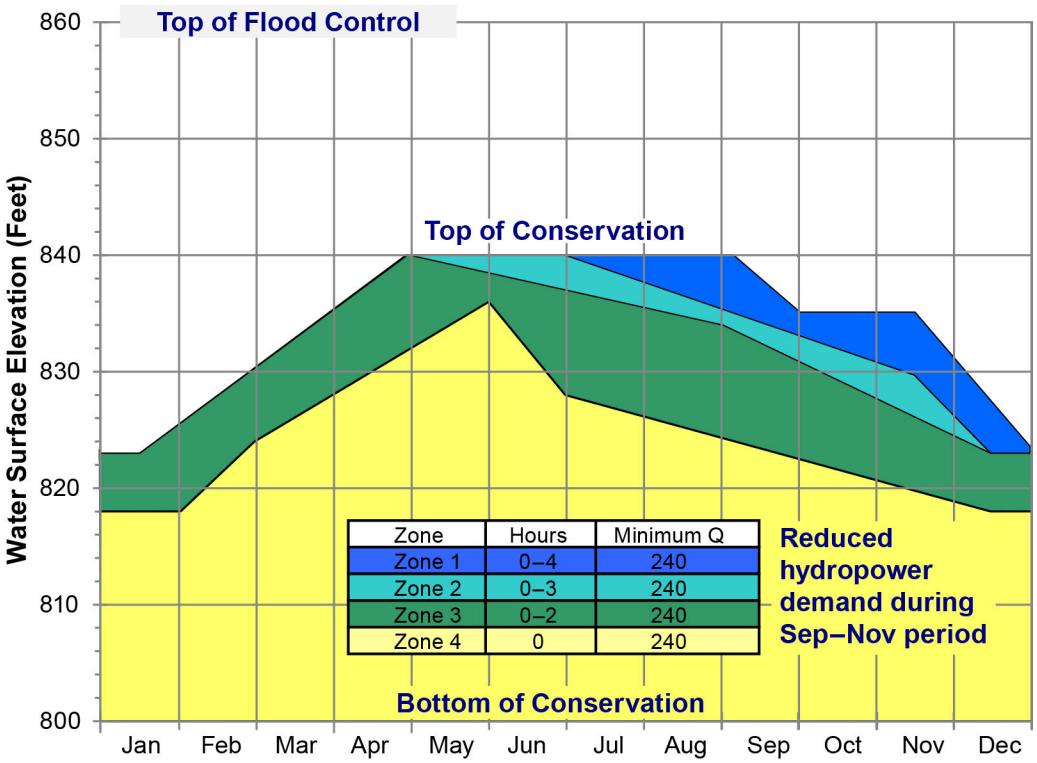


Figure 5.4-1. Operations under the Proposed Action Alternative at Allatoona Lake.

- The current minimum flow requirement would remain at 240 cfs from Carters Reregulation Dam. Refined operations at Carters Lake would include the use of two action zones to manage downstream releases. The top of the new Zone 2 begins at elevation 1,066 ft in January, increasing to 1,070.5 ft in May, dropping to 1,070 ft by October, and returning to elevation 1,066 ft through December (Figure 4.2-8). When Carters Lake is in Zone 1, minimum flow releases at Carters Reregulation Dam would be equal to the seasonal minimum flow. Those minimum flow releases are based on the mean monthly flow upstream of Carters Lake. If Carters Lake elevation drops into Zone 2, minimum flow releases from the Carters Reregulation Dam would be 240 cfs.
- Two entities, the city of Cartersville, Georgia and CCMWA, have entered into water supply agreements for the use of 6,371 ac-ft and 13,140 ac-ft of storage, respectively, in Allatoona Lake for water supply. Total storage allocated to water supply in Allatoona Lake is 19,511 ac-ft.
- The city of Chatsworth has entered into a water supply agreement for the use of 818 ac-ft of storage in Carters Lake for water supply.
- USACE would continue to manage fish spawning operations at Allatoona Lake as outlined in SADR PDS-O-1 and draft Mobile District SOP 1130-2-9. During the largemouth bass spawning period, from March 15 to May 15, USACE seeks to maintain generally stable or rising reservoir levels at Allatoona Lake. Generally stable or rising levels are defined as not lowering the reservoir levels by more than 6 inches, with the base elevation generally adjusted upward as levels rise from increased inflows or refilling of the reservoir.
- USACE would continue migratory fish passage operations at Claiborne Lock and Dam and Millers Ferry Lock and Dam, as stated under the No Action Alternative.

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6 Environmental Consequences

This section of the EIS describes the environmental and socioeconomic effects of proposed updates to water management operations at USACE reservoirs in the ACT Basin. The affected environment described in Section 2 serves as a baseline from which potential environmental and socioeconomic effects likely to result from these proposed changes were determined.

Section 3.1.11 and Table 3.1-2 identifies and provides a brief overview of federal statutes and EOs that are generally relevant to USACE water resource projects and define specific requirements or guidance for federal water resource related activities as part of the framework for decision-making. Compliance with the pertinent federal statutes and executive orders (EOs) for the proposed WCM update is summarized in Table 6-1 below. The table includes the status of compliance for each statute or EO and reference(s) to specific sections in this EIS where the effects on pertinent resources as well as USACE compliance actions (if required) are discussed in more detail.

Table 6-1.
Environmental compliance with applicable laws and EOs

Applicable authority	Status of compliance[a]	Remarks
Federal laws		
Archeological and Historical Preservation Act, 16 U.S.C. 469	Full compliance	See Section 6.8
Archeological Resources Protection Act, 16 U.S.C. 470aa-470ll	Full compliance	See Section 6.8
The CWA, 33 U.S.C. 1344 *et seq.*; also known as the Federal Water Pollution Control Act of 1972	Full compliance	PAA is not subject to section 404 or 401 water quality certification (no discharge of dredged or fill material involved); PAA effects on reservoir and river water quality (including relationship to water quality standards) are described in Section 6.1.2.
CAA, 42 U.S.C. 7401	Full compliance	No effects on air quality (see Section 2.7); Section 309 compliance (EPA review of federal agency EISs) complete upon Final EIS coordination
Coastal Zone Management Act of 1972 as amended P.L. 92-583, 16 U.S.C. 1451-1464	Full compliance	Flows from ACT Basin enter Mobile Bay estuary; PAA would have no effect on the Alabama coastal zone based on the analysis in the EIS (see Section 6.1.1.3.5, 6.5.3.3, and 6.10)
Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9601-9675	Not applicable	The PAA would not be expected to have an effect on hazardous and toxic materials. See Section 2.12
Emergency Wetlands Resources Act of 1986, 16 U.S.C. 3901-3932	Not applicable	Provisions of the Act are not applicable to the proposed WCM update (PAA).
Endangered Species Act, 16 U.S.C. 1531	Full compliance	See Section 6.5.4
Fish and Wildlife Coordination Act	Full compliance	See Section 6.5
Fish and Wildlife Conservation Act, 16 U.S.C. 2901	Full compliance	See Section 6.5
Federal Land Policy and Management Act of 1976, 43 U.S.C. 1701-1784	Full compliance	See Section 6.4

Applicable authority	Status of compliance[a]	Remarks
Magnuson-Stevens Fishery Conservation Management Act, as amended by the Sustainable Fisheries Act of 1996 (P.L. 104-267; 16 U.S.C. 1801	Full compliance	The PAA would not affect essential fish habitat (EFH) in estuarine or marine areas See Section 6.5.3.3
Marine Protection, Research, and Sanctuaries Act of 1972 33 U.S.C. 1401-1445, 16 U.S.C. 1431 *et seq*. and 33 U.S.C. 1271	Not applicable	The PAA would not involve ocean dredged material disposal or any other effects on estuarine or marine resources (see Section 6.5.3.3).
Migratory Bird Treaty Act, 16 U.S.C. 701-719c	Full compliance	See Section 6.5.2
NEPA, P.L. 91-190	Full compliance	Section 6 and pertinent portions of Section 2 address environmental consequences of the PAA. The EIS meets the requirements of NEPA and implementing regulations.
The National Historic Preservation Act, 16 U.S.C. 470 *et seq.*	Full compliance	See Section 6.8
Noise Control Act of 1972 as amended, 42 U.S.C. 4901 *et seq*.	Full compliance	See Section 2.9
North American Wetlands Conservation Act, 16 U.S.C. 4401 *et seq*.	Not applicable	Provisions of the Act are not applicable to the proposed WCM update (PAA).
Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901-6992k	Not applicable	The PAA would not be expected to have an effect on hazardous and toxic materials. See Section 2.11
Safe Drinking Water Act as amended, 42 U.S.C. 300f *et seq*, 6939b and 15 U.S.C. 1261 *et seq*.	Not applicable	Provisions of the Act are not applicable to the proposed WCM update (PAA).
Toxic Substances Control Act of 1976, 15 U.S.C. 2601	Not applicable	The PAA would not be expected to have an effect on hazardous and toxic materials. See Section 2.11
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001	Not applicable	Provisions of the Act are not applicable to the proposed WCM update (PAA).
Water Pollution Control Act Amendments of 1961, P.L. 87-88	Full compliance	See Section 6.1.2
Executive Orders		
EO 11988: Floodplain Management	Full compliance	See Section 6.1.1.1, 6.5.1, 6.5.3, 6.6.5
EO 11990: Protection of Wetlands	Full compliance	See Section 6.5.1
EO 12088: Federal Compliance with Pollution Control Standards	Full compliance	Effects of the PAA with respect to pollution control standards established under the laws cited in the EO have been fully considered and addressed in Sections 2 and 6 of the EIS.
EO 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	Full compliance	See Section 6.6.8
EO 13045: Protection of Children from Environmental Health Risks and Safety Risks	Full compliance	See Section 6.6.9
EO 13061: American Heritage Rivers	Not applicable	No designated American Heritage Rivers in ACT Basin
EO 13175: Consultation and Coordination with Indian Tribal Governments	Full compliance	See Section 6.8
EO 13186: Responsibilities of Federal Agencies to Protect Migratory Birds	Full compliance	See Section 6.5.2
EO 13423: Strengthening Federal Environmental, Energy, and Transportation Management (replaced EOs 13101, 13123, and 13148)	Not applicable	Does not directly apply to reservoir management activities and the proposed WCM update (PAA)

[a] Full compliance will be documented upon completion of public coordination of the Final EIS and signing of a Record of Decision.

The USACE Environmental Operating Principles (EOP) are introduced and described in Section 3.1.7, and they are applicable to all USACE activities, including the ACT WCM update. Throughout the ACT WCM update process, including scoping and coordination with agencies and the public, formulation of alternatives, technical analysis of alternatives, consideration of trade-offs and environmental consequences, and selecting the Proposed Action Alternative, these environmental principles for USACE activities have been applied.

6.1 Water Resources

The HEC-ResSim model was used to simulate flow operations in the ACT Basin. HEC-ResSim is a state-of-the-art tool for simulating flow operations in managed systems. The USACE Hydrologic Engineering Center (HEC) developed this software, which is now the standard for USACE reservoir operations modeling. The analysis for this water control plan update at the draft EIS stage was performed using HEC-ResSim Version 3.1 *Release Candidate 3, Build 42* (2010). *Release Candidate* means that the software was undergoing final testing before distribution as an official version. HEC-ResSim is the next generation graphic user interface-based reservoir operations simulation software that replaces its predecessor, HEC-5.

HEC-ResSim has a graphical user interface designed to follow Windows® software development standards. The model's interface can be learned without extensive tutorials. Familiar data entry features make model development relatively easy, and localized mini plots graph the data entered in most tables so that errors can be seen and corrected quickly. A variety of default plots and reports, along with tools to create customized plots and reports, facilitate output analysis.

HEC-ResSim provides a realistic view of the physical river/reservoir system using a map-based schematic. The program's user interface allows the user to draw the network schematic as a stick figure or as an overlay on one or more geo-referenced maps of the watershed. HEC-ResSim represents a system of reservoirs as a network composed of four types of physical elements: junctions, routing reaches, diversions, and reservoirs. By combining those elements, the HEC-ResSim modeler is able to build a network capable of representing anything from a single reservoir on a single stream to a highly developed and interconnected system like that of the ACT Basin. A reservoir is the most complex element of the reservoir network and is composed of a pool and a dam. HEC-ResSim assumes that the pool is level (i.e., it has no routing behavior), and its hydraulic behavior is completely defined by an elevation-storage-area table. The real complexity of HEC-ResSim's reservoir network begins with the dam.

The ACT reservoirs are constructed for one or more of the following purposes: flood risk management, hydropower generation, navigation, recreation, water supply, water quality, and fish and wildlife conservation. The purposes typically define the goals and constraints that describe the reservoir's release objectives. Other factors that might influence the objectives include time of year, hydrologic conditions, water temperature, current pool elevation (or zone), and simultaneous operations by other reservoirs in a system. HEC-ResSim uses an original rule-based description of the operational goals and constraints that reservoir operators must consider when making release decisions.

For purposes of evaluating alternative operational plans for the ACT WCM update, a 70-year hydrologic period of record (1939 through 2008) was initially used to run the simulations at the draft EIS stage for the WCM update. Historical water use data were provided by the appropriate state agencies to model water diversions in the ACT Basin. Net water withdrawals for all documented diversions throughout the ACT Basin for 2006 were used to model water diversions in the basin, except for diversions at Allatoona Lake (CCMWA and city of Cartersville) and Carters Lake (city of Chatsworth). In those cases, existing water supply storage agreement values were used in the model at the draft EIS stage. Year 2006 represents the greatest annual amount of water diversions in the ACT Basin during the period of

simulation and, consequently, the year of greatest stress on the system from water withdrawals for human use. Starting with average monthly values for each diversion, average daily values were calculated for each month (by dividing by the number of days), resulting in a year of daily values. The values were repeated and applied to each calendar year in the simulation. In other words, the diversions were applied to hydrologic conditions for each year in the period of record in the model simulation. Generally the differences between the No Action Alternative and the other alternatives described in subsequent sections are due to the proposed water management operations. However, some of the observed differences may be due to the water supply assumptions made for the No Action alternative compared to the other alternatives.

For the WCM update at the draft EIS stage, USACE determined that the 70-year hydrologic period of record (1939–2008) would provide a reasonable range of future hydrologic conditions by which to assess and compare the effects that would be expected from existing project operations (the No Action Alternative) and alternative water management plan updates. The model includes the following basic assumptions that apply to the simulations for the ACT Basin:

- All the current USACE and APC projects would be in place and operational over the entire period of record.
- Diversions (withdrawals and returns) would occur at 2006 levels over the entire period of record and would be incorporated into the model, with the exception of CCMWA, Cartersville, and Chatsworth withdrawals from Allatoona and Carters lakes as described above.
- USACE and APC projects in the ACT Basin would be operated over the entire period of record as they are currently operated (applicable to the No Action Alternative) or as they would be operated under each of the alternative water management plan updates.

Subsequent to agency and public review of the draft EIS as well as further review by the USACE technical team, adjustments and updates were made to the HEC-ResSim modeling for the ACT Basin. All of the pertinent revisions to the HEC-ResSim model are described in detail in an addendum to the HEC-ResSim modeling report included in Appendix C of the EIS. The key revisions and updates to the modeling reflected in the final EIS for the WCM update include:

- The baseline condition (No Action Alternative) for analysis of alternatives was revised to reflect actual withdrawals by CCMWA and the city of Cartersville from Allatoona Lake as well as the city of Chatsworth from Carters Lake. For purposes of the HEC-ResSim model, "actual withdrawals" are represented by actual water use reported throughout the basin in 2006, which represents the greatest annual amount of water diversions in the ACT Basin during the period of simulation and, consequently, the year of greatest stress on the system from water withdrawals for human use. For all alternative plans for the WCM update, withdrawals from the USACE reservoirs by these entities continued to be based upon withdrawal rates commensurate with current water supply storage agreements with USACE. Refer to Section 4.2.6 for a more detailed description of how CCMWA, Cartersville, and Chatsworth withdrawals were considered in the No Action Alternative and the WCM update alternatives.
- The hydrologic period of record for unimpaired flows and for model simulation of the ACT WCM update alternatives was extended from 70 years (1939-2008) used in the draft EIS to 73 years (1939-2011) for use in the final EIS.
- Provisions for operation of the recently completed Hickory Log Creek reservoir were incorporated into the HEC-ResSim model. An updated description of Hickory Log Creek reservoir is provided in Section 2.1.1.1.4.17 of the EIS. Refer to the addendum to the HEC ResSim modeling report in Appendix C of the EIS for a detailed description of how the Hickory Log Creek reservoir and associated operations were incorporated into the model.

- The Carters-Carters Reregulation Dam flood risk management operation was changed from a seasonal maximum channel capacity rule (varied from 3,200 to 5,000 cfs) to a constant maximum capacity of 5,000 cfs.
- Based on further review of available data during and following the comment period for the draft EIS, the Corps technical team made some adjustments to the navigation "template" for the months of November and December. The navigation template provides the technical basis for the monthly flow requirements necessary to support navigable channel depths in the Alabama River.
- Based on APC comments on the draft EIS for the WCM update, APC reservoir storage-elevation tables and other pertinent physical reservoir data were revised and updated in the model as well as in the WCMs and EIS.
- Minor adjustments were made to the low basin inflow drought trigger table for the drought management plan in coordination with APC.
- USACE used an updated version of the HEC-ResSim model (version 3.2 Dev), December 2013 Build 3.2.1.22, in lieu of HEC-ResSim version 3.1.

Based on the HEC-ResSim model updates described above, model simulations were re-run for the water management alternatives considered in the draft EIS (No Action, Alternative D, Alternative F, and Alternative G (Proposed Action), and the Environmental Consequences section was updated accordingly.

In addition, further model simulations were conducted to better understand the sensitivity of the Proposed Action Alternative to the potential implications of (1) projected increases in long-range water supply demands in the basin, (2) potential for a long term reduction in rainfall in the basin due to climate change, and (3) potential for increased air temperature due to climate change. Both HEC-ResSim and HEC-5Q (addressing water quality) were run to compare the effects of the Proposed Action Alternative for these scenarios. These scenarios, the associated sensitivity analysis process, and the potential effects are discussed in more detail in Section 6.9 (Sensitivity Analysis) and 6.10 (Cumulative Effects). Details associated with the modeling for the sensitivity analysis are provided in Appendices C (HEC-ResSim) and D (HEC-5Q).

Given the assumptions used in the HEC-ResSim model for the ACT Basin, observed or historic values for such parameters as lake levels or flows during the hydrologic period of record, would be expected to vary from computed values in the simulations for the No Action Alternative. While observed values may track closely with model results in some cases, there are likely to be many cases where the differences could be more substantial because the model is not intended to replicate historic operating conditions.

The analysis presented in this final EIS is based upon model simulations completed and made available to the project team for analysis in May 2014.

6.1.1 Water Quantity Environmental Consequences

The following sections describe the expected effects of the No Action Alternative; Alternative Plans D and F; and the Proposed Action Alternative (Plan G) for update of the WCM for the ACT Basin on water quantity considerations, including flood risk management operations, reservoir water surface elevations and associated storage considerations, streamflow, drought operations, navigation conditions, and water withdrawals.

Numerous figures are used throughout the following sections to describe and compare the effects of the No Action Alternative and the three alternative plans. In a number of cases, results for two or more of the plans were nearly identical for a portion of the plot (or curve) or over the entire range. The curves were

plotted in the following order: No Action Alternative, Plan D, Plan F, and the Proposed Action Alternative. If fewer than four curves appear on a figure, the data for one or more of the alternatives plotted is identical to another. The last curve plotted will appear in the figure if one or more is (are) identical. The text associated with each figure will provide specific clarification as necessary.

6.1.1.1 Flood Risk Management Operations

In developing potential water management measures and operational alternatives for update of the ACT Basin WCM, management measures that would involve using allocated flood storage for purposes other than flood storage were not considered. Thus, water management measures that would likely increase flood risks were not included in the WCM update alternatives. Potential water management measures that would at least maintain, or incidentally improve, existing flood risk management levels were considered in the alternative plans. Current water control objectives and operational guidelines for flood risk management in the ACT Basin are described in Section 2.1.1.2 and in the existing project water control manuals.

6.1.1.1.1 No Action Alternative

Implementing the No Action Alternative would continue to provide the current level of flood risk management at USACE and APC projects in the ACT Basin that are specifically authorized to operate for that purpose, including Allatoona Lake (USACE), Carters Lake (USACE), Weiss Lake (APC), H. Neely Henry Lake (APC), Logan Martin Lake (APC), and R.L. Harris Lake (APC).

The No Action Alternative does not include proposed winter guide curve revisions for APC's Weiss, H. Neely Henry, and Logan Martin lakes, which are under consideration as part of the ongoing FERC relicensing process for APC's Coosa River Hydropower Project. Those proposed revisions are described in Sections 2.1.1.1.4.3 through 2.1.1.1.4.5. Under the FERC relicensing process, the potential effects of the proposed revisions on the flood risk management function of the projects will be considered. USACE is involved in reviewing the flood risk management aspects of the proposed guide curve revisions for the new FERC license. If the proposed guide curve revisions are incorporated into the new license by FERC, future update(s) to the ACT Basin WCM may be needed to address pertinent operational changes for flood risk management.

[NOTE: On June 20, 2013, following public review of the draft EIS for the ACT WCM update, FERC issued a new license for the APC Coosa River projects. The license approved the proposed revision to the H. Neely Henry guide curve (with concurrence from USACE) but did not take action on the proposed Weiss Lake and Logan Martin Lake guide curve revisions. Any future modification of the FERC license to accommodate guide curve revisions for Weiss and Logan Martin lakes will require USACE review and concurrence, and possible further update of the ACT WCM, as described above.]

6.1.1.1.2 Alternative Plan D

For Plan D, no changes to the guide curves or flood operations are proposed for Allatoona Lake or Carters Lake. Plan D incorporates proposed winter guide curve change to APC's H. Neely Henry Lake as described in Section 2.1.1.1.4.4. USACE has concurred with APC (and has indicated to FERC) that the change would have no adverse effect on flood operations in the ACT Basin. No changes to guide curves or current flood operations for Weiss, Logan Martin, or R.L. Harris lakes are included in Plan D. Plan D, as presented herein, would have neither an adverse or beneficial effect with respect to existing flood operations in the ACT Basin.

Proposed winter guide curve revisions for APC's Weiss and Logan Martin lakes are under consideration in the ongoing FERC relicensing process for APC's Coosa River Hydropower Project. Potential flood risk management implications associated with the proposed revisions will be addressed separately as described in Section 6.1.1.1.1 above. [NOTE: The new FERC license for APC Coosa River projects was issued on June 20, 2013, and did not include approval of guide curve changes for Weiss and Logan Martin lakes.]

6.1.1.1.3 Alternative Plan F

Plan F includes the revised fall phased drawdown guide curve for Allatoona Lake; no change to the Carters Lake guide curve or current flood operations; a proposed winter guide curve change for APC's H. Neely Henry Lake as described in Section 2.1.1.1.4.4; and no changes to guide curves or flood operations for Weiss, Logan Martin, or R.L. Harris lakes. The proposed fall phased drawdown guide curve at Allatoona Lake necessitated an analysis to determine potential effects on flood conditions downstream of the project.

Three historic flood events (December 1961, March 1979, and March 1990), all of which had distinctly different storm patterns in the upper ACT Basin, were selected to use as patterns for five frequency events, expressed as percent probability of occurrence in any given year (0.2, 0.5, 1.0, 2.0, and 5.0). The fall phased drawdown operation would have no effect on flood frequency flows at Kingston, Georgia (about 26.4 mi downstream of Allatoona Lake) for the 1961 and 1990 hydrograph shapes and would slightly reduce the flood frequency flows at Kingston for the 1979 hydrograph shape. The fall phased drawdown operation would have no effect on flood frequency flows at the Rome-Coosa gage, Georgia (about 56 mi downstream of Allatoona Lake) for the 1961 hydrograph shape and would slightly reduce the flood frequency flows at the Rome-Coosa gage for the 1979 and 1990 hydrograph shapes. The detailed analyses for effects on flood risk management capability resulting from potential Allatoona Lake guide curve revisions are summarized in Section 6.6.5.2.1 and are presented in the HEC-ResSim Modeling Report for the ACT Basin (EIS Appendix C).

Apart from the effects of the fall phased drawdown at Allatoona Lake as described above, Plan F would have neither an adverse or beneficial effect on flood risk management operations in the balance of the ACT Basin.

Proposed winter guide curve revisions for APC's Weiss and Logan Martin lakes are under consideration in the ongoing FERC relicensing process for APC's Coosa River Hydropower Project. Potential flood risk management implications associated with those proposed revisions will be addressed separately as described in Section 6.1.1.1.1 above. [NOTE: The new FERC license for APC Coosa River projects was issued on June 20, 2013, and did not include approval of guide curve changes for Weiss and Logan Martin lakes.]

6.1.1.1.4 Alternative Plan G (Proposed Action Alternative)

The Proposed Action Alternative includes the revised fall phased drawdown guide curve, with reduced hydropower generation during the drawdown period, for Allatoona Lake; no change to the Carters Lake guide curve or current flood operations; a proposed winter guide curve change to APC's H. Neely Henry Lake as described in Section 2.1.1.1.4.4; and no changes to guide curves or flood operations for Weiss, Logan Martin, or R.L. Harris lakes.

The Allatoona Lake fall phased drawdown guide curve feature would have the same beneficial effect on flood risk management operations downstream of Allatoona Lake as described for Plan F above. The additional water management measure for Allatoona Lake included in the Proposed Action (reduction of

hydropower generation during the fall drawdown period) would have no adverse or beneficial effects on flood risk management operations at Allatoona Lake.

Apart from the effects of the fall phased drawdown at Allatoona Lake as described above, the Proposed Action would have neither an adverse or beneficial effect on flood risk management operations in the balance of the ACT Basin.

Proposed winter guide curve revisions for APC's Weiss and Logan Martin lakes are under consideration in the ongoing FERC relicensing process for APC's Coosa River Hydropower Project. Potential flood risk management implications associated with the proposed revisions will be addressed separately as described in Section 6.1.1.1.1 above. [NOTE: The new FERC license for APC Coosa River projects was issued on June 20, 2013, and did not include approval of guide curve changes for Weiss and Logan Martin lakes.]

6.1.1.2 Lake Level Conditions in the ACT Basin

This section summarizes the effects of alternative water management plans for the ACT Basin on USACE and APC reservoirs throughout the system. Representative summaries of HEC-ResSim model outputs will be presented on the basis of simulation of project operations under the alternative plans over the modeled period of record (1939–2011). On the basis of the model results, this section describes the likely impacts on lake levels and associated conservation storage conditions at pertinent USACE and APC reservoirs. For purposes of addressing the effects of the No Action Alternative and Plans D, F, and G (the Proposed Action Alternative) on lake level conditions in the basin, this section first addresses the most upstream USACE reservoirs (Carters Lake and Allatoona Lake) individually. Following those summaries, the APC projects on both the Coosa and Tallapoosa rivers are addressed as a group. Lastly, the three USACE lakes on the Alabama River downstream of Montgomery (R.E. "Bob" Woodruff Lake, William "Bill" Dannelly Lake, and Claiborne Lake) operate essentially in series and largely in response to water management actions at the upstream APC reservoirs. Consequently, those three projects are addressed as a group with respect to assessing lake level conditions associated with the No Action Alternative and the alternative plans.

In the final EIS, figures depicting "median" lake level conditions in the basin have been included in lieu of "average" conditions. Median values are considered to provide a more representative characterization of conditions for evaluation and comparison among alternatives. Instead of a numeric average of a set of values over the modeled period of record, the median value represents the point at which 50 percent of the values are higher and 50 percent are lower. In addition, figures depicting the 90 percent exceedance level have been included, meaning that the values presented for each day would be exceeded 90 percent of the time over the period of record. The 90 percent exceedance value would be representative of extremely dry conditions in the basin and low basin inflow to the reservoirs. These figures were added in response to several public comments requesting more information and greater focus on how the alternative plans perform under extreme drought conditions.

6.1.1.2.1 Carters Lake

As indicated in Section 2.1.1.1.4.1, the Carters Lake project operates as a pumped storage hydropower generation facility. Hydropower generation occurs during periods of peak power demand. Water released during hydropower generation is captured in the reregulation pool immediately downstream and, with the exception of prescribed minimum flow releases from the reregulation dam, is pumped back up into Carters Lake during off-peak hours to be reused for hydropower generation during subsequent peak demand periods. This section describes the effects of operations under the No Action Alternative and Alternatives D, F, and G (Proposed Action Alternative).

Figure 6.1-1 through Figure 6.1-3 present results of model outputs of Carters Lake operations over the modeled period of hydrologic record for existing conditions (or the No Action Alternative). The figures also present results for proposed revisions to the ACT WCM as defined in Alternative Plans D, F, and G (the Proposed Action). The results for the alternatives will be discussed in subsequent subsections.

6.1.1.2.1.1 No Action Alternative

Figure 6.1-1 depicts the median daily water surface elevation over the modeled period of record for the No Action Alternative. Median daily water surface elevations would generally follow the shape of the guide curve between January and July. Median daily pool levels would decline from August through October by about 0.4 ft below the guide curve. During the fall drawdown period and through the month of December, the median daily pool level would be expected to follow the project guide curve.

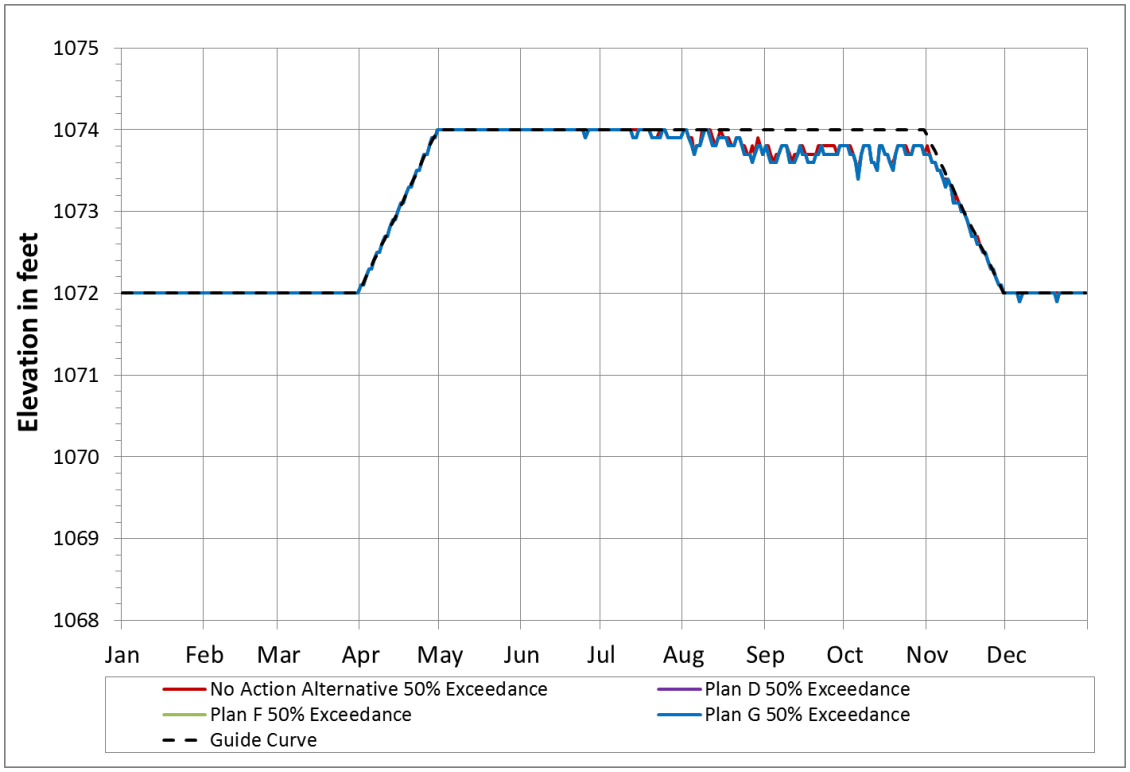


Figure 6.1-1. Carters Lake, median daily water surface elevation over the modeled period of record (1939–2011).

Figure 6.1-2 depicts daily water surface elevations throughout the year that would be exceeded 90 percent of the time over the modeled period of record. The 90 percent exceedance values would reflect conditions representative of low basin inflow (or drought) in the basin. For the No Action Alternative at the 90 percent exceedance level, pool elevations would be 0.6 ft or less below the guide curve for the months of January through April. For the months of May through November when the guide curve is at elevation 1,074 ft, daily water surface elevations for the No Action Alternative (90 percent exceedance) would fluctuate between 0.4 ft and 1.8 ft below the guide curve. Similar fluctuations below the guide curve would be expected to continue during the fall drawdown period and through the month of December.

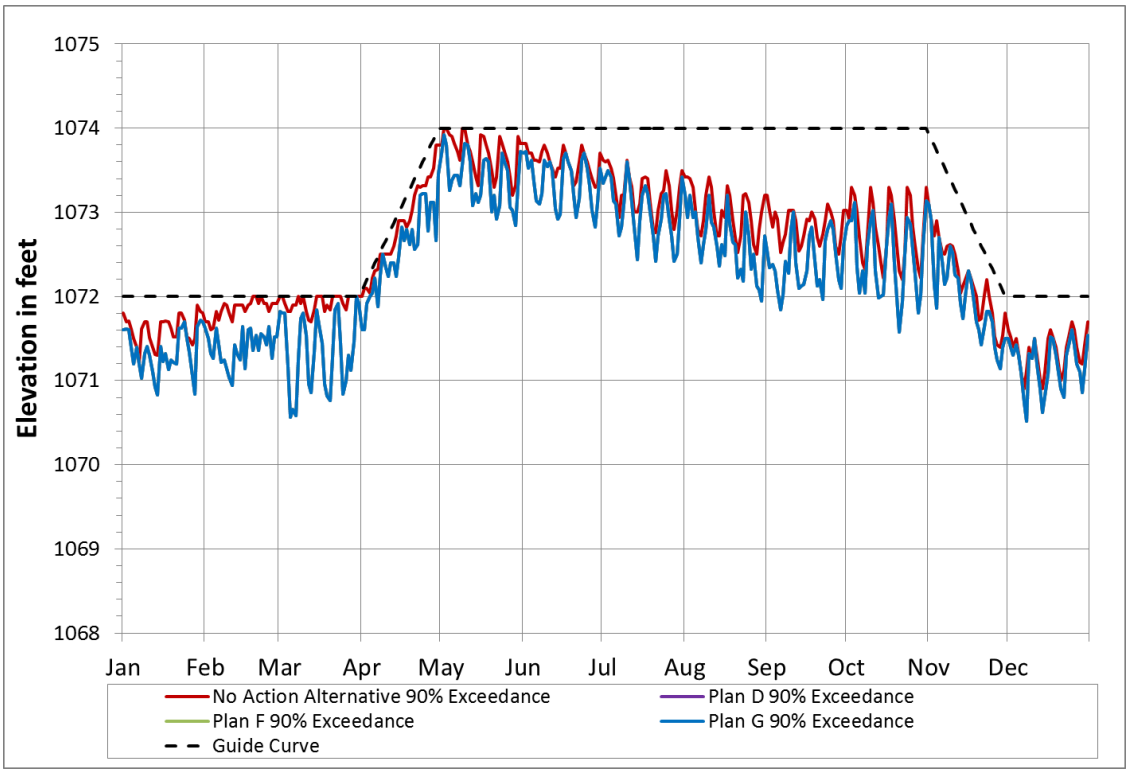


Figure 6.1-2. Carters Lake, daily water surface elevations that would be exceeded 90 percent of the time over modeled period of record (1939–2011).

For the No Action Alternative, Figure 6.1-3 indicates that a water surface elevation of 1,072 ft (equal to the winter guide curve level and 2 ft below summer pool level) would likely be equaled or exceeded on 90 percent of the days during the modeled period of record. Carters Lake would be expected to maintain a highly stable average daily water surface elevation, ranging between elevation 1,071 ft and 1,074 ft about 98 percent of the time. Using the established routine operating parameters for the No Action Alternative, the lowest pool elevation that would be expected over the modeled period of record would be about elevation 1,063 ft, which would be 9 ft below the winter guide curve level.

It should be noted that historically observed lake levels may not match modeled lake levels for the No Action Alternative and, under extreme hydrologic conditions in the ACT Basin, may differ substantially as extraordinary water management actions may be required at certain projects to address special circumstances. The No Action Alternative in the HEC-ResSim model assumes a constant level of hydropower generation at Carters Dam as a basis for comparison of the effects of different water management scenarios. Depending on the hydropower needs in the basin at any given time, the District has the discretion to meet the demand or to operate a bit more conservatively. For example, under extreme drought conditions in the basin in December 2007, Carters Lake dropped to a record low of about 1045 ft for a brief time. Due to significant drought-related operational constraints at other reservoir projects in the system during that period, the bulk of hydropower generated by the Mobile District was produced at Carters Dam because of its large available capacity to generate power and its pumpback capability.

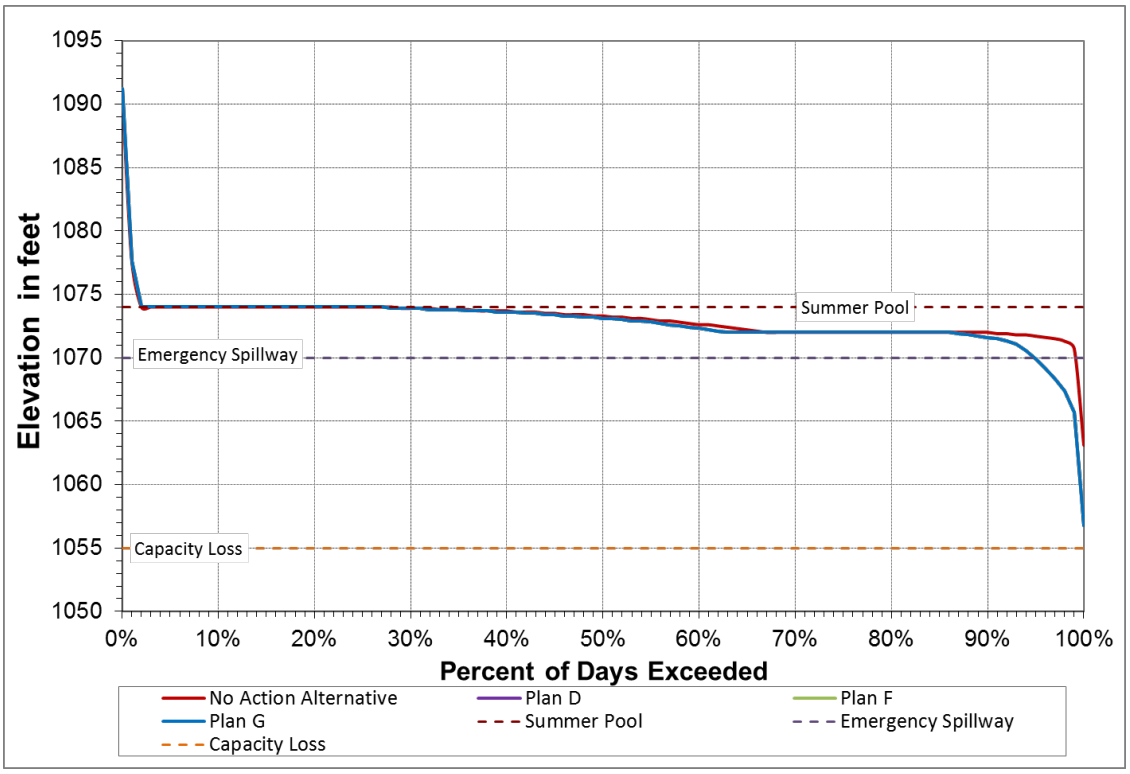


Figure 6.1-3. Carters Lake, daily water surface elevations—percent of days exceeded over modeled period of record (1939–2011).

For the No Action Alternative, the Carters Reregulation Dam pool downstream of Carters Lake would continue to fluctuate widely on a daily basis (as described in Section 2.1.1.1.4.1) as waters discharged into the pool from Carters Lake during peaking hydropower generation are pumped back into Carters Lake during off-peak hours.

6.1.1.2.1.2 Alternative Plan D

As presented in Figure 6.1-1, median daily water surface elevations would essentially match the elevations for the No Action Alternative. In some instances, the, modeling indicates that Plan D water surface elevations may be slightly lower, but only by 0.1 to 0.2 ft. Median daily water surface elevations under Plan D over the modeled period of record would equal the guide curve elevation from January through July and November through December. The change in operations under Plan D to implement seasonal minimum flows downstream of Carters Reregulation Dam would have negligible effect on median daily water surface elevations in Carters Lake.

At the 90 percent exceedance level for Carters Lake water surface elevations, Figure 6.1-2, Plan D would likely produce daily elevations that range from about 0.1 to 1.3 ft lower than the No Action Alternative from January through March. For the balance of the months, that difference would decrease to a range of about 0.1 to 0.6 ft. Implementation of seasonal minimum flows downstream of Carters Reregulation Dam is likely to be responsible for a slight decrease in Carters Lake water surface elevations under drier conditions in the basin.

For Plan D, Figure 6.1-3 indicates that a water surface elevation of 1,072 ft (equal to the winter guide curve level and 2 ft below summer pool level) would likely be exceeded over 86 percent of the days during the modeled period of record. Daily average lake levels would be likely to remain highly stable

under Plan D, with water surface elevations ranging between elevation 1,071 ft and 1,074 ft about 93 percent of the time. The percent of days exceeded values are slightly lower for Plan D compared to the No Action Alternative. The lowest pool elevation that would be expected over the modeled period of record would be about elevation 1,057 ft, 15 ft below the winter guide curve level. For infrequent periods where drier conditions would prevail (fewer than 10 percent of the days over the modeled period of record), lake levels would tend to range from slightly lower to as much as 6 ft lower under Plan D compared to the No Action Alternative.

The Carters Reregulation Dam pool downstream of Carters Lake would continue to fluctuate widely on a daily basis under Plan D (as described for the No Action Alternative) as waters discharged into the reregulation pool from Carters Lake during peaking hydropower generation are pumped back into Carters Lake during off-peak hours. The pool fluctuations under Plan D would likely be no different than those under No Action Alternative.

6.1.1.2.1.3 Alternative Plan F

Implementing Plan F would likely result in the same effects on water surface elevations in Carters Lake as would result from Plan D. The curves for Carters Lake depicting median daily water surface elevation (Figure 6.1-1), daily water surface elevations at the 90 percent exceedance level (Figure 6.1-2), and water surface elevation percent of days exceeded (Figure 6.1-3) over the modeled period of record are essentially identical to the curves for Plan D.

The Carters Reregulation Dam pool downstream of Carters Lake would continue to fluctuate widely on a daily basis (as described for the No Action Alternative) as waters discharged into the reregulation pool from Carters Lake during peaking hydropower generation are pumped back into Carters Lake during off-peak hours. The pool fluctuations under Plan F would likely be no different than the No Action Alternative.

6.1.1.2.1.4 Alternative Plan G (Proposed Action Alternative)

Implementing the Proposed Action Alternative would likely result in the same effects on water surface elevations in Carters Lake as would result from Plan D. The curves for Carters Lake depicting median daily water surface elevation (Figure 6.1-1), daily water surface elevations at the 90 percent exceedance level (Figure 6.1-2), and water surface elevation percent of days exceeded (Figure 6.1-3) over the modeled period of record are essentially identical to the curves for Plan D.

The Carters Reregulation pool downstream of Carters Lake would continue to fluctuate widely on a daily basis (as described for the No Action Alternative) as waters discharged into the reregulation pool from Carters Lake during peaking hydropower generation are pumped back into Carters Lake during off-peak hours. The pool fluctuations under the Proposed Action Alternative would likely be no different than the No Action Alternative.

6.1.1.2.2 Allatoona Lake

Allatoona Lake has about 11.7 percent of available conservation storage in the ACT Basin. As described in Section 2.1.1.1.4.2, the lake levels fluctuate seasonally as conservation storage is used to meet hydropower generation demands and downstream water needs and to accommodate flood risk management functions of the project. The following subsections describe the effects the No Action Alternative and Alternative Plans D, F, and G would have on lake level conditions at Allatoona Lake.

Figure 6.1-4 through Figure 6.1-7 present results of model outputs for Allatoona Lake operations over a 73-year period of hydrologic record (1939–2011) for existing conditions (or the No Action Alternative) and for proposed revisions to the ACT WCM as defined in Alternative Plans D, F, and G (the Proposed Action).

6.1.1.2.2.1 No Action Alternative

Figure 6.1-4 presents the median daily water surface elevation from model simulations over the modeled hydrologic period of record (1939–2011). For the No Action Alternative, the simulation indicates that the median daily elevation closely follows the guide curve (top of conservation pool) for the project from the months of January through May. Beginning in early June, the median daily elevation would gradually decline through the summer months and into the early fall, such that by early October the median daily water surface elevation under the No Action Alternative would be about seven ft below the top of conservation pool. The water surface elevation would gradually continue to decline from October through November, generally consistent with the fall drawdown period for the current guide curve but declining at a slower rate than the guide curve. By early December, the median daily water surface elevation for the No Action Alternative would again closely follow the current guide curve. For months of August and September over the modeled period of record, the median daily water surface elevations under the No Action Alternative would be several feet below the guide curve, consistent with historical trends.

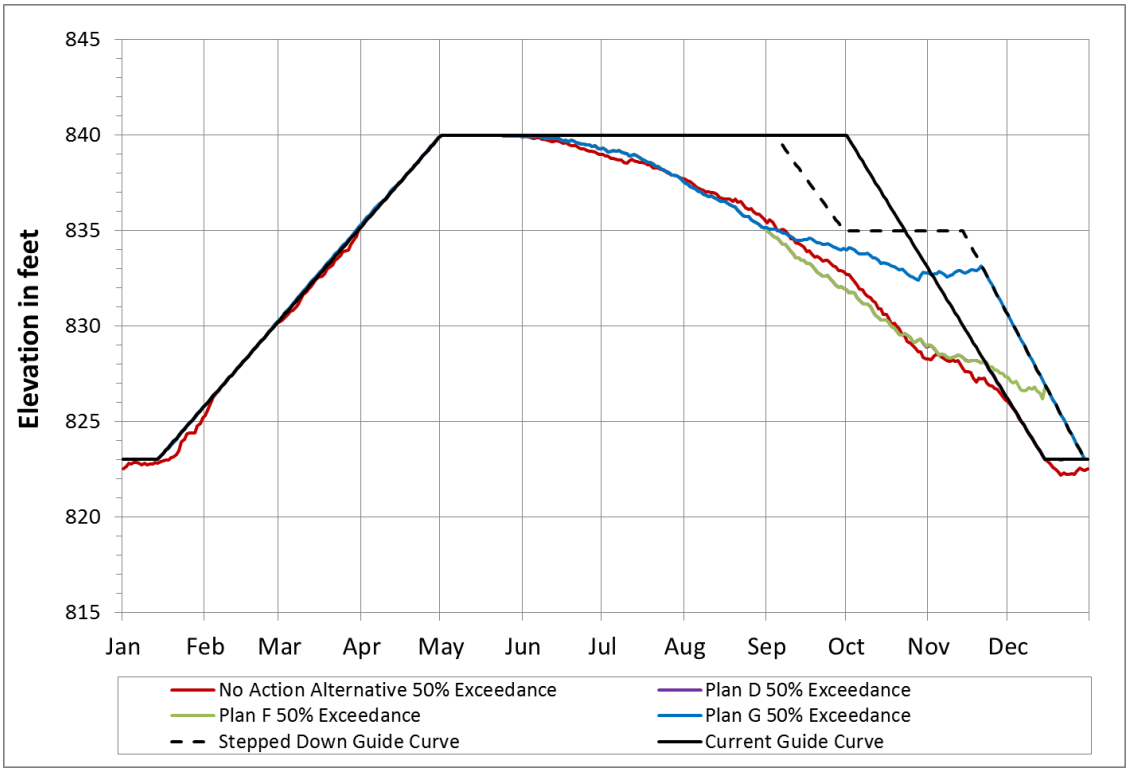


Figure 6.1-4. Allatoona Lake, median daily water surface elevation over modeled period of record (1939–2011).

Figure 6.1-5 depicts daily water surface elevations throughout the year that would be exceeded 90 percent of the time over the modeled period of record, representative of extremely low basin inflow (or drought) conditions in the basin. For the No Action Alternative, water surface elevations at the 90 percent exceedance level would likely range two to three feet below the guide curve from January through May.

From June through December at the 90 percent exceedance level, daily water surface elevations would steadily decline from about elevation 838.5 ft on June 1 to about 821 ft on December 31. Based upon the proposed fall phased drawdown guide curve, elevations for the No Action Alternative would be about 5.5 ft below the guide curve elevation on August 1, about 8.5 ft below on September 1, about 7.8 ft below on October 1, and about 10.3 ft below on November 1.

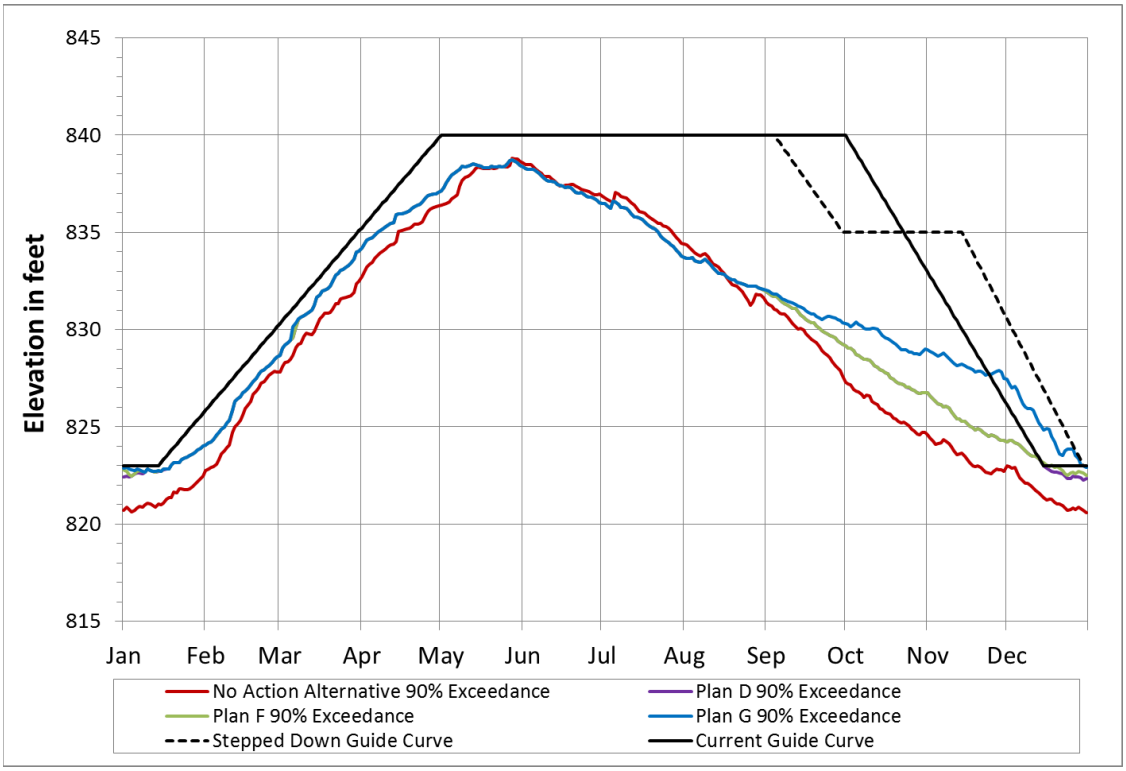


Figure 6.1-5. Allatoona Lake, daily water surface elevations that would be exceeded 90 percent of the time over modeled period of record (1939–2011).

Figure 6.1-6 provides information on the percentage of days during the 73-year modeled period of record that lake levels would be expected to exceed a range of water surface elevations, including certain elevations that are key indicators of potential impact on resources or uses of the lake. Those key elevations include the indicators for level of impact on recreational use of the lakes: Initial Impact level (IIL); Recreation Impact level (RIL), and Water Access Limited (WAL) level. Those impact levels are defined in Section 2.1.1.2.1.4, and the specific recreational impacts are discussed in Section 6.6.6. As delineated, the current guide curve for Allatoona Lake (applicable to the No Action Alternative) calls for the water surface elevation to be below the IIL about 50 percent of the time during the year, below the RIL about 44 percent of the time, and below the WAL level about 22 percent of the time. For the No Action Alternative at Allatoona Lake, lake elevations during the modeled period of record would be expected to decline below the IIL on 66 percent of the days, below the RIL on 57 percent of the days, and below the WAL level on 29 percent of the days. Over the modeled period of record, the lowest water surface elevation that the lake would be expected to reach would be elevation 816.9 ft, more than 6 ft below the winter guide curve level (elevation 823 ft).

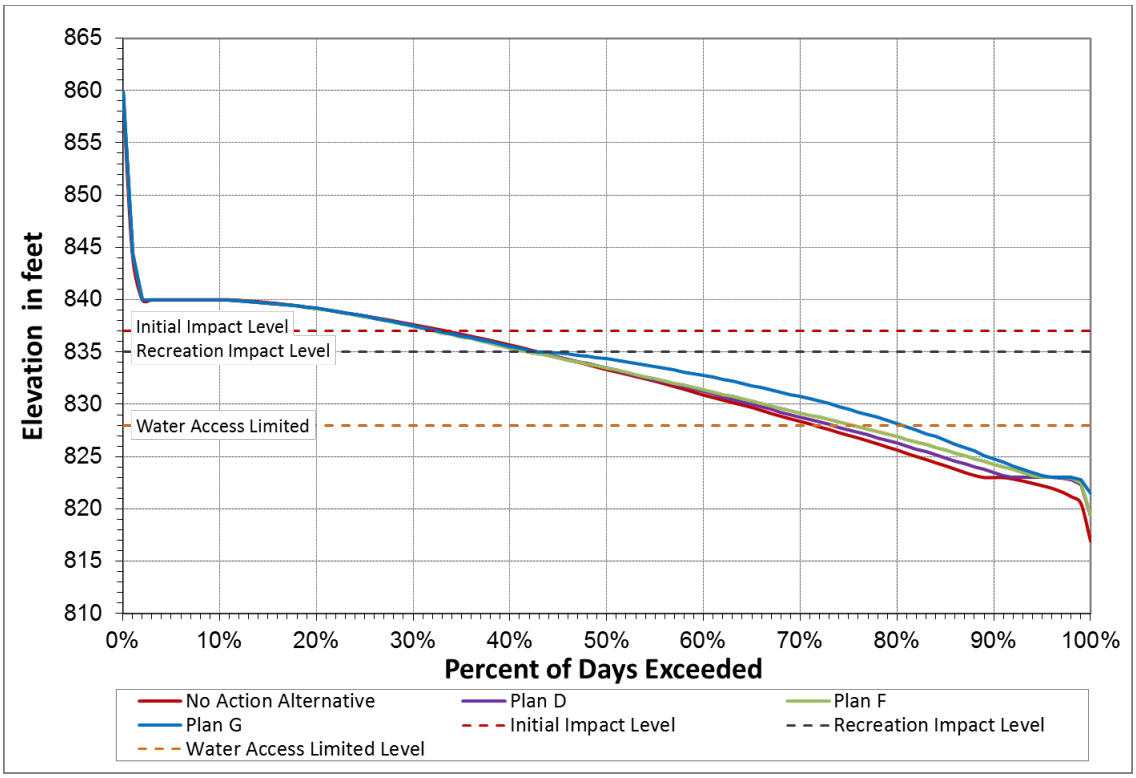


Figure 6.1-6. Allatoona Lake, daily water surface elevations—percent of days exceeded over modeled period of record (1939–2011).

Figure 6.1-7 summarizes percent of days exceeded results for Allatoona Lake for November (a key month during the fall drawdown period) over the modeled period of record. For the No Action Alternative at Allatoona Lake, lake elevations for November over the modeled period of record would be expected to decline below the IIL on 99 percent of the days, below the RIL on 99 percent of the days, and below the WAL level on 65 percent of the days. Over the modeled period of record, the lowest water surface elevation that the lake would be expected to reach in November would be elevation 818.2 ft, about 4.8 ft below the winter guide curve level.

Figure 6.1-8 displays the number of years that Allatoona Lake water surface elevations might be expected to decline below the three previously defined impact levels during the summer recreation season (June to September) over the modeled period of record. The year is counted if, at any time during any year, the model outputs indicate that lake levels would decline below an impact level. For the No Action Alternative, water surface elevations at Allatoona Lake during the summer recreation season would be expected to decline below the IIL in 69 of 73 years, below the RIL in 55 of 73 years, and below the WAL level in 9 of 73 years.

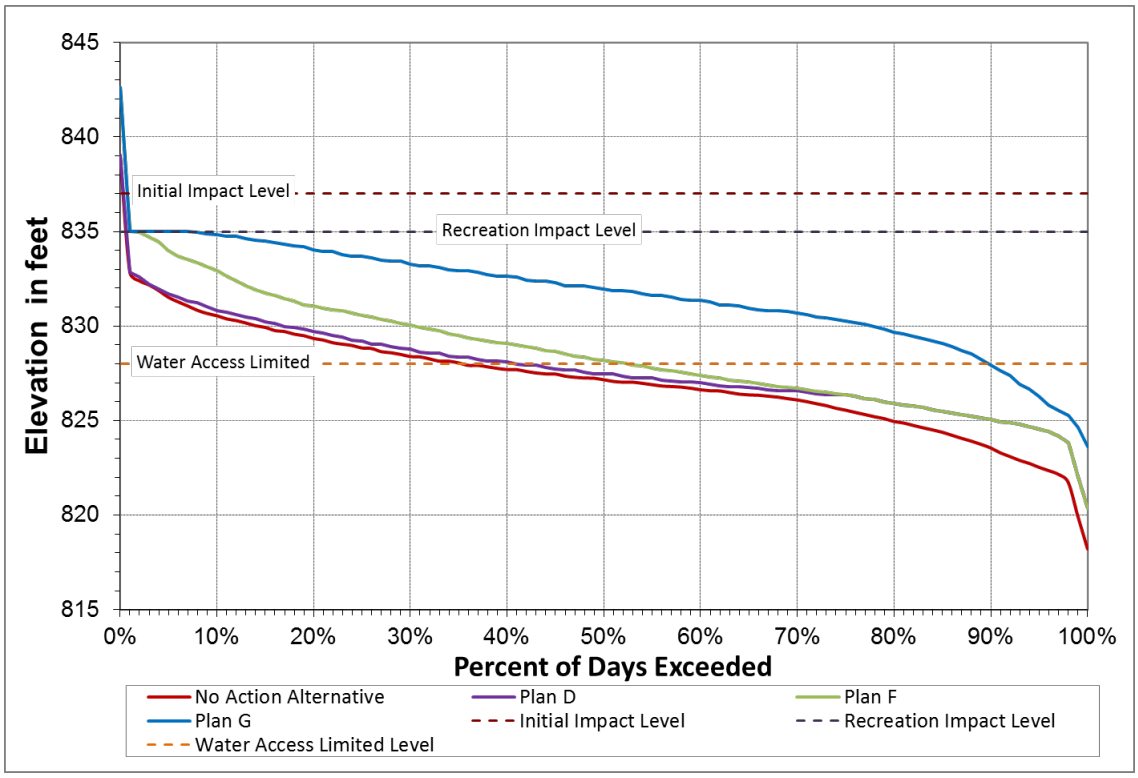


Figure 6.1-7. Allatoona Lake, daily water surface elevations—percent of days exceeded for November over the modeled period of record (1939–2011).

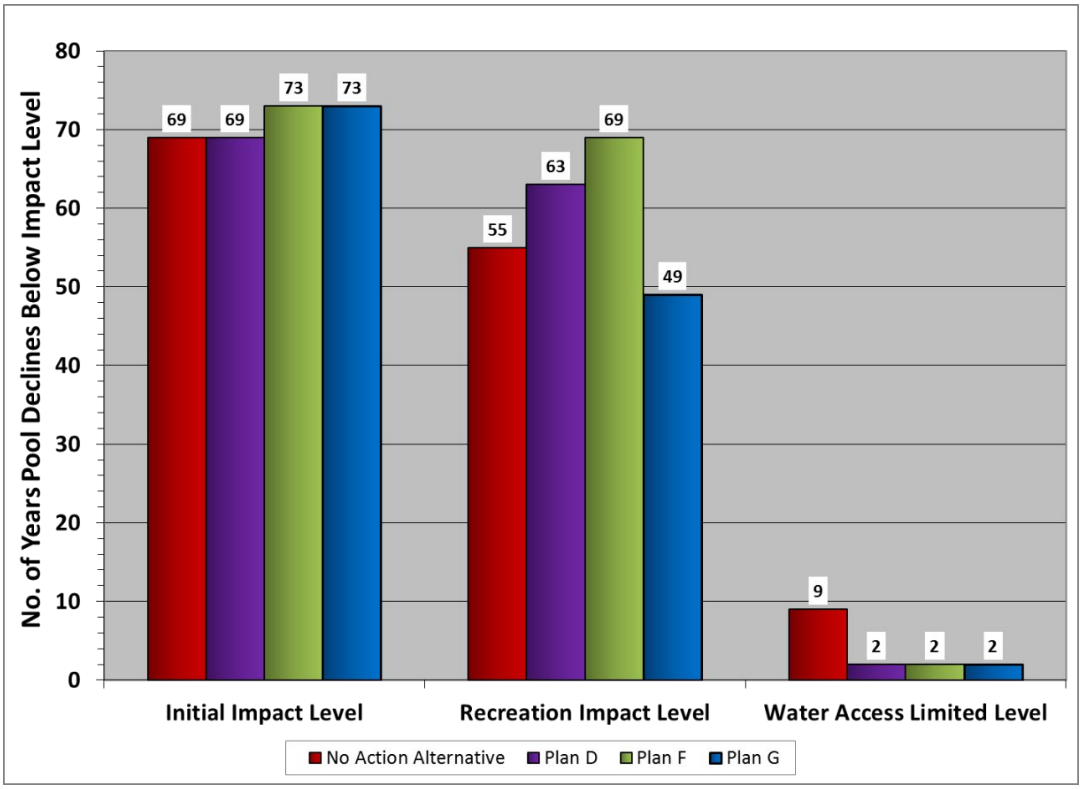


Figure 6.1-8. Allatoona Lake, number of years that summer pool elevations (June–September) would decline below key impact levels over modeled period of record (1939–2011).

6.1.1.2.2.2 Alternative Plan D

For Plan D, Figure 6.1-4 indicates that the median water surface elevation in Allatoona Lake over the modeled hydrologic period of record would be about the same as elevations for the No Action Alternative from January through May. Median daily elevations for Plan D would be slightly higher (up to 0.5 ft) than No Action during June and most of July. From August through mid-October, Plan D median daily elevations would be slightly below No Action (up to about one ft). From mid-October through late November, the Plan D elevations would be slightly higher than No Action (ranging one to two feet higher). From late November through December, Plan D would follow the guide curve through the remaining portion of the fall drawdown period under the current guide curve configuration. The slight median lake level variations would basically be attributable to project operations using the revised action zones for Allatoona Lake that are included in Plan D. The revised action zones would likely trigger actions to curtail releases and operate to conserve storage with the onset of drought conditions and an excessive rate of decline in conservation storage.

Figure 6.1-5 depicts daily water surface elevations throughout the year that would be exceeded 90 percent of the time over the modeled period of record, representative of extremely low basin inflow (or drought) conditions in the basin. For Plan D, daily water surface elevations at the 90 percent exceedance level would likely range one to two ft above the No Action Alternative levels from January through mid-May, transitioning to slightly below the No Action Alternative (less than one ft) from mid-May to mid-August. Thereafter (September through December), the 90 percent exceedance water surface elevations for Plan D would be about one to two feet higher than the No Action Alternative elevations. This improvement in water surface elevation conditions at Allatoona Lake under Plan D would largely be attributable to the revised action zones that would call for more conservative project operations to conserve storage with the onset of extremely dry conditions in the basin.

Figure 6.1-6 provides information on the percentage of days during the modeled period of record that lake levels would be expected to exceed a range of water surface elevations. As delineated, the current guide curve for Allatoona Lake (applicable to Plan D) calls for the water surface elevation to be below the IIL about 50 percent of the time, below the RIL about 44 percent of the time, and below the WAL level about 22 percent of the time. For Plan D at Allatoona Lake, lake elevations during the modeled period of record would be expected to decline below the IIL on 67 percent of the days, below the RIL on 58 percent of the days, and below the WAL level on 27 percent of the days. Those results indicate a slight improvement at the WAL level compared to the No Action Alternative. Over the modeled period of record, the lowest water surface elevation that the lake would be expected to reach would be elevation 819.3 ft, about 3.7 ft below the winter guide curve level (elevation 823 ft). Over the modeled period of record, operation under Plan D would represent an improvement of about 2.4 ft in the lowest level that Allatoona Lake might be expected to reach compared to the No Action Alternative.

Figure 6.1-7 summarizes percent of days exceeded results for Allatoona Lake for November (a key month during the fall drawdown period) over the modeled period of record. For Plan D at Allatoona Lake, lake elevations for November over the modeled period of record would be expected to decline below the IIL on 99 percent of the days, below the RIL on 99 percent of the days, and below the WAL level on 59 percent of the days. Over the modeled period of record, the lowest water surface elevation that the lake would be expected to reach in November would be elevation 820.4 ft, about 2.6 ft below the winter guide curve level of elevation 823. Over the modeled period of record, operation under Plan D for days during November would represent an improvement of about 2.2 ft in the lowest level that Allatoona Lake might be expected to reach during November compared to the No Action Alternative.

For Plan D, water surface elevations at Allatoona Lake during the summer recreation season (June to September) over the modeled period of record would likely decline below the IIL in 69 of 73 years, below the RIL in 63 of 73 years, and below the Water Access Limited level in 2 of 73 years (Figure 6.1-8).

Compared to the No Action Alternative, Plan D would represent no change at the IIL, an increase in the number of years that lake levels would be likely to decline below the RIL from 55 to 63, and a significant decrease in the number of years that lake levels would likely decline below the WAL level from 9 to 2. The reduction in the number of years over the period of record that lake levels would decline below the WAL level during the recreation season is a particularly noteworthy improvement because that impact level is indicative of the most severe effect on public use of the lake.

6.1.1.2.2.3 Alternative Plan F

For Plan F, Figure 6.1-4 indicates that the median water surface elevation in Allatoona Lake over the modeled hydrologic period of record would be essentially the same as Plan D from the month of January through late November. From late November through mid-December, median daily water surface elevations would decline at a slower pace than the No Action Alternative and Plan D based on project operations following the proposed fall phased drawdown guide curve (a feature of Plan F) rather than the current guide curve (a feature of No Action and Plan D). By mid-December, the median daily pool elevations for Plan F would likely be about four ft higher than No Action or Plan D elevations. By the end of December, Plan F median pool elevations would decline in accordance with the phased drawdown guide curve to the winter pool elevation of 823 ft. The higher median lake levels in November through December would be attributable to incorporating both the revised action zones and the fall phased drawdown guide curve into Allatoona Lake project operations under Plan F. The shape of the revised guide curve for Plan F would reflect the initiation of the fall drawdown period a few weeks sooner than the No Action Alternative and, by phasing the fall drawdown, extending it by 2 to 4 weeks later than the No Action Alternative, thus producing higher median lake levels in November and December.

Figure 6.1-5 depicts daily water surface elevations throughout the year that would be exceeded 90 percent of the time over the modeled period of record, representative of extremely low basin inflow (or drought) conditions in the basin. For Plan F, daily water surface elevations at the 90 percent exceedance level over the modeled period of record would be essentially the same as for Plan D, both providing for higher lake elevations under drought conditions than the No Action Alternative. This improvement in water surface elevation conditions at Allatoona Lake under Plan F would largely be attributable to the revised action zones that would call for more conservative project operations to conserve storage with the onset of extremely dry conditions in the basin.

As delineated, the proposed phased drawdown guide curve for Allatoona Lake (applicable to the Plan F) would result in the water surface elevations below the IIL about 61 percent of the time, below the RIL about 37 percent of the time, and below the WAL level about 18 percent of the time. For Plan F, modeled water surface elevations at Allatoona Lake over the entire period of record would be expected to decline below the IIL on 68 percent of the days, below the RIL on 59 percent of the days, and below the WAL level on 25 percent of the days (Figure 6.1-6). Those results indicate a slight improvement at the WAL level for Plan F compared to the No Action Alternative and Plan D. Over the modeled period of record, the lowest water surface elevation that the lake would be expected to reach would be elevation 819.3 ft, about 3.7 ft below the winter guide curve level (elevation 823 ft). Operation under Plan F would represent an improvement of about 2.4 ft in the lowest level that Allatoona Lake might be expected to reach compared to the No Action Alternative and would be at the same level as would be expected for Plan D.

For November (a key month during the fall drawdown period), Allatoona Lake water surface elevations for Plan F over the modeled period of record would be expected to decline below the IIL on 99 percent of the days, below the RIL on 98 percent of the days, and below the WAL level on 48 percent of the days (Figure 6.1-7). Plan F would be expected to provide an increase of 17 percent in the number of November days over the period of record that lake levels would remain above the WAL level compared to the No Action Alternative. Over the period of record, the lowest water surface elevation that the lake would be

expected to reach in November would be elevation 820.4 ft, about 2.6 ft below the winter guide curve level of elevation 823 ft. Operation under Plan F for days during November would represent an improvement of about 2.2 ft in the lowest level that Allatoona Lake might be expected to reach during that month compared to the No Action Alternative.

For Plan F, water surface elevations at Allatoona Lake in the summer recreation season (June through September) would be expected to decline below the IIL in 73 of 73 years, below the RIL in 69 of 73 years, and below the WAL level in 2 of 73 years (Figure 6.1-8). Compared to the No Action Alternative, Plan F would represent a slight increase in the number of years that lake levels would be likely to decline below the IIL from 69 to 73 years, a moderate increase at the RIL from 55 to 69 years, and a significant decrease in the number of years that lake levels would likely decline below the WAL level from 9 to 2 years. The reduction in the number of years over the period of record that lake levels would likely decline below the WAL level is a particularly noteworthy improvement because that impact level is indicative of the most severe effect on public use of the lake.

6.1.1.2.2.4 Alternative Plan G (Proposed Action Alternative)

For the Proposed Action Alternative, Figure 6.1-4 indicates that the median daily water surface elevation in Allatoona Lake over the modeled period of record would closely match the guide curve and all the alternatives (including No Action) from the months of January through May. Plan G median pool elevations would be slightly higher (less than one foot) than No Action in June and July and slightly lower (less than one foot) than No Action in August through mid-September. Median elevations would likely decline slightly between mid-September through late November from about elevation 834 ft to 833 ft. By late November, Plan G median daily pool elevations would be about six ft higher than the No Action Alternative and five ft higher than Plans D and F. Plan G pool elevations would be expected to match the phased drawdown guide curve from late November through December. The higher median lake levels in September through December in Allatoona Lake would be attributable to incorporating the following features into Allatoona Lake project operations under Plan G: (1) the revised action zones, (2) the fall phased drawdown (or phased) guide curve, and (3) reduced fall hydropower generation. In addition to the increase in average lake levels from the revised action zones and fall phased drawdown guide curve as discussed above for Plan F, the management measure to reduce fall hydropower production in conjunction with the other measures would be expected to produce notable improvement in median daily lake levels in October and November over all the other alternatives.

Figure 6.1-5 depicts daily water surface elevations throughout the year that would be exceeded 90 percent of the time over the modeled period of record, representative of extremely low basin inflow (or drought) conditions in the basin. For Plan G, daily water surface elevations at the 90 percent exceedance level over the modeled period of record would be essentially the same as for Plans D and F from January through September. Compared to the No Action Alternative, lake level conditions for Plan G would be moderately improved between January and May and slightly lower between May and mid-August. However, for the remaining months of the year, Plan G would provide for substantially higher lake elevations under drought conditions than the No Action Alternative or Plans D and F. In mid-November, Plan G would be expected to provide lake elevations as much as three ft higher than Plans D and F and five ft higher than the No Action Alternative. This improvement in water surface elevation conditions at Allatoona Lake under Plan G would largely be attributable to the proposed phased drawdown guide and revised action zones that would call for more conservative project operations to conserve storage with the onset of extremely dry conditions in the basin.

Water surface elevations at Allatoona Lake under the Proposed Action Alternative over the modeled period of record would be expected to decline below the IIL on 67 percent of the days, below the RIL on 56 percent of the days, and below the WAL level on 20 percent of the days (Figure 6.1-6). As delineated,

the proposed phased drawdown guide curve for Allatoona Lake (applicable to the Plan G) would result in water surface elevations below the IIL about 61 percent of the time, below the RIL about 37 percent of the time, and below the WAL level about 18 percent of the time. Those results indicate water levels decline to the WAL level nine percent less often for the Proposed Action Alternative compared to the No Action Alternative and five percent less often compared to Plan F. Over the modeled period of record, the lowest water surface elevation that the lake would be expected to reach would be elevation 821.5 ft, about 1.5 ft below the winter guide curve level (elevation 823 ft). Operation under the Proposed Action Alternative would represent an improvement of about 4.6 ft in the lowest level that Allatoona Lake might be expected to reach compared to the No Action Alternative and about 2.2 ft higher than would be expected for Plans D and F.

For November (a key month during the fall drawdown period), Allatoona Lake daily water surface elevations for the Proposed Action Alternative over the modeled period of record would be expected to decline below the IIL on 99 percent of the days, below the RIL on 92 percent of the days, and below the WAL level on 11 percent of the days (Figure 6.1-7). The Proposed Action Alternative would be expected to produce a decrease from 65 percent to 11 percent in the number of November days over the period of record that lake levels would decline below the WAL level compared to the No Action Alternative. Over the period of record, the lowest water surface elevation that the lake would be expected to reach in November would be elevation 823.6 ft, about 0.6 ft above the winter guide curve level of elevation 823 ft. Operation under the Proposed Action Alternative for the days during the month of November would represent an improvement of about 5.4 ft in the lowest level that Allatoona Lake might be expected to reach during that month compared to the No Action Alternative.

For the Proposed Action Alternative, water surface elevations at Allatoona Lake during the summer recreation season would be expected to decline below the IIL in 73 of 73 years, below the RIL in 49 of 73 years, and below the WAL level in 2 of 73 years (Figure 6.1-8). Compared to the No Action Alternative, the Proposed Action Alternative would represent an increase in the number of years that lake levels would be likely to decline below the IIL from 69 to 73 years, a moderate decrease in the number of years that lake levels would likely decline below the RIL from 55 to 49 years, and a significant decrease in the number of years that lake levels would likely decline below the Water Access Limited level from 9 to 2 years. The reduction in the number of years over the period of record that lake levels would likely decline below the WAL level during the recreation season is a particularly noteworthy improvement because that impact level is indicative of the most severe effect on public use of the lake.

6.1.1.2.3 APC Lakes (Coosa and Tallapoosa Rivers)

APC lakes in the ACT Basin and their general operations under existing conditions are described in Section 2.1.1.1.4. Operation of the USACE reservoirs in the ACT Basin is closely linked to operation of the APC reservoirs. Consequently, the alternative water control plan revisions considered in this EIS may result in effects on water surface elevations in APC reservoirs that include conservation storage. Those reservoirs are Weiss, H. Neely Henry, and Logan Martin lakes on the Coosa River and R.L. Harris Lake and Lake Martin on the Tallapoosa River. The other APC projects in the ACT Basin (Lay Lake, Mitchell Lake, and Jordan Dam and Lake and Bouldin Dam on the Coosa River as well as Yates and Thurlow lakes on the Tallapoosa River) essentially operate as run-of-river facilities. The alternative water control plan revisions considered herein would have a negligible effect on the water surface elevations of the reservoirs, and they are not discussed further in this section.

Winter guide curve revisions for APC's Weiss, H. Neely Henry, and Logan Martin lakes are under consideration as part of the ongoing FERC relicensing process for APC's Coosa River Hydropower Project. The proposed revisions are described in Sections 2.1.1.1.4.3 through 2.1.1.1.4.5. Because the FERC relicensing process is not complete, the effects of the proposed revisions at those three lakes are

not considered as part of the No Action Alternative in this EIS. However, winter guide curve revision at H. Neely Henry Lake is included as a component of Plans D, F, and G, and the associated effects on lake water surface elevations are addressed in this EIS. The H. Neely Henry Lake winter guide curve revision has been in effect since 2001 under a temporary variance from FERC. As part of the FERC variance process, USACE reviewed the proposed guide curve revision and concurred that it would not adversely affect the flood risk management function of the project.

[NOTE: On June 20, 2013, following public review of the draft EIS for the ACT WCM update, FERC issued a new license for the APC Coosa River projects. The license approved the proposed revision to the H. Neely Henry guide curve (with concurrence from USACE) but did not take action on the proposed Weiss Lake and Logan Martin Lake guide curve revisions. Any future modification of the FERC license to accommodate guide curve revisions for Weiss and Logan Martin lakes will require USACE review and concurrence, and possible further update of the ACT WCM, as described above.]

6.1.1.2.3.1 No Action Alternative

Current USACE and APC operations in the ACT Basin (the No Action Alternative) were modeled over the period of hydrologic record (1939–2011). Figure 6.1-9 through Figure 6.1-32 present model outputs for water surface elevations at the following APC reservoir projects based on current USACE and APC operations: Weiss, H. Neely Henry, and Logan Martin lakes on the Coosa River and R.L. Harris Lake and Lake Martin on the Tallapoosa River. Those figures also include outputs for proposed revisions to the ACT WCM as defined in Alternative Plans D, F, and G (the Proposed Action). The results for the alternatives are discussed in subsequent subsections.

6.1.1.2.3.1.1 Weiss Lake

Figure 6.1-9 through Figure 6.1-12 present results of model outputs for Weiss Lake operations over the modeled period of record (1939–2011) for existing conditions (or the No Action Alternative).

Median daily water surface elevations over the modeled period of record for the No Action Alternative, as depicted in Figure 6.1-9, would generally match the shape of the guide curve (referred to as rule curve by APC) from the months of January through June. From July through September median pool elevations would decline slightly below the guide curve (from zero up to about 0.4 ft). The No Action Alternative would follow the guide curve from October through the balance of the year.

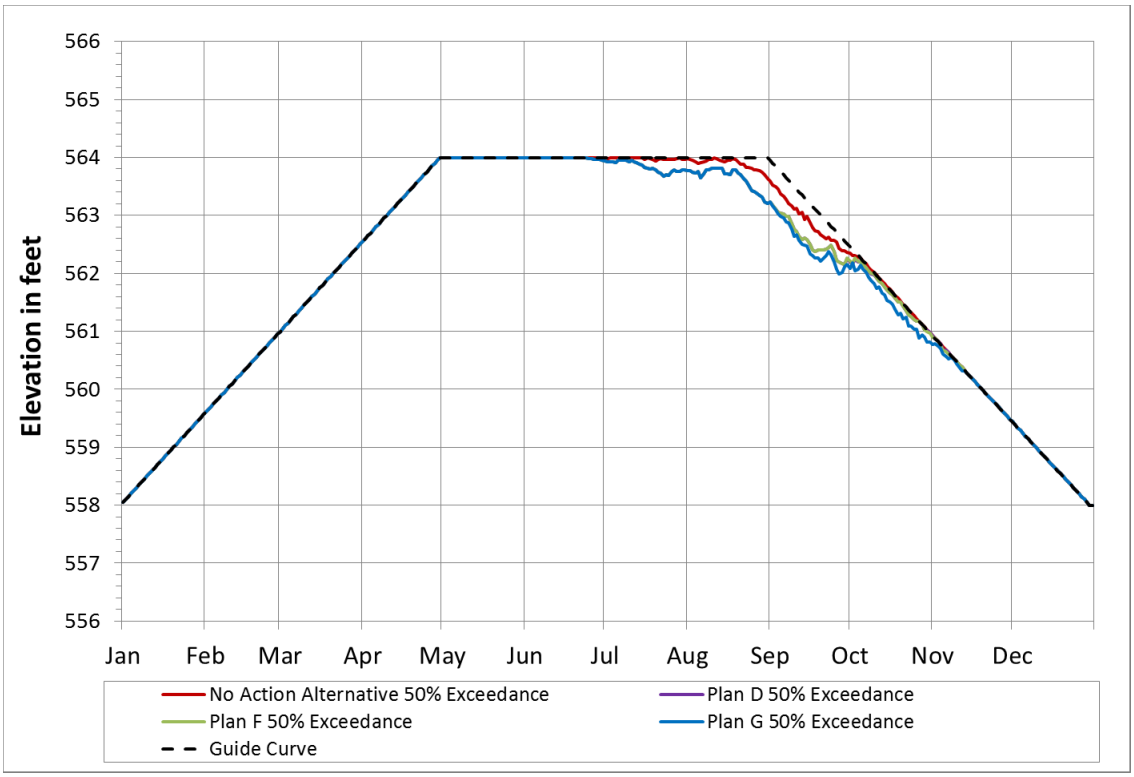


Figure 6.1-9. Weiss Lake, median daily water surface elevation over the modeled period of record (1939–2011).

Figure 6.1-10 depicts daily water surface elevations throughout the year that would be exceeded 90 percent of the time over the modeled period of record, representative of extremely low basin inflow (or drought) conditions in the basin. For the No Action Alternative, daily water surface elevations at the 90 percent exceedance level over the modeled period of record would be expected to follow the project guide curve from January through late April. In May and June, the 90 percent exceedance water surface level would fluctuate slightly above and below elevation 563.5 ft, about 0.5 ft below the guide curve, thereafter declining steadily to a point about two ft below the guide curve on September 1 and about 1.5 ft below the guide curve on November 1. By early December, the 90 percent exceedance water surface elevations match the guide curve elevation, continuing through the balance of the month of December. Under severe drought conditions as represented by the 90 percent exceedance curve, pool elevations would be expected to decline by no more than two feet below the guide curve at any time.

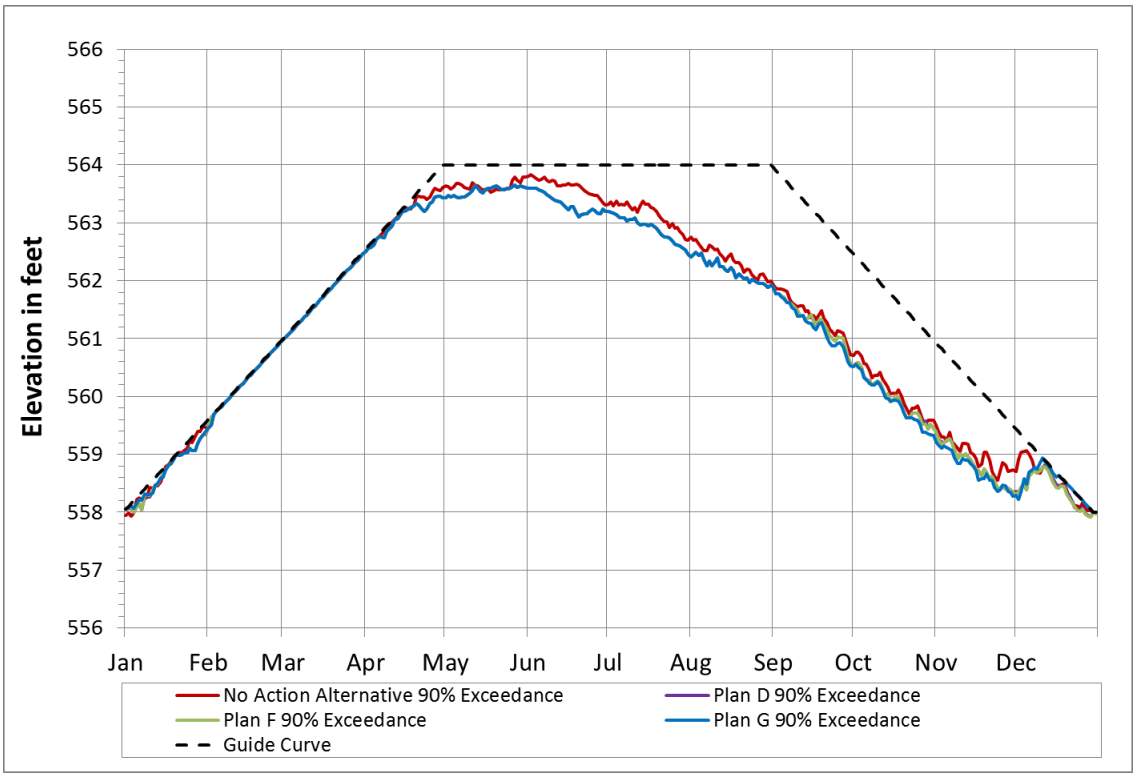


Figure 6.1-10. Weiss Lake, daily water surface elevations that would be exceeded 90 percent of the time over modeled period of record (1939–2011).

According to Figure 6.1-11, water surface elevations for the No Action Alternative over the modeled period of record would equal or exceed elevation 564 (the summer guide curve elevation) about 20 percent of the time. For comparison, the guide curve for the Weiss project is at elevation 564 about 33 percent of the time during the year (May–August). The winter pool level (elevation 558 ft) would be exceeded about 97 percent of the time. The lowest pool elevation that would be expected over the modeled period of record for the No Action Alternative would likely be at about 552 ft, which would be six ft below the winter guide curve level. In the month of June (during the peak recreation season) over the entire period of record (depicted in Figure 6.1-12), the summer pool elevation would likely equal or exceed the summer guide curve elevation of 564 ft about 70 percent of the time and would exceed elevation 563 ft (one ft lower than the guide curve) about 94 percent of the time, During the month of June over the modeled period of record, the lowest water surface elevation that would be expected would be about 552 ft.

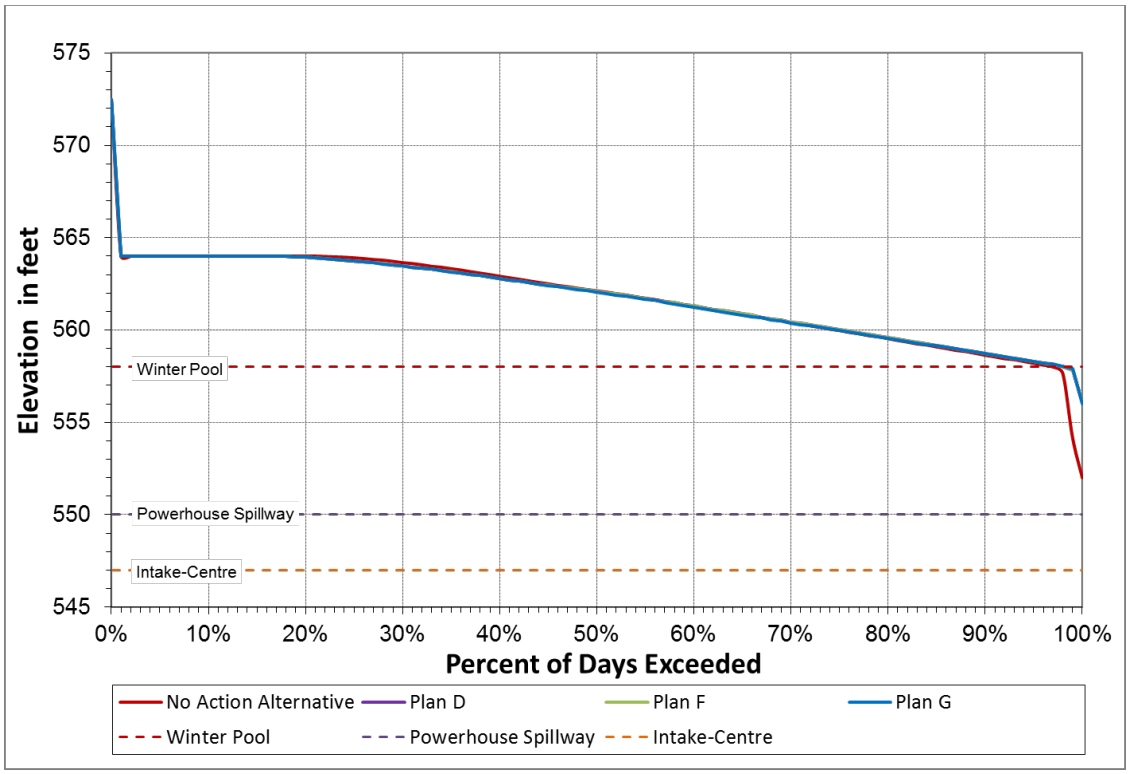


Figure 6.1-11. Weiss Lake, daily water surface elevations—percent of days exceeded over modeled period of record (1939–2011).

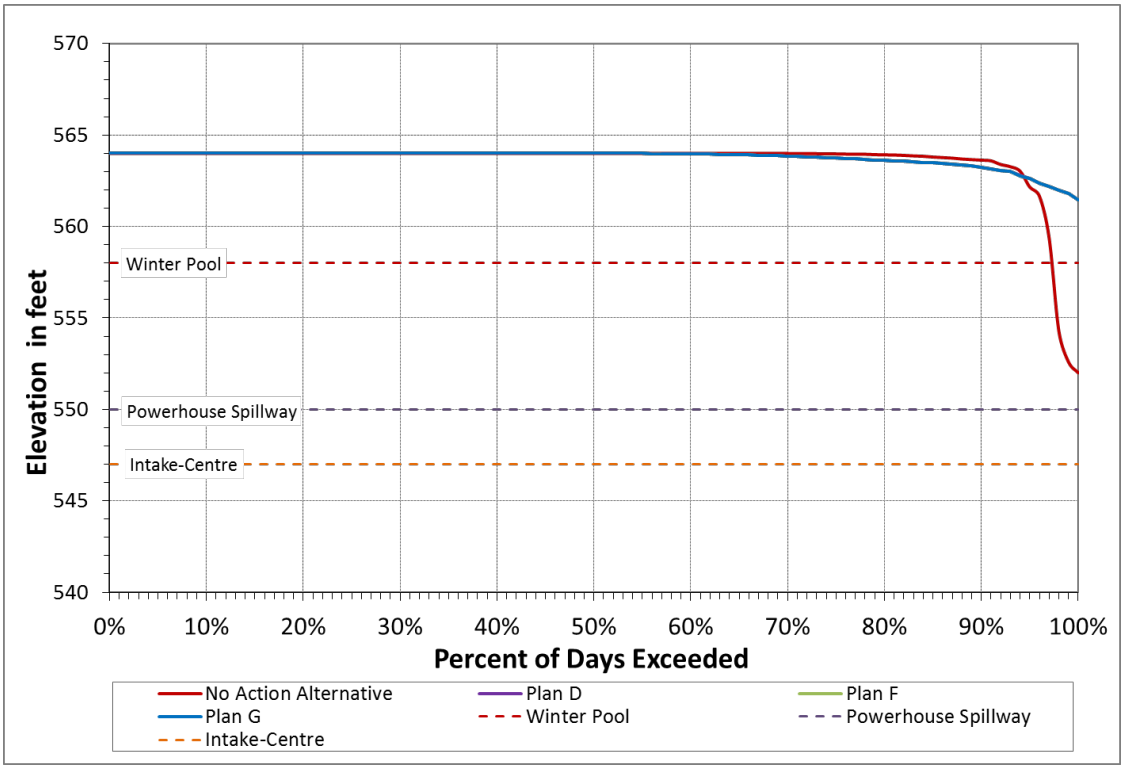


Figure 6.1-12. Weiss Lake, daily water surface elevations—percent of days exceeded for June over modeled period of record (1939–2011).

6.1.1.2.3.1.2 H. Neely Henry Lake

Figure 6.1-13 through Figure 6.1-17 present model results for water surface elevations at H. Neely Henry Lake for the No Action Alternative over the modeled period of record.

The guide curve applicable to the No Action Alternative would be the curve specified in the FERC license that was in effect during the formulation and evaluation of alternative water plans, as discussed in Section 5.1 (not the interim-approved guide curve that was in effect at that time). As depicted in Figure 6.1-13, median daily water surface elevations for the No Action Alternative over the modeled period of record would generally match the guide curve. The only exception would occur from mid-August through September when median daily water surface elevations would decline up to about 0.4 ft below the summer guide curve elevation of 508 ft.

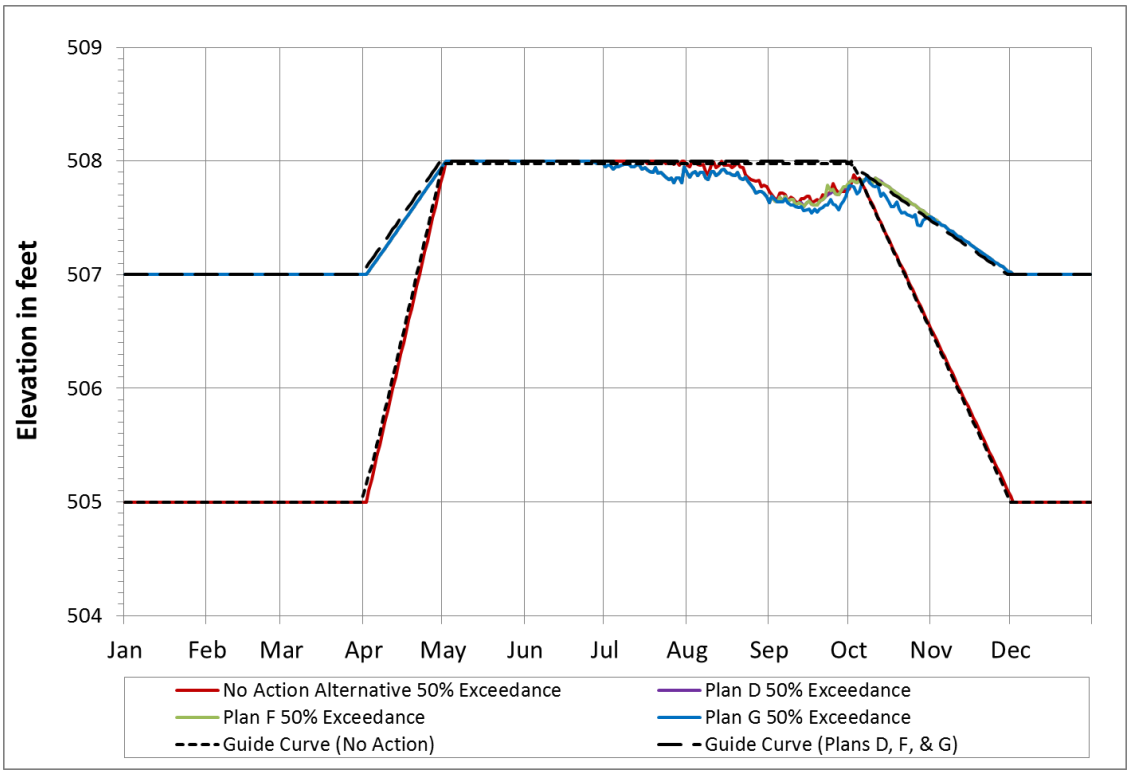


Figure 6.1-13. H. Neely Henry Lake, median daily water surface elevation over modeled period of record (1939–2011).

Figure 6.1-14 depicts daily water surface elevations throughout the year that would be exceeded 90 percent of the time over the modeled period of record, representing extremely low basin inflow (or drought) conditions in the basin. For the No Action Alternative, daily water surface elevations at the 90 percent exceedance level over the modeled period of record would be expected to equal the project guide curve from January through late April. From May through November, water surface elevations would fluctuate from about 0.4 ft to 1.6 ft below the guide curve. During the month of December, water surface elevations would be expected to closely follow the guide curve.

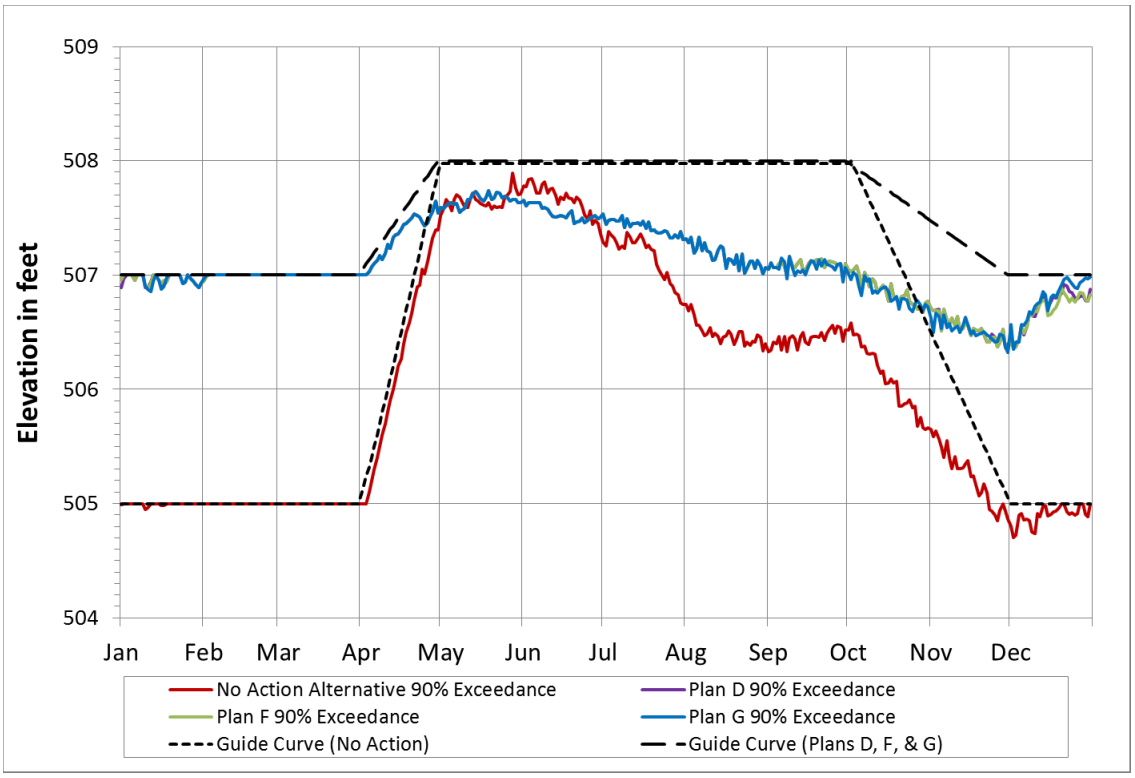


Figure 6.1-14. H. Neely Henry Lake, daily water surface elevations that would be exceeded 90 percent of the time over modeled period of record (1939–2011).

According to Figure 6.1-15, water surface elevations for the No Action Alternative over the modeled period of record would be equal to or within 0.5 ft of the summer pool level of elevation 508 ft about 36 percent of the time. The guide curve, as defined, is above elevation 507.5 ft about 46 percent of the time. The winter pool level (elevation 505 ft) would be equaled or exceeded about 95 percent of the time. The lowest pool elevation that would be expected over the modeled period of record for the No Action Alternative would likely be at about elevation 503.3 ft, or 1.7 ft below the winter guide curve level.

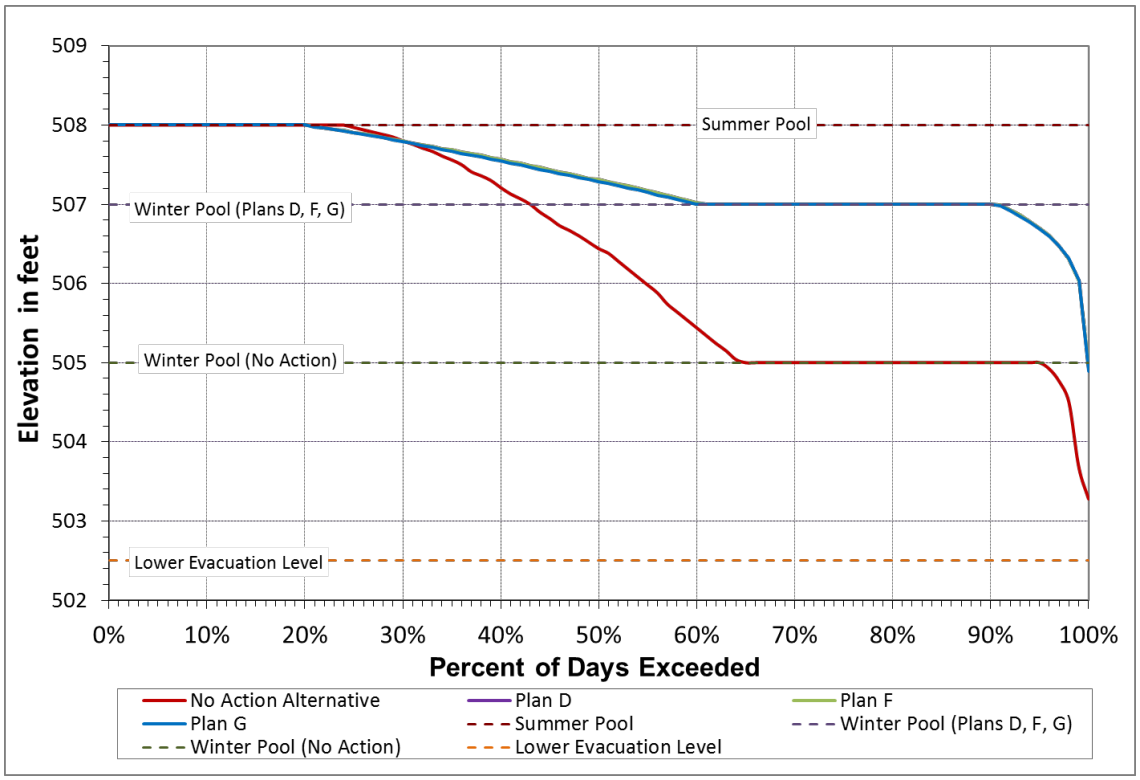


Figure 6.1-15. H. Neely Henry Lake, daily water surface elevations—percent of days exceeded over modeled period of record (1939–2011).

Two months during the year were selected for closer examination with respect to the No Action Alternative. For the days in June over the entire period of record (depicted in Figure 6.1-16), water surface elevations would be equal to or within 0.5 ft of the summer guide curve (elevation 508 ft) about 91 percent of the time. The lowest water surface elevation that would be expected during June over the period of record would be elevation 503.3 ft. For the days in September over the entire period of record (depicted in Figure 6.1-17), water surface elevations would be equal to or within 0.5 ft of the summer guide curve (elevation 508 ft) about 59 percent of the time and above the winter guide curve level (elevation 505 ft) about 96 percent of the time. The lowest water surface elevation that would be expected in September over the period of record would be about elevation 503.6 ft.

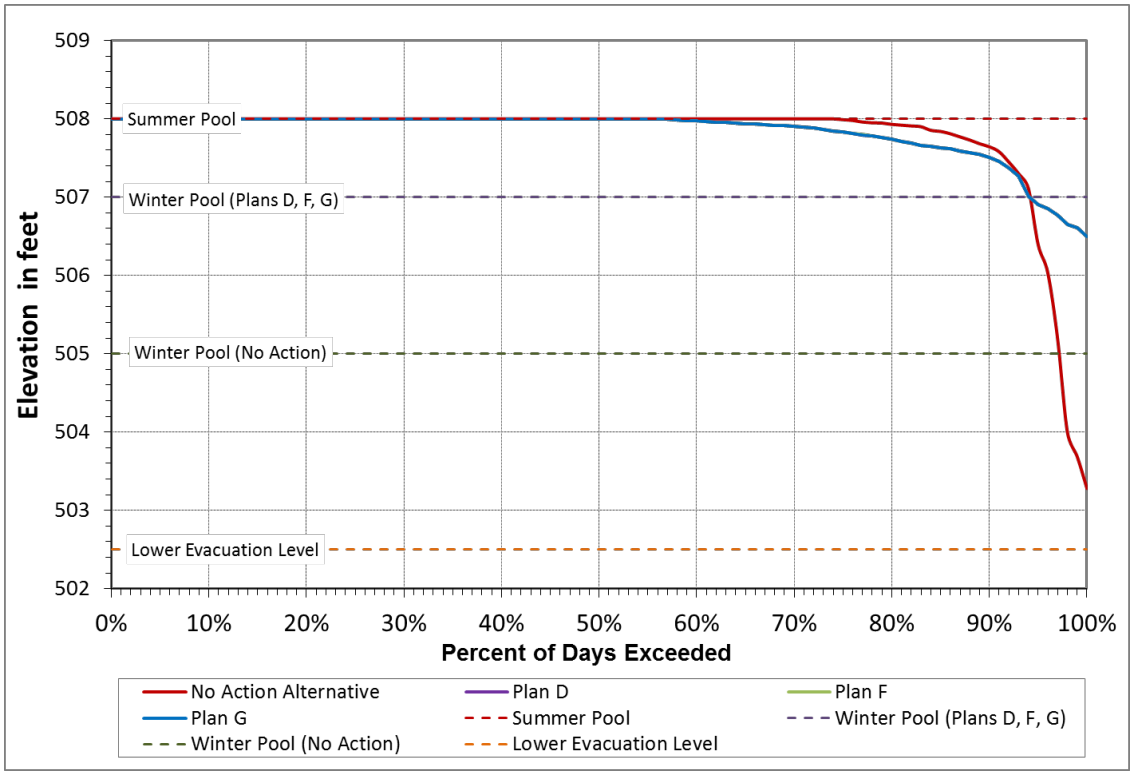


Figure 6.1-16. H. Neely Henry Lake, daily water surface elevations—percent of days exceeded for June over modeled period of record (1939–2011).

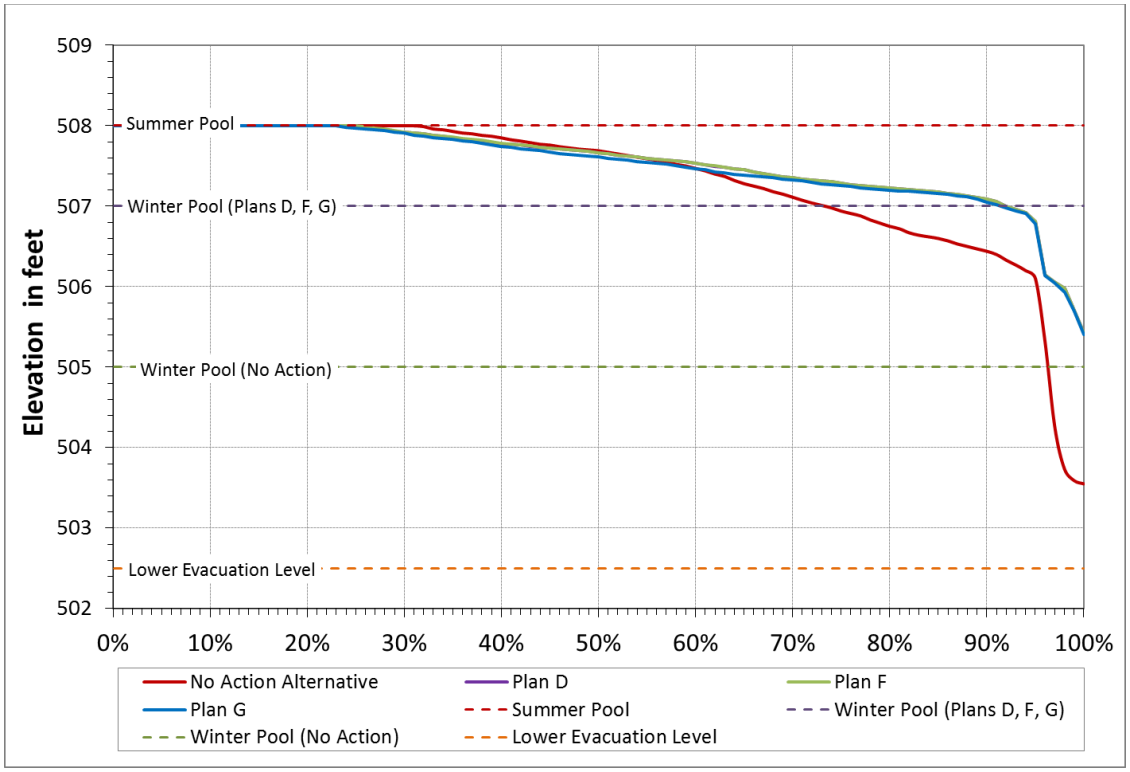


Figure 6.1-17. H. Neely Henry Lake, daily water surface elevations—percent of days exceeded for September over modeled period of record (1939–2011).

6.1.1.2.3.1.3 Logan Martin Lake

Figure 6.1-18 through Figure 6.1-22 present model results for water surface elevations at Logan Martin Lake for the No Action Alternative over the modeled period of record. Median daily water surface elevations for the No Action Alternative over the modeled period of record (Figure 6.1-18) would essentially match the project guide curve from the month of January through July. In August and September, median daily pool levels would decline slightly (up to about 0.5 feet below the guide curve in September). During October through December, median daily pool elevations would be expected to match the guide curve.

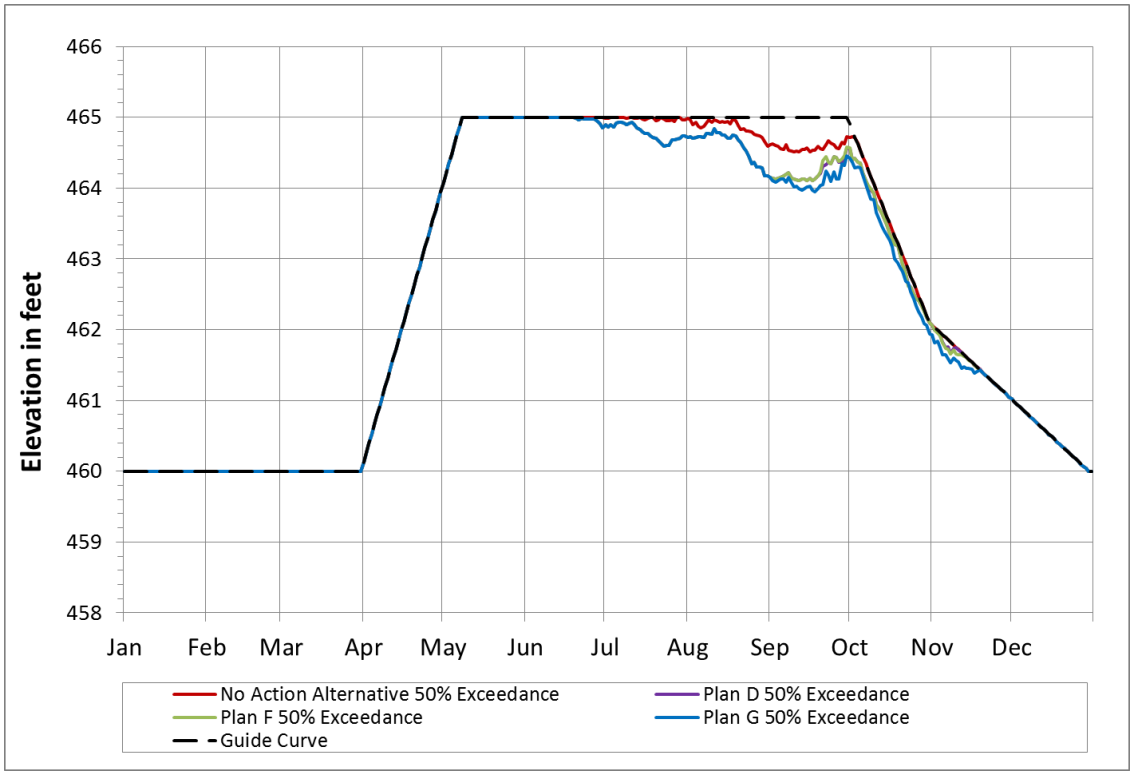


Figure 6.1-18. Logan Martin Lake, median daily water surface elevation over modeled period of record (1939–2011).

Figure 6.1-19 depicts daily water surface elevations throughout the year that would be exceeded 90 percent of the time over the modeled period of record, indicative of drought conditions in the basin. For the No Action Alternative, daily water surface elevations at the 90 percent exceedance level over the modeled period of record would match the project guide curve from January through late April. Thereafter through the end of the month of November, pool elevations at the 90 percent exceedance level would generally fluctuate from about 0.5 ft to two ft below the guide curve, with the largest deficit in August and September. In December, water surface elevations would be slightly below the guide curve elevation.

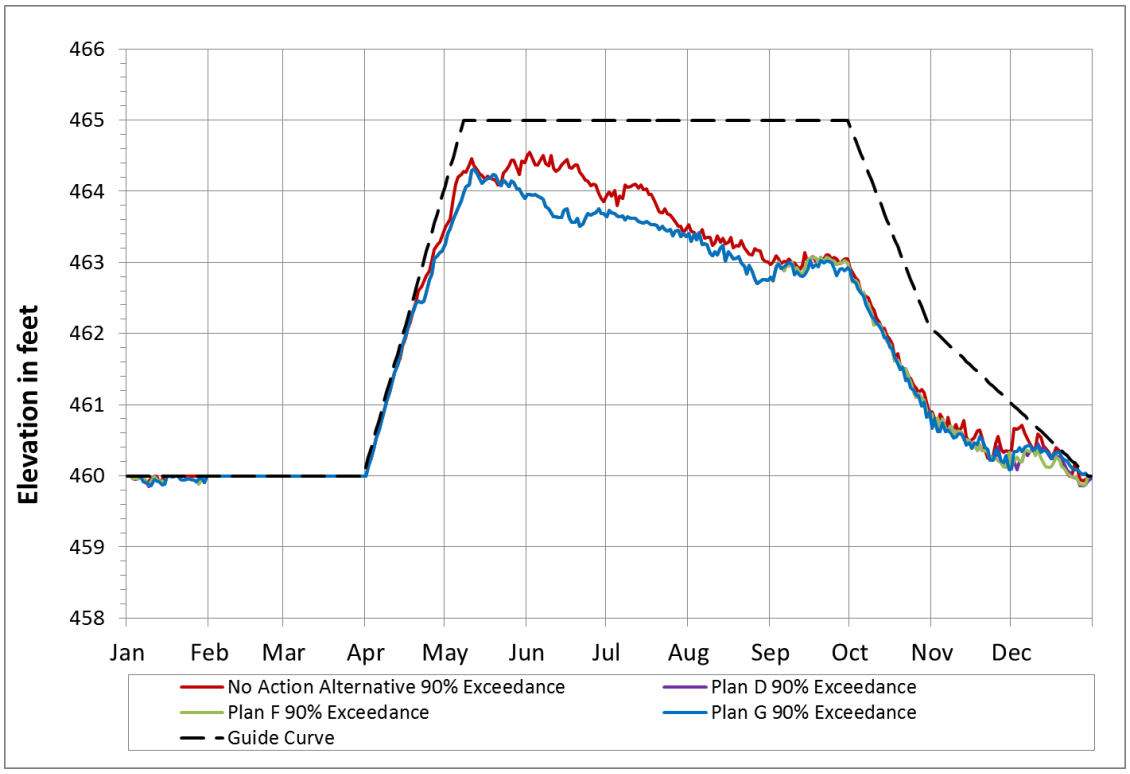


Figure 6.1-19. Logan Martin Lake, daily water surface elevations that would be exceeded 90 percent of the time over modeled period of record (1939–2011).

According to Figure 6.1-20, water surface elevations for the No Action Alternative over the modeled period of record would be within 0.5 ft of the summer pool level of elevation 465 ft or higher about 33 percent of the time. For comparison, the guide curve elevation, as defined, is higher than elevation 464.5 ft about 42 percent of the time. Water surface elevations would be at or above the winter pool level (elevation 460 ft) about 97 percent of the time. The lowest pool elevation that would be expected over the modeled period of record for the No Action Alternative would likely be about elevation 456.2 ft, or 3.8 ft below the winter guide curve level.

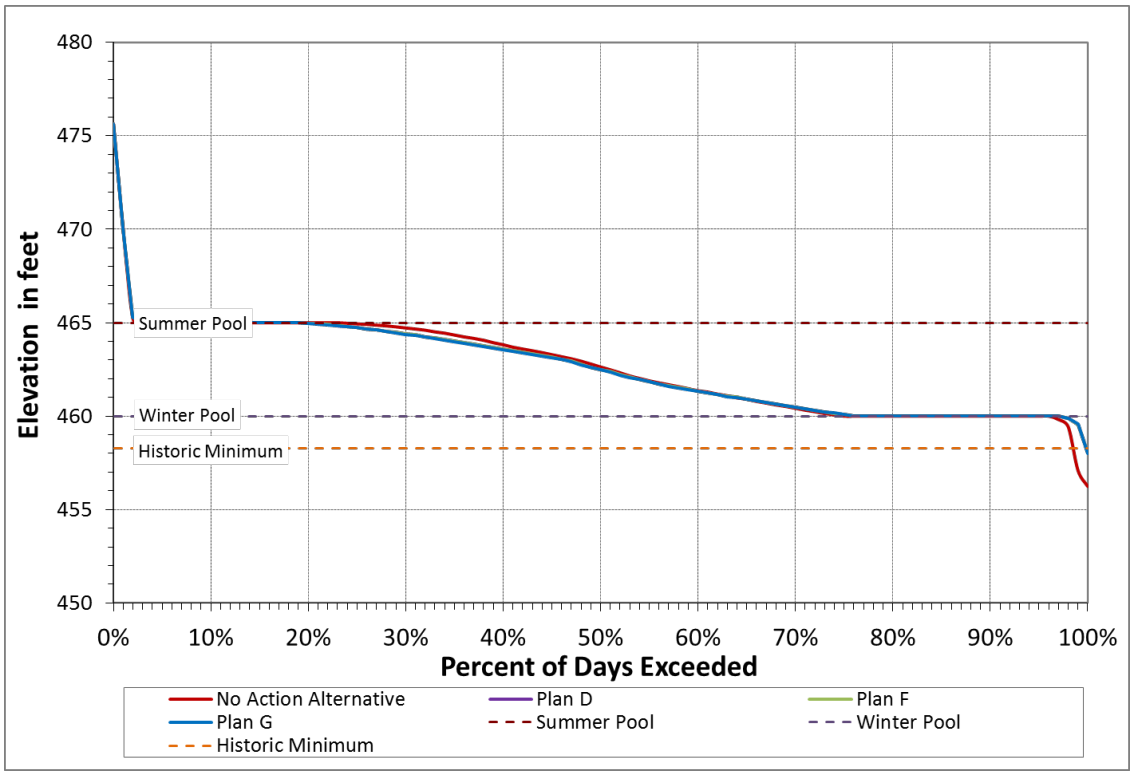


Figure 6.1-20. Logan Martin Lake, daily water surface elevations—percent of days exceeded over modeled period of record (1939–2011).

Two months during the year were selected for closer examination for the No Action Alternative. For the days in June over the entire period of record (depicted in Figure 6.1-21), the summer pool elevation of 465 ft would likely be equaled or exceeded 70 percent of the time (elevation 464 would be exceeded 91 percent of the time). The lowest water surface elevation that would be expected in June over the period of record would be elevation 456.3 ft. For the days in September over the entire period of record (depicted in Figure 6.1-22), the summer pool elevation (465 ft) would likely be equaled or exceeded about 30 percent of the time (elevation 464 would likely be exceeded 66 percent of the time). The lowest water surface elevation that would be expected in September over the period of record would be about elevation 456.7 ft, about 3.3 ft below the winter guide curve elevation.

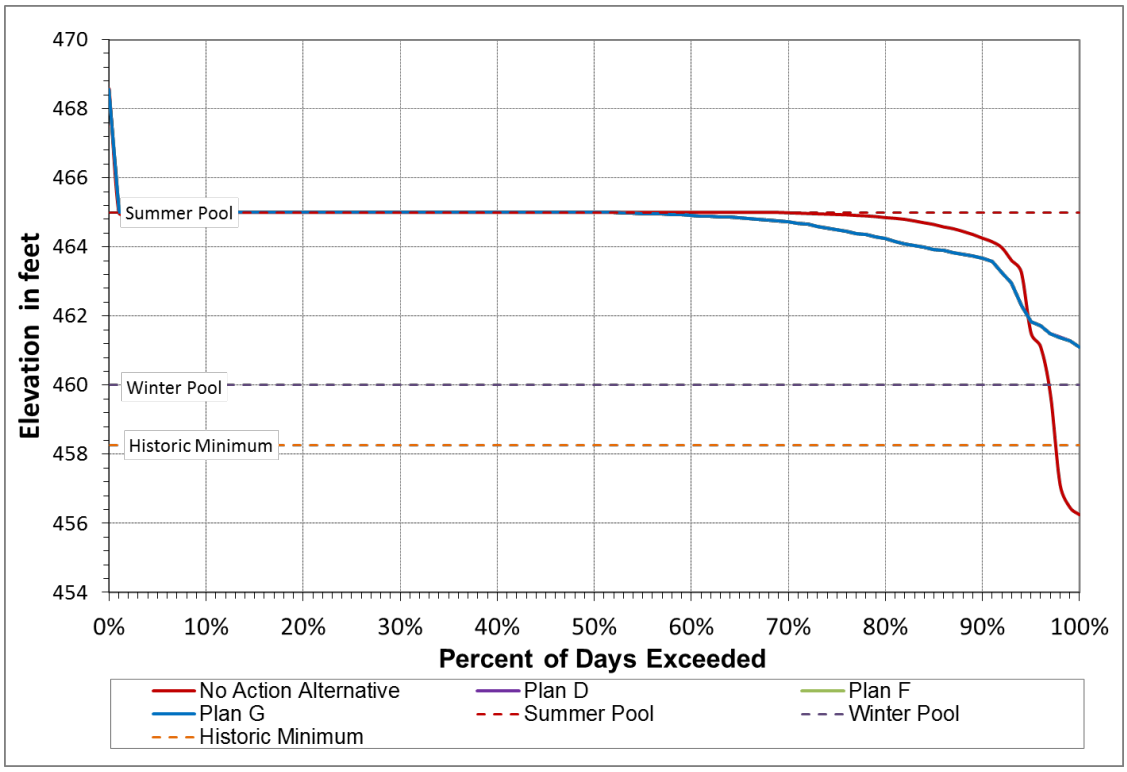


Figure 6.1-21. Logan Martin Lake, daily water surface elevations—percent of days exceeded for June over modeled period of record (1939–2011).

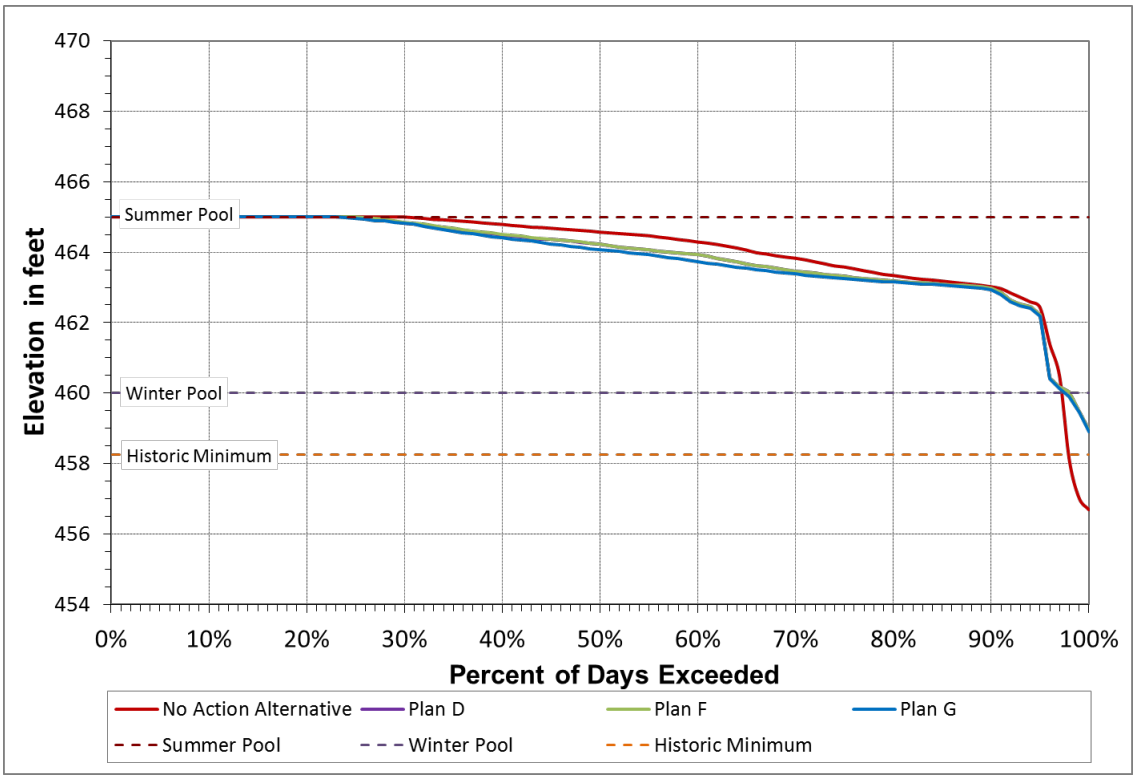


Figure 6.1-22. Logan Martin Lake, daily water surface elevations—percent of days exceeded for September over modeled period of record (1939–2011).

6.1.1.2.3.1.4 R.L. Harris Lake

Figure 6.1-23 through Figure 6.1-27 present model results for water surface elevations for the No Action Alternative at R.L. Harris Lake over the modeled period of record. Median daily water surface elevations for the No Action Alternative over the modeled period of record (Figure 6.1-23) would generally equal the project guide curve elevation from January through April. Median pool elevations would gradually decline through the summer months (May–September), such that the median elevation for the No Action Alternative by the end of September would be about 1.7 ft below the summer guide curve level. During the balance of the year (October–December), median daily water surface elevations would range from 0.5 to 1.7 ft below the guide curve elevation.

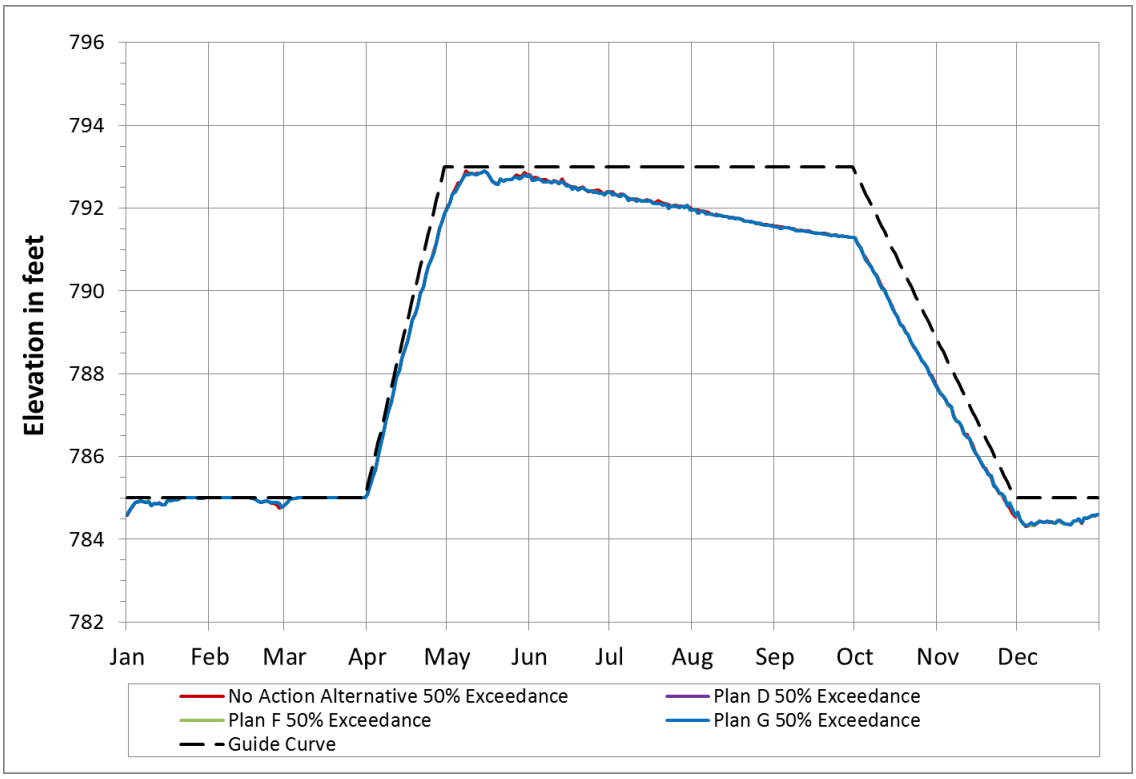


Figure 6.1-23. R.L. Harris Lake, median daily water surface elevation over modeled period of record (1939–2011).

Figure 6.1-24 depicts daily water surface elevations throughout the year for R. L. Harris Lake that would be exceeded 90 percent of the time over the modeled period of record, indicative of drought conditions in the basin. For the No Action Alternative, daily water surface elevations at the 90 percent exceedance level over the modeled period of record would range from about one to 2.5 ft below the guide curve elevation from January through April. The 90 percent exceedance pool elevation would peak at the end of May at about elevation 792.5 ft (about 0.5 below the summer guide curve elevation), thereafter declining to an elevation about 790 ft by the end of September (about three ft below the guide curve elevation). For the balance of the months of the year, median pool elevation would range from about one to 1.5 ft below the guide curve.

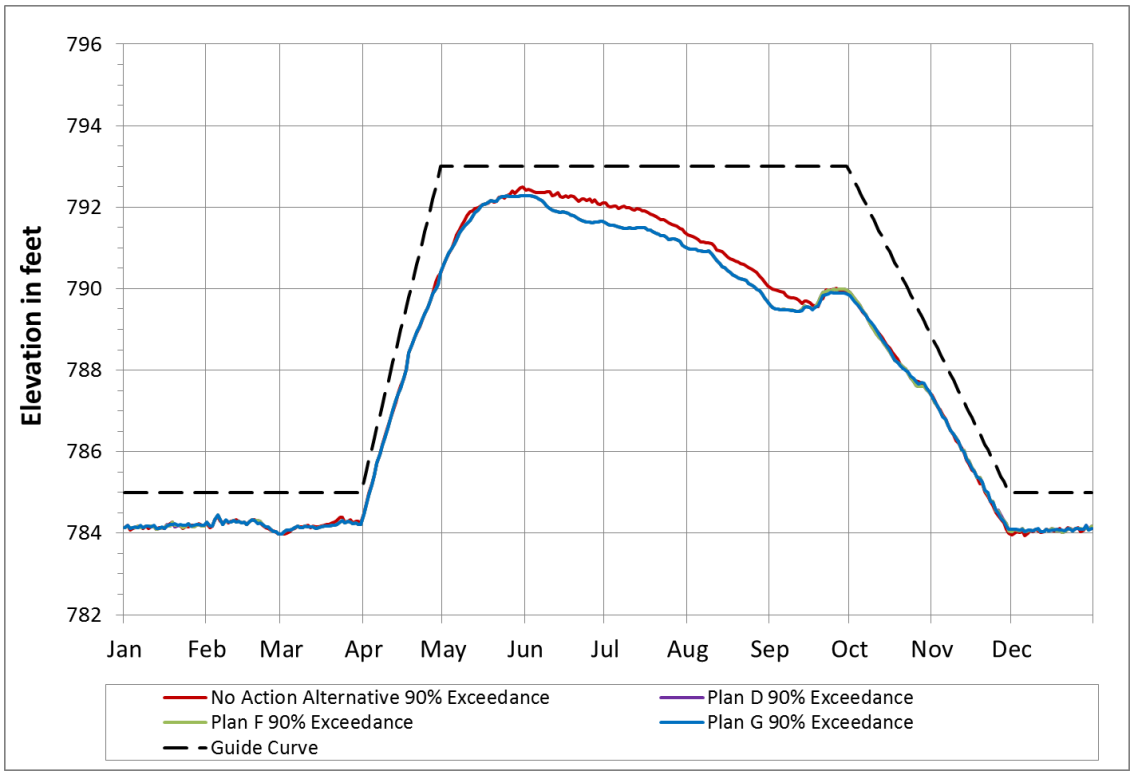


Figure 6.1-24. R.L. Harris Lake, daily water surface elevations that would be exceeded 90 percent of the time over modeled period of record (1939–2011).

According to Figure 6.1-25, water surface elevations for the No Action Alternative for R.L. Harris Lake over the modeled period of record would equal or exceed the summer guide curve elevation (793 ft) only about 7 percent of the time. The summer guide pool is at elevation 793 about 42 percent of the time during the year. The winter pool level (elevation 785 ft) is equaled or exceeded about 79 percent of the time. The lowest pool elevation that would be expected over the modeled period of record for the No Action Alternative would likely be about elevation 773.6 ft, or 11.4 ft below the winter guide curve level.

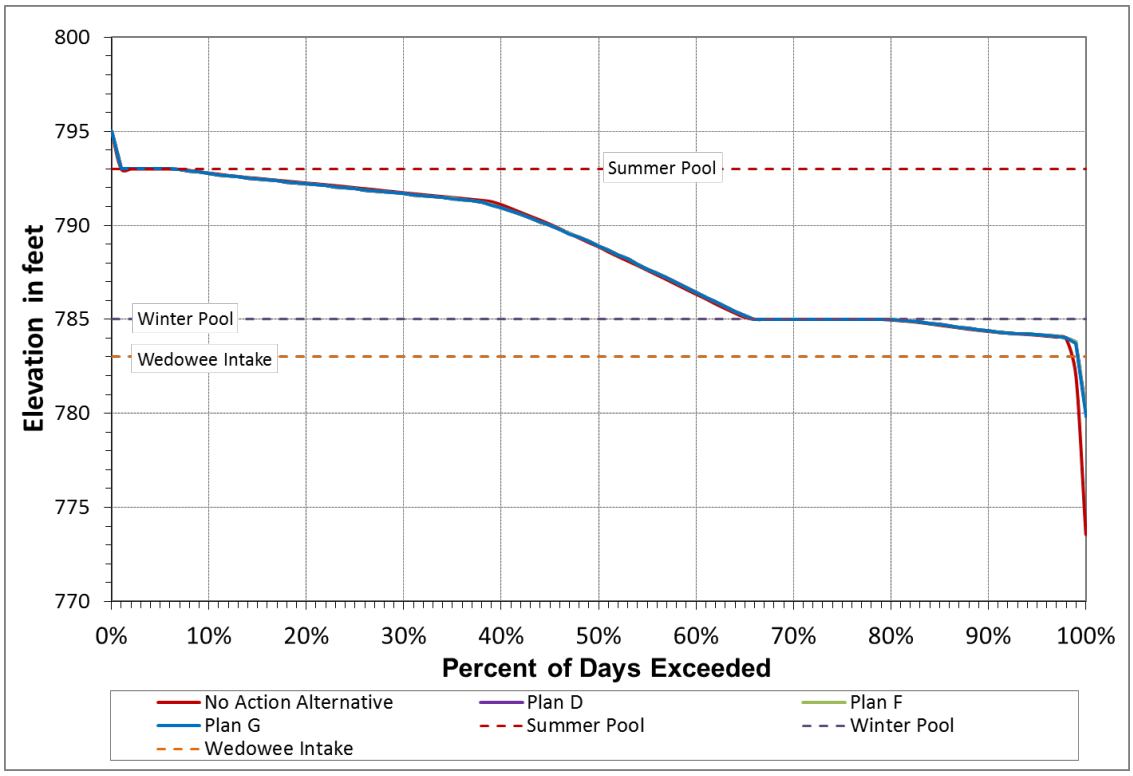


Figure 6.1-25. R.L. Harris Lake, daily water surface elevations—percent of days exceeded over modeled period of record (1939–2011).

Two months during the year were selected for closer examination for the No Action Alternative. For the days in June over the entire period of record (depicted in Figure 6.1-26), the summer pool elevation of 793 ft would likely be equaled or exceeded about 19 percent of the time (elevation 792 ft would be exceeded 92 percent of the time). The lowest water surface elevation that would be expected in June over the period of record would be elevation 787.4 ft. For the days in September over the entire period of record (depicted in Figure 6.1-27), the summer pool elevation (793 ft) would likely be equaled or exceeded about 2 percent of the time (elevation 792 ft would likely be exceeded only 8 percent of the time). The lowest water surface elevation that would be expected in September over the period of record would be about elevation 780.5 ft, about 4.5 ft below the winter guide curve elevation.

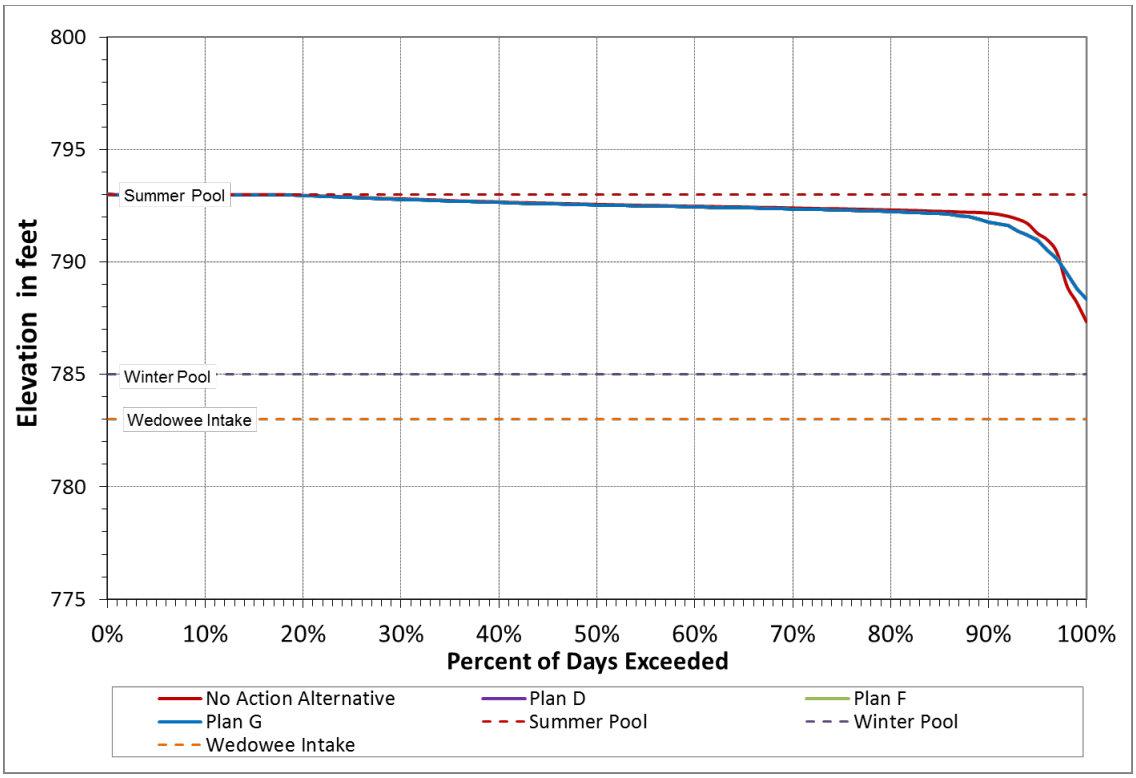


Figure 6.1-26. R.L. Harris Lake, daily water surface elevations—percent of days exceeded for June over modeled period of record (1939–2011).

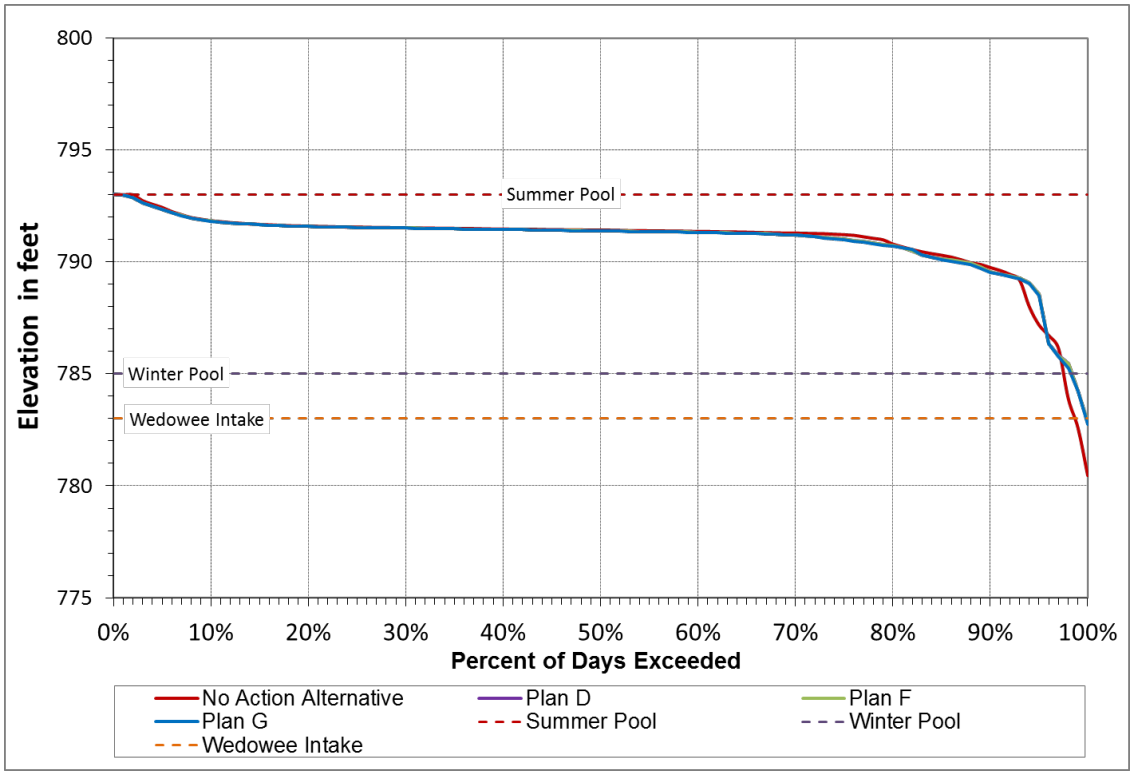


Figure 6.1-27. R.L. Harris Lake, daily water surface elevations—percent of days exceeded for September over modeled period of record (1939–2011).

6.1.1.2.3.1.5 Lake Martin

Figure 6.1-28 through Figure 6.1-32 present model results for water surface elevations at Lake Martin for the No Action Alternative over the modeled period of record. The elevations for Lake Martin are referenced to Martin Datum, which is equivalent to one ft below mean sea level. Note that the actual guide curve elevation used in the HEC-ResSim modeling was 489.5 ft, even though the published summer guide curve (top of conservation pool) elevation is 490 ft (Martin datum). APC actually manages the summer pool to elevation 489.5 ft, and the use of that elevation for the modeling was coordinated with the APC (Hathorn 2014).

Median daily water surface elevations for the No Action Alternative at Lake Martin (Figure 6.1-28) would generally match the guide curve elevations for the months of January through June. From July through mid-October, median pool elevations under the No Action Alternative would fall below the guide curve, with the largest deficit (about 1.2 ft) about September 1. From mid-October through December, median daily water surface elevations would be expected to match the project guide curve.

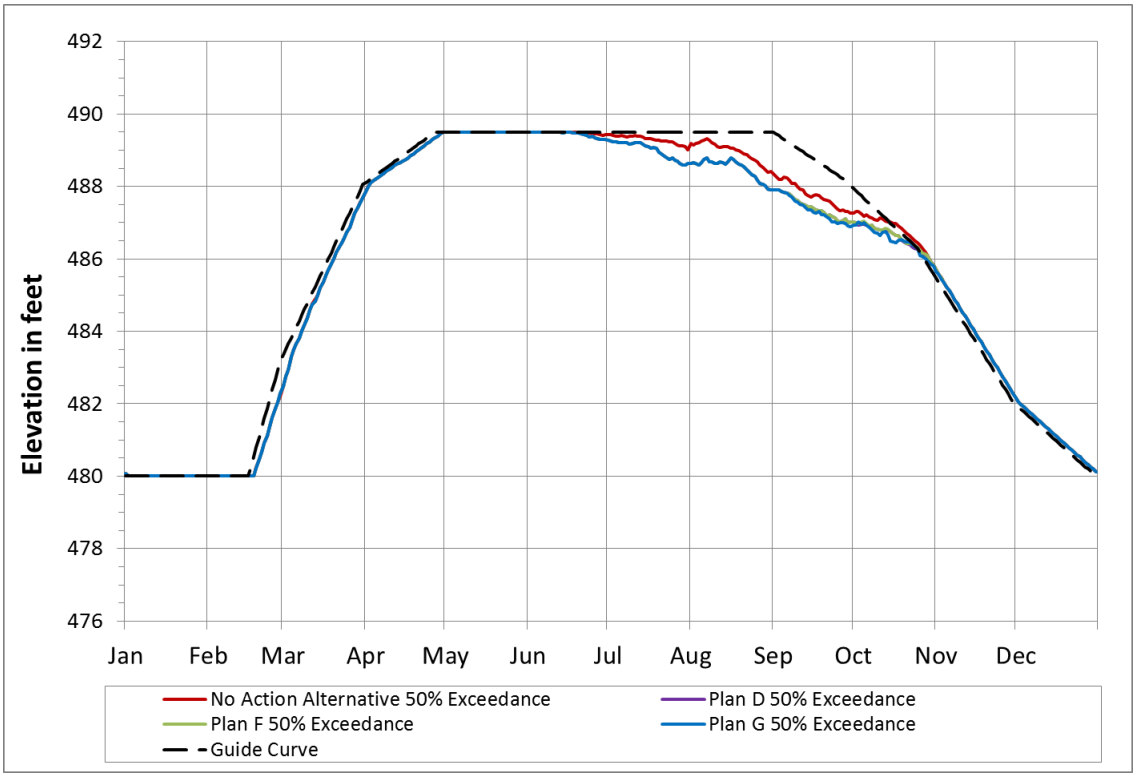


Figure 6.1-28. Lake Martin, median daily water surface elevation over modeled period of record (1939–2011) (elevations referenced to Martin Datum).

Figure 6.1-29 depicts daily water surface elevations throughout the year for Lake Martin that would be exceeded 90 percent of the time over the modeled period of record, indicative of drought conditions in the basin. For the No Action Alternative, daily water surface elevations at the 90 percent exceedance level over the period of record would match the project guide curve from January through mid-February. From mid-February through June, 90 percent exceedance pool levels would generally range from about one to two ft below the guide curve, peaking at an elevation of about 488.7 in early June. Thereafter, the pool elevations would gradually decline throughout the summer and early fall, ranging from about one to 3.6 ft below the project guide curve to an elevation about 482 ft by the end of November, returning to match guide curve elevations during the month of December.

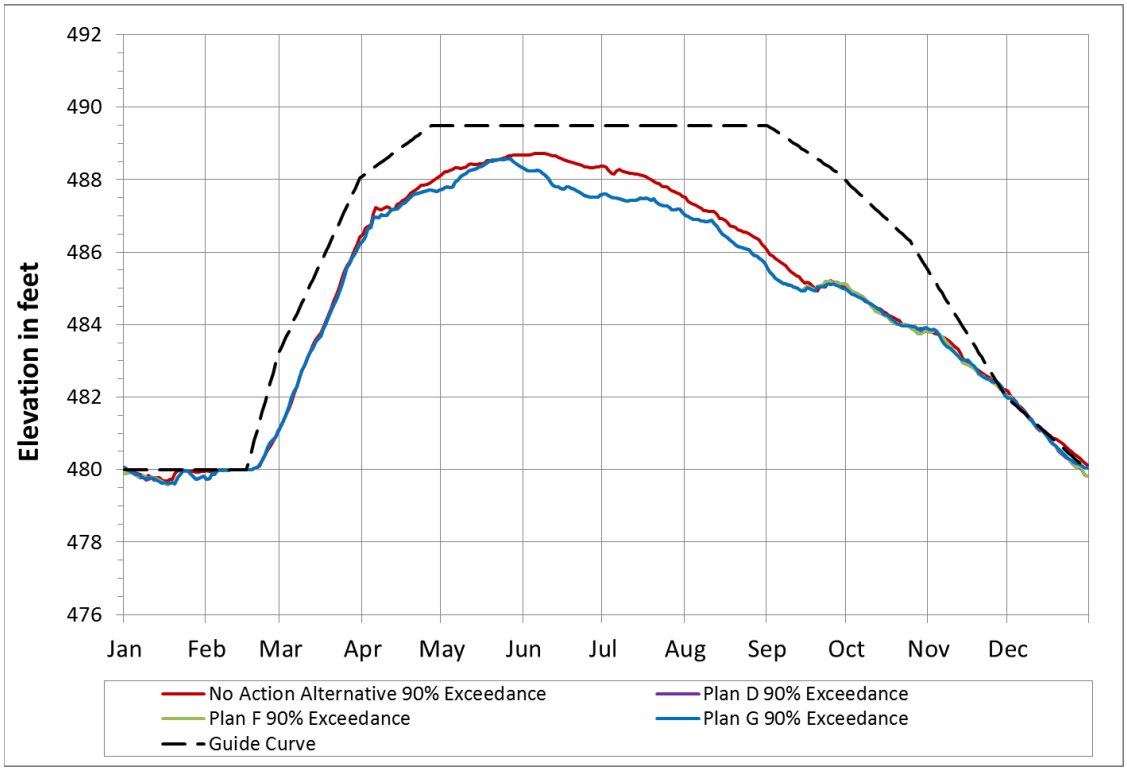


Figure 6.1-29. Lake Martin, daily water surface elevations that would be exceeded 90 percent of the time over modeled period of record (1939–2011) (elevations referenced to Martin Datum).

According to Figure 6.1-30, water surface elevations for the No Action Alternative at Lake Martin over the modeled period of record would equal or exceed the summer pool level (elevation 489.5 ft) about 15 percent of days and the winter pool level (elevation 480 ft) about 96 percent of the time. The lowest pool elevation that would be expected over the modeled period of record for the No Action Alternative would be about elevation 456.2 ft, or 23.8 ft below the winter guide curve level.

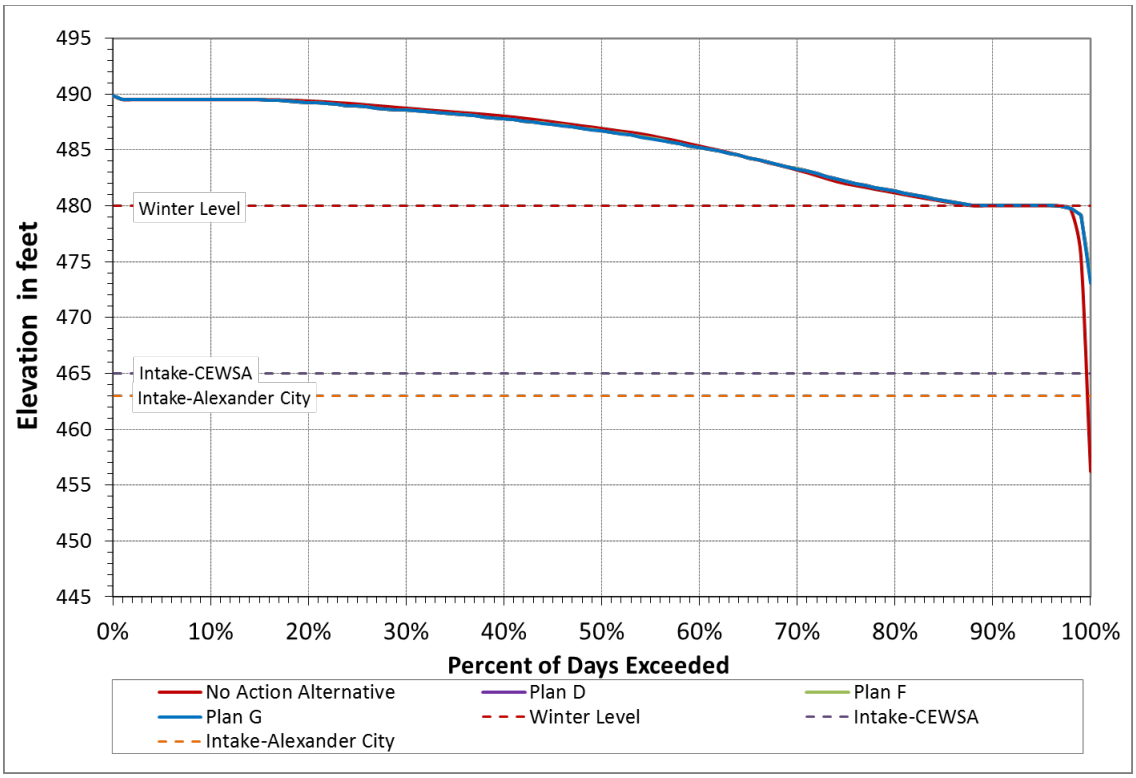


Figure 6.1-30. Lake Martin, daily water surface elevations—percent of days exceeded over modeled period of record (1939–2011) (all elevations referenced to Martin Datum).

Two months during the year were selected for closer examination for the No Action Alternative. For the days in June over the entire period of record (depicted in Figure 6.1-31), Lake Martin would be expected to equal or exceed the summer pool elevation of 489.5 ft on 50 percent of the days. Elevation 488.5 ft (one foot lower than the summer guide curve elevation) would likely be exceeded 89 percent of the time. The lowest water surface elevation that would be expected in June over the period of record would be elevation 480.9 ft. For the days in November over the entire period of record (depicted in Figure 6.1-32), elevation 482 ft (the guide curve elevation at the end of November) would likely be equaled or exceeded about 91 percent of the time. The lowest water surface elevation that would be expected in November over the period of record for the No Action Alternative would be about elevation 459.9 ft, or 20.1 ft below the winter guide curve elevation for Lake Martin.

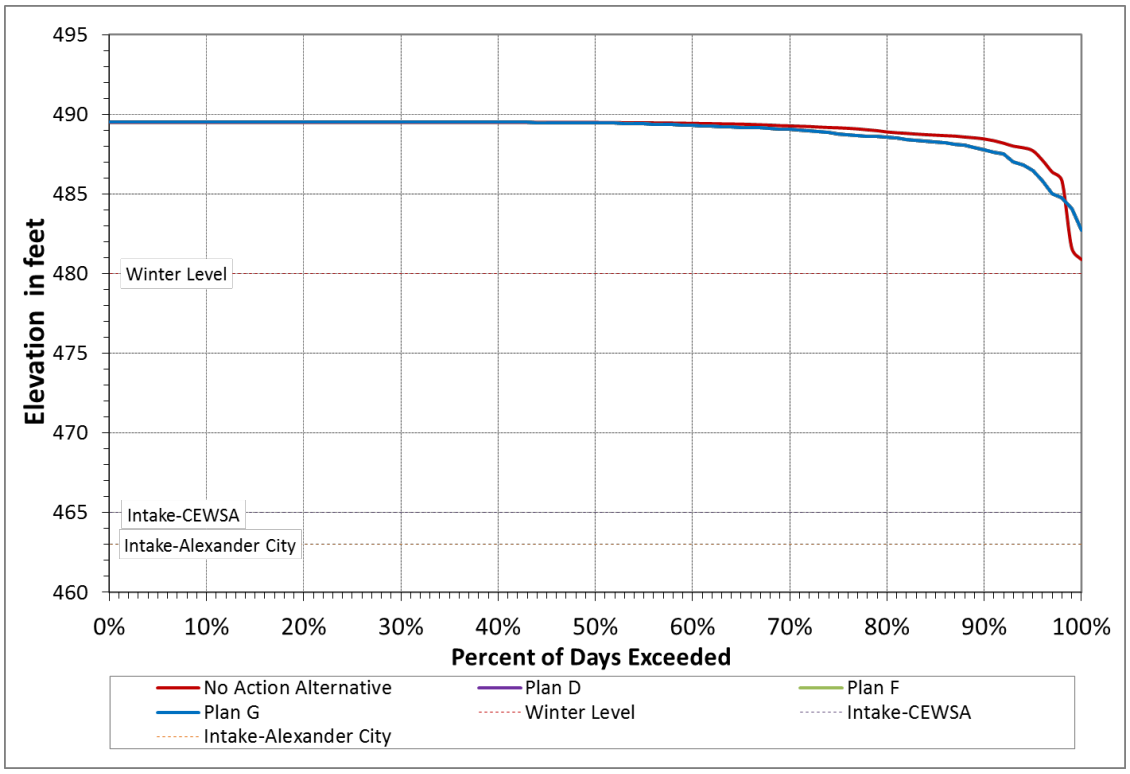


Figure 6.1-31. Lake Martin, daily water surface elevations—percent of days exceeded for June over modeled period of record (1939–2011) elevations referenced to Martin Datum).

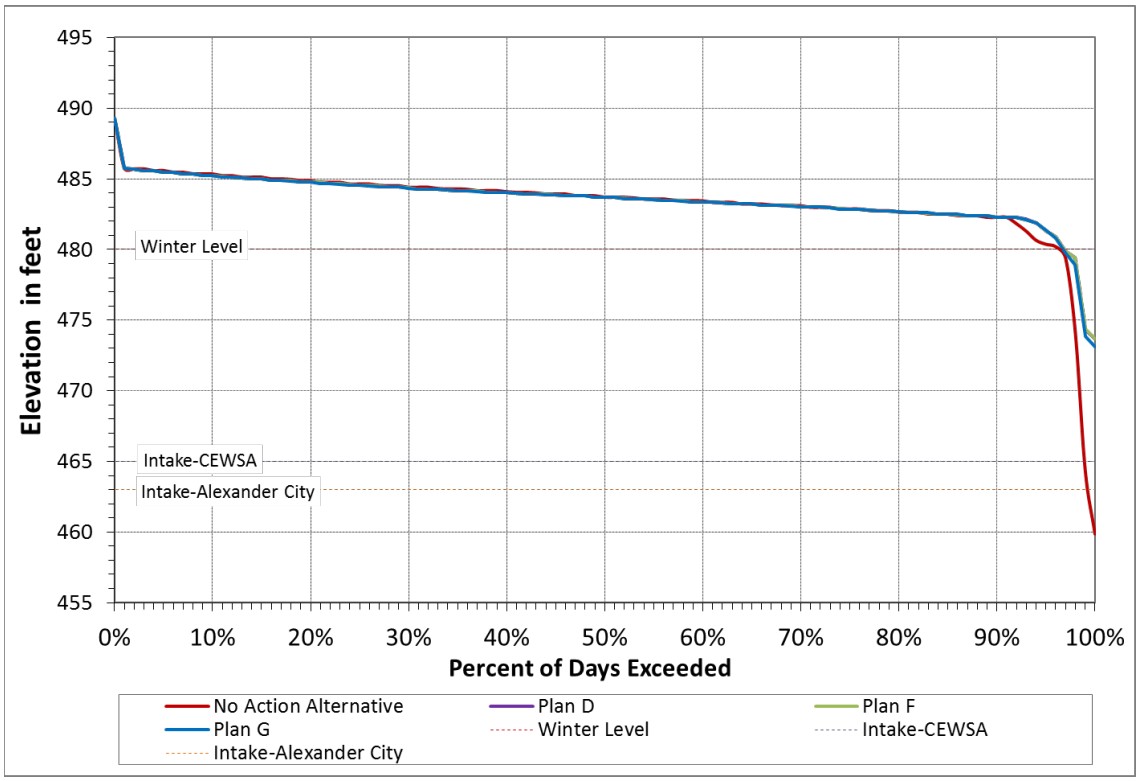


Figure 6.1-32. Lake Martin, daily water surface elevations—percent of days exceeded for November over modeled period of record (1939–2011) (elevations referenced to Martin Datum).

6.1.1.2.3.2 Alternative Plan D

Figure 6.1-9 through Figure 6.1-32 include model outputs for water surface elevations at APC's Weiss, H. Neely Henry, and Logan Martin lakes on the Coosa River and R.L. Harris Lake and Lake Martin on the Tallapoosa River resulting from operations under Plan D over the modeled period of hydrologic record. The effects associated with Plan D for each of those lakes are discussed below.

6.1.1.2.3.2.1 Weiss Lake

Figure 6.1-9 through Figure 6.1-12 depict results of model runs for water surface elevations at Weiss Lake for Plan D over the modeled period of record. Median daily water surface elevations (Figure 6.1-9) would be equivalent to those for the No Action Alternative, except for the period from early July through the end of September when Plan D elevations would be slightly lower (by about 0.2 to 0.4 ft). These differences in median water surface elevations between No Action and Plan D are considered minor.

At the 90 percent exceedance level (Figure 6.1-10), which would be representative of drought conditions in the basin, the water surface elevations for Plan D would be equivalent to the guide curve for Weiss Lake and water surface elevation for the No Action Alternative from the months of January through April. Thereafter, water surface elevations for Plan D would drop slightly below those for the No Action Alternative for the balance of the year. The elevation difference would vary from 0.1 ft to a maximum of about 0.5 ft in mid-June. These differences would be considered minor and unlikely to have an appreciable effect on existing purposes and uses of the lake.

According to Figure 6.1-11 water surface elevations for Plan D over the modeled period of record would equal or exceed the summer guide curve elevation of 564 ft about 18 percent of the time and would exceed the winter pool level (elevation 558 ft) about 98 percent of the time, a slight overall decrease in both measures compared to the No Action Alternative. The lowest pool elevation that would be expected over the modeled period of record for Plan D would be about elevation 556.1 ft, about two ft below the winter guide curve level and four ft higher than the lowest lake level expected to occur under the No Action Alternative.

Lake levels for June during the peak recreation season were examined more closely. For days in June over the entire period of record (depicted in Figure 6.1-12), the summer guide curve elevation of 564 ft would likely be equaled or exceeded 55 percent of the time under Plan D, and elevation 563 ft would likely be exceeded about 93 percent of the time. Those results would be slightly lower than the No Action Alternative. However, during the most infrequent events associated with drought conditions, the lowest water surface elevation that would be expected in June over the entire period of record under Plan D would be about elevation 561.5 ft. That elevation would be about 9.5 ft higher than the lowest level expected under the No Action Alternative for June.

Proposed operational changes in the upstream USACE projects in the ACT Basin and drought operations features associated with Plan D would likely have an overall minor adverse effect on daily water surface elevations in Weiss Lake under normal conditions. Implementing drought features in Plan D would be expected to provide notable improvement in lake level conditions at Weiss Lake during extreme drought conditions (occurring less than 5 percent of the time over the modeled period of record).

6.1.1.2.3.2.2 H. Neely Henry Lake

Figure 6.1-13 through Figure 6.1-17 depict model results for water surface elevations at H. Neely Henry Lake for Plan D over the modeled period of record. For H. Neely Henry Lake, Plan D incorporates the guide curve with revised winter pool levels that has been in effect since June 1999 under a variance from FERC to the current hydropower license (with USACE concurrence), whereas the No Action Alternative

includes the guide curve from the FERC license in effect at the time the current WCM update process was initiated in 2008. [NOTE: The H. Neely Henry guide curve revision was included in the new FERC license for APC Coosa River on June 20, 2013.]

For Plan D, median daily water surface elevations in H. Neely Henry Lake over the modeled period of record would generally align with the revised guide curve (previously in effect under a FERC interim-approved variance and included in the June 2013 FERC re-license of the Coosa River projects) (see Figure 6.1-13). The only exception would occur in the months of July through September when Plan D median pool elevations would decline up to about 0.4 ft below the summer guide curve elevation and marginally below median water surface elevations for the No Action Alternative, by about 0.1 ft on average. From October through December, water surface elevations for Plan D would be equivalent to the guide curve elevation associated with Plan D. Actual differences in median water surface elevations between Plan D and No Action during the months of January through March and December would be two ft (and zero to two feet) during April and October through November. These differences are solely driven by the different guide curves applied to No Action and to Plan D.

As depicted on Figure 6.1-14, daily water surface elevations for Plan D at H. Neely Henry Lake that would be exceeded 90 percent of the days over the modeled period of record would represent extremely dry conditions in the basin. Water surface elevations for Plan D would match the June 2013 FERC-approved guide curve from January through mid-April and would be up to two feet higher than elevations under the No Action Alternative for reasons stated in the previous paragraph. The elevations would peak in mid-May at about elevation 507.6 ft and would trend gradually downward to an elevation in the range of about 506.4 ft by the end of November, thereafter increasing to about elevation 507 ft by the end of December. Except for a brief period in June when elevations for the No Action Alternative would be marginally higher than Plan D. Plan D water surface elevations at the 90 percent exceedance level would be higher by variable amounts ranging from about 0.2 ft up to two ft.

According to Figure 6.1-15, water surface elevations for Plan D over the modeled period of record at H. Neely Henry Lake would be equal to or within 0.5 ft of the summer guide curve level of elevation 508 ft about 42 percent of the time. For comparison, the revised guide curve, as defined, is above elevation 507.5 about 54 percent of the time during the year. The revised winter pool level (elevation 507 ft) would be exceeded about 91 percent of the time. The lowest pool elevation that would be expected over the modeled period of record for Plan D would likely be about 504.9 ft (2.1 ft below the revised winter guide curve level), but representing a 1.6-ft improvement over the lowest level expected at H. Neely Henry Lake under the No Action Alternative.

Water surface elevations for Plan D at H. Neely Henry Lake in June and September over the modeled period of record were examined to assess differences with the No Action Alternative. For those days in June over the entire period of record (depicted in Figure 6.1-16), water surface elevations would be equal to or within 0.5 ft of the summer guide curve (elevation 508 ft) about 90 percent of the time. Those curves on Figure 6.1-16 for Plan D and the No Action Alternative up to the point of 94 percent of days exceeded are closely aligned. However, during the more infrequent events associated with drought conditions, the lowest water surface elevation that would be expected in June over the entire period of record under Plan D would be about elevation 506.5 ft. That elevation would be about 3.2 ft higher than the lowest level expected at H. Neely Henry Lake for the No Action Alternative in June.

For the days in September over the entire period of record (depicted in Figure 6.1-17), water surface elevations would be equal to or within 0.5 ft of the summer guide curve (elevation 508 ft) about 62 percent of the time and above the revised winter guide curve level (elevation 507 ft) about 92 percent of the time. Figure 6.1-17 clearly indicates that improved lake elevation conditions in September would be likely with Plan D compared to the No Action Alternative. During the more infrequent events associated with drought conditions, the lowest water surface elevation that would be expected in

September over the period of record under Plan D would be about elevation 505.4 ft. That elevation would be about 1.9 ft higher than the lowest level expected at H. Neely Henry Lake for the No Action Alternative during September.

Proposed operational changes in the upstream USACE projects in the ACT Basin and drought operation features associated with Plan D would likely have a moderate overall beneficial effect on water surface elevations in H. Neely Henry Lake. Implementing drought features in Plan D would be expected to provide notable improvement in lake level conditions at H. Neely Henry Lake during extreme drought conditions (occurring less than 10 percent of the time over the modeled period of record).

6.1.1.2.3.2.3 Logan Martin Lake

Figure 6.1-18 through Figure 6.1-22 depict results of model runs for water surface elevations at Logan Martin Lake for Plan D over the modeled period of hydrologic record. For Plan D, median daily water surface elevations in Logan Martin Lake over the modeled period of record (Figure 6.1-18) would essentially match the project guide curve and elevations for the No Action Alternative for the months of January through June. From July through September, median daily pool elevations would likely decline below the guide curve elevation of 465 ft (in the range of 0.1 to 0.9 ft) and slightly below median elevations for the No Action Alternative (by zero to 0.4 ft). During October through December, median water surface elevations for Plan D would fall a minimal amount (by zero to about 0.2 ft) below the project guide curve and No Action Alternative elevations.

As depicted on Figure 6.1-19, daily water surface elevations for Plan D at Logan Martin Lake that would be exceeded 90 percent of the days over the modeled period of record would represent extremely dry conditions in the basin. Under these conditions, water surface elevations for Plan D would be nearly equivalent to elevations for the No Action Alternative with the following difference. From mid-May through August, pool elevations at the 90 percent exceedance level would be lower than the No Action Alternative by amounts varying from zero up to about 0.8 ft. Under extremely dry conditions in the basin, Logan Martin Lake would be slightly lower during the summer season under Plan D than No Action.

According to Figure 6.1-20, water surface elevations for Plan D over the modeled period of record at Logan Martin Lake would be within 0.5 ft of the summer guide curve level of elevation 465 ft or higher about 28 percent of the time. Water surface elevations would be at or above the winter pool level (460 ft) about 97 percent of the time, which is essentially the same result as for the No Action Alternative. However, the lowest pool elevation that would be expected over the modeled period of record for Plan D would likely be at about elevation 458.1 ft (1.9 ft below the winter guide curve level), representing about a 1.9 improvement over the lowest level expected at Logan Martin Lake under the No Action Alternative.

Water surface elevations for Plan D at Logan Martin Lake in June and September over the modeled period of record were examined to assess differences with the No Action Alternative. For those days in June over the entire period of record (depicted in Figure 6.1-21), the summer pool elevation of 465 ft would likely be equaled or exceeded about 52 percent of the time (464 ft would be exceeded about 83 percent of the time), slightly less than the results for the No Action Alternative. However, during the more infrequent events associated with drought conditions, the lowest water surface elevation that would be expected during June over the entire period of record under Plan D would be about elevation 461.1 ft. That elevation would be about 4.9 ft higher than the lowest level expected at Logan Martin Lake for the No Action Alternative during the month of June.

For the days in the month of September over the modeled period of record (depicted in Figure 6.1-22), the summer pool elevation (465 ft) would likely be equaled or exceeded about 24 percent of the time (464 ft would likely be exceeded 58 percent of the time). Figure 6.1-22 clearly indicates that lake elevation conditions for Plan D would be expected to be slightly lower compared to the No Action Alternative for a

sizeable portion of days in September. However, during the more infrequent events associated with extreme drought conditions, the lowest water surface elevation that would be expected during September over the period of record under Plan D would be about elevation 459 ft. That elevation would be about 2.2 ft higher than the lowest level expected at Logan Martin Lake for the No Action Alternative during September.

Proposed operational changes in the upstream USACE projects in the ACT Basin and drought operations features associated with Plan D would likely have a minor overall effect on daily water surface elevations in Logan Martin Lake compared to the No Action Alternative. Implementing drought features in Plan D would be expected to provide notable improvement in lake level conditions at Logan Martin Lake during extreme drought conditions (occurring less than 10 percent of the time over the modeled period of record).

6.1.1.2.3.2.4 R.L. Harris Lake

Figure 6.1-23 through Figure 6.1-27 depict results of model runs for water surface elevations at R.L. Harris Lake for Plan D over the modeled period of hydrologic record. For Plan D, median daily water surface elevations in R.L. Harris Lake over the modeled period of record (Figure 6.1-23) would be essentially equivalent to the median daily elevations for the No Action Alternative.

As depicted on Figure 6.1-24, daily water surface elevations for Plan D at R.L. Harris Lake that would be exceeded 90 percent of the days over the modeled period of record would represent extremely dry conditions in the basin. Under these conditions, water surface elevations for Plan D would be nearly equivalent to elevations for the No Action Alternative with the following difference. From June through mid-September, water surface elevations at the 90 percent exceedance level would be slightly lower than the No Action Alternative by amounts varying from zero up to about 0.5 ft. Thus, under extremely dry conditions in the basin, R.L. Harris Lake would be slightly lower during the summer season under Plan D.

According to Figure 6.1-25, water surface elevations for Plan D over the modeled period of record at R.L. Harris Lake would equal or exceed the summer guide curve elevation (793 ft) about 7 percent of the time and the winter pool level (785 ft) about 79 percent of the time, which is essentially the same result as for the No Action Alternative. However, the lowest pool elevation that would be expected over the modeled period of record for Plan D would likely be about elevation 780.1 ft (4.9 ft below the winter guide curve level), representing an improvement of about 6.4 ft above the lowest level expected at R.L. Harris Lake for the No Action Alternative.

Water surface elevations for Plan D at R.L. Harris Lake in June and September over the modeled period of record were examined to assess differences with the No Action Alternative. For those days in June over the entire period of record (depicted in Figure 6.1-26), the summer pool elevation of 793 ft would likely be equaled or exceeded about 18 percent of the time (elevation 792 ft would be exceeded about 88 percent of the time), about the same results that would be expected for the No Action Alternative. However, during the more infrequent events associated with extreme drought conditions, the lowest water surface elevation that would be expected in June over the entire period of record under Plan D would be about elevation 788.3 ft. That elevation would be about one ft higher than the lowest level expected at R.L. Harris Lake for the No Action Alternative in June.

For the days during September over the entire period of record (depicted in Figure 6.1-27), the summer pool elevation (793 ft) would likely be equaled or exceeded only about 2 percent of the time (elevation 792 ft would be exceeded 7 percent of the time). Figure 6.1-27 indicates that lake elevation conditions would be expected to be about the same for Plan D compared to the No Action Alternative for up to 93 percent of days during the month of September. However, during the more infrequent events associated with extreme drought conditions, the lowest water surface elevation that would be expected during

September over the period of record under Plan D would be about elevation 782.8 ft. That elevation would be about 2.3 ft higher than the lowest level expected at R.L. Harris Lake for the No Action Alternative for the month of September.

As indicated above, there is little difference in water surface elevations at R.L. Harris Lake between Plan D and the No Action Alternative except under more extreme drought conditions when Plan D elevations would likely be slightly lower (up to about 0.5 ft lower) from June through mid-September. Inclusion of a specific strategy for downstream flows to support navigation, when appropriate, coupled with drought operations measures in Plan D, factor into these slight differences. Implementing drought features in Plan D would be expected to provide notable improvement in lake level conditions at R.L. Harris Lake during extreme drought conditions (those that occur less than 10 percent of the time over the modeled period of record).

6.1.1.2.3.2.5 Lake Martin

Figure 6.1-28 through Figure 6.1-32 depict results of model runs for water surface elevations at Lake Martin for Plan D over the modeled period of hydrologic record. For Plan D, median daily water surface elevations in Lake Martin (Figure 6.1-28) would be expected to closely follow the guide curve the months of January through June. From July through mid-October, water surface elevations for Plan D would fall slightly below those for the No Action Alternative in the range of zero to 0.5 ft. From mid-October through December, water surface elevations for both Plan D and the No Action Alternative would match the project guide curve. The slight differences in median water surface elevations over the period of record between Plan D and the No Action Alternative are attributable to inclusion of a specific strategy for flows to support downstream navigation, when appropriate, coupled with specific drought management features for the basin that provide more effective and clear guidelines governing releases to conserve storage under drought conditions, depending on the degree of severity of those conditions.

As depicted Figure 6.1-29, daily water surface elevations for Plan D at Lake Martin that would be exceeded 90 percent of the days over the modeled period of record would be indicative of extremely dry conditions in the basin. Under these conditions, water surface elevations for Plan D would be nearly equivalent to elevations for the No Action Alternative with the following difference. Between late April and mid-September, water surface elevations at the 90 percent exceedance level would be slightly lower than the No Action Alternative by amounts varying from zero up to about 0.8 ft. Thus, under extremely dry conditions in the basin, Lake Martin would be slightly lower than the No Action Alternative during the summer season under Plan D.

According to Figure 6.1-30, water surface elevations for Plan D over the modeled period of record at Lake Martin would equal or exceed the summer pool level (elevation 489.5 ft) about 14 percent of the time and the winter pool level (elevation 480 ft) about 97 percent of the time, about the same as the No Action Alternative. Additionally, the lowest pool elevation that would be expected for Plan D over the period of record would likely be about elevation 473.7 ft (6.3 ft below the winter guide curve level), representing an improvement of about 17.5 ft above the lowest level expected at Lake Martin for the No Action Alternative.

Water surface elevations for Plan D at Lake Martin in June and November over the modeled period of record were examined to assess differences with the No Action Alternative. For those days in June over the entire period of record (depicted in Figure 6.1-31), Lake Martin would be expected to equal or exceed the summer pool elevation of 489.5 ft for 43 percent of the time over the modeled period of record. Elevation 488.5 ft (one foot lower than the summer guide curve elevation) would likely be exceeded 81 percent of the time, similar to results that would be expected for the No Action Alternative. However, during infrequent events associated with extreme drought conditions, the lowest water surface elevation

that would be expected during June over the entire period of record under Plan D would be about elevation 482.7 ft. This elevation would be about 1.8 ft higher than the lowest level expected at Lake Martin for the No Action Alternative for the month of June over the period of record.

For the days in November over the entire period of record (depicted in Figure 6.1-32), elevation 482 ft (the guide curve elevation at the end of November) would likely be equaled or exceeded about 93 percent of the time, which would indicate a slight increase in the number of days exceeding that level compared to the No Action Alternative. Also, during infrequent events associated with extreme drought conditions, the lowest water surface elevation that would be expected in November for Plan D over the period of record would be about elevation 473.7 ft. This elevation would be about 13.8 ft higher than the lowest level expected at Lake Martin for the No Action Alternative in November over the period of record.

As indicated above, inclusion of a specific strategy for downstream flows to support navigation, when appropriate, coupled with drought operations measures in Plan D would likely result in a slight decrease in water surface elevations at the 50 percent exceedance (median) and 90 percent exceedance levels in the summer and early fall periods over the modeled period of record when compared to the No Action Alternative. Implementing drought operations measures included in Plan D would be expected to provide notable improvement in lake level conditions at Lake Martin during extreme drought conditions (those that occur less than 10 percent of the time over the modeled period of record).

6.1.1.2.3.3 Alternative Plan F

Figure 6.1-9 through Figure 6.1-32 display model outputs for water surface elevations at APC's Weiss, H. Neely Henry, and Logan Martin lakes on the Coosa River and R.L. Harris Lake and Lake Martin on the Tallapoosa River resulting from operations under Plan F over the modeled period of hydrologic record. The effects associated with Plan F on lake levels at each of the lakes are addressed below.

6.1.1.2.3.3.1 Weiss Lake

On the basis of the model outputs as presented in Figure 6.1-9 through Figure 6.1-12, Plan F would be expected to have essentially the same effects on water surface elevations in Weiss Lake as described for Plan D above.

6.1.1.2.3.3.2 H. Neely Henry Lake

On the basis of the model outputs as presented in Figure 6.1-13 through Figure 6.1-17, Plan F would be expected to have essentially the same effects on water surface elevations in H. Neely Henry Lake as described for Plan D above.

6.1.1.2.3.3.3 Logan Martin Lake

On the basis of the model outputs as presented in Figure 6.1-18 through Figure 6.1-22, Plan F would be expected to have essentially the same effects on water surface elevations in Logan Martin Lake as described for Plan D above.

6.1.1.2.3.3.4 R.L. Harris Lake

On the basis of the model outputs as presented in Figure 6.1-23 through Figure 6.1-27, Plan F would be expected to have essentially the same effects on water surface elevations in R.L. Harris Lake as described for Plan D above.

6.1.1.2.3.3.5 Lake Martin

On the basis of the model outputs as presented in Figure 6.1-28 through Figure 6.1-32, Plan F would be expected to have essentially the same effects on water surface elevations in Lake Martin as described for Plan D above.

6.1.1.2.3.4 Alternative Plan G (Proposed Action Alternative)

Figure 6.1-9 through Figure 6.1-32 present model outputs for water surface elevations over the modeled period of hydrologic record at APC's Weiss, H. Neely Henry, and Logan Martin lakes on the Coosa River and R.L. Harris Lake and Lake Martin on the Tallapoosa River resulting from operations under Plan G (Proposed Action Alternative). The effects associated with the Proposed Action Alternative on lake levels at each of those lakes are addressed below.

6.1.1.2.3.4.1 Weiss Lake

On the basis of the model outputs as presented in Figure 6.1-9 through Figure 6.1-12, the Proposed Action Alternative would be expected to have essentially the same effects on water surface elevations in Weiss Lake as described for Plan D above, with the following exception. Daily water surface elevations at the 50 percent (median) and 90 percent exceedance levels for Plan G would be marginally lower than Plan D from September through November and marginally higher than Plan D in December. Differences would typically be minimal, in the general range of 0.1 to 0.2 ft.

6.1.1.2.3.4.2 H. Neely Henry Lake

On the basis of the model outputs as presented in Figure 6.1-13 through Figure 6.1-17, the Proposed Action Alternative would be expected to have essentially the same effects on water surface elevations in H. Neely Henry Lake as described for Plan D above, with the following exception. Daily water surface elevations at the 50 percent (median) and 90 percent exceedance levels for Plan G would be marginally lower than Plan D from mid-September through November and marginally higher than Plan D in December. Differences would be minimal, in the general range of 0.1 to 0.2 ft.

6.1.1.2.3.4.3 Logan Martin Lake

On the basis of the model outputs as presented in Figure 6.1-18 through Figure 6.1-22, the Proposed Action Alternative would be expected to have essentially the same effects on water surface elevations in Logan Martin Lake as described for Plan D above, with the following exception. Daily water surface elevations at the 50 percent (median) and 90 percent exceedance levels for Plan G would be marginally lower than Plan D from mid-September through November. At the 90 percent exceedance level, water surface elevations would be marginally higher than Plan D in December. Differences would be minimal, in the general range of 0.1 to 0.2 ft.

6.1.1.2.3.4.4 R.L. Harris Lake

On the basis of the model outputs as presented in Figure 6.1-23 through Figure 6.1-27, the Proposed Action Alternative would be expected to have essentially the same effects on water surface elevations in R.L. Harris Lake as described for Plan D above.

6.1.1.2.3.4.5 Lake Martin

On the basis of the model outputs as presented in Figure 6.1-28 through Figure 6.1-32, the Proposed Action Alternative would be expected to have essentially the same effects on water surface elevations in Lake Martin as described for Plan D above.

6.1.1.2.4 Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake, Millers Ferry Lock and Dam and William "Bill" Dannelly Lake, and Claiborne Lock and Dam and Claiborne Lake

Despite the fact that Woodruff and Dannelly lakes on the Alabama River include hydropower generation among their operating purposes, storage in those reservoirs for that purpose is minor. Consequently, those projects essentially operate as run-of-river impoundments. Claiborne Lake is fully a run-of-river operation. The general operational characteristics of the projects are described in more detail in Sections 2.1.1.1.4.15 through 2.1.1.1.4.17. The following subsections describe the effects the No Action Alternative and Alternative Plans D, F, and G would have on lake level conditions at the projects.

Figure 6.1-33 and Figure 6.1-34 present results of model outputs for water surface elevation for existing conditions (or the No Action Alternative) on Woodruff and Dannelly lakes, respectively, over the modeled period of hydrologic record. Those figures also include results for proposed revisions to the ACT WCM as defined in Alternative Plans D, F, and G (the Proposed Action). The results for those alternatives are discussed in subsequent subsections.

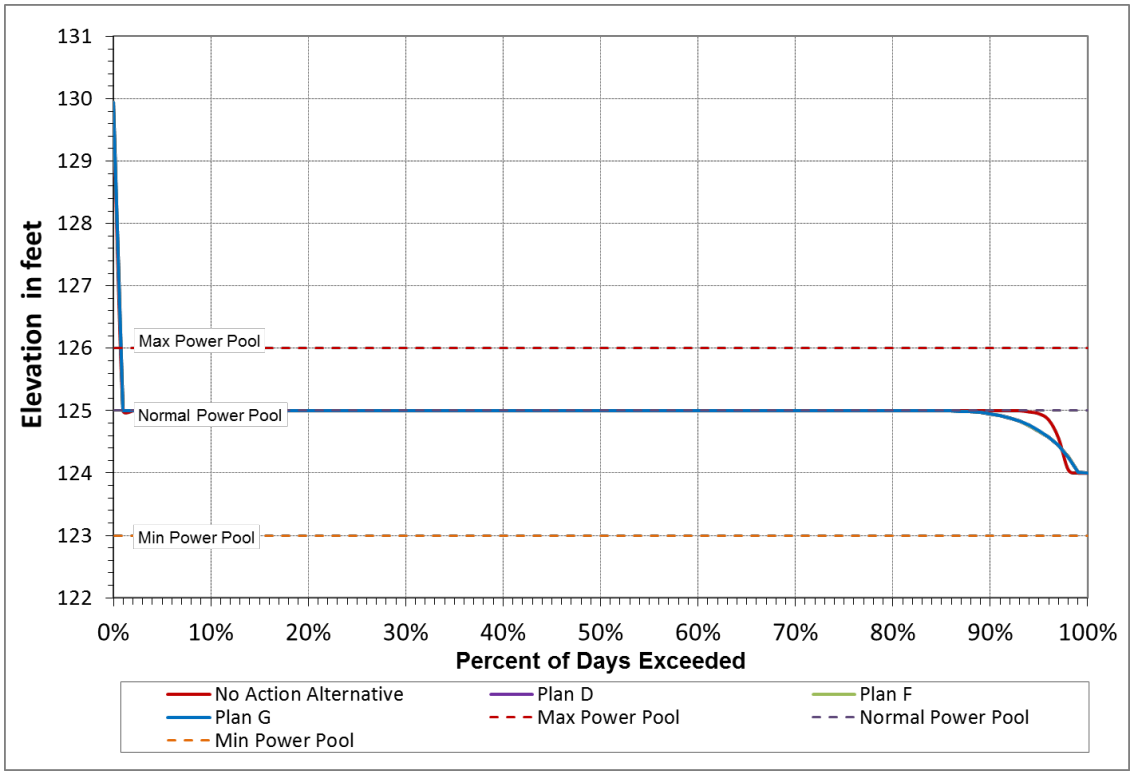


Figure 6.1-33. Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake, daily water surface elevations—percent of days exceeded over modeled period of record (1939–2011).

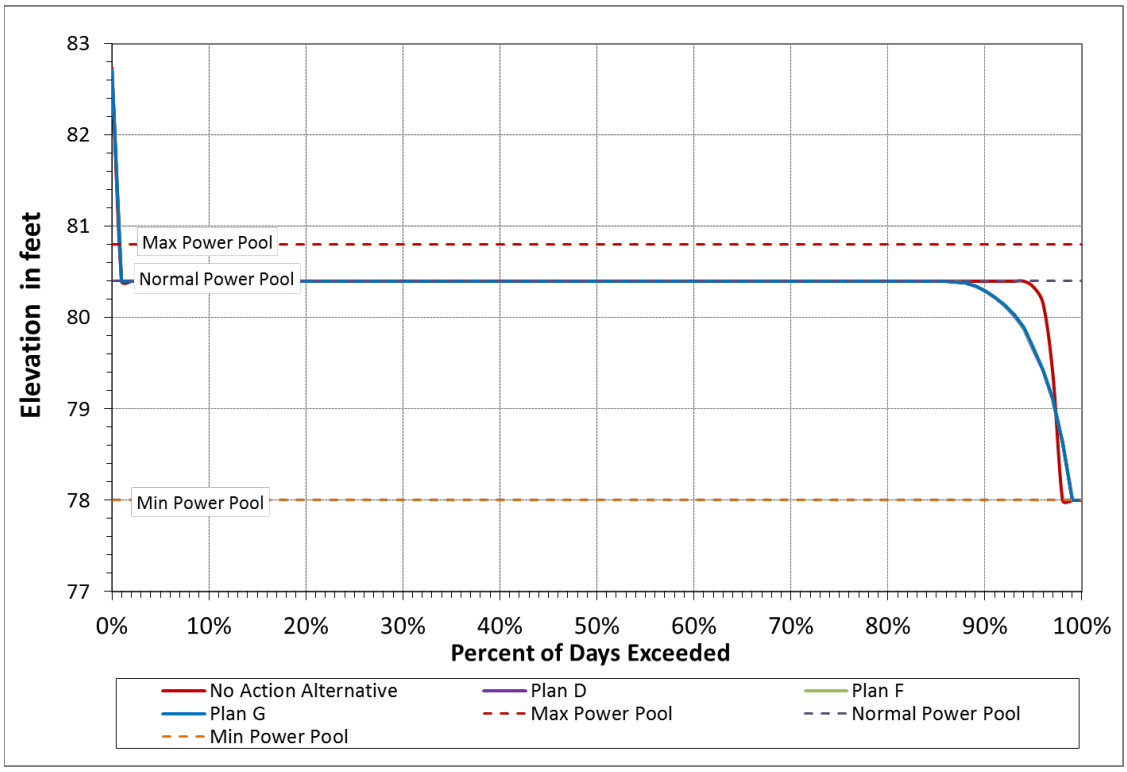


Figure 6.1-34. Millers Ferry Lock and Dam and William "Bill" Dannelly Lake, daily water surface elevations—percent of days exceeded over modeled period of record (1939–2011).

6.1.1.2.4.1 No Action Alternative

HEC ResSim outputs over the modeled period of record indicate that median daily water surface elevations for Woodruff and Dannelly lakes for the No Action Alternative would be 125 ft and 80.4 ft, respectively, for all months of the year. For Woodruff Lake, water surface elevations at the 90 percent exceedance level would likely fall below elevation 125 ft in August through mid-November, ranging from zero to about 0.5 ft, with the maximum decline in the month of October. For Dannelly Lake, 90 percent exceedance elevations would similarly fall below 80.4 ft in August through mid-November, ranging from zero to about one ft, with the maximum decline in October.

As depicted in Figure 6.1-33, Woodruff Lake would likely operate at elevation 125 ft or greater under the No Action Alternative on about 93 percent of all days during the modeled period of record. For the remaining seven percent of the time over the modeled period, the pool elevation would be expected to vary between elevation 124 and 125 ft. For Dannelly Lake (Figure 6.1-34), the water surface elevation would likely be 80.4 ft or greater on about 94 percent of the days during the modeled period of record and would be expected to range between elevation 80.4 and 78 ft in the remaining 6 percent of the time. The daily median elevations for the lakes are quite consistent and vary appreciably only during more extreme high-flow events (as high as elevation 129.8 ft for Woodruff Lake and about elevation 82.7 ft for Dannelly Lake) and during more infrequent, drier periods that occur no more often than five to six percent of the time over the modeled period.

Based upon model outputs over the period of record and historically observed conditions, Claiborne Lake normally would have a pool elevation of 36 ft under the No Action Alternative, except for brief periods during high flow conditions or extremely low flow conditions. For brief periods, the lake can operate in

the range between elevation 32 and 36 ft. Under extreme flood conditions, the water surface elevation at the lock and dam can go as high as elevation 58 ft (1961 flood).

6.1.1.2.4.2 Alternative Plan D

Figure 6.1-33 presents the duration curve for water surface elevations on Woodruff Lake for Plan D over the modeled period of hydrologic record. Woodruff Lake would likely operate at elevation 125 ft or greater under Plan D about 86 percent of all days during the modeled period of record. For the remaining 14 percent of the time over the modeled period, the pool elevation would be expected to vary between elevation 124 and 125 ft. About 86 percent of the time, pool elevations for the No Action Alternative and Plan D would be expected to be the same. In the remaining 14 percent of days over the period of record (generally representing drought conditions), pool levels under Plan D would be expected to be slightly lower than under the No Action Alternative.

HEC ResSim outputs over the modeled period of record indicate that median daily water surface elevations for Woodruff Lake for Plan D would be 125 ft for all months of the year. Water surface elevations at the 90 percent exceedance level would likely fall below 125 ft in June through mid-November from zero to about 0.6 ft, with the maximum decline in the month of September. Compared to the No Action Alternative, Plan D would result in water surface elevations at the 90 percent exceedance level that would be slightly lower and cover a longer period of time during the summer months. These differences associated with these rare occurrences are considered to be negligible.

For Dannelly Lake, the duration curve for water surface elevations (Figure 6.1-34), indicates that elevations would likely be 80.4 ft or greater on about 87 percent of the days during the modeled period of record and would range between elevation 80.4 and 78 ft during the remaining 13 percent of the time. About 87 percent of the time, pool elevations for the No Action Alternative and Plan D would be expected to be the same. In most of the remaining 13 percent of days over the period of record (generally representing drought conditions), pool levels for Plan D would be expected to be slightly lower the under the No Action Alternative.

HEC ResSim outputs over the modeled period of record indicate that median daily water surface elevations for Dannelly Lake for Plan D would be 80.4 ft for all months of the year. Water surface elevations at the 90 percent exceedance elevations would fall below 80.4 ft in late May through mid-November from zero to about 1.4 ft, with the maximum decline in the month of September. Compared to the No Action Alternative, Plan D would result in water surface elevations at the 90 percent exceedance level that would be slightly lower and cover a longer period of time during the summer months. Differences associated with these rare occurrences are considered to be negligible.

This minor effect for Plan D under drought conditions, compared to the No Action Alternative, would be expected to extend through Claiborne Lake under drought conditions.

6.1.1.2.4.3 Alternative Plan F

The lake elevation outputs for Woodruff and Dannelly lakes under Plan F over the modeled period of record would be essentially the same as for Plan D discussed above. Compared to the No Action Alternative, the effects of Plan F on water surface elevations at Woodruff and Dannelly lakes would be negligible. Implementing Plan F would affect Claiborne Lake in the same manner as for Plan D.

6.1.1.2.4.4 Alternative Plan G (Proposed Action Alternative)

The lake elevation outputs for Woodruff and Dannelly lakes under the Proposed Action Alternative over the modeled period of record would be essentially the same as for Plan D discussed above. Compared to the No Action Alternative, the effects of the Proposed Action Alternative on water surface elevations at Woodruff and Dannelly lakes would be negligible. Implementing Plan F would affect Claiborne Lake in the same manner as for Plan D.

6.1.1.3 Stream Flow Conditions in the ACT Basin

This section summarizes the effects of alternative water management plans for the ACT Basin on stream flow conditions at strategic points throughout the system. Representative summaries of HEC-ResSim model outputs are presented in this section on the basis of simulation of project operations under the alternative plans over the modeled period of record (1939–2011). On the basis of the model results, this section describes the likely effects of the No Action Alternative and Alternative Plans D, F, and G on stream flow conditions at the five following key locations in the basin: (1) Coosawattee River downstream of Carters Reregulation Dam; (2) Etowah River downstream of Allatoona Lake; (3) Coosa River at Rome, Georgia; (4) Alabama River at Montgomery, Alabama; and (5) Alabama River downstream of Claiborne Lock and Dam.

For general comparison purposes, each figure in this section that presents model outputs on flow conditions for the No Action Alternative and Plans D, F, and G also includes the "unimpaired flows." Unimpaired flows are defined as historically observed flows adjusted for human influence by accounting for the construction of surface water reservoirs and for withdrawals and returns to serve municipal, industrial, thermal power, and agricultural water uses (USACE Mobile District 1997). The unimpaired flows are considered to be a reasonable representation of "natural" flow conditions absent the reservoirs and other human uses of the water resources.

In the final EIS, figures depicting "median" flow conditions in the basin have been included in lieu of "average" flow conditions. Median values are considered to provide a more representative characterization of conditions for evaluation and comparison among alternatives. Instead of a numeric average of a set of values over the modeled period of record, the median value represents the point at which 50 percent of the values are higher and 50 percent are lower. In addition, figures depicting the 90 percent exceedance level have been included, meaning that the values presented for each day are exceeded 90 percent of the time over the period of record. The 90 percent exceedance value would be representative of extremely dry conditions in the basin and low basin inflow to the reservoirs. These figures were added in response to several public comments requesting more information and greater focus on how the alternative plans perform under extreme drought conditions.

6.1.1.3.1 Coosawattee River downstream of Carters Reregulation Dam

The following subsections describe the effects the No Action Alternative and Alternative Plans D, F, and G would have on stream flow conditions in the Coosawattee River downstream of Carters Reregulation Dam. The No Action Alternative would retain the current requirement to provide for a continuous minimum flow downstream of Carters Reregulation Dam of 240 cfs. The alternative plans would all include seasonally variable minimum flow targets, consistent with recommendations made by the USFWS, as described in Section 4.2.3.

Figure 6.1-35 through Figure 6.1-39 present model results for flow conditions in the Coosawattee River downstream of Carters Reregulation Dam over the modeled period of hydrologic record (1939–2011) for the No Action Alternative, the proposed revisions to the ACT WCM as defined in Plans D, F, and G (Proposed Action Alternative), and the unimpaired flows (for general comparison purposes). Median

daily flows (Figure 6.1-35) below Carters Reregulation Dam for No Action and the other alternatives would generally be comparable to the unimpaired flows, except that the unimpaired flows would be slightly higher during April and slightly lower in November and early December. At the 90 percent exceedance level (Figure 6.1-36), representing dry conditions in the basin, daily unimpaired flows would be appreciably higher than the water management alternatives (including No Action) from mid-February through early May and lower during the drier periods (August through November). In Figure 6.1-37 through Figure 6.1-39, the annual flow duration curve and curves for selected months (March and December), indicate that the unimpaired flows are a close fit with No Action and Plans D, F, and G except under extreme high and low flow events. These results are consistent with those expected downstream of a storage reservoir where peak flows in the wetter months are stored with increased releases in the drier months that would tend to exceed natural flow conditions. The model results for the alternatives and the associated effects are discussed in the subsequent subsections addressing each alternative.

6.1.1.3.1.1 No Action Alternative

Figure 6.1-35 depicts model results for median daily flow in the Coosawattee River downstream of the reregulation dam for the No Action Alternative, analyzed over the entire period of record. Daily flows would average in the range of 1,000 to 1,200 cfs in early January, peaking in the range of 16,000 cfs by the end of March. Median daily flows would gradually decline from that peak through the summer and early fall to a low of about 400 to 500 cfs in September and October. From that level, median daily flows would gradually increase in November and December to about 1,000 cfs at the end of December.

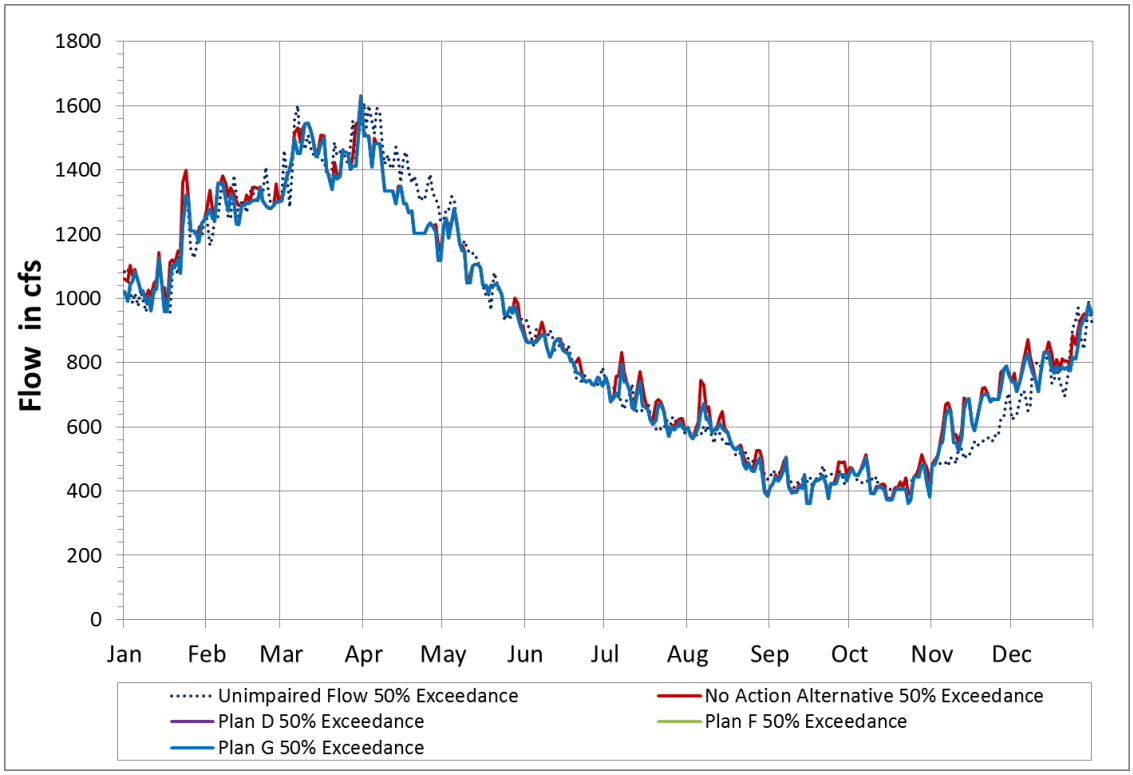


Figure 6.1-35. Coosawattee River downstream of Carters Reregulation Dam, median daily discharge (cfs) over the modeled period of record (1939–2011).

Figure 6.1-36 depicts model results for the 90 percent exceedance flows in the Coosawattee River downstream of the reregulation dam for the No Action Alternative, analyzed over the entire period of record. Daily flows would fluctuate in the range of about 350 cfs to 650 cfs in January upward to the range of 720 to 920 cfs by early April. The 90 percent exceedance flows gradually decline from early April to the minimum flow level of 240 cfs by early August, remaining at that level until early November. Daily flows at the 90 percent exceedance level would be expected to fluctuate between 240 and 500 cfs in November and December. As shown in Figure 6.1-36, flows at the 90 percent exceedance level for the No Action Alternative would likely be considerably below the seasonally adjusted minimum flow targets established for Plans D, F, and G during much of the year.

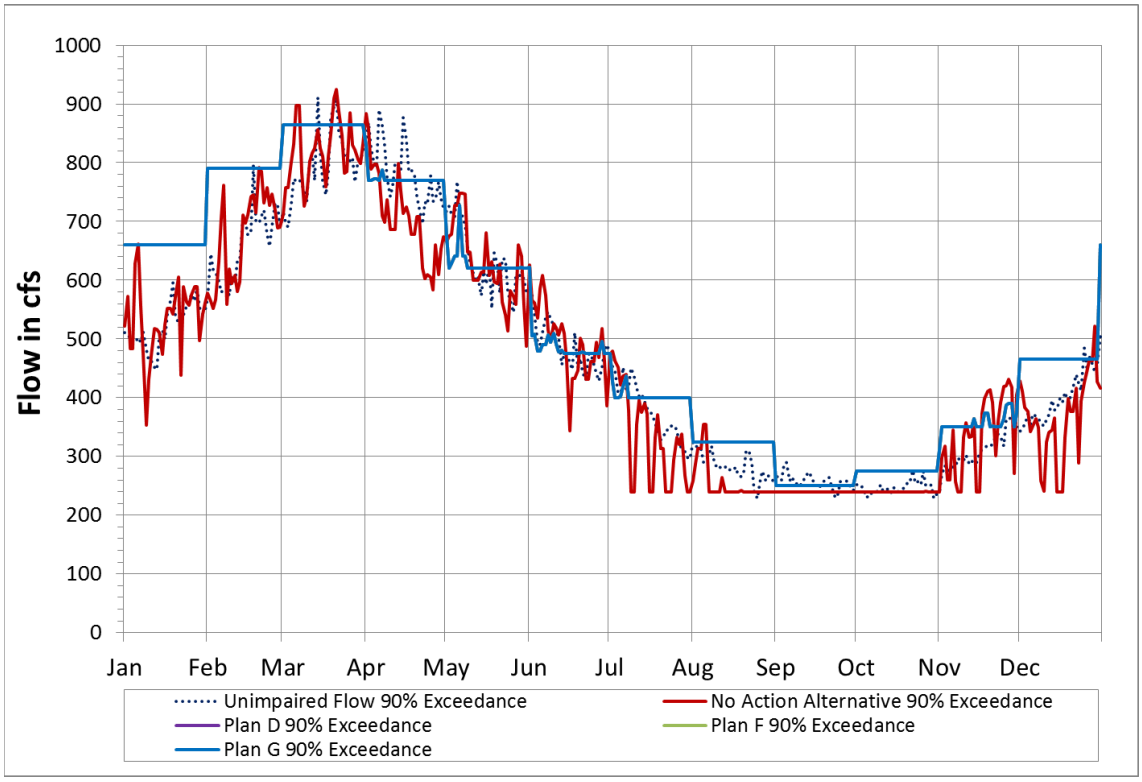


Figure 6.1-36. Coosawattee River downstream of Carters Reregulation Dam, daily discharge (cfs) at the 90 percent exceedance level over the modeled period of record (1939–2011).

Figure 6.1-37 is a flow-duration curve for the Coosawattee River downstream of the reregulation dam that depicts the number of days over the modeled period of record (expressed as a percentage) that the entire range of potential flows would likely be exceeded. For the No Action Alternative, flows at the location range from a high of 5,000 cfs to a low of 240 cfs. A minimum release of 240 cfs from the reregulation dam is required. Daily flows would be likely to exceed 1,000 cfs about 38 percent of the time and 300 cfs about 90 percent of the time. Flows would decline to the minimum release level of 240 cfs for the No Action Alternative on about seven percent of the days over the entire period of record.

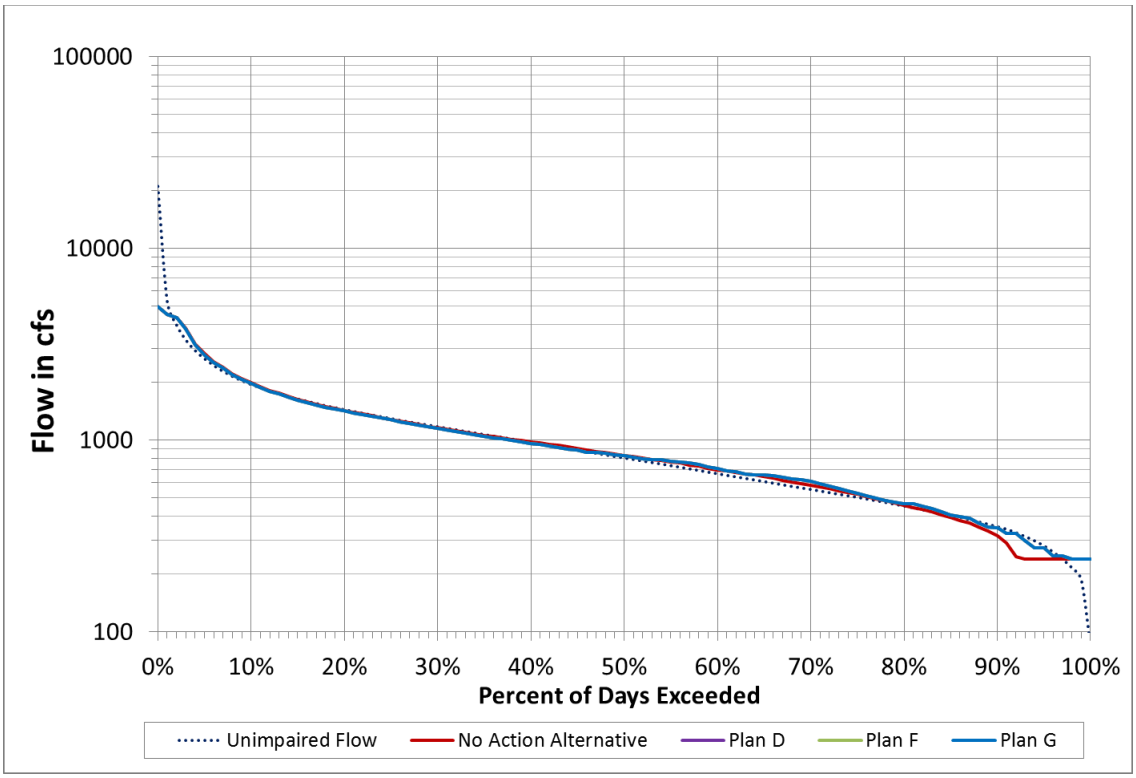


Figure 6.1-37. Coosawattee River downstream of Carters Reregulation Dam, daily discharge (cfs)—percent of days exceeded over the modeled period of record (1939–2011).

To examine flow conditions more closely at selected times of the year, Figure 6.1-38 and Figure 6.1-39 present flow-duration curves for March and December for the modeled period of record. As stated above, the USFWS has recommended that USACE adopt specific seasonal minimum flow targets, varying monthly over a range from 240 to 865 cfs. March and December were selected as examples to review overall flow conditions at the location for the No Action Alternative and to assess the degree to which existing operational practices address the minimum flow targets recommended by the USFWS for those months.

According to Figure 6.1-38, daily flows during March for the No Action Alternative over the period record would exceed 1,000 cfs about 80 percent of the time and would exceed 500 cfs about 98 percent of the time. Flows would be expected to decline to the minimum flow level of 240 cfs less than 1 percent of the time. The USFWS minimum flow recommendation for March is 865 cfs. For the No Action Alternative, flows would equal or exceed 865 cfs about 87 percent of the time.

According to Figure 6.1-39, daily flows in December for the No Action Alternative over the period record would exceed 1,000 cfs about 35 percent of the time and would exceed 500 cfs about 77 percent of the time. Flows would be expected to decline to the minimum flow level of 240 cfs about 5 percent of the days in December over the period of record. The USFWS minimum flow recommendation for December is 465 cfs. For the No Action Alternative, flows would likely equal or exceed 465 cfs about 81 percent of the time.

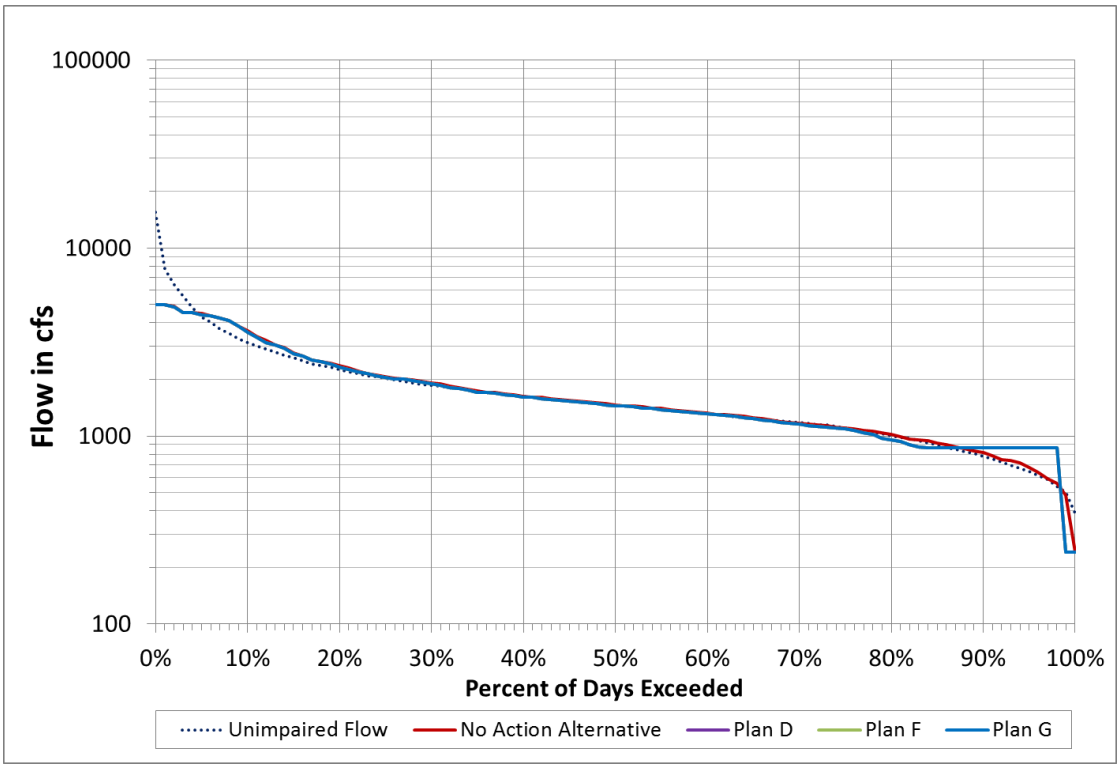


Figure 6.1-38. Coosawattee River downstream of Carters Reregulation Dam, daily discharge (cfs)—percent of days exceeded for March over the modeled period of record (1939–2011).

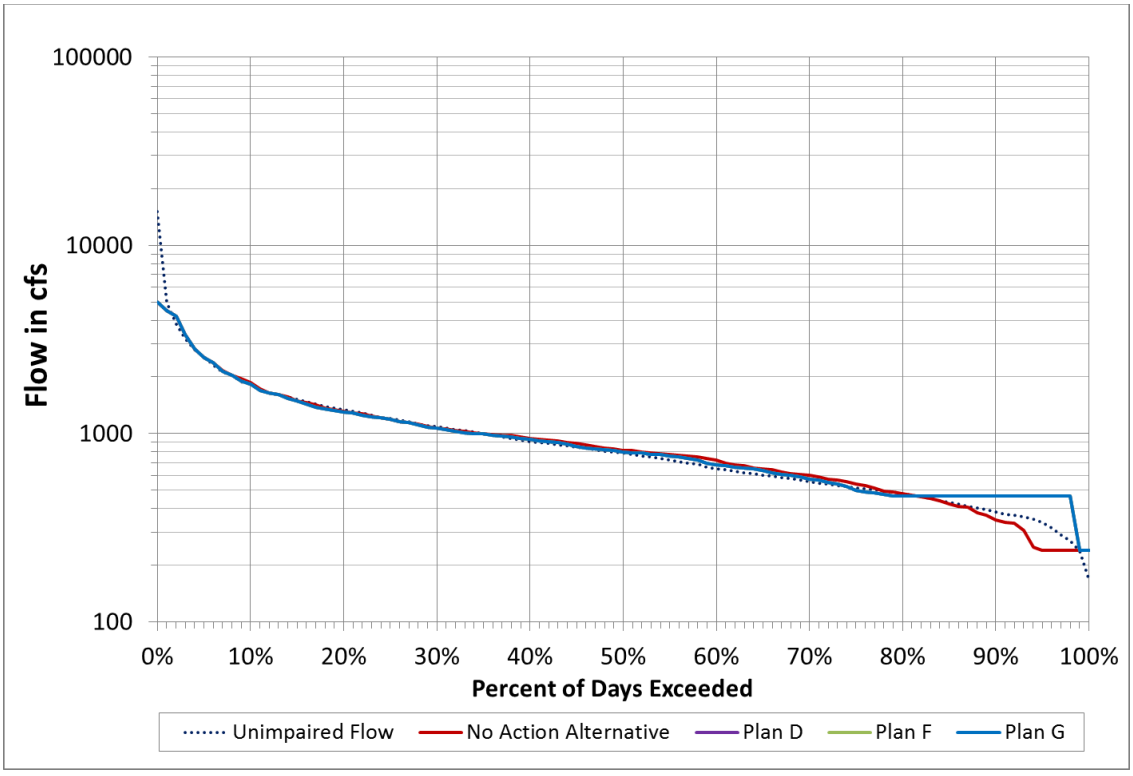


Figure 6.1-39. Coosawattee River downstream of Carters Reregulation Dam, daily discharge (cfs)—percent of days exceeded for December over the modeled period of record (1939–2011).

6.1.1.3.1.2 Alternative Plan D

As indicated in Figure 6.1-35, median daily flows below the Carters Reregulation Dam for Plan D over the modeled period of record would be essentially the same, with minor deviations, as for the No Action Alternative. On the basis of the model results, inclusion of seasonally variable minimum flow targets in Plan D would not be expected to have appreciable effects on median daily flows over the period of record.

At the 90 percent exceedance flow level (Figure 6.1-36), Plan D would be expected to meet the seasonally adjusted minimum flow targets throughout the year and, in some cases, would likely provide flows slightly above the monthly minimum flow targets. Thus, the seasonally adjusted minimum flow targets from the reregulation dam would likely be met in all but the most extreme drought occurrences.

For Plan D, Coosawattee River flows downstream of Carters Reregulation Dam would be essentially equal to those for the No Action Alternative on about 89 percent of days over the modeled period of record (Figure 6.1-37). For low-flow events that occur less than 10 percent of the time, flow levels for Plan D would likely be slightly improved compared to the No Action Alternative. Over the entire period of record, flows would be expected to decline to the minimum level of 240 cfs about four percent of time for Plan D and about eight percent of the time for the No Action Alternative. That would represent a substantial number of additional days during which the Carters project would deliver flows above the minimum requirement of 240 cfs compared to the No Action Alternative.

For the month of March (Figure 6.1-38), Plan D would be expected to provide flows approximately equal to those for the No Action Alternative about 88 percent of the time over the modeled period of record. The seasonal minimum flow target of 865 cfs for March, as recommended by the USFWS and included in Plan D, would be equaled or exceeded on 98 percent of the days in March over the modeled period of record, compared to 87 percent for the No Action Alternative. That result for Plan D would represent an increase by 11 percent in the number of days in March in which the seasonal minimum flow target would be met or exceeded. Additionally, flows in March would likely decline to the mandatory minimum low-flow level of 240 cfs only about one percent of the time.

For December (Figure 6.1-39), Plan D would be expected to provide flows approximately equal to those for the No Action Alternative about 81 percent of the time over the modeled period of record. The seasonal minimum flow target of 465 cfs for December, as recommended by the USFWS and included in Plan D, would be equaled or exceeded on 98 percent of the days in December over the modeled period of record, compared to 81 percent for the No Action Alternative. Plan D would result in an increase by 17 percentage points in the number of days in December in which the seasonal minimum flow target would be met or exceeded. Further, flows in December would likely decline to the mandatory minimum low flow level of 240 cfs about only one percent of the time compared to about six percent for the No Action Alternative.

Table 6.1-1 summarizes the monthly minimum flow targets recommended by the USFWS for the Coosawattee River downstream of Carters Reregulation Dam for each month of the year and the percent of time over the modeled period of record that the targets would likely be equaled or exceeded for the unimpaired flows, the No Action Alternative, and Plan D. On the basis of the model results, Plan D would successfully address the objective for seasonal minimum flows from Carters Reregulation Dam compared to unimpaired flows and the No Action Alternative with minimal effect on water surface elevations in Carters Lake and the pool below Carters Reregulation Dam (as discussed in Section 6.1.1.2.1.2).

Table 6.1-1.
Coosawattee River downstream of Carters Reregulation Dam, seasonally variable minimum flow targets, percent of time targets would be met or exceeded

Month	Monthly minimum flow target (cfs)	Percent of time flow target would be equaled or exceeded		
		Unimpaired Flow	No Action Alternative	Plans D, F, and G
January	660	80%	82%	98%
February	790	83%	84%	98%
March	865	86%	88%	98%
April	770	90%	86%	97%
May	620	89%	89%	97%
June	475	90%	90%	94%
July	400	86%	84%	95%
August	325	85%	80%	95%
September	250	90%	78%	97%
October	275	84%	76%	98%
November	350	82%	90%	98%
December	465	82%	81%	98%

6.1.1.3.1.3 Alternative Plan F

Water management measures for Carters Lake in Plan F that could affect flow conditions downstream of Carters Reregulation Dam are identical to those in Plan D. Therefore, implementing Plan F would be expected to have the same effects on flow conditions in the Coosawattee River downstream of Carters Reregulation Dam as described for Plan D above.

6.1.1.3.1.4 Alternative Plan G (Proposed Action Alternative)

Water management measures for Carters Lake in the Proposed Action Alternative (Plan G) that could affect flow conditions downstream of Carters Reregulation Dam are identical to those included in Plan D. Therefore, implementing the Proposed Action Alternative would be expected to have the same effects on flow conditions in the Coosawattee River downstream of Carters Reregulation Dam as described for Plan D above.

6.1.1.3.2 Etowah River downstream of Allatoona Dam

The following subsections describe the effects the No Action Alternative and Alternative Plans D, F, and G would have on stream flow conditions in the Etowah River downstream of Allatoona Dam. Flow conditions at that location are directly governed by water management activities at Allatoona Lake. Various revisions of water management practices at Allatoona Lake included in Plan D, F, and G could alter the downstream flow regime in terms of quantity or timing or both. Under all alternatives, the Allatoona project must meet the requirement to provide a continuous minimum release of 240 cfs. Note that in modeling the releases from Allatoona Dam, the minimum flow in the model included continuous releases from the small service generator at the project plus an allowance for leakage at the dam. Thus, the minimum releases in the model outputs, as depicted in the figures that follow, are shown as 290 cfs.

Figure 6.1-40 through Figure 6.1-44 present model results for flow conditions in the Etowah River downstream of Allatoona Dam over the modeled period of hydrologic record (1939–2011) for the No Action Alternative, the proposed revisions to the ACT WCM as defined in Plans D, F, and G (Proposed Action Alternative), and the unimpaired flows (for general comparison purposes). Median daily flow patterns (Figure 6.1-40) below Allatoona Dam for No Action and the other alternatives would be considerably different than for the unimpaired flows. The unimpaired daily flow values would be substantially higher than No Action and Plans D, F, and G from mid-January through April, peaking at about 2,500 cfs compared to values ranging from about 1,000 to 2,000 cfs. Unimpaired median daily flows would be substantially lower than those for No Action and Plans D, F, and G from June through December, dropping as low as about 600 cfs in September and October compared to flows ranging from about 1,100 to about 1,500 cfs for the water management alternatives, including No Action. At the 90 percent exceedance level (Figure 6.1-41), representing dry conditions in the basin, daily unimpaired flows would generally be appreciably higher than those under the water management alternatives (including No Action) from mid-January through June, similar during the drier season (July through November), and lower in December and early January.

Figure 6.1-42 (the annual flow-duration curve) indicates that the unimpaired flows for all days over the period of record are similar to No Action and Plans D, F, and G, except under extreme high and low flow events. Figure 6.1-43 and Figure 6.1-44, flow duration curves for selected months (September and December), indicate that the unimpaired flows would likely be substantially lower for about 70 to 80 percent of the days during September and about 80 to 90 percent of days during December over the modeled period of record as releases are made during the fall drawdown period. These results are consistent with those expected downstream of a storage reservoir where peak flows in the wetter months are stored with increased releases in the drier months that would tend to exceed natural flow conditions. The model results for the alternatives and the associated effects are discussed in the subsequent subsections addressing each alternative.

6.1.1.3.2.1 No Action Alternative

Figure 6.1-40 depicts model results for median daily flow in the Etowah River downstream of Allatoona Dam for the No Action Alternative, analyzed over the entire period of record. Median daily flows would likely range between 1,000 to 2,000 cfs through the year. The months of May through November exhibit a much more uniform range of median daily flows (from about 1,200 to 1,800 cfs), indicating relatively consistent patterns of hydropower generation during those months. The highest median daily flows (about 2,000 cfs) over the modeled period of record would occur during the months of January, March, and mid-November through December.

Figure 6.1-41 presents model results for the 90 percent exceedance daily flow values over the modeled period of record in the Etowah River downstream of Allatoona Dam. With the exception of the month of May and early December over the period of record, the 90 percent exceedance values for the No Action Alternative would be equal to the modeled minimum flow value downstream of Allatoona Dam, which is 290 cfs. In May, the value would be in the range of 700 to 800 cfs. In early December, the value would reach as high as 1,100 cfs. Both indicate that some hydropower generation consistently occurs during these periods, even during extremely dry conditions.

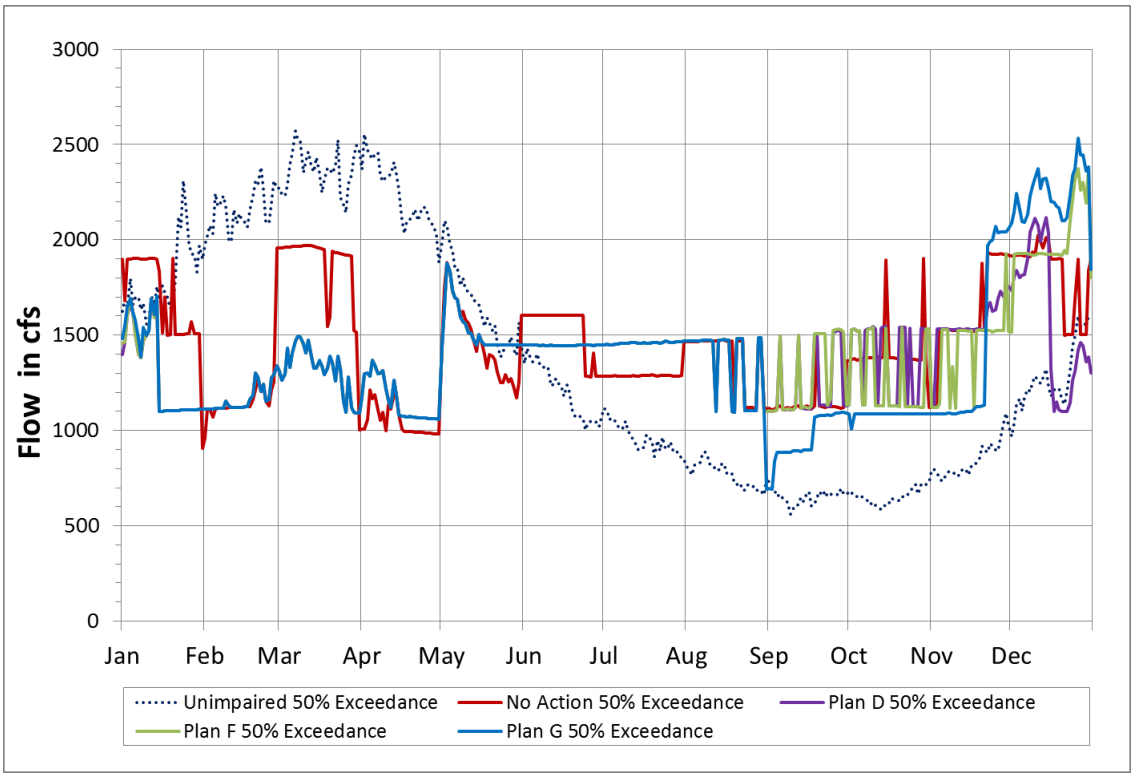


Figure 6.1-40. Etowah River downstream of Allatoona Dam, median daily discharge (cfs) over the modeled period of record (1939–2011).

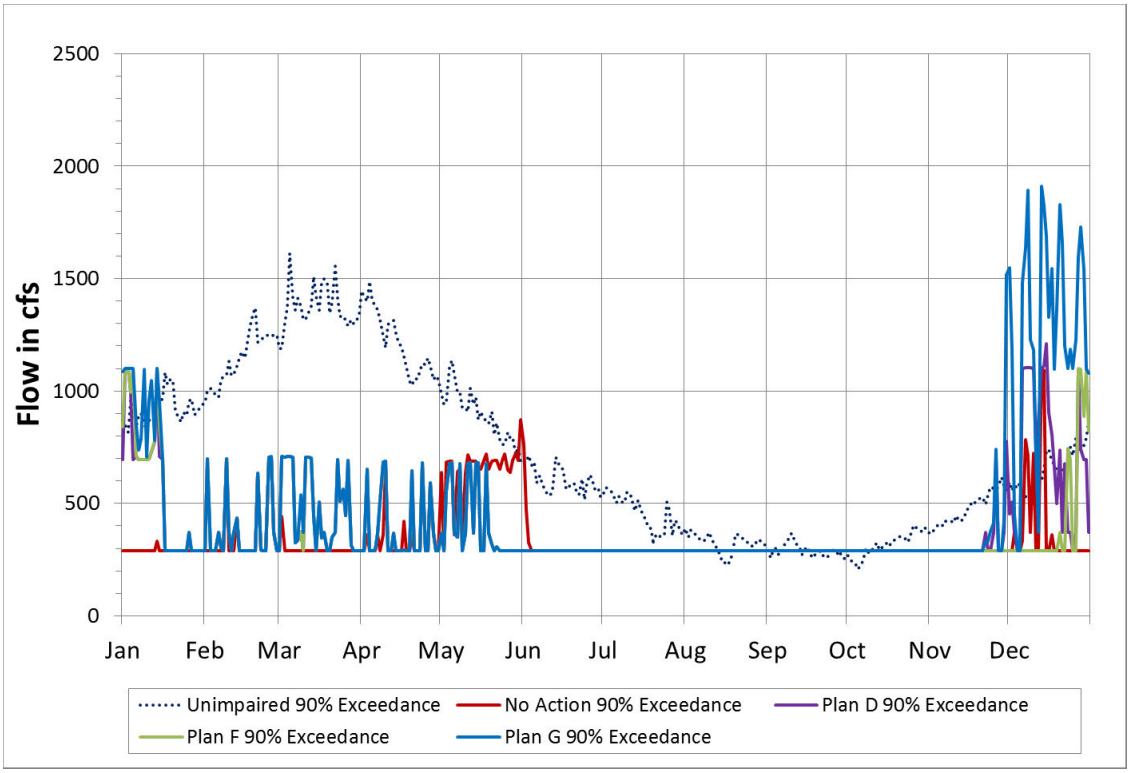


Figure 6.1-41. Etowah River downstream of Allatoona Dam, daily discharge (cfs) at the 90 percent exceedance level over the modeled period of record (1939–2011)

Figure 6.1-42 is a flow-duration curve for the Etowah River downstream of Allatoona Lake that depicts the number of days over the modeled period of record (expressed as a percentage) that the range of potential flows would likely be exceeded. For the No Action Alternative, daily flows would be expected to exceed 1,000 cfs on 70 percent of days during the period of record and exceed 290 cfs during 100 percent of those days.

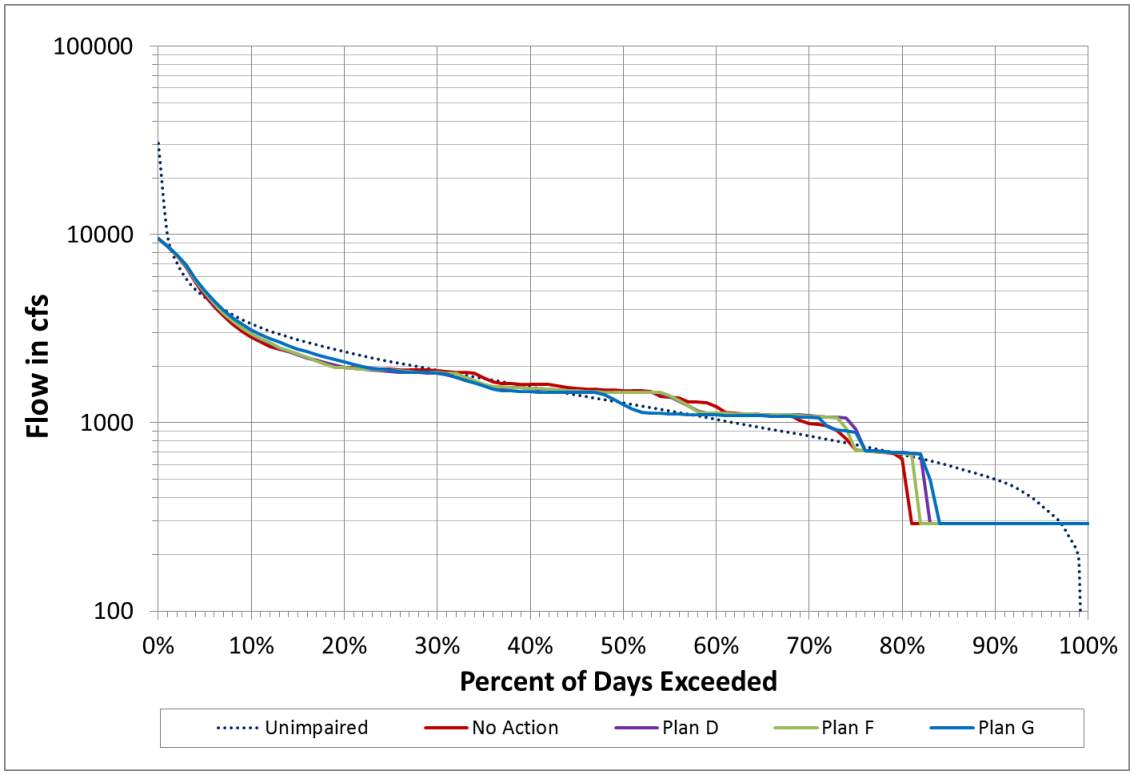


Figure 6.1-42. Etowah River downstream of Allatoona Dam, daily discharge (cfs)—percent of days exceeded over the modeled period of record (1939–2011).

To examine flow conditions in the Etowah River more closely at selected times of the year when key changes to Allatoona Lake operations are proposed, Figure 6.1-43 and Figure 6.1-44 present flow-duration curves for the months of September and December. For the No Action Alternative, flows over the period of record for September would be expected to exceed 1,000 cfs on about 67 percent of the days and exceed 290 cfs during 72 percent of those days. Flows would be at the modeled minimum level of 290 cfs approximately 28 percent of the time in September.

For the No Action Alternative, flows over the period of record for December would be expected to exceed 1,000 cfs on 81 percent of the days and exceed 290 cfs during 85 percent of those days. Modeling results indicate that flows would be at a level of about 290 cfs approximately 15 percent of the time in December.

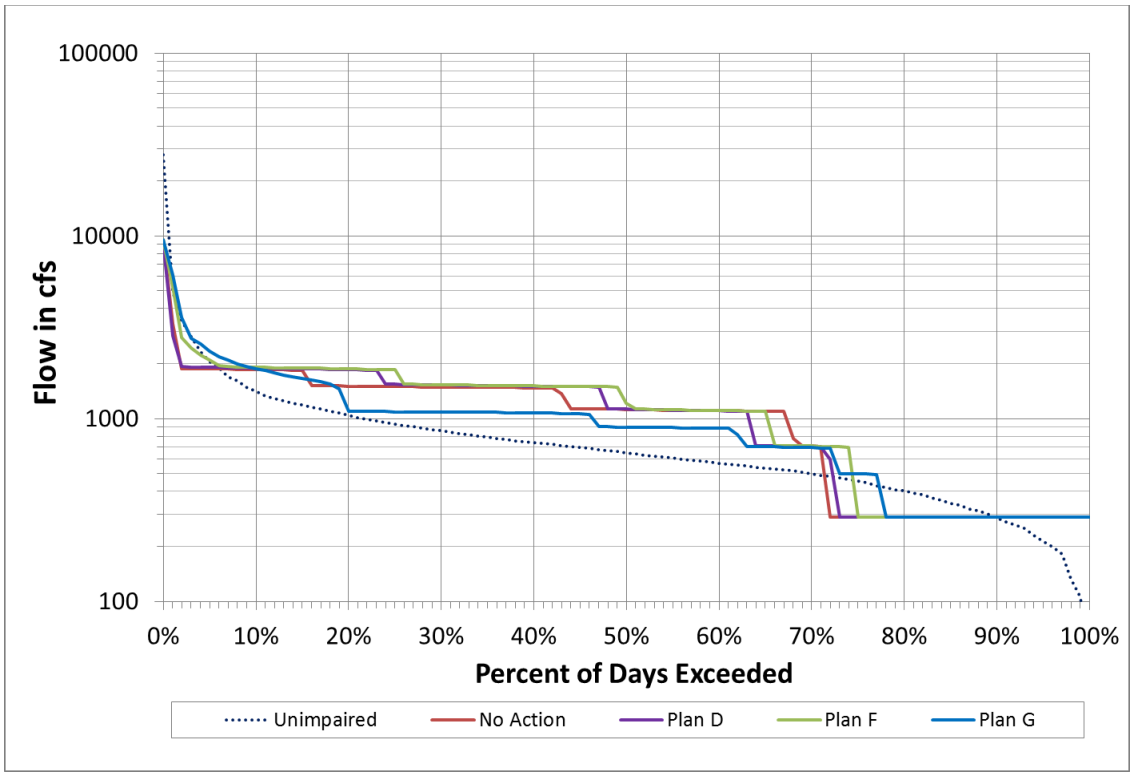


Figure 6.1-43. Etowah River downstream of Allatoona Dam, daily discharge (cfs)—percent of days exceeded for September over the modeled period of record (1939–2011).

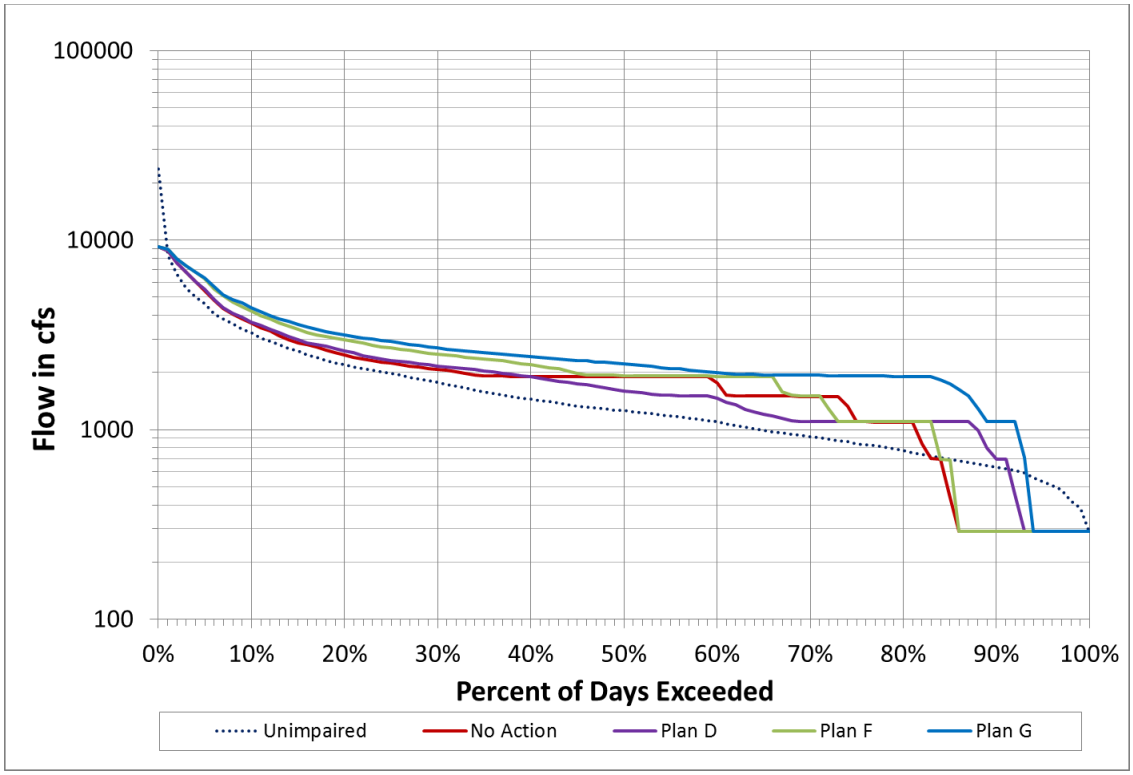


Figure 6.1-44. Etowah River downstream of Allatoona Dam, daily discharge (cfs)—percent of days exceeded for December over the modeled period of record (1939–2011).

6.1.1.3.2.2 Alternative Plan D

As indicated in Figure 6.1-40, over the modeled period of record, median daily flows in the Etowah River downstream of Allatoona Dam for Plan D would likely follow a similar pattern throughout the year, with flow values within a similar range, as the No Action Alternative. Exceptions would include lower median flows for Plan D from mid-December through January and in March and slightly higher flows in portions of September, October, and early December. The only noteworthy operational change at Allatoona Lake between the No Action Alternative and Plan D is the number and configuration of the action zones for the use of conservation storage in the lake. The No Action Alternative has the current two action zone configuration. Plan D has four action zones that are configured to curtail hydropower generation and conserve storage when conditions warrant, particularly during the fall drawdown period when lake levels decline more rapidly in drier years.

Figure 6.1-41 presents model results for the 90 percent exceedance daily flow values over the modeled period of record in the Etowah River downstream of Allatoona Dam. The 90 percent exceedance curve represents flows that would be expected under extreme dry conditions in the basin. Compared to the No Action Alternative, flows at the 90 percent exceedance level for Plan D would be notably higher in portions of the months December and January and higher (in the typical range of 400 cfs) in portions of the months of February through May. Otherwise, flow conditions from June through November at the 90 percent exceedance level would be essentially the same as the No Action Alternative (about 290 cfs).

On an annual basis, the flow-duration curve for Plan D for the Etowah River downstream of Allatoona Dam would generally align, with minor deviations, with the curve for the No Action Alternative (Figure 6.1-42). Daily flows would be expected to exceed 1,000 cfs on 74 percent of days during the period of record and exceed 290 cfs during 82 percent of those days. Modeling results indicate that about 18 percent of the time, flows would be at the modeled minimum flow level of about 290 cfs. Those results indicate slight increases in the percent of time that flows at the 1,000 cfs and 290 cfs levels would be exceeded on an annual basis for Plan D versus the No Action Alternative.

The most noteworthy changes in flows downstream of Allatoona Dam for Plan D versus the No Action Alternative would occur from September through December. For Plan D, flows over the period of record for the month of September would be expected to exceed 1,000 cfs on 63 percent of the days and exceed 290 cfs during 72 percent of those days (Figure 6.1-43). Modeling results indicate that flows would be at the modeled minimum flow level of 290 cfs approximately 28 percent of the time in September. For Plan D, flows above 1,000 cfs would be expected to occur four percent less often than the No Action Alternative, with a slight increase (one percent) in the days where 290 cfs would be exceeded.

For Plan D, flows over the period of record for December would be expected to exceed 1,000 cfs on 87 percent of the days and exceed 290 cfs during 92 percent of those days (Figure 6.1-44). Modeling results indicate that flows would be at a level of about 290 cfs approximately eight percent of the time in the month of December. December flows above the 1,000 and 290 cfs levels would increase by six and seven percent, respectively, above those for the No Action Alternative.

The annual flow-duration curve for Plan D (Figure 6.1-42) would be slightly higher than the curve for the No Action Alternative at daily flow levels exceeding 1,000 cfs. Below 1,000 cfs, the curve for Plan D would be slightly higher than the No Action Alternative as well. The two additional action zones (from two to four) and reshaped action zones under Plan D would tend to temper full peaking hydropower releases with the onset of drier conditions to conserve storage for more judicious use as hydrologic conditions could either improve or worsen. Over the period of record, the modeling indicates that on average, releases for Allatoona Dam would tend to be slightly lowered in September to October and slightly increased in November to December.

6.1.1.3.2.3 Alternative Plan F

Plan F includes the four-action zone configuration and the phased fall drawdown guide curve for Allatoona Lake. As depicted in Figure 6.1-40, median daily flows downstream of Allatoona Dam for Plan F, with minor deviations, would likely follow the same seasonal pattern and similar values as Plan D from January through mid-August. Adding the phased fall drawdown feature coupled with the four-action zone configuration would result in daily flows in September ranging slightly higher than those for the No Action Alternative and Plan D (up to about 300 cfs higher), slightly lower overall in October and November, and higher in December by up to 400 cfs. Under extreme low flow conditions, as reflected by the 90 percent exceedance flow levels (Figure 6.1-41), Plan F would perform similarly to Plan D. Daily flows under Plan F would likely be notably higher than No Action in portions of the months of December and January and higher in portions of the months of February through May (in the typical range of 400 cfs). Otherwise, flow conditions from June through November at the 90 percent exceedance level would be essentially the same as the No Action Alternative.

On an annual basis, the flow-duration curve for Plan F for the Etowah River downstream of Allatoona Dam would generally align, with minor deviations, with the curve for the No Action Alternative (Figure 6.1-42). Daily flows would be expected to exceed 1,000 cfs on 74 percent of days during the period of record and exceed 290 cfs during 81 percent of those days. Approximately 19 percent of the time, flows would be at the modeled minimum flow level of 290 cfs. Such results indicate a slight increase in the percent of time (four percent) that flows would be expected to exceed 1,000 cfs on an annual basis for Plan F versus the No Action Alternative, with a one percent increase at the 290 cfs level.

For Plan F, flows above 1,000 cfs would be expected to occur about two percent less often than for the No Action Alternative during September over the period of record (Figure 6.1-43). At the modeled minimum flow level of 290 cfs, the number of days exceeded with Plan F would be higher by three percent than the No Action Alternative. Flows would be at a modeled minimum flow level of about 290 cfs approximately 25 percent of the time in September.

For Plan F, flows above 1,000 cfs would be expected to occur two percent more often than for the No Action Alternative during December over the period of record (Figure 6.1-44). At the modeled minimum flow level of 290 cfs, the number of days exceeded with Plan F would be the same as the No Action Alternative. Flows would be at a modeled minimum flow level of 290 cfs approximately 14 percent of the time in December.

The annual flow-duration curve for Plan F (Figure 6.1-42) would be slightly lower than the curve for the No Action Alternative at daily flow levels exceeding 1,000 cfs, except that the number of days that flows would exceed 1,000 cfs would be expected to increase slightly. Below flow levels of 1,000 cfs, the curve for Plan F would be similar to the curve for the No Action Alternative, except that the number of days at flow levels between 1,000 and 290 cfs over the modeled period of record would increase by two to three percent under Plan F. The two additional action zones (from two to four) and reshaped action zones under Plan F would tend to temper full peaking hydropower releases with the onset of drier conditions to conserve storage for more judicious use as hydrologic conditions could either improve or worsen. Additionally, the phased guide curve would shift the timing of releases over an extended drawdown period between September and December. Such a shift in reservoir operations would help to maintain higher levels in Allatoona Lake later in the year (October through December) but would not have a dramatic overall effect on releases over the duration of the drawdown period. Some minor increase in flow would likely occur in December under Plan F compared to the No Action Alternative.

6.1.1.3.2.4 Alternative Plan G (Proposed Action Alternative)

The Proposed Action Alternative features for Allatoona Lake include the four-action zone configuration, the phased fall drawdown guide curve, and reduced hydropower generation in the fall drawdown period. As depicted in Figure 6.1-40, median daily flows downstream of Allatoona Dam for the Proposed Action Alternative (Plan G), with minor deviations, would likely follow the same seasonal pattern and similar values as Plan D from January through mid-August. Because of the added phased fall drawdown feature coupled with the four-action zone configuration, and reduced hydropower generation during fall drawdown, median daily flows in the Etowah River under Plan G would be expected to be lower than the No Action Alternative and Plans D and F during the months of September through late November. The daily flows during this period may generally range from 100 to 500 cfs lower. From late November through December, flows would range higher than No Action and Plans D and F by about 200 to 400 cfs. Under extreme low flow conditions, as reflected by the 90 percent exceedance flow levels (Figure 6.1-41), Plan G would perform similarly to Plan D. Daily flows under Plan G would be higher in portions of the months December and January than Plan D. During much of the period from February through May, the 90 percent exceedance flows for Plan G would be similar to Plan D and both would generally be higher than the No Action Alternative (by up to 400 cfs). Flow conditions from June through November at the 90 percent exceedance level would be essentially the same as the No Action Alternative.

On an annual basis, the flow-duration curve for the Proposed Action Alternative for the Etowah River downstream of Allatoona Dam would generally align, with minor deviations, with the curve for the No Action Alternative (Figure 6.1-42). For daily flows in excess of 1,000 cfs, the curve for the Proposed Action Alternative is similar to the No Action Alternative. However, for instances of flow less than 1,000 cfs down to the modeled minimum flow of 290 cfs, the curve for the Proposed Action Alternative is slightly higher than the No Action Alternative. Daily flows would be expected to exceed 1,000 cfs on 71 percent of days during the period of record (two percent more than the No Action Alternative) and exceed 290 cfs during 83 percent of those days. Approximately 17 percent of the time, flows would be at the modeled minimum flow level of 290 cfs.

During September over the period of record (Figure 6.1-43), flows would be notably lower for the Proposed Action Alternative compared to the No Action Alternative. Flows above 1,000 cfs would be expected to occur about 21 percent less often than for the No Action Alternative. However, at the lowest end of the range of flows in September, the Proposed Action Alternative would provide flows downstream of Allatoona Dam in excess of 290 cfs at a rate of six percent more often than the No Action Alternative. Flows would be at the modeled minimum flow level of 290 cfs approximately 23 percent of the time in September.

In December over the period of record (Figure 6.1-44), flows would be notably higher for the Proposed Action Alternative compared to the No Action Alternative. Flows above 1,000 cfs would be expected to occur 92 percent of the time in the month of December, 11 percent more than for the No Action Alternative. The Proposed Action Alternative would provide flows exceeding the modeled minimum flow level of 290 cfs during 93 percent of the time, eight percent higher than the No Action Alternative. Flows would be at the modeled minimum flow level of 290 cfs only about six percent of the time in the month of December.

The annual flow-duration curve for the Proposed Action Alternative (Figure 6.1-42) would be slightly lower than the curve for the No Action Alternative at daily flow levels exceeding 1,000 cfs, except that the number of days that flows would exceed 1,000 cfs would be expected to increase slightly. Below 1,000 cfs, the curve for the Proposed Action Alternative would be slightly higher than the curve for the No Action Alternative. The two additional action zones (from two to four) and reshaped action zones under the Proposed Action Alternative (Plan G) would tend to temper full peaking hydropower releases with the onset of drier conditions to conserve storage for more judicious use as hydrologic conditions

could either improve or worsen. Additionally, the phased guide curve and the added measure to reduce hydropower generation during the fall drawdown period would shift the timing of releases over an extended drawdown between September and December. Such a shift in reservoir operations would help to maintain higher levels in Allatoona Lake later in the year (October through December) than under the No Action Alternative but would not have a dramatic overall effect on total releases over the duration of the drawdown period. A notable increase in flow would likely occur in December under the Proposed Action Alternative compared to the No Action Alternative to offset curtailed releases earlier in the phased drawdown period.

6.1.1.3.3 Coosa River at Rome, Georgia

The following subsections describe the effects the No Action Alternative and Alternative Plans D, F, and G would have on stream flow conditions in the Coosa River at Rome, Georgia. The USGS stream gage at that location measures flow just downstream of the confluence of two major rivers—the Oostanaula and Etowah. Flow conditions at the location would be affected by water management activities at both Carters Lake and Allatoona Lake. Proposed revisions to water management practices at those projects included in Plans D, F, and G could alter the downstream flow regime in terms of quantity and/or timing. Data from the Rome-Coosa USGS gage station provides the 7Q10 flow values that serve as a basis for the one of the three drought *triggers* (flow at the Alabama-Georgia state line) that guides implementing the tiered drought management strategy for the ACT Basin in Alternative Plans D, F, and G.

Figure 6.1-45 through Figure 6.1-50 present model results for flow conditions in the Coosa River at Rome, Georgia over the modeled period of hydrologic record (1939–2011) for the No Action Alternative, the proposed revisions to the ACT WCM as defined in Plans D, F, and G (Proposed Action Alternative), and the unimpaired flows (for general comparison purposes). Median daily flows (Figure 6.1-45) in the Coosa River at Rome for No Action and the other alternatives would generally be comparable to the unimpaired flows, except that the unimpaired flows would be slightly higher during February through April (ranging from zero to 15 percent) and slightly lower from mid-July through mid- December. At the 90 percent exceedance level (Figure 6.1-46), representing dry conditions in the basin, the general shape of the curve for daily unimpaired flows and the water management alternatives (including No Action) would be similar, but the unimpaired flow values would be appreciably higher from late January through mid-May and slightly lower during July through December. Figure 6.1-47 through Figure 6.1-50, the annual flow-duration curve and curves for selected months (September, October, and December), indicate that the unimpaired flow values are similar to the No Action Alternative and Plans D, F, and G over the modeled period of record except under extreme high and low flow events. These results are consistent with those expected downstream of storage reservoirs where peak flows in the wetter months are stored with increased releases in the drier months that would tend to exceed natural flow conditions. The model results for the alternatives and the associated effects are discussed in the subsequent subsections addressing each alternative.

6.1.1.3.3.1 No Action Alternative

Figure 6.1-45 depicts median daily flows for the No Action Alternative in the Coosa River at Rome over the modeled period of record. Median flow ranges from about 6,000 cfs in early January to a peak at about 10,300 cfs by early April. Median flows steadily decrease through late spring and summer months to a low of about 2,000 cfs in September and October. Thereafter, median daily flow increases to a level of about 5,200 cfs by the end of December.

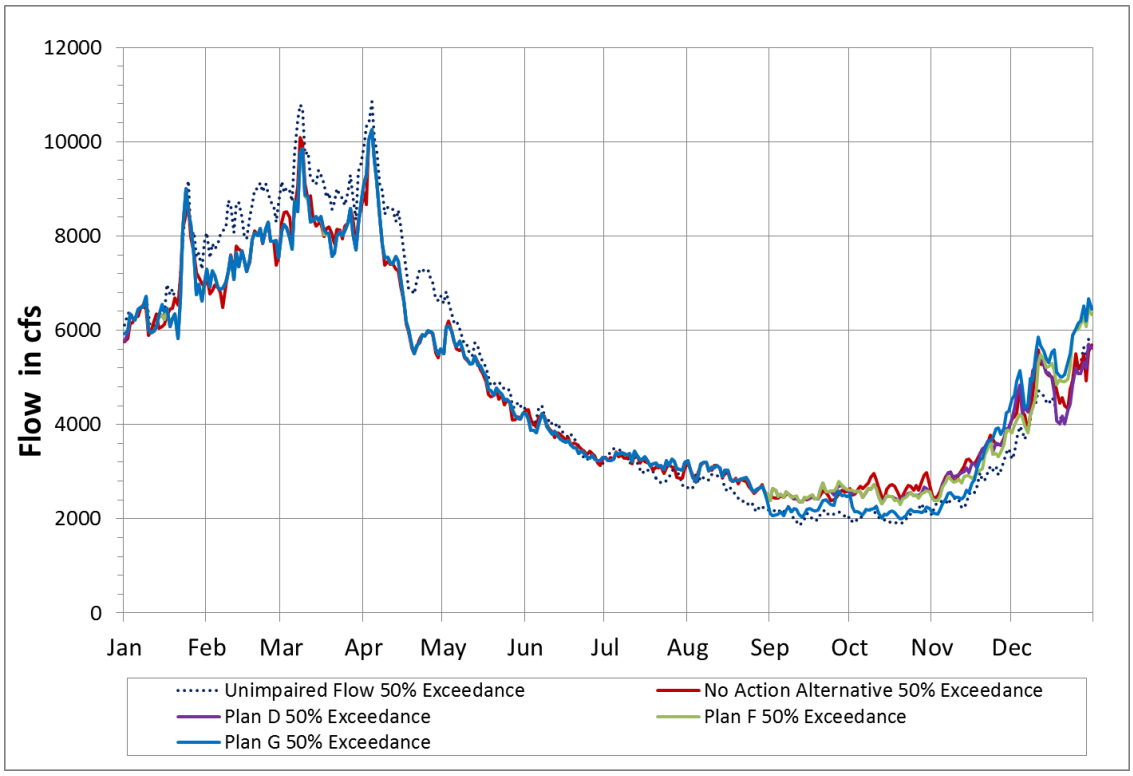


Figure 6.1-45. Coosa River at Rome (Georgia), median daily discharge (cfs) over the modeled period of record (1939–2011).

Figure 6.1-46 presents daily flows at the 90 percent exceedance level (flows that would be exceeded 90 percent of the time). These flow levels would be representative of extremely dry conditions in the basin. Under these conditions, flows for the No Action Alternative would range from about 3,000 cfs in January up to about 5,000 cfs in mid-March, generally declining to a minimum level of about 1,200 to 1,500 cfs in September. Daily flows at the 90 percent exceedance level would be expected to gradually increase to about 2,200 to 2,400 cfs by end of December.

The annual flow-duration curve for the No Action Alternative for the modeled period of record is depicted in Figure 6.1-47. The modeled maximum flow would be 54,587 cfs, the minimum flow would be 686 cfs, and the median annual flow would be 4,110 cfs. Flow at the 25th percentile level (or 75 percent of days exceeded), indicative of dry conditions, would be 2,730 cfs. At the 10th percentile level (90 percent of days exceeded), which would be indicative of severe drought conditions, flow would be expected to be 1,970 cfs.

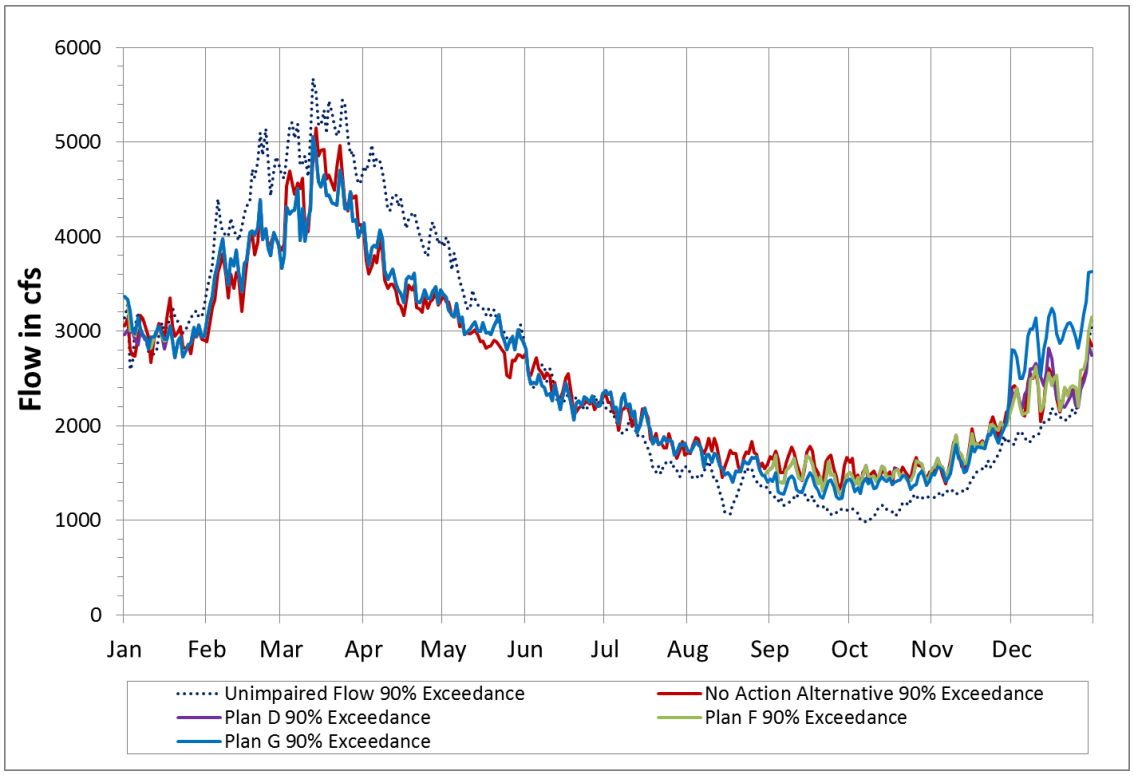


Figure 6.1-46. Coosa River at Rome (Georgia), daily discharge (cfs) at the 90 percent exceedance level over the modeled period of record (1939–2011).

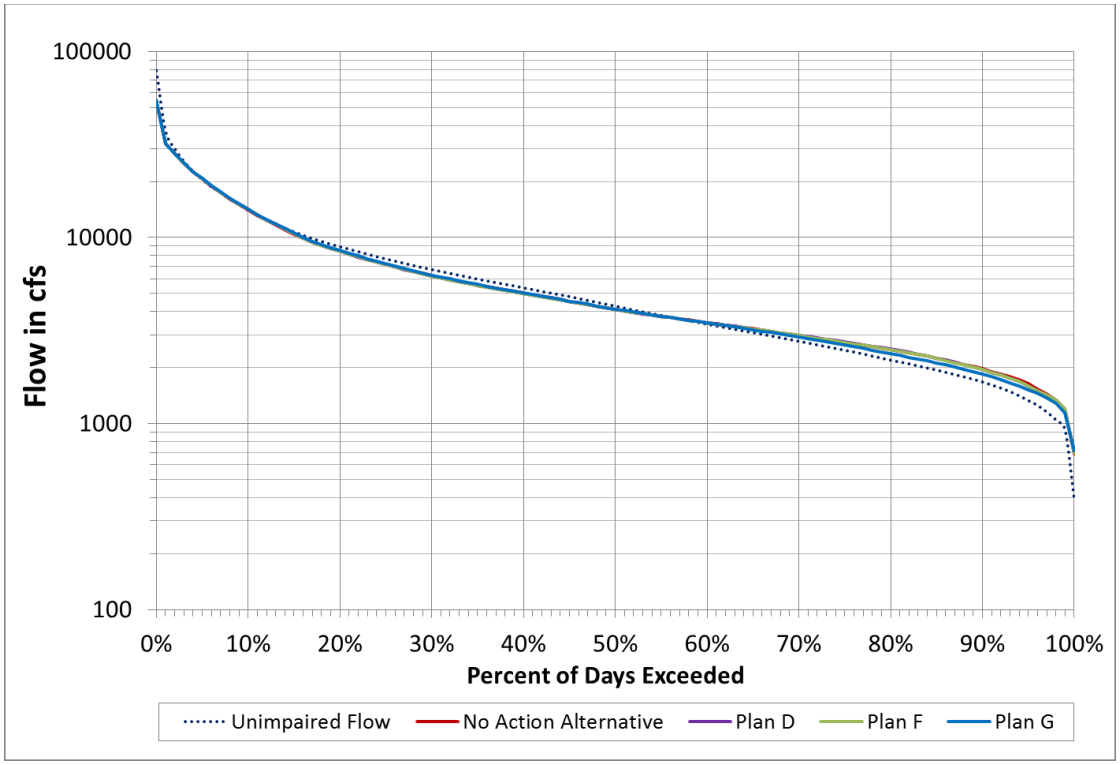


Figure 6.1-47. Coosa River at Rome, Georgia, daily discharge (cfs)—percent of days exceeded over the modeled period of record (1939–2011).

The flow-duration curves for September, October, and December are provided as Figure 6.1-48, Figure 6.1-49, and Figure 6.1-50, respectively. Curves for those months were selected to aid in comparison of the effects of alternative water management measures for Carters Lake and Allatoona Lake. September and October represent the lowest flow period during the year for the Coosa River at Rome. Even though the Allatoona Lake guide curve under the No Action Alternative depicts the fall drawdown of the lake beginning in early October, historically the lake level is already drawing down in September as peak hydroelectric power demands are being met. The median flow for the Coosa River at Rome for September over the modeled period of record would be 2,455 cfs. At the 10th percentile level (90 percent of days exceeded), flow for September would be 1,557 cfs. The median flow for October over the modeled period of record would be 2,654 cfs. At the 10th percentile level, flow for October would be 1,495 cfs. December is a period of higher flows, and it coincides with the end of the drawdown period at Allatoona Lake. The median flow for December over the modeled period of record would be 4,862 cfs. At the 10th percentile level, flow for December would be 2,377 cfs.

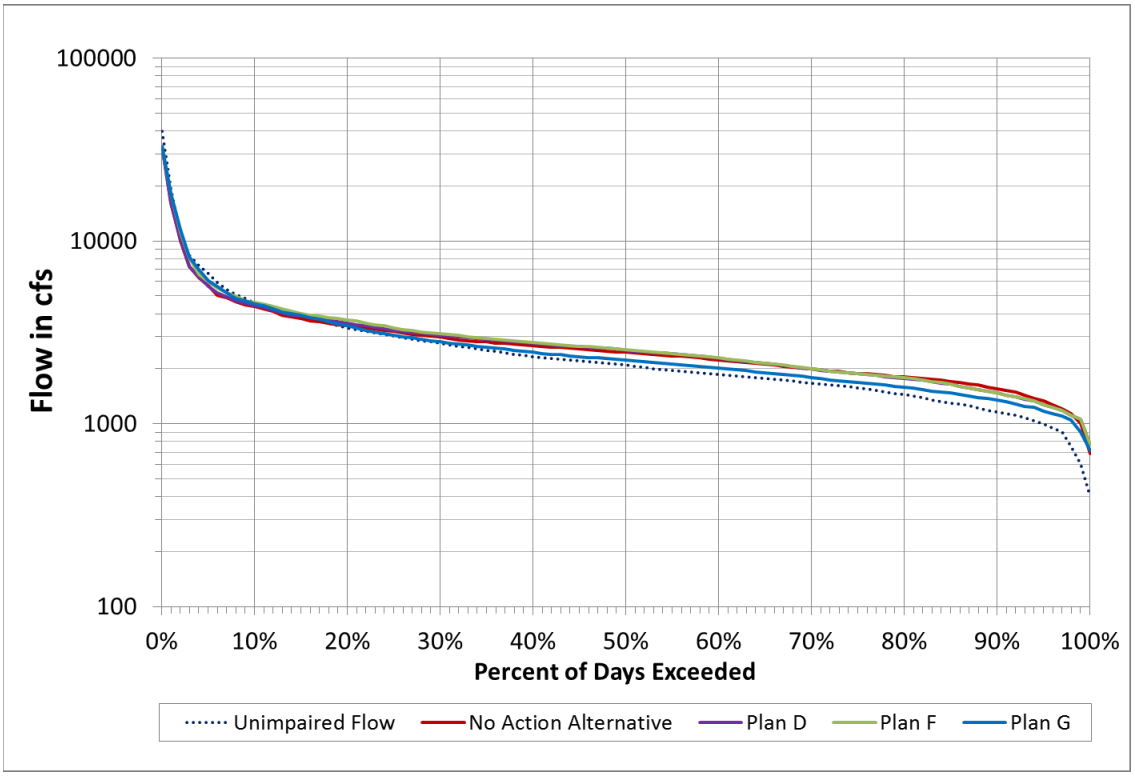


Figure 6.1-48. Coosa River at Rome, Georgia, daily discharge (cfs)—percent of days exceeded for September over the modeled period of record (1939–2011).

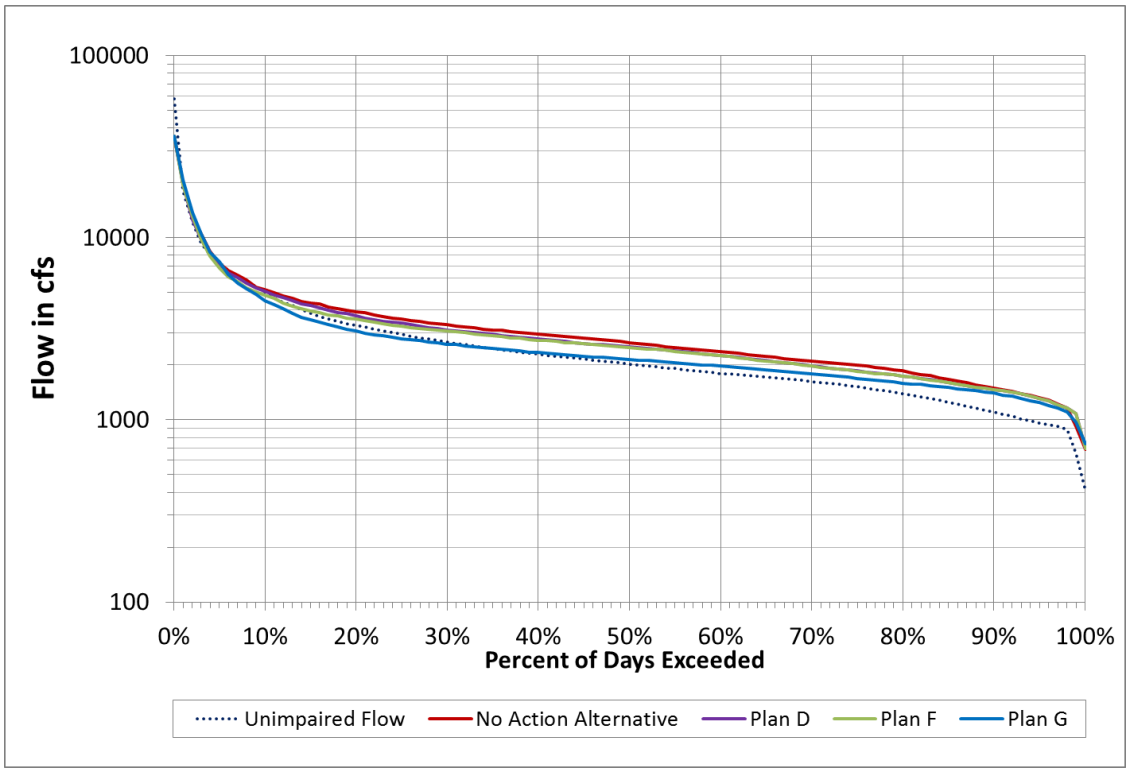


Figure 6.1-49. Coosa River at Rome, Georgia, daily discharge (cfs)—percent of days exceeded for October over the modeled period of record (1939–2011).

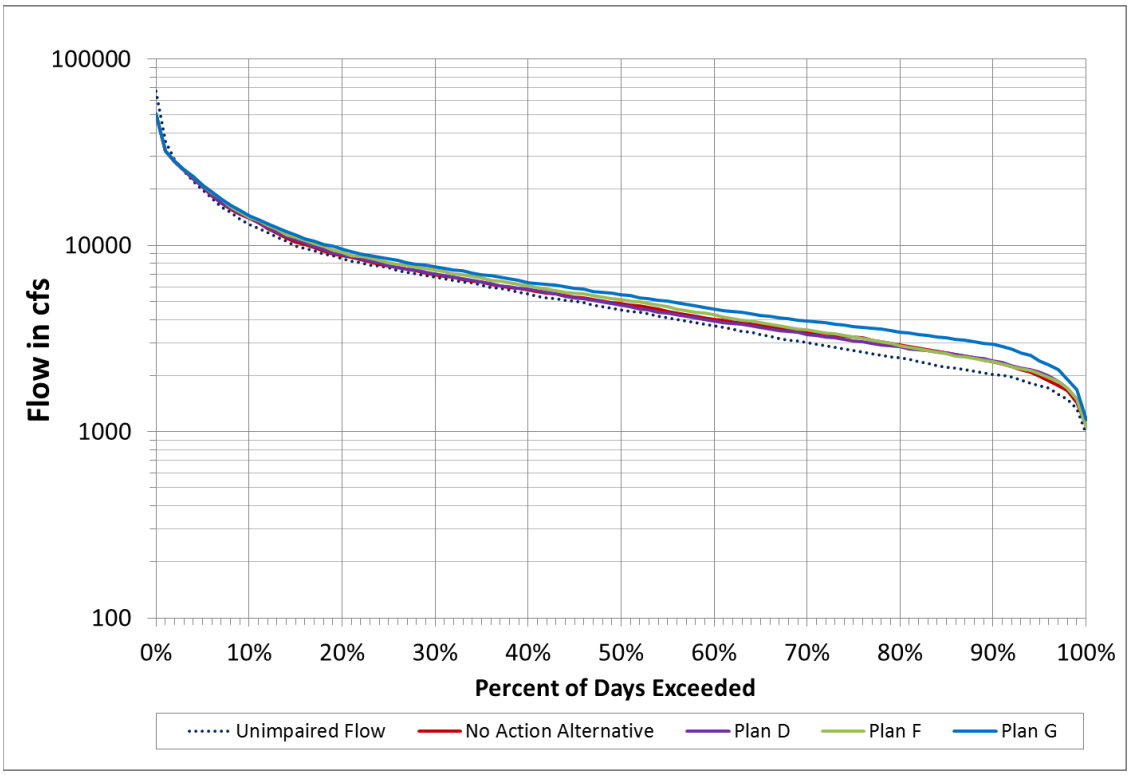


Figure 6.1-50. Coosa River at Rome, Georgia, daily discharge (cfs)—percent of days exceeded for December over the modeled period of record (1939–2011).

6.1.1.3.3.2 Alternative Plan D

As indicated in Figure 6.1-45, median daily flows in the Coosa River at Rome for Plan D over the modeled period of record would be essentially the same as those for the No Action Alternative, with the exception of a minor deviation in October. During October, median daily flows for Plan D would likely decline slightly below flows for the No Action Alternative (in the general range of 300 cfs lower). That minor effect is principally associated with revisions to action zones at Allatoona Lake where declining lake levels into lower actions zones in the fall would be expected to dictate curtailed hydropower operations to conserve storage and, consequently, slightly reduced releases downstream.

Figure 6.1-46 presents daily flows at the 90 percent exceedance level (flows that would be exceeded 90 percent of the time). These flow levels would be representative of extremely dry conditions in the basin. Under these conditions, flows for Plan D would closely align with the No Action Alternative over most of the months of the year. In portions of March and in the lower flow period (August through October), Plan D would provide flows at the 90 percent exceedance level that would be slightly lower than the No Action Alternative (in the range of zero to ten percent). Plan D would produce slightly higher flows than the No Action Alternative during the month of May.

The annual flow-duration curve for Plan D (Figure 6.1-47) is essentially the same as that for the No Action Alternative, except that the curve for Plan D lies just slightly below the No Action Alternative at the lower, less frequently encountered, flow levels (80 to 95 percent of days exceeded). Revisions to the actions zones for Allatoona Lake and seasonal flows at Carters Reregulation Dam, while potentially having more noteworthy effects on flow during certain months, have little overall effect on the annual flow-duration curve.

As noted in Section 6.1.1.3.3.1, flow-duration curves for September, October, and December were reviewed to assess effects of alternative plans on flow in the Coosa River at Rome that might be expected from upstream changes in project operations. Compared to the No Action Alternative, implementing Plan D would have little effect on the flow duration curves for September, October, and December over the modeled period of record (see Figure 6.1-48, Figure 6.1-49, and Figure 6.1-50).

Flow conditions in the Coosa River at Rome have added importance in management of the ACT Basin because one of the three key triggers that activate the drought plan included in Plan D (see Section 4.2.2.2) is based on 7Q10 flows at the Alabama/Georgia state line, a short distance downstream from the USGS Rome-Coosa stream gage. The 7Q10 flows for the drought trigger were derived from historic flow data at the Rome-Coosa gage. When flow levels decline below the 7Q10 value (established by month), drought operations (Level 1 or higher depending on whether one or more of the other triggers have been exceeded) would be activated for management of downstream APC reservoirs. Table 6.1-2 below presents the 7Q10 values by month at the Rome-Coosa gage and the percent of days over the modeled period of record that 7Q10 flows would be exceeded for the No Action Alternative and Plan D.

For both the No Action Alternative and for Plan D, the percent of days over the modeled period of record during which flow in the Coosa River at Rome would likely exceed 7Q10 values would be in the range of 90 percent or higher. The percentages for both plans during most months are about the same. The biggest deviation in Table 6.1-2 between the No Action Alternative and Plan D would occur in August and September, when the percent of days exceeded for Plan D would decline two to three percent compared to the No Action Alternative.

On the basis of a review of model outputs over the modeled period of record, upstream changes in reservoir operations at Allatoona Lake and Carters Lake included in Plan D do not result in appreciable overall deviation in flows characteristics in the Coosa River at Rome compared to the No Action Alternative.

6.1.1.3.3.3 Alternative Plan F

Implementing Plan F would have essentially the same effects on flow characteristics in the Coosa River at Rome as those for Plan D. Plots of median daily flows (Figure 6.1-45) and daily flows at the 90 percent exceedance level (Figure 6.1-46) indicate little difference between the plans. The annual flow-duration curve and the more specific flow-duration curves for September, October, and December also indicate little change in overall flow characteristics at the location between Plans D and F. Table 6.1-2 also indicates that the percent of days over the modeled period of record that flows would exceed 7Q10 values would be about the same for Plan D and Plan F.

Table 6.1-2.
Coosa River at Rome, Georgia—Percent of days (by month) over the modeled period of record (1939–2011) that flows would likely exceed 7Q10 value

		Percent of days flow would likely exceed 7Q10 values				
Month	7Q10 flow value (cfs)	Unimpaired Flow	No Action Alternative	Plan D	Plan F	Proposed Action Alternative (Plan G)
January	2,544	94.2%	93.1%	93.6%	93.8%	94.1%
February	2,982	96.7%	93.4%	94.6%	94.6%	94.6%
March	3,258	97.8%	97.1%	97.0%	97.0%	97.0%
April	2,911	97.3%	93.8%	94.5%	94.5%	94.5%
May	2,497	94.7%	92.8%	93.4%	93.4%	93.4%
June	2,153	91.7%	92.1%	91.9%	91.9%	91.9%
July	1,693	90.8%	93.3%	93.8%	93.8%	93.8%
August	1,601	83.9%	91.5%	89.2%	89.2%	89.1%
September	1,406	81.2%	93.5%	91.7%	91.8%	87.4%
October	1,325	82.6%	95.1%	94.5%	94.5%	92.6%
November	1,608	82.9%	92.5%	92.9%	92.9%	91.4%
December	2,043	89.8%	94.5%	95.4%	95.0%	97.4%

6.1.1.3.3.4 Alternative Plan G (Proposed Action Alternative)

As indicated in Figure 6.1-45, median daily flows in the Coosa River at Rome for the Proposed Action Alternative (Plan G) over the modeled period of record would be essentially the same as those for the No Action Alternative from January through August. From September through about mid-November, median daily flows for the Proposed Action Alternative would likely decline slightly below flows for the No Action Alternative. Median flows would be reduced in the range of 200 to a maximum of about 700 cfs during this period. From late November through December, median daily flows for the Proposed Action Alternative would increase above flows for the No Action Alternative. Flow differences during that period would be in the range of 150 to as much as 900 cfs higher than flows under the No Action Alternative. That effect is principally associated with the addition of the water management measure at Allatoona Lake in the Proposed Action Alternative to reduce hydropower production during the fall drawdown period, coupled with the fall phased drawdown guide curve.

Figure 6.1-46 presents daily flows at the 90 percent exceedance level (flows that would be exceeded 90 percent of the time). These flow levels would be representative of extremely dry conditions in the basin. Under these conditions, flows under Plan G would closely align with the No Action Alternative over most of the months of the year. In portions of March and in the lower flow period of August through October, Plan G would provide flows at the 90 percent exceedance level that would be lower than the

No Action Alternative and slightly lower than Plans D and F. During the lower flow period, the flow reduction as a result of Plan G would be expected to generally range from zero to a maximum of about 20 percent compared to the No Action Alternative. At the 90 percent exceedance level, the Proposed Action Alternative (Plan G) would produce slightly higher flows than the No Action Alternative during the month of May and substantially higher flows during the month of December (up to about 25 percent higher).

The annual flow-duration curve for the Proposed Action Alternative (Figure 6.1-47) is essentially the same as that for the No Action Alternative, except that the curve for the Proposed Action Alternative lies just slightly below the No Action Alternative at the lower, more infrequent flow levels (70 to 99 percent of days exceeded). While revisions to the action zones, the phased fall drawdown guide curve, reduced hydropower during fall drawdown at Allatoona Lake, and seasonal minimum flows at Carters Reregulation Dam might have effects of limited duration during the year, the overall effect on the annual flow-duration curve for the Coosa River at Rome would be minor.

As noted in Section 6.1.1.3.3.1, flow-duration curves for September, October, and December were reviewed to assess effects of alternative plans on flow in the Coosa River at Rome that might be expected from upstream changes in project operations (Figure 6.1-48, Figure 6.1-49, and Figure 6.1-50). Implementing the Proposed Action Alternative would slightly lower the flow-duration curve for September compared to the No Action Alternative. About 85 percent of the time over the period of record for September, flows for the Proposed Action Alternative would be slightly lower (ranging up to 10 percent lower) than for the No Action Alternative. For example, 2,000 cfs would likely be exceeded about 61 percent of the time for the Proposed Action Alternative and 70 percent of the time for the No Action Alternative. This trend would be likely to continue at a slightly larger scale for October for the Proposed Action Alternative compared to the No Action Alternative. Over 90 percent of the time over the period of record for October, flows for the Proposed Action Alternative would be lower (ranging up to about 20 percent lower) than for the No Action Alternative. For example, 2,000 cfs would likely be exceeded about 58 percent of the time for the Proposed Action Alternative and 75 percent of the time for the No Action Alternative.

For December, implementing the Proposed Action Alternative would moderately increase the flow-duration curve compared to the No Action Alternative. About 95 percent of the time over the period of record for December, flows for the Proposed Action Alternative would be slightly to moderately higher (ranging up to about 20 percent higher) than for the No Action Alternative. For example, 3,000 cfs would likely be exceeded about 89 percent of the time for the Proposed Action Alternative and 79 percent of the time for the No Action Alternative.

Table 6.1-2 presents the 7Q10 values by month at the Rome-Coosa gage and the percent of days over the modeled period of record that 7Q10 flows would be exceeded for the Proposed Action Alternative. For both the Proposed Action Alternative and the No Action Alternative, the percent of days (by month) over the modeled period of record during which flow in the Coosa River at Rome would likely exceed 7Q10 values would be in the range of 87.4 percent or higher. The percentages for the Proposed Action Alternative are about the same, or slightly higher, compared to the No Action Alternative from January through July. Table 6.1-2 indicates that from August through November, the Proposed Action Alternative would be expected to reduce the number of days that Coosa River flows at Rome would exceed 7Q10 values from two to five percent below the No Action Alternative. For December, the Proposed Action Alternative would likely increase the number days the 7Q10 values would be exceeded by three percent compared to the No Action Alternative.

Operational changes at upstream USACE projects included as part of the Proposed Action Alternative, particularly the water management measure to reduce hydropower generation at Allatoona Lake during the fall drawdown period, would somewhat shift releases in time over the period from September through

December. However, on the basis of model runs over the hydrologic period of record, those adjustments result in slightly lower flow in the Coosa River at Rome, Georgia, during the September to November period. The impact does not appear significant because drought operation is triggered only one percent more often (see Table 6.1-4). During the month of September over the modeled period of record, model runs indicate there would be a decrease in meeting 7Q10 flows at Rome from 93.5 percent of days for the No Action alternative to 87.4 percent of days for the Proposed Action. However, as discussed in Section 6.1.2.4, the resulting effects on water quality would be minor.

6.1.1.3.4 Alabama River at Montgomery, Alabama

The following subsections describe the effects the No Action Alternative and Alternative Plans D, F, and G would have on stream flow conditions in the Alabama River at Montgomery, Alabama. The location is just downstream of the confluence of the Coosa and Tallapoosa rivers. Flow conditions at that location are principally affected by water management activities at APC projects upstream on both rivers. Operations at Carters Lake and Allatoona Lake in the upper portion of the ACT Basin have minimal influence on flow conditions at this location. Proposed revisions to water management practices included in Plans D, F, and G could alter the downstream flow regime in terms of quantity or timing or both. Flows targets at the location play a strategic role in meeting both navigation and waste assimilation objectives in the Alabama River downstream of Montgomery. A combined minimum release target of 4,640 cfs (weekly average) from the APC JBT projects near Montgomery has been established historically to support downstream navigation use, but these releases also conjunctively support downstream water quality, hydropower generation, recreation, and fish and wildlife conservation (see Section 2.1.1.1.4.13). The combined JBT release target is also an important element of the drought management strategy included in Alternative Plans D, F, and G. Each of the three drought levels in those alternative plans triggers a progressively more restrictive flow response to be delivered by releases from the APC JBT projects on the Coosa and Tallapoosa rivers

Figure 6.1-51, Figure 6.1-52, and Figure 6.1-53 present model results for flow conditions in the Alabama River near Montgomery, Alabama over the modeled period of hydrologic record (1939–2011) for the No Action Alternative, the proposed revisions to the ACT WCM as defined in Alternative Plans D, F, and G (the Proposed Action), and the unimpaired flows (for general comparison purposes). In general, median daily flows (Figure 6.1-51) in the Alabama River near Montgomery for No Action and the other alternatives would closely mimic the unimpaired flows, except that the unimpaired flows would be slightly higher (ranging from about 1,000 to 6,000 cfs) from mid-February through early May and slightly lower (ranging from 1,000 to 3,000 cfs) from September through December. At the 90 percent exceedance level (Figure 6.1-52), representing dry conditions in the basin, daily unimpaired flows would be appreciably higher than the water management alternatives (including No Action) from mid-February through early May and much lower than the alternatives during the drier periods (August through November). Figure 6.1-53 indicates that the unimpaired flows under low flow conditions (at 70 percent of days exceeded and greater) are less than flow levels for all the alternatives (including No Action). These results are consistent with those expected for a basin with multiple storage reservoirs where a portion of the peak flows in the wetter months is stored in reservoirs with releases in the drier months that would tend to exceed natural flow conditions.

6.1.1.3.4.1 No Action Alternative

Figure 6.1-51 depicts median daily flows in the Alabama River at Montgomery over the modeled period of record. Median daily flows in early January would be about 21,000 to 25,000 cfs, gradually increasing to a peak at about 39,000 cfs by the end of March. Thereafter, median flows at Montgomery would decline rapidly during April through June to about 10,000 cfs by the end of June. Median flows would

continue to trend downward to a minimum level of about 7,500 cfs in September. For the remainder of the year, median flows gradually increase to about 24,000 cfs by the end of December.



Figure 6.1-51. Alabama River at Montgomery, median daily discharge (cfs) over the modeled period of record (1939–2011).

Figure 6.1-52 presents daily flows at the 90 percent exceedance level (flows that would be exceeded 90 percent of the time) for the Alabama River at Montgomery. These flow levels would be representative of extremely dry conditions in the basin. Under these conditions, flows would range from about 10,000 cfs in January up to about 17,000 cfs in March, generally declining to a minimum level of about 5,000 cfs by July. Flows would be expected to continue at that level until around mid-November, thereafter gradually increasing to about 10,000 cfs by the end of December.

For the No Action Alternative, Figure 6.1-53 depicts the number of days over the period of record (expressed as a percentage) that the entire range of potential flows would likely be exceeded in the Alabama River at Montgomery. The modeled maximum flow would be 220,575 cfs, and the median annual flow would be 13,618 cfs. Flow at the 25th percentile level (or 75 percent of days exceeded), indicative of dry conditions, would be 8,699 cfs. At the 10th percentile level (90 percent of days exceeded), which would be indicative of severe drought conditions, flow would be expected to be 6,246 cfs. The combined minimum release requirement of 4,640 cfs (weekly average) from the JBT projects, as specified in the current FERC licenses, would be met 99 percent of the time over the modeled period of record for the No Action Alternative.

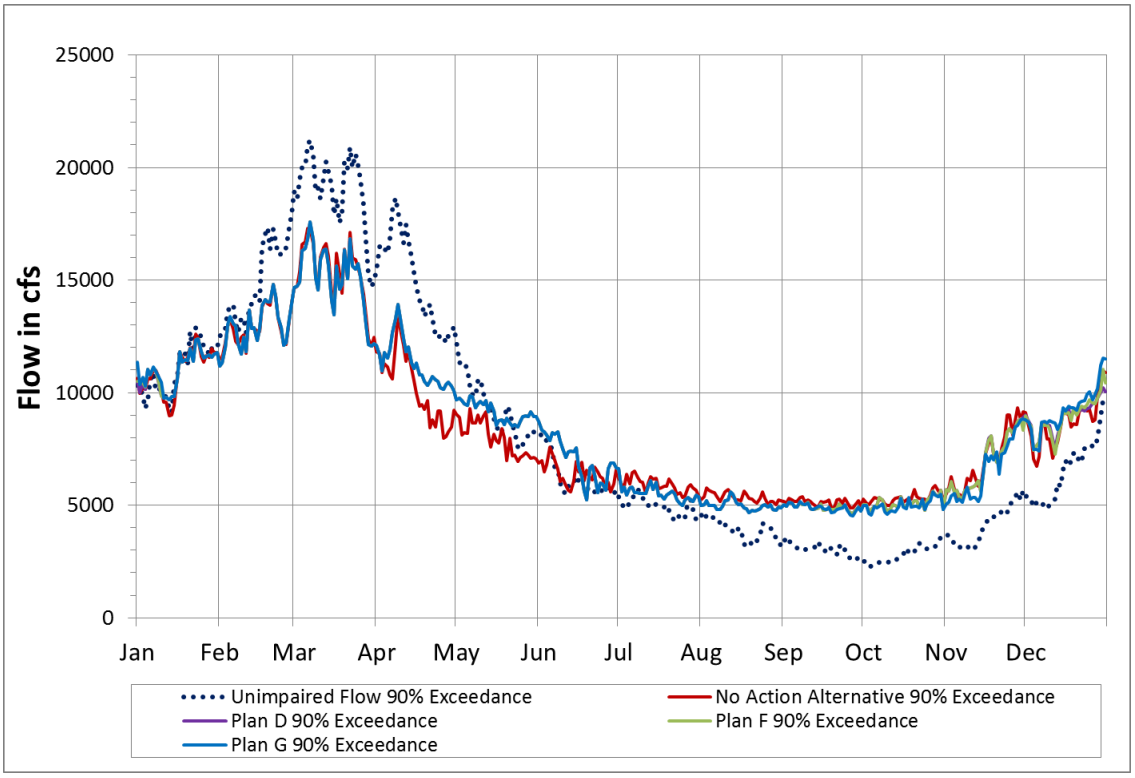


Figure 6.1-52. Alabama River at Montgomery, daily discharge (cfs) at the 90 percent exceedance level over the modeled period of record (1939–2011).

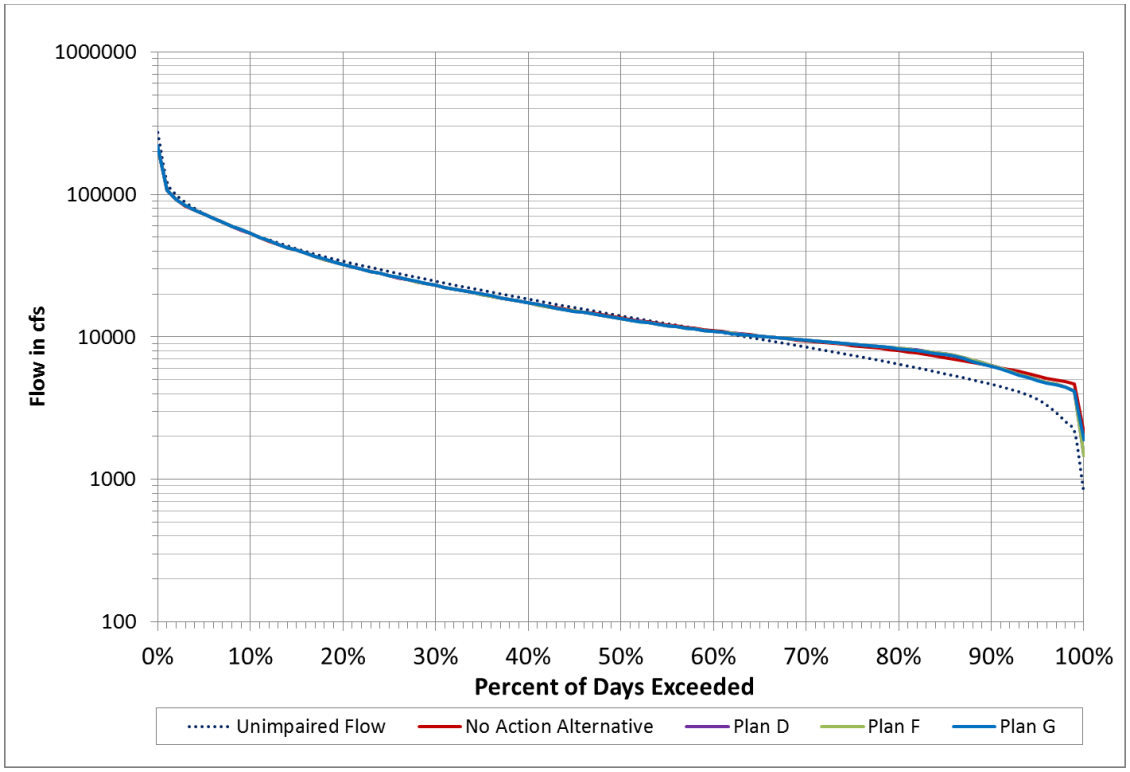


Figure 6.1-53. Alabama River at Montgomery, daily discharge (cfs)—percent of days exceeded over the modeled period of record (1939–2011).

6.1.1.3.4.2 Alternative Plan D

As indicated in Figure 6.1-51, median daily flows in the Alabama River at Montgomery for Plan D over the modeled period of record would, with minor deviations, track closely with median flows for the No Action Alternative. In October and November, median daily flows for Plan D would be slightly lower (ranging from zero to about ten percent lower) than flows for the No Action Alternative. For most of the remainder of the year, flows would tend to be about equal to, or slightly higher, than flows under the No Action Alternative. The minor deviations are principally associated with adjustments in releases from APC's JBT projects that would address the navigation management and drought management strategies in Plan D (see sections 4.2.1 and 4.2.2).

Figure 6.1-52 presents daily flows at the 90 percent exceedance level (flows that would be exceeded 90 percent of the time). These flow levels would be representative of extremely dry conditions in the basin. Under these conditions, flows under Plan D would closely align with the No Action Alternative, except that Plan D flows would range from zero to about 2,400 cfs higher between mid-April and mid-June. Between the months of July and mid-November, Plan D flows at the 90 percent exceedance level would be slightly lower than the No Action Alternative. These minor deviations are principally associated with adjustments in releases from APC's JBT projects that would address the navigation management and drought management strategies in Plan D (see sections 4.2.1 and 4.2.2).

The annual flow-duration curve for the Alabama River at Montgomery (Figure 6.1-53) indicates that there would be little overall difference between the plots for No Action and for Plan D. At 91 percent of days exceeded and higher, flow levels for Plan D are slightly lower than the No Action Alternative (ranging from zero to 10 percent lower).

The water management measures in Plan D would represent adjustments to project operations to manage the system to meet navigation needs when sufficient flows are available coupled with a specific plan to terminate navigation flows and activate a drought management plan with progressively stringent release criteria when conditions so dictate. Consequently, implementing Plan D would be expected to improve navigation conditions downstream of Montgomery (see Section 6.1.1.5) and improve drought management practices throughout the ACT Basin (see Section 6.1.1.4). Those objectives would be at least partially met by Plan D without substantial change in the overall flow characteristics of the Alabama River at Montgomery.

Plan D would be expected to meet the combined minimum release requirement of 4,640 cfs (weekly average) from the JBT projects near Montgomery at least 96 percent of the time over the modeled period of record.

6.1.1.3.4.3 Alternative Plan F

On the basis of model simulations over the modeled hydrologic period of record, Figure 6.1-51, Figure 6.1-52, and Figure 6.1-53 indicate that implementing Plan F would essentially have the same effect on flow conditions in the Alabama River at Montgomery as described for Plan D above.

6.1.1.3.4.4 Alternative Plan G (Proposed Action Alternative)

On the basis of model simulations over the 73-year modeled period of record, Figure 6.1-51, Figure 6.1-52, and Figure 6.1-53 indicate that implementing the Proposed Action Alternative would essentially have the same effect on flow conditions in the Alabama River at Montgomery as described for Plan D above.

6.1.1.3.5 Alabama River downstream of Claiborne Lock and Dam

The following subsections describe the effects the No Action Alternative and Alternative Plans D, F, and G would have on stream flow conditions in the Alabama River downstream of Claiborne Lock and Dam. Flow levels downstream of Claiborne Lock and Dam are an important determinant in measuring the viability of commercial navigation depths on the Alabama River. Maintaining flow conditions conducive to viable commercial navigation on the Alabama River downstream of Claiborne Lock and Dam, assuming continued maintenance dredging of the channel, is discussed in Section 6.1.1.5. A minimum flow target of 6,600 cfs is established for the Alabama River downstream of Claiborne Lock and Dam, representing the 7Q10 flow at that location, for waste assimilation purposes. That minimum flow target of 6,600 cfs downstream of Claiborne Lock and Dam would generally not provide conditions sufficient to maintain a viable navigation channel in the lower Alabama River, with or without maintenance dredging in that reach.

Figure 6.1-54, Figure 6.1-55, and Figure 6.1-56 present model results for flow conditions in the Alabama River downstream of Claiborne Lock and Dam over the modeled period of hydrologic record (1939–2011) for the No Action Alternative, the proposed revisions to the ACT WCM as defined in Alternative Plans D, F, and G (the Proposed Action), and the unimpaired flows (for general comparison purposes). In general, median daily flows (Figure 6.1-54) in the Alabama River below Claiborne Lock and Dam for No Action and the other alternatives would closely mimic the unimpaired flows, except that the unimpaired flows would be slightly higher from mid-February through early May and slightly lower from September through December. At the 90 percent exceedance level (Figure 6.1-55), representing dry conditions in the basin, daily unimpaired flows would be appreciably higher than the water management alternatives (including No Action) from mid-February through early May and much lower during the drier periods (August through November). Figure 6.1-56 indicates that the unimpaired flows under lower flow conditions (70 percent of days exceeded and greater) are less than flow levels for all the alternatives (including No Action). These results are consistent with those expected for a basin with multiple storage reservoirs where a portion of the peak flows in the wetter months is stored in reservoirs with releases in the drier months that would tend to exceed natural flow conditions.

6.1.1.3.5.1 No Action Alternative

Figure 6.1-54 depicts median daily flows in the Alabama River downstream of Claiborne Lock and Dam over the modeled period of record. Median flows in early January would be about 32,000 cfs, gradually increasing to a peak at slightly below 66,000 cfs by early April. Thereafter, median flows downstream of Claiborne Lock and Dam would decline rapidly through April and May to about 17,000 cfs by early June. Median flows would continue to trend downward to a minimum level of about 9,000 cfs by mid-September. For the remainder of the year, median flows gradually increase to about 32,000 cfs by the end of December. Robert F. Henry Lock and Dam and Millers Ferry Lock and Dam have limited capability to reregulate flows enough to have an appreciable effect on flows downstream of Claiborne Lock and Dam over time.

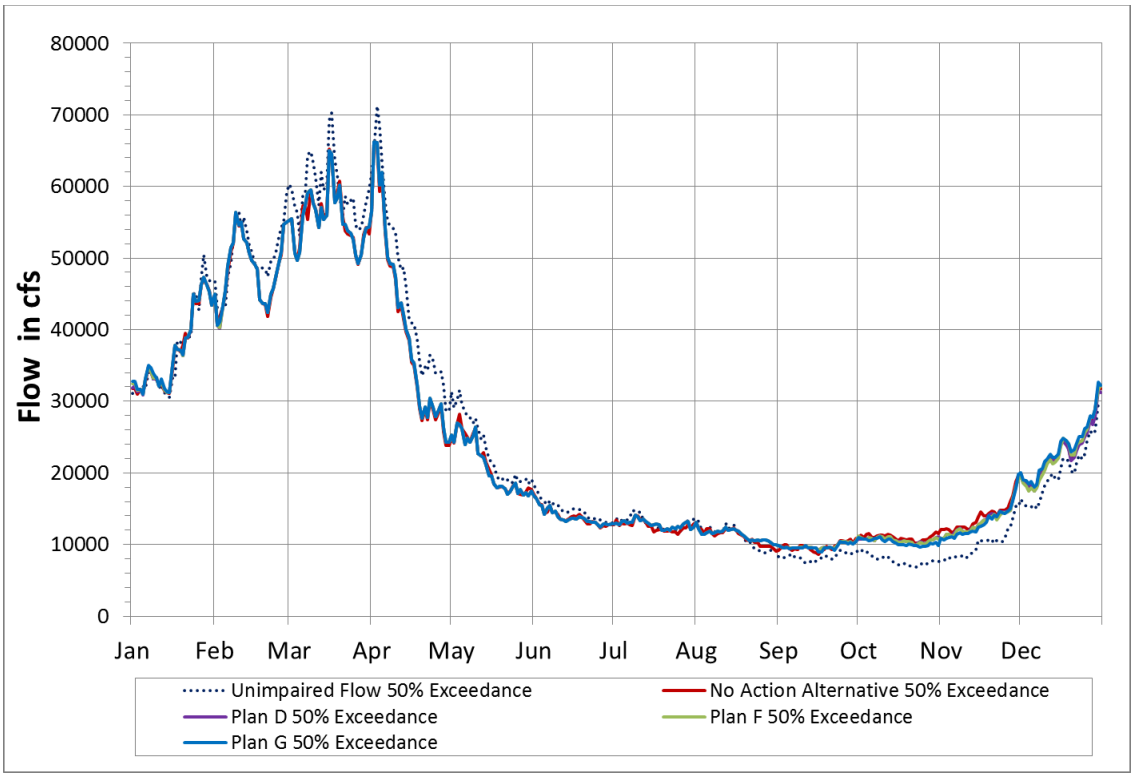


Figure 6.1-54. Claiborne Lock and Dam, median daily discharge (cfs) over the modeled period of record (1939–2011).

Figure 6.1-55 presents daily flows at the 90 percent exceedance level (flows that would be exceeded 90 percent of the time). These flow levels would be representative of extremely dry conditions in the basin. Under these conditions, flows would range from about 15,000 cfs in January up to 20,000 to 25,000 cfs in March, generally declining to minimum flow levels (6,600 cfs) by mid-June. Flows would be expected to hold at that level until around mid-November, thereafter gradually increasing to about 15,000 cfs by the end of December.

For the No Action Alternative, Figure 6.1-56 depicts the number of days over the modeled period of record (expressed as a percentage) that the entire range of potential flows would likely be exceeded in the Alabama River downstream of Claiborne Lock and Dam. The modeled maximum flow would be about 268,121 cfs, and the median flow would be 18,198 cfs. Flow at the 25th percentile level (or 75 percent of days exceeded), indicative of dry conditions, would be 11,013 cfs. At the 10th percentile level (90 percent of days exceeded), which would be indicative of drought conditions, flow would be expected to be 7,703 cfs. The minimum flow requirement of 6,600 cfs for the Alabama River downstream of Claiborne Lock and Dam, representing the 7Q10 flow at that location, would be met 97 percent of the time over the modeled period of record for the No Action Alternative.

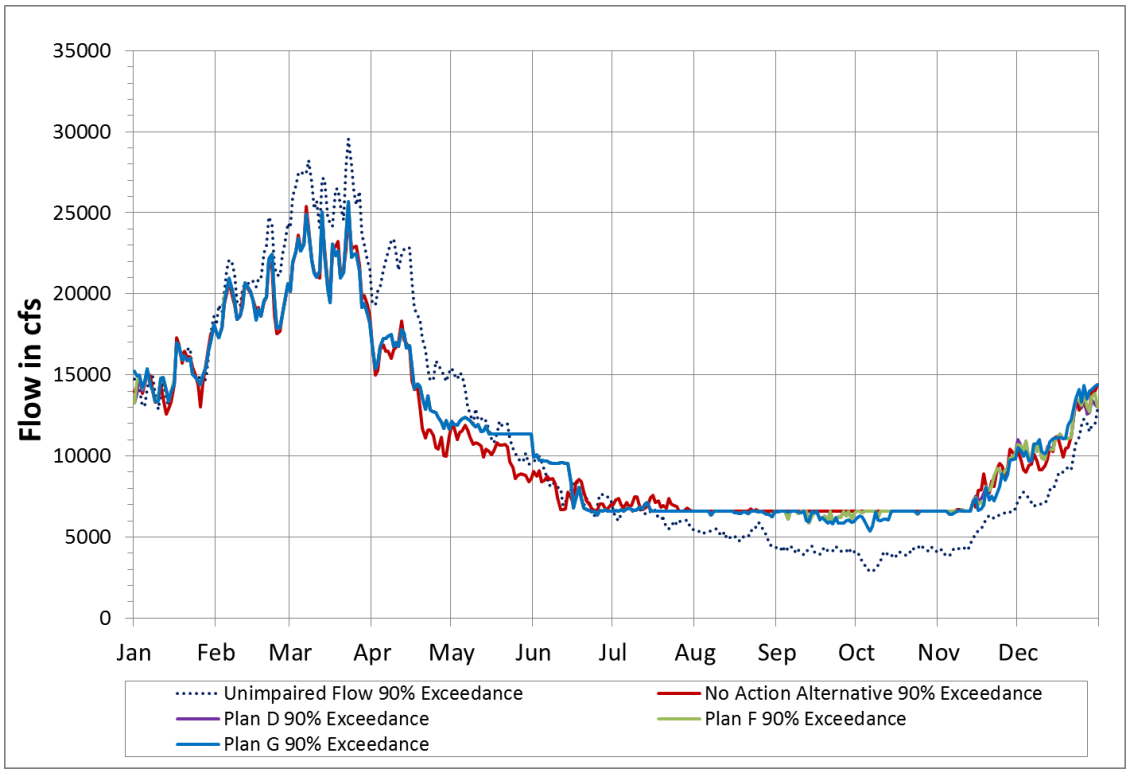


Figure 6.1-55. Claiborne Lock and Dam, daily discharge (cfs) at the 90 percent exceedance level over the modeled period of record (1939–2011).

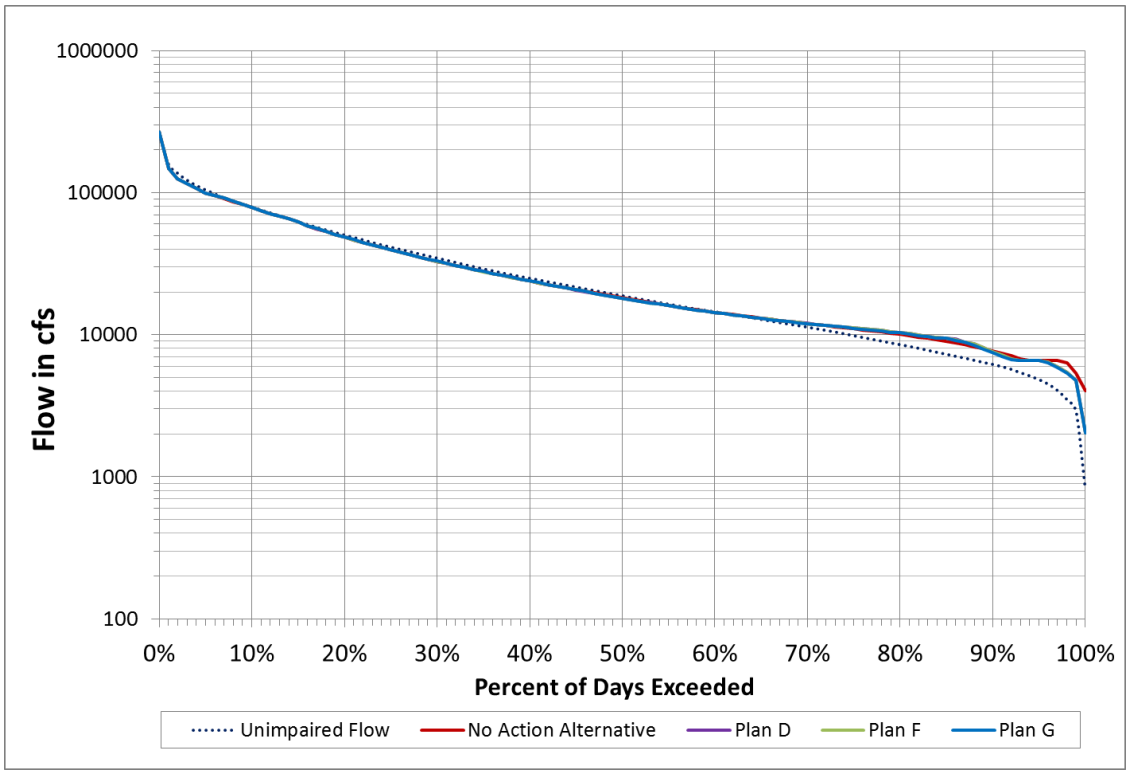


Figure 6.1-56. Downstream of Claiborne Lock and Dam, daily discharge (cfs)—percent of days exceeded over the modeled period of record (1939–2011).

6.1.1.3.5.2 Alternative Plan D

As indicated in Figure 6.1-54, median daily flows in the Alabama River downstream of Claiborne Lock and Dam for Plan D over the modeled period of record would, with minor deviations, track closely with median flows for the No Action Alternative. In October and November, median daily flows for Plan D would be slightly lower than flows for the No Action Alternative. During most of the remainder of the year, flows would tend to be about equal to, or slightly higher, than flows under the No Action Alternative. The minor deviations are principally associated with adjustments in releases from APC's JBT projects that would address the navigation flow management and drought management operations that are included in Plan D. Robert F. Henry Lock and Dam and Millers Ferry Lock and Dam have limited capability to reregulate flows enough to have an appreciable effect on flows downstream of Claiborne Lock and Dam over time.

Figure 6.1-55 presents daily flows at the 90 percent exceedance level (flows that would be exceeded 90 percent of the time). These flow levels would be representative of extremely dry conditions in the basin. Under these conditions, flows under Plan D would closely align with the No Action Alternative, except between mid-April and mid-June when flows would range from zero to about 3,000 cfs higher. Higher flows for Plan D in the spring at the 90 percent exceedance level would indicate the effect of increased JBT releases associated with the established navigation flow target that is not part of the No Action Alternative.

For Plan D, Figure 6.1-56 depicts the number of days over the modeled period of record (expressed as a percentage) that the entire range of potential flows would likely be exceeded in the Alabama River downstream of Claiborne Lock and Dam. For flow levels at or below the 10^{th} percentile (90 percent of days exceeded), representative of extreme low-flow conditions, Plan D flow levels would be slightly less (about one percent less) than the No Action Alternative. The minimum flow target of 6,600 cfs below Claiborne Lock and Dam would be met about 95 percent of the time.

The water management measures in Plan D would represent adjustments to project operations to manage the system to meet navigation needs when sufficient flows are available, coupled with a specific plan to suspend navigation flow releases and to activate drought operations with progressively stringent release criteria when conditions so dictate. Thus, implementing Plan D would be expected to provide for improved navigation flow conditions downstream of Montgomery (see Section 6.1.1.5) and improved drought management practices throughout the ACT Basin (see Section 6.1.1.4). Those objectives would be at least partially met by Plan D without substantial change in the overall flow characteristics of the Alabama River downstream of Claiborne Lock and Dam.

6.1.1.3.5.3 Alternative Plan F

As indicated by Figure 6.1-54, Figure 6.1-55, and Figure 6.1-56, implementing Plan F would be expected to have essentially the same effect on overall flow conditions in the Alabama River downstream of Claiborne Lock and Dam as described for Plan D above.

6.1.1.3.5.4 Alternative Plan G (Proposed Action Alternative)

As indicated by Figure 6.1-54, Figure 6.1-55, and Figure 6.1-56, implementing the Proposed Action Alternative would be expected to have essentially the same effect on overall flow conditions in the Alabama River downstream of Claiborne Lock and Dam as described for Plan D above. During October and November, flows for Plan G would likely decline slightly below those for Plan D.

6.1.1.4 Drought Management

This section briefly discusses the effects of including a drought plan or strategy in Alternative Plans D, F, and G. The drought plan in Plans D, F, and G was developed principally by USACE and APC, with input from the USFWS. The key features of the drought plan are described in detail in Section 4.2.2. The drought plan would be activated when one or more of the following drought triggers is met: (1) basin inflow trigger; (2) composite conservation storage trigger in APC reservoirs; and (3) state line flow trigger. Drought management actions would become increasingly more austere when two triggers are met (Drought Level 2) or all three are met (Drought Level 3).

In general, the inclusion of a coordinated USACE/APC drought plan in Alternatives D, F, and G, provides for a more predictable and proactive set of response actions by USACE and APC as hydrologic conditions deteriorate with the onset of a drought period. Over the simulated period of hydrologic record, implementation of the drought plan, when conditions dictate, would likely result in improved storage conditions and higher lake levels (see Section 6.1.1.2), particularly in the APC lakes, than would be expected without the drought plan, while continuing to meet downstream flow requirements and targets as well as essential water needs (quantity and quality) for municipal and industrial users to the extent possible.

Model revisions following the draft stage of the EIS, as summarized in Section 6.1, resulted in some minor changes in the number of occurrences or the percent of time over the modeled period of record during which drought operations would likely be triggered at Drought Levels 1, 2, or 3. The updated model results are reflected in the text and tables below. The percent of time in drought operations declined slightly in the updated model results for all alternatives, largely due to extending the hydrologic period of record for modeling by three years to a total of 73 years (1939 -2011). Years 2009–2011 represent a period generally characterized by normal or above normal rainfall in the basin.

6.1.1.4.1 No Action Alternative

The No Action Alternative (or the baseline operating condition) does not include a set of defined *drought triggers* or a specific coordinated plan or strategy for operating USACE and APC projects in the ACT Basin to manage the system under drought conditions. Drought conditions have been traditionally addressed when they occur, and drought management actions have been coordinated as needed among USACE, APC, the states, and key stakeholders without prescribed formal drought management protocols. Statewide drought management plans have been developed in recent years (see Section 2.1.1.2.5) to facilitate coordination of drought management activities, but they do not include specific drought plans for the projects in the ACT Basin.

Because the No Action Alternative does not include a prescribed drought plan with explicit protocols and triggers, it is not possible to make a clear comparison to the model simulation results presented in the following sections. The sections summarize how the implementation of the drought plan might be affected by other proposed updates to water management measures for projects in the ACT Basin included in Alternatives D, F, and G. A general discussion of the benefits and effects of including a coordinated USACE/APC drought plan in the WCM update is provided in Sections 4.2.2 and 6.1.1.4 and elsewhere in Section 6. Because the triggers for implementing the drought plan are principally governed by hydrologic conditions in the basin and not by project operations, the number of times that Drought Level 1, 2, or 3 conditions would be met under the No Action Alternative would likely be about the same as for Alternative D (described in the following paragraph). However, for the No Action Alternative, no specific drought plan would be initiated in response to drought conditions as would be done under Alternatives D, F, and G.

6.1.1.4.2 Alternative Plan D

As indicated in Table 6.1-3, Plan D would be expected to trigger Drought Level 1 operations 122 times over the modeled period of record. Drought Level 1 conditions could be encountered more than once in any year. Drought Levels 2 and 3 would likely be encountered much less frequently—26 and 5 occurrences, respectively, over the modeled period of record. The number of times that a particular drought level is triggered does not indicate how long that duration might be. Based upon the manner in which the drought level is checked and updated, the minimum duration for a drought level designation would be 14 days. The drought level duration could extend from 14 days to several weeks or months as long as the conditions that triggered drought operations in the ACT system would persist.

Table 6.1-3.
Number of times drought operations would be triggered over the modeled period of record (1939–2011)

	Plan D	Plan F	Proposed Action Alternative (Plan G)
Drought Level 1	122	119	122
Drought Level 2	26	26	30
Drought Level 3	5	5	5

Table 6.1-4 summarizes the percent of time over the modeled period of record that operations would be considered *normal* versus various levels of drought operation. *Normal operations* in this context would include any period when drought operations have not been triggered. The ACT Basin projects would be in normal operation about 84 percent of the time for Plan D and in drought operations a total of about 16 percent of the time, most of that time being in Drought Level 1 operations.

Table 6.1-4.
Percent of time that ACT system would be operating in normal and drought mode over the modeled period of record (1939–2011)

	Plan D	Plan F	Proposed Action Alternative (Plan G)
Normal	84.0%	84.1%	83.1%
Drought Level 1	11.7%	11.6%	12.3%
Drought Level 2	3.0%	3.0%	3.3%
Drought Level 3	1.3%	1.3%	1.3%

According to Table 6.1-5, the state line flow would be the drought trigger most often reached to activate drought operations, followed closely by the basin inflow trigger. The composite conservation storage trigger for APC projects would rarely be reached, in only the most extreme drought conditions.

Table 6.1-5.
Percent of time that drought operations activated and individual drought triggers met over the modeled period of record (1939–2011)

	Plan D	Plan F	Proposed Action Alternative (Plan G)
Drought Operations Activated	16.0%	15.9%	16.9%
Basin Inflow Trigger Met	9.4%	9.4%	9.3%
State Line Flow Trigger Met	10.6%	10.5%	11.6%
Composite Conservation Storage Trigger Met	1.4%	1.4%	1.5%

6.1.1.4.3 Alternative Plan F

Plan F, as presented in Table 6.1-3, Table 6.1-4, and Table 6.1-5, would be expected to provide similar results to Plan D with respect to drought management operations for the ACT Basin. Plan F would result in three less occurrences of Drought Level 1 operations than Plan D over the modeled period of record. The percent of time over the modeled period of record that the ACT project would be in drought operations for Plan F (15.9 percent) would be slightly lower than for Plan D (16.0 percent). Incorporating the fall phased drawdown guide curve configuration at Allatoona Lake for Plan F would be expected to slightly decrease the number of instances when drought management operations would be triggered, and the percent of time in drought operations, over the modeled period of record compared to Plan D.

6.1.1.4.4 Alternative Plan G (Proposed Action Alternative)

The Proposed Action Alternative (Plan G) would be expected to provide similar results to Plans D and F with respect to drought management operations for the ACT Basin. Results for the Proposed Action Alternative depicted in Table 6.1-3, Table 6.1-4, and Table 6.1-5 indicate that (1) Drought Level 1 occurrences (122) would be the same as Plan D and slightly higher than Plan F; (2) Drought Level 2 occurrences (30) would be higher than both Plans D and F (26 each); and (3) the percent of time when Drought Levels 1 and 2 would be activated would be slightly higher than both Plans D and F; and (4) increased exposure to drought operations would likely be based on a slight increase in the time during which the state line flow trigger would be exceeded. That minor increase in susceptibility to drought operations over the modeled period of record would most likely be attributable to the water management measure to reduce hydropower generation at Allatoona Lake during the fall drawdown period.

6.1.1.5 Navigation Flow Targets—Alabama River

Maintenance of navigable depths in the federally authorized channel in the Alabama River downstream of Montgomery is dependent on both seasonal maintenance dredging and sufficient flow conditions throughout the year.

The following paragraphs describe the performance of the alternative plans with respect to the following objectives guiding the WCM update:

- More accurately define flow requirements for APC projects to support navigation on the Alabama River downstream of Claiborne Lock and Dam.
- Develop a drought management plan as required by USACE regulations.
- Improve system performance to achieve congressionally authorized purposes.

In developing water management measures and alternative plans for the updated ACT Basin WCM, USACE evaluated flow requirements for the Alabama River downstream of Montgomery which, when coupled with seasonal dredging, would adequately accommodate commercial navigation as long as sufficient water is available in the ACT system. Establishing a well-defined, system wide drought management plan for the ACT Basin is a critical element of the navigation strategy because it defines specific hydrologic triggers at the onset of dryer conditions in the basin. The hydrologic indicators would trigger specific water management actions in USACE or APC projects signifying that commercial navigation channel depths cannot be sustained until hydrologic conditions improve to levels that exceed the trigger values. The primary goal of the navigation strategy in the alternative plans for the ACT WCM update was to determine minimum flow requirements to support navigation throughout the year and to operate to achieve those flows to the extent practicable, on balance with the other needs and requirements in the basin. Also, the navigation strategy is intended to a provide a clearer and more predictable process for successfully managing the system for navigation and more effectively communicating with waterway

users and stakeholders when hydrologic conditions in the ACT Basin cannot support commercial navigation depths.

To evaluate the effects of the alternative plans (No Action, and Plans D, F, and G), model simulations were run over the 37-year period of record (1975–2011) covering years during which the federally authorized navigation project upstream to Montgomery has been in place. For the simulations, the model outputs are compared against observed values in regard to channel availability. Model simulation results are also presented and discussed for the entire modeled period of record (1939–2011) for each of the alternatives. The evaluation of the model results considered the federally authorized navigation channel depth of 9 ft and a depth of 7.5 ft, which would still allow for light-loaded barges to successfully navigate.

The following sections summarize model results to depict the relative availability of 9-ft and 7.5-ft navigation channel depths over the 37-year and 73-year periods of record by presenting the information from two different perspectives. They are as follows:

- The first perspective graphically depicts the number of years (displayed for each month of the year) during which sufficient flows would likely be available to provide 9-ft and 7.5-ft channel depths for the entire month (every day of that month). For example, if the simulation for February for any given year met the flow target in only 26 of 28 days, that year's result for February would not be counted in the total number of years that the target would likely be met.
- The second perspective graphically depicts the percent of days (also displayed for each month of the year) over the 37-year navigation period of record and entire modeled period of hydrologic record during which the flow targets for 9-ft and 7.5-ft channel depths would likely be met.

The model results presented in the subsequent sections reflect the adjustments and updates to the HEC-ResSim model for the ACT Basin that were incorporated following the agency and public review of the draft EIS for the WCM update. The adjustments and updates are summarized in Section 6.1. Overall, these revisions had minimal impact on the results for navigation flow targets compared to those presented in the draft EIS. The only exception was the revision to the navigation flow target template based on additional review of available technical information and further consultation with navigation experts. The flow requirements for navigation channel availability for the month of November and early December were revised downward, thereby indicating that modeled flow conditions would likely be sufficient to support navigable channel depths during as many as an additional ten years for the month of November over the entire 73-year modeled period of record compared to results prior to revision of the template. The percent of time during the month of November that the navigation target flows would be exceeded for the 9-ft channel over the entire modeled period of record for the Proposed Action Alternative (Plan G) increased from about 59 percent to 73 percent as a result of the revised navigation flow target template.

6.1.1.5.1 No Action Alternative

The No Action Alternative was evaluated using model simulations over a 37-year navigation period of record (through 2011), beginning with the completion of all the Alabama River navigation project features in 1975. Existing operational parameters for the ACT Basin were evaluated, assuming that adequate routine seasonal dredging would occur and using recently developed seasonal flow levels downstream of Claiborne Lock and Dam determined to be necessary to support adequate channel depths (for 9- and 7.5-ft channel depths). On the basis of current assumptions and information, simulations for the No Action Alternative would not necessarily match with actual observations over the 37-year period.

Figure 6.1-57 depicts the number of years over the 37-year period (displayed for each month) during which 9-ft navigation depths would likely be fully available under the No Action Alternative. Between December and April, 9-ft depths would be available in at least 54 percent of the years (December) ranging up to 81 percent (March). Reliability of 9-ft channel depths would decline substantially between May and November, ranging from no more than 46 percent of the years in the months of May and November to as low as four of 37 years (12 percent) in September.

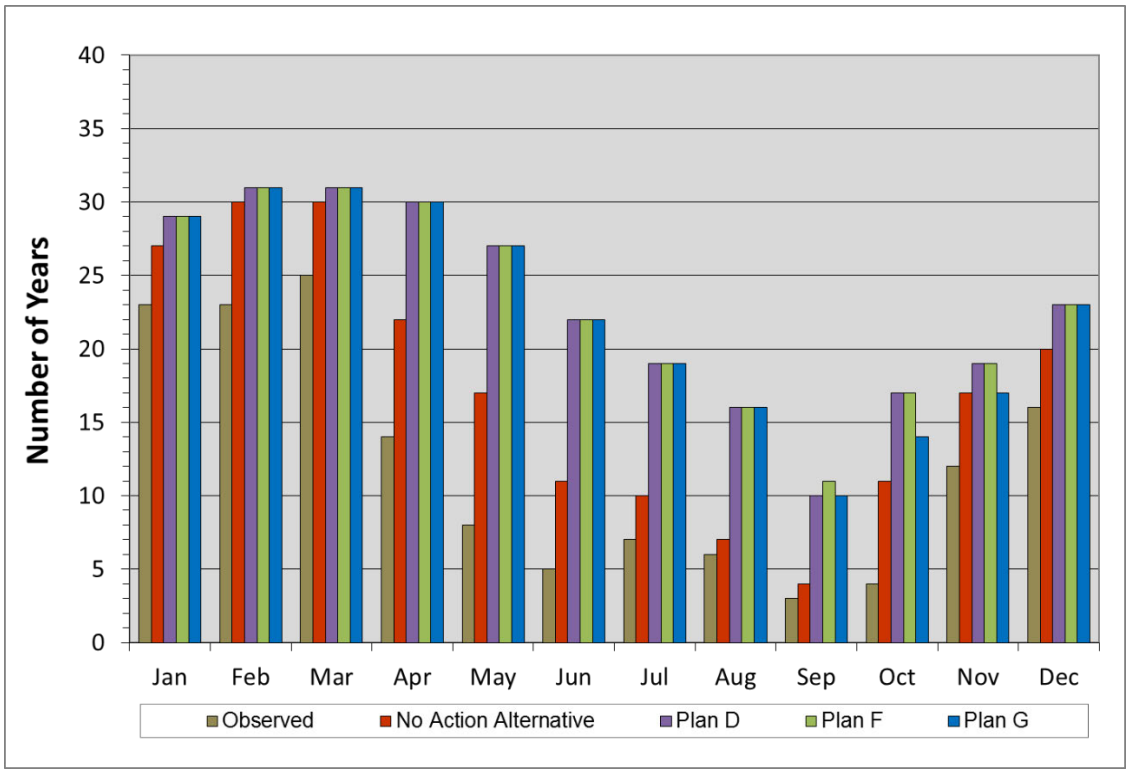


Figure 6.1-57. Alabama River, number of years (by month) that flow downstream of Claiborne Lock and Dam would be sufficient to support 9-ft channel during period of historical navigation use (1975–2011).

Observed values over the 37-year period of navigation record (as depicted in Figure 6.1-57) tend to reflect a lower number of years in which 9-ft depths were actually available than the modeled results for the No Action Alternative. In some months, the values were substantially lower. The differences in channel availability are primarily the result the well-defined operation to support navigation with a clearly identified flow requirement, whereas actual operations did not include a precise flow target to support navigation depths. Further, seasonal flow requirements downstream of APC projects at Montgomery that are necessary to adequately support downstream channel depths have not been well-documented in the past. The established combined minimum releases of 4,640 cfs (weekly average) downstream of APC's JBT projects near Montgomery, Alabama, has never actually been sufficient to fully support navigation channel depths downstream.

The model results over the 37-year navigation period of record were evaluated relative to the projected availability of a minimum navigation channel depth of 7.5 ft downstream of Montgomery. Using that performance measure, the number of years that channel depths would be available under the No Action Alternative (for each month as depicted in Figure 6.1-58) would follow a pattern similar to the 9-ft channel results. However, while following a similar pattern throughout the year, the availability of a channel at least 7.5-ft deep would generally increase by a range of one to five years for each month (over

the 37-year navigation period of record). As with the 9-ft channel depth results and for the same reasons as described in the previous paragraph, observed values over the navigation period of record relative to a 7.5-ft channel depth are generally lower than model outputs for the No Action Alternative, but they much more closely mirror the No Action Alternative results at the 7.5-ft depth than the results for the 9-ft channel.

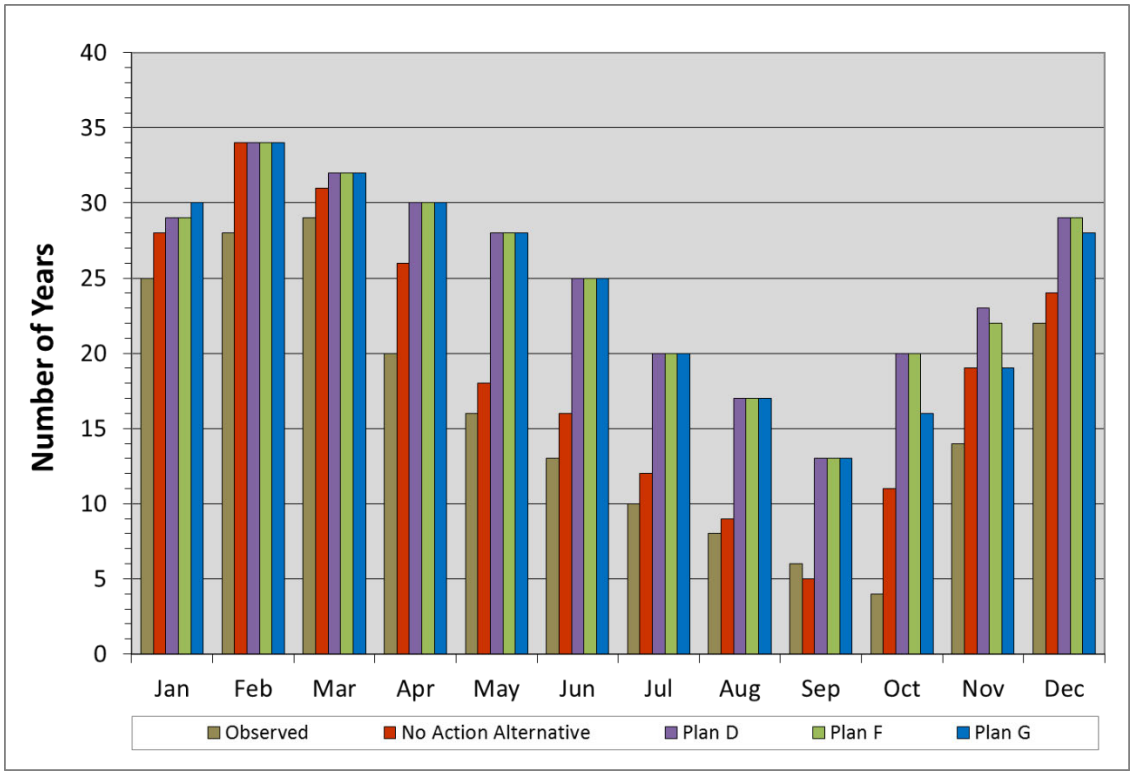


Figure 6.1-58. Alabama River, number of years (by month) that flow downstream of Claiborne Lock and Dam would be sufficient to support 7.5-ft channel during period of historical navigation use (1975–2011).

Figure 6.1-59 and Figure 6.1-60, respectively, depict the percent of time (by month) over the 37-year navigation period of record that flows downstream of Claiborne Lock and Dam would be expected to equal or exceed the levels necessary to sustain the federally authorized 9-ft channel depth and the minimum viable navigation channel depth of 7.5 ft. The figures include model results over that 37-year period of record for the No Action Alternative and the alternative plans.

For the No Action Alternative, sufficient flows to provide full 9-ft channel depths would be expected to be available at least 86 percent of the days from December through April (Figure 6.1-59). The percent of time that flows would likely exceed those necessary to sustain 9-ft channel depths would gradually decline each month from May through September. For August and September, navigation flows would be exceeded about 46 percent of the time. For October and November, the percent of time that target navigation flows would be exceeded would increase to 59 percent and 73 percent, respectively.

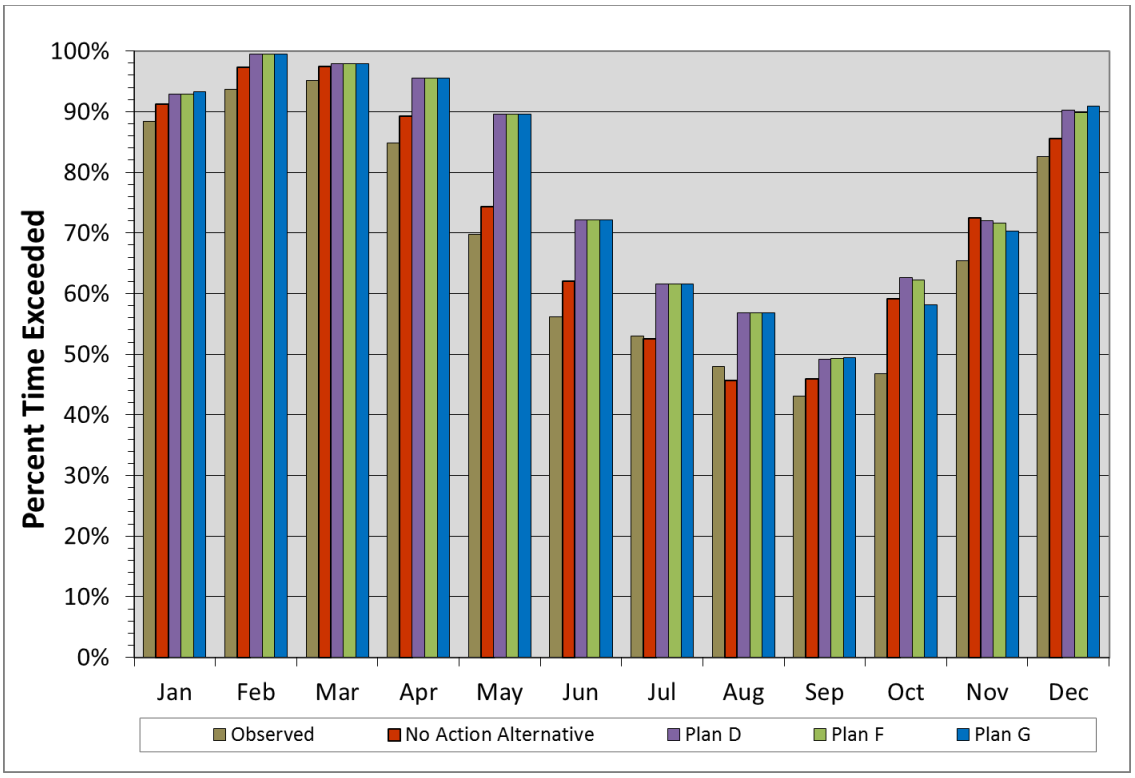


Figure 6.1-59. Alabama River, percent of time that 9-ft navigation channel flow target downstream of Claiborne Lock and Dam would be exceeded during period of historical navigation use (1975–2011).

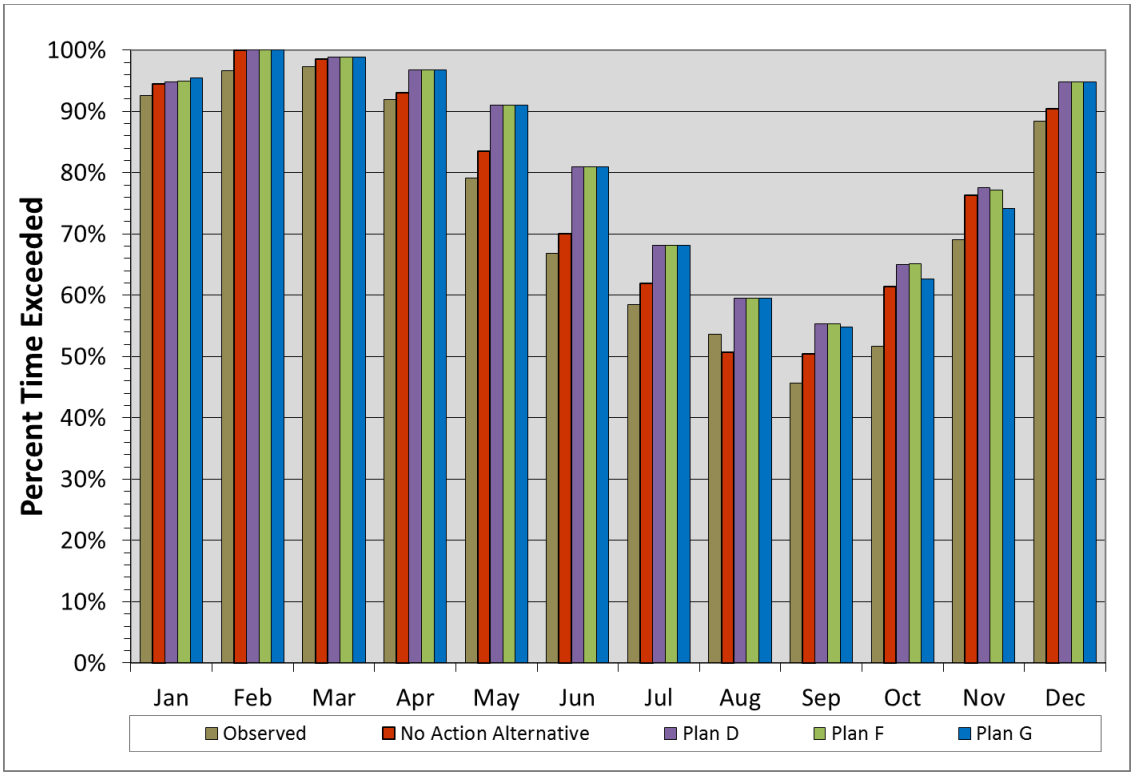


Figure 6.1-60. Alabama River, percent of time that 7.5-ft navigation channel flow target downstream of Claiborne Lock and Dam would be exceeded over period of navigation use (1975–2011).

For the No Action Alternative, sufficient flows to provide a minimum 7.5-ft channel would be expected to be available at least 90 percent of the days from December through April (Figure 6.1-60). The percent of time that flows would likely exceed those necessary to sustain 7.5-ft channel depths would gradually decline each month from May through September. For September, navigation flows would be exceeded about 50 percent of the time. For October and November, the percent of time that target navigation flows would be exceeded would increase to 61 percent and 76 percent, respectively.

Observed values shown on Figure 6.1-59 and Figure 6.1-60 are generally consistent with results from the model simulation for the No Action Alternative. All monthly observed values are within 5 percent of the No Action Alternative results except for October, where the observed values are about 20 percent lower (for the 9-ft channel) and about 16 percent lower (for the 7.5-ft channel). Reasons why observed values over the 37-year navigation period of record might differ from the No Action Alternative simulation are discussed earlier in this section.

Figure 6.1-61 depicts the number of years for each month over the entire simulated period of record (1939–2011) that flows downstream of Claiborne Lock and Dam would likely be sufficient to support a 9-ft navigation channel. For the No Action Alternative, model outputs indicate that flows between December and May would likely provide for a 9-ft navigation channel in 44 or more years over the modeled period of record (61 or more years between January and March). However, even with seasonal dredging of the navigation channel between May and October, sufficient flows to maintain 9-ft channel depths would likely be considerably less available between June and November, ranging from 34 of 73 years for November to as low as 11 of 73 years for September.

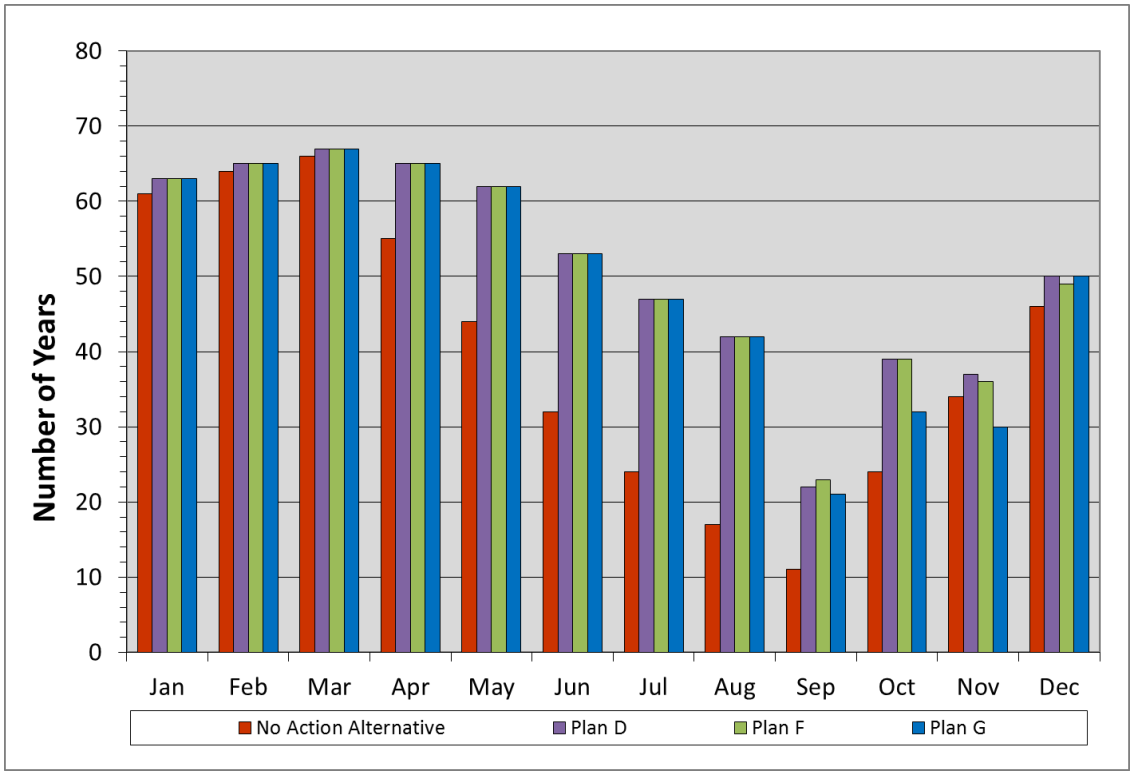


Figure 6.1-61. Alabama River, number of years (by month) that flow downstream of Claiborne Lock and Dam would be sufficient to support 9-ft channel during modeled period of record (1939–2011).

As presented in Figure 6.1-62, the number of years that a minimum 7.5-ft navigation channel would likely be available under the No Action Alternative over the modeled period of record represents a notable increase over the availability of a 9-ft channel, particularly during April through July and November through December. Nonetheless, under the No Action Alternative, the number of years during which flows to support a minimum 7.5-ft channel depth would likely remain relatively low for July through October, dropping as low as 13 of 73 years for September.

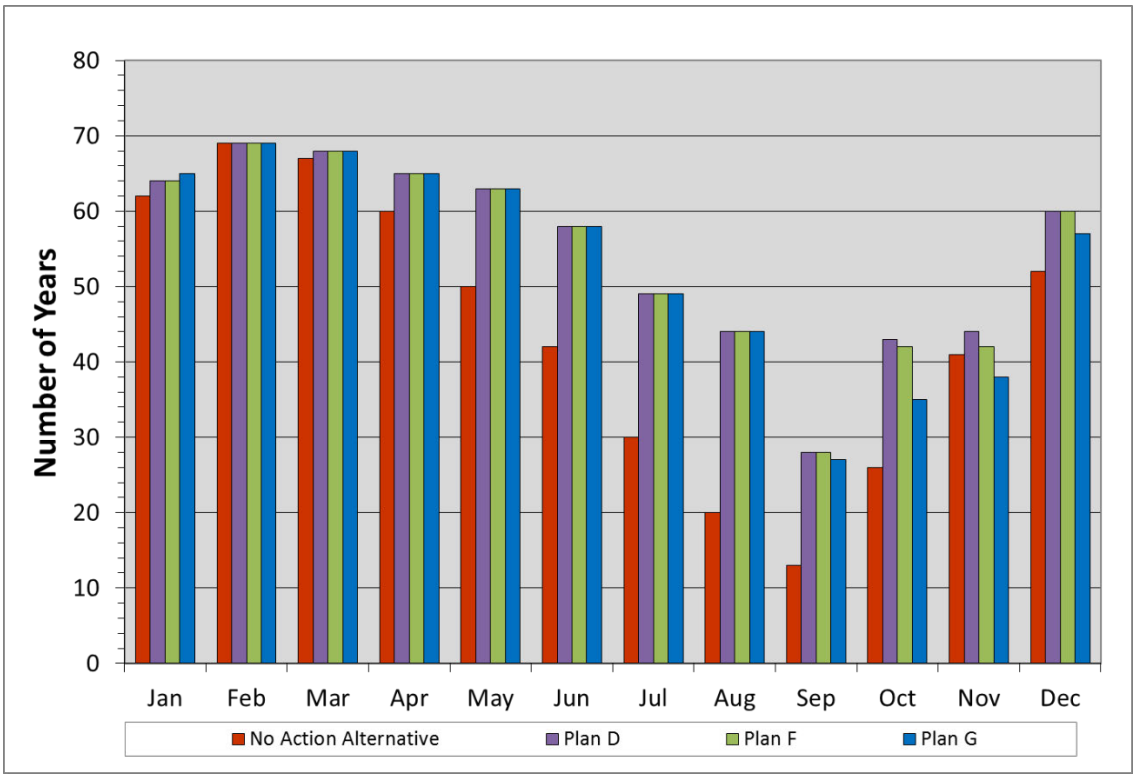


Figure 6.1-62. Alabama River, number of years (by month) that flow downstream of Claiborne Lock and Dam would be sufficient to support 7.5-ft channel during modeled period of record (1939–2011).

Figure 6.1-63 and Figure 6.1-64, respectively, depict the percent of time (by month) over the modeled period of record that flows downstream of Claiborne Lock and Dam would be expected to equal or exceed the levels necessary to sustain the federally authorized 9-ft channel depth and the minimum viable navigation channel depth of 7.5 ft. The figures include model results over the modeled period of record for the No Action Alternative and the alternative plans.

For the No Action Alternative, flows sufficient to support full 9-ft channel depths would be expected to be available at least 85 percent of the days in December through May (Figure 6.1-63). The percent of time that flows would likely exceed those necessary to sustain 9-ft channel depths would gradually decline each month from June through September, ranging from 74 percent for June to about 53 percent for September. For October and November, the percent of time that target navigation flows for those months would be exceeded would likely be about 66 percent and 79 percent, respectively. Note that navigation flow targets for a 9-ft channel for February over the period of record would be likely to be exceeded over 98 percent of the time. Despite that high percentage, 9-ft depths would not be available for the full month of February in nine years of the 73-year modeled period of record (Figure 6.1-61).

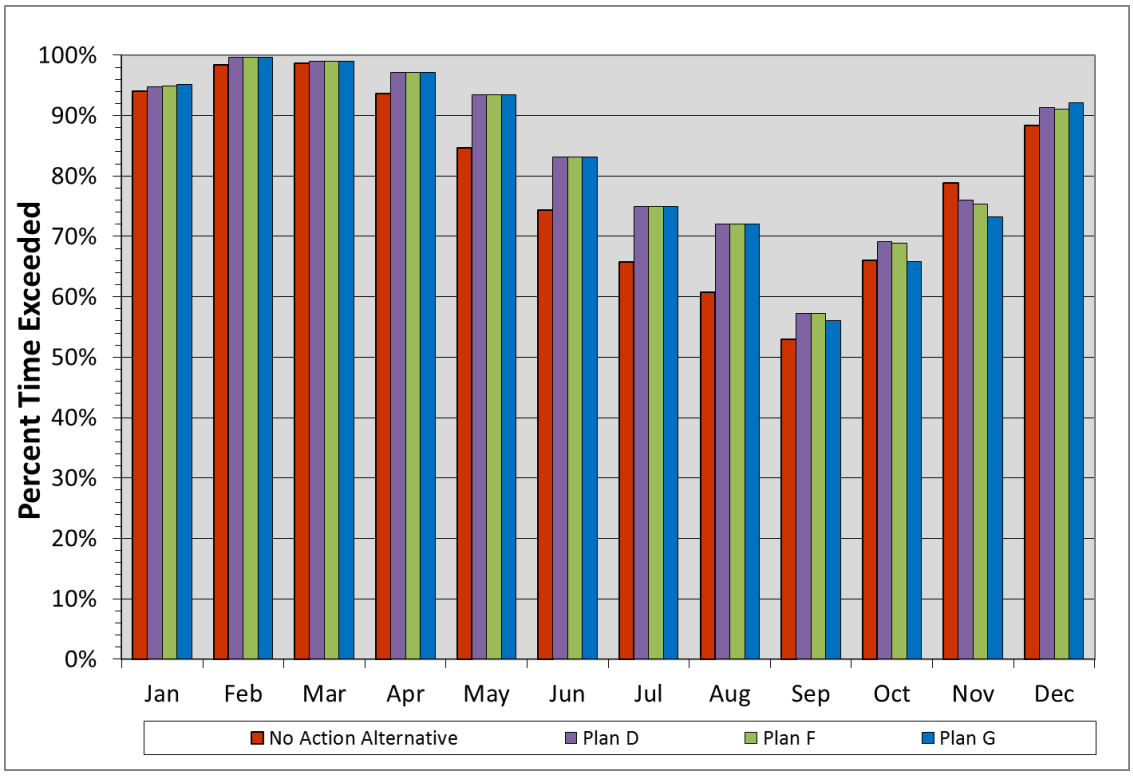


Figure 6.1-63. Alabama River, percent of time that 9-ft navigation channel flow target downstream of Claiborne Lock and Dam would be exceeded during modeled period of record (1939–2011).

For the No Action Alternative, flows sufficient to support a minimum 7.5-ft channel would be expected to be available at least 91 percent of the days in December through May (Figure 6.1-64). The percent of time that flows would likely exceed those necessary to sustain a 7.5-ft channel depth would gradually decline each month from June through September, ranging from 81 percent for June to about 60 percent for September. For October and November, the percent of time that target navigation flows would be exceeded would likely be about 71 percent and 83 percent, respectively. Note that navigation flow targets for a 7.5-ft channel for February over the period of record would be likely to be exceeded over 99 percent of the time. Despite that high percentage, 7.5-ft depths would not be available for the full month of February in four years of the 73-year modeled period of record (Figure 6.1-62).

Under existing conditions (the No Action Alternative), provisions for adequate and reasonably reliable channel conditions for commercial navigation on the Alabama River, from its juncture with the Mobile River upstream to Montgomery, have been sporadic in recent years for a combination of reasons. The absence of a clear delineation of seasonal flow requirements in partnership with APC to augment routine seasonal maintenance dredging (May through October) to sustain navigable depths has been at least partially responsible for the sporadic results and the corresponding decline in commercial use of the waterway. A variety of other socioeconomic factors could have also contributed to the decline as discussed in Section 2.6.1.2. Under the No Action Alternative, navigation channel conditions are likely to continue to deteriorate, and commercial navigation use of the Alabama River is likely to continue its decline.

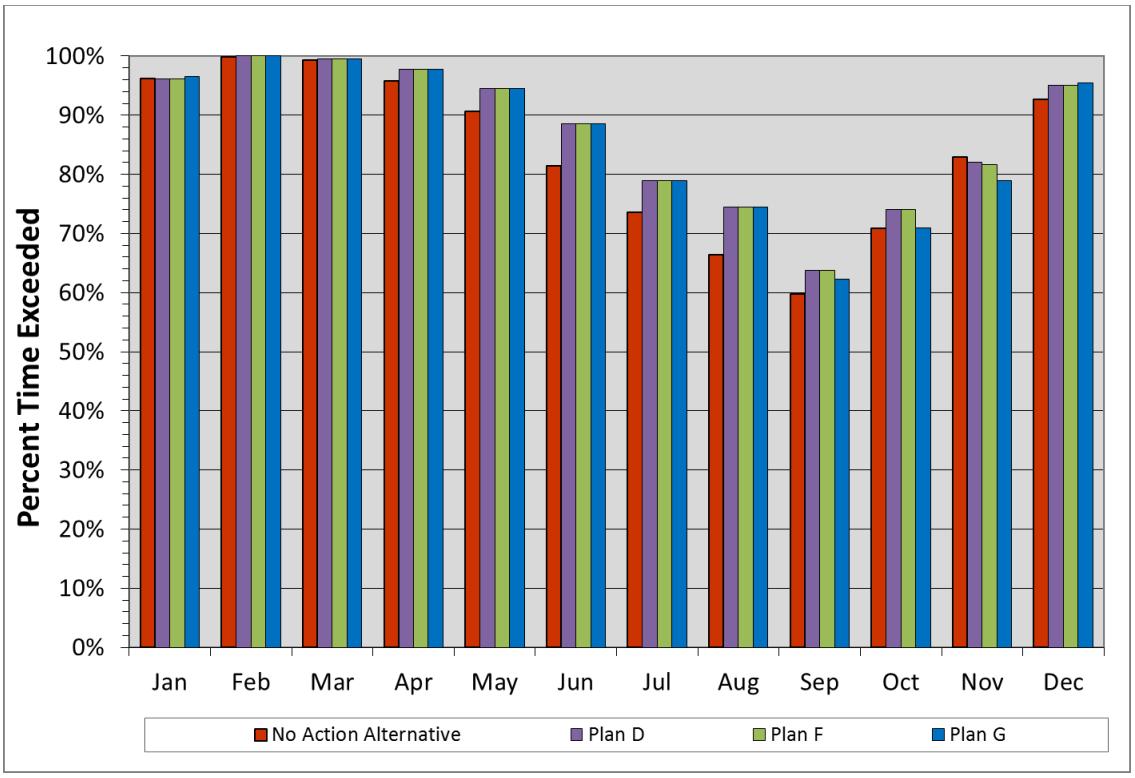


Figure 6.1-64. Alabama River, percent of time that 7.5-ft navigation channel flow target downstream of Claiborne Lock and Dam would be exceeded during modeled period of record (1939–2011).

6.1.1.5.2 Alternative Plan D

Over the 37-year navigation period of record in the model simulation, implementing Plan D would likely result in a notable increase in the number of years during which full 9-ft navigation channel depths would be available for commercial navigation compared to the No Action Alternative. The increase would be particularly noteworthy during the period of May through October, generally coinciding with the drier season in the ACT Basin. As depicted in Figure 6.1-57, increases in the availability of a 9-ft channel during those months would likely range from six to 11 years (out of 37). The simulation also indicates that smaller increases would likely occur in most of the remaining months (November through April). Most of those months are generally associated with wetter conditions and higher stream flows that would inherently be conducive to depths sufficient for navigation in most years.

The effects of Plan D with respect to the availability of 7.5-ft channel depths over the 37-year navigation period of record would follow a similar pattern as results for the 9-ft channel. Plan D would be expected to provide sufficient flows to support a minimum 7.5-ft navigation channel depth in December through May in at least 76 percent of the 37 years, as indicated in Figure 6.1-58. Under the No Action Alternative, that level of performance is likely to be attained only in January through March. Similar to the results for 9-ft channel depths, Plan D would likely result in a noteworthy increase in availability of the 7.5-ft channel depth in May through October compared to the No Action Alternative. As depicted in Figure 6.1-58, increases in the availability of 7.5-ft channel depths during May through October would likely range from eight to as many as 10 years (out of 37) compared to the No Action Alternative.

Over the 37-year navigation period of record in the model simulation, the percent of time that flows downstream of Claiborne Lock and Dam would be expected to exceed that needed to support both 9 and 7.5-ft channel depths in the Alabama River would increase under Plan D compared to the No Action Alternative (see Figure 6.1-59 and Figure 6.1-60). The increase is likely to be most notable in May through August for both navigation depths, where increases ranging from six to 15 percent over the No Action Alternative would be expected on the basis of the model results. More modest increases less than five percent would likely occur in the remaining eight months of the year.

For the entire modeled period of record (1939–2011), operations under Plan D would likely result in an appreciable overall increase in the number of years during which a full 9-ft navigation channel would be available for commercial navigation compared to the No Action Alternative. The increase would be particularly significant in April through October. As presented in Figure 6.1-61, availability of full 9-ft navigation depth during those months would likely increase by a range from 10 years (for September) to 25 years (for August) over the modeled period of record. The simulation results also indicate that more modest increases over the No Action Alternative would likely occur in most of the remaining months (November through March), when navigation channel availability already tends to be relatively high under existing conditions.

Under Plan D, the availability of 7.5-ft channel depths (by month) over the modeled period of record would follow a similar pattern to that for the 9-ft channel. Plan D would be expected to provide sufficient flows to support a minimum 7.5-ft navigation channel from December through June in at least 80 percent of the 73 years of record simulated in the model, as indicated in Figure 6.1-62. Under the No Action Alternative, that level of performance is only likely to be attained in January through April. Plan D would likely result in an appreciable increase in availability of the 7.5-ft channel depth in May through October compared to the No Action Alternative. As depicted in Figure 6.1-62, availability of full 7.5-ft navigation depth during those months would likely increase by a range from 13 years (for May) to 24 years (for August) over the modeled period of record compared to the No Action Alternative. The simulation results also indicate that more modest increases over the No Action Alternative would likely occur in most of the remaining months (November through April), when navigation channel availability already tends to be relatively high under existing conditions.

Over the hydrologic period of record in the model simulation, the percent of time that flows downstream of Claiborne Lock and Dam would be expected to exceed the levels needed to support both 9 and 7.5-ft channel depths in the Alabama River would increase under Plan D compared to the No Action Alternative (refer to Figure 6.1-63 and Figure 6.1-64). The increase is likely to be most notable in May through August for both navigation depths, where increases ranging from eight to 11 percent above the No Action Alternative would be expected for 9-ft depths on the basis of the model results and four to nine percent for 7.5-ft depths. More modest increases would likely occur in the remaining eight months of the year.

Key features incorporated into Plan D—updated and more realistic flows targets to support navigation along with drought plan triggers and operating protocols to better identify and respond to conditions in the ACT Basin under which navigation flows cannot be sustained—would result in improved management of the basin to meet navigation objectives on balance with other water resource objectives and requirements.

6.1.1.5.3 Alternative Plan F

Model simulation results over the 37-year navigation period of record (1975–2011) and over the full period of record (1939–2011) indicate that Plan F would have essentially the same effects as Plan D on the availability of navigation channel depths at the 9-ft and 7.5-ft levels in the federally authorized channel in the Alabama River downstream of Montgomery. The results for Plan F vary slightly from the results for Plan D in October through December. The slight differences are principally associated with

release patterns from Allatoona Lake during the fall reservoir drawdown period in accordance with either the existing guide curve (in Plan D) or the proposed fall phased drawdown guide curve (in Plan F). The minor differences between the effects of Plans D and F in October through December are reflected in Figure 6.1-57 through Figure 6.1-64. Overall, operations at Allatoona Lake under either Plan D or Plan F would have an inconsequential effect on navigation conditions in the Alabama River downstream of Montgomery.

6.1.1.5.4 Alternative Plan G (Proposed Action Alternative)

Model simulation results over the 37-year navigation period of record (1975–2011) and over the full period of record (1939–2011) indicate that the Proposed Action Alternative would have effects on the availability of navigation channel depths at the 9-ft and 7.5-ft levels in the Alabama River downstream of Montgomery similar to those resulting from Plans D and F. Figure 6.1-57 through Figure 6.1-64 present model results for the Proposed Action Alternative (Plan G) and the other alternatives relative to important navigation performance measures. The Proposed Action Alternative includes the proposed fall phased drawdown guide curve at Allatoona Lake (also a component of Plan F) and the management measure to "reduce hydropower generation during fall drawdown," as described in Sections 4.2.4 and 4.3.12. The results for January through September would be essentially the same for Plans D, F, and G. In those months, navigation conditions were generally improved for all the plans over the No Action Alternative. However, the fall phased drawdown at Allatoona Lake and reduced hydropower production during the drawdown period under the Proposed Action Alternative would result in some differences for October through December. Those differences are briefly summarized below.

The Proposed Action Alternative would generally result in a slight reduction in the number of years that navigation depths of 9 ft and 7.5 ft would be fully available for September through December compared to Plans D and F. The results are similar for both the 37-year historical navigation period of record modeled (1975–2011) and the full 73-year period of modeled record (1939–2011). However, in all months of the year except November, the navigation flow conditions for Plan G equal or represent an improvement over conditions for the No Action Alternative. Slight adverse effects during November principally would result from the phased drawdown with reduced hydropower production. See Figures Figure 6.1-57, Figure 6.1-58, Figure 6.1-61, and Figure 6.1-62.

Similarly, the Proposed Action Alternative would likely result in slight reductions in the percent of time during the months of October and November that flows downstream of Claiborne Lock and Dam would exceed those necessary to support channel depths of 9 ft and 7.5 ft, respectively, as compared to Plans D and F. A slight increase would be likely to occur for December. During these months the results for Plan G would be similar to those for the No Action Alternative. The results are similar for both the 37-year historical navigation period of record modeled (1975–2011) and the full 73-year modeled period of record. See Figure 6.1-59, Figure 6.1-60, Figure 6.1-63, and Figure 6.1-64.

The overall effects of operations at Allatoona Lake under the Proposed Action Alternative (Plan G) on navigation conditions in the Alabama River downstream of Montgomery compared to the other alternative plans (Plans D and F) would likely be inconsequential according to the results of model simulations.

6.1.1.6 Water Withdrawals

Numerous M&I water withdrawals occur at the USACE and APC reservoirs and in the mainstem rivers in the ACT Basin. Those withdrawals are summarized in Section 2.1.1.2.3. This section addresses potential effects on water withdrawals and intake structures from the No Action Alternative and Plans D, F, and G.

Adjustments and updates to the HEC ResSim model for the ACT Basin following agency and public review of the draft EIS did not provide any results that would affect the assessment of potential impacts on water withdrawal structures in the basin.

6.1.1.6.1 No Action Alternative

Existing information has been reviewed to determine if current operating conditions for ACT Basin projects, even under record drought conditions (e.g., 2007–2008), could have imposed unacceptable effects or constraints on water withdrawals or associated intake structures. In September 2007, as reported by way of the weekly drought calls with USACE and various news accounts, the Alabama River Pulp Company intake structure about 3.5 mi downstream of Claiborne Lock and Dam began to lose capability to withdraw water as river levels declined, and the company temporarily placed a barge with supplemental pumps into the river to provide sufficient water to the plant until flow conditions improved. For the No Action Alternative over the modeled period of record, temporary disruptions and inconveniences can rarely occur under extreme drought conditions for some existing M&I water withdrawals along the mainstem rivers of the ACT Basin. Withdrawals from ACT reservoirs should not be appreciably affected.

6.1.1.6.2 Alternative Plan D

On the basis of the model results over the modeled period of record, water management measures incorporated into Plan D would generally improve lake level conditions under extreme drought conditions compared to the No Action Alternative. Water withdrawals and intake structures would be most vulnerable under those conditions. Plan D would not likely change flow conditions in the rivers enough to increase the vulnerability of water supply intake structures to low water conditions compared to the No Action Alternative. Implementing Plan D would not be expected to adversely affect existing M&I water withdrawals in the ACT reservoirs or along the mainstem rivers to any degree greater than the No Action Alternative.

6.1.1.6.3 Alternative Plan F

Plan F would likely have similar effects on M&I water withdrawals as described for Plan D above. Implementing Plan F would not be expected to affect existing M&I water withdrawals in the ACT reservoirs or along the mainstem rivers to any degree greater than the No Action Alternative.

6.1.1.6.4 Alternative Plan G (Proposed Action Alternative)

The Proposed Action Alternative would likely have similar effects as Plan D. Implementing the Proposed Action Alternative would not be expected to affect existing M&I water withdrawals in the ACT reservoirs or along the mainstem rivers of the ACT Basin to any degree greater than the No Action Alternative.

6.1.2 Water Quality Environmental Consequences

The HEC-5Q model was used to evaluate the effects of ACT project operations on basin water quality. The HEC-5Q model was linked with the HEC-ResSim model through an input of flows by reach. The effects on water quality of the ACT Basin mainstems were examined. The proposed operations of USACE reservoirs would not be expected to affect tributaries in the basin.

The benefit of using the HEC-5Q model is its ability to simulate the entire riverine and reservoir system in a single model. It can perform a holistic examination of the basin from top to bottom and simulate the

watershed inflows, reservoirs, and river segments. Modeled output produced in that way allows a clear, longitudinal presentation of conditions for comparison between various operations scenarios.

The HEC-5Q model includes both point source and nonpoint source loads, which consist of BOD, nitrogen, phosphorous, and DO. The M&I point sources are based on discharge monitoring reports or, when values were not available, on concentrations representative of the type of discharge. The point source inputs are only dischargers that contribute more than one mgd. The nonpoint source loads from tributaries were developed in previous modeling efforts and confirmed with measured data for the modeled period, 2001–2008 representing point (Table 2.1-27) and nonpoint contributions. The model inputs and assumptions are detailed in Appendix D (HEC5Q Water Quality Modeling Report).

The sections that follow detail the results of modeling under various alternatives including the No Action Alternative, Plan D, Plan F, and the Proposed Action Alternative (Plan G). The HEC-5Q results presented in this section are for the modeled period (2001–2008). That period represents the most recent point (Table 2.1-27) and nonpoint contributions. Loads from both point and nonpoint sources were not varied in modeling scenarios. Instead, the results presented illustrate how water quality is affected by hydrologic conditions and water management activities in the ACT Basin.

The purpose of simulating conditions over the period of record (2001-2008) was not to capture historical changes in water quality; rather, the intent was to capture the range of potential hydrologic conditions that influence water quality. The modeled period includes wet, dry, and normal flow conditions, which allows a display of the water quality response to varying hydrologic conditions. Wet years are defined by the wettest 25th percentile rainfall and dry years are defined by the driest 25th percentile rainfall. Normal years are represented by median rainfall. The wet, dry, and normal years presented are 2003, 2007, and 2002, respectively. Those years were selected to represent the range of hydrologic conditions that can occur, understanding that conditions can vary greatly over the entire basin.

The sections to follow present the change (or *delta*) in various modeled parameters between the No Action Alternative, Plan D, Plan F, and Plan G (the Proposed Action Alternative). The longitudinal occurrence profiles by RM illustrate how water quality varies along the reach, and how water quality might be affected by dams, other structures, or discharges from point and nonpoint sources. Presenting data in such a way illustrates the amount of time a concentration is higher or lower than a given value. In those plots, the 5th, 50th (or median), and 95th percent occurrences are illustrated. Those percentiles illustrate the range of concentrations that would be likely to occur. These results are based on modeled output. The figures are not meant to present statistical ranges. Such profiles illustrate the percentage of time a concentration of pollutant occurs as a *Percent Occurrence* at stations in mainstem sections of the ACT Basin. The locations of those stations are presented in Table 4-1 of Appendix D (HEC5Q Water Quality Modeling Report).

The median values reflect the points at which 50 percent of the calculated values are higher and 50 percent are lower. The 95th percent occurrence and 5th percent occurrence bracket the range of high and low calculated values that rarely occur. For example, a DO plot showing a 5 percent occurrence level at 5 mg/L means that 5 percent of the time results were lower than that concentration. An occurrence level of 95 percent at 12 mg/L shows that 95 percent of modeled concentrations fell below 12 mg/L. Conversely, that would indicate that 5 percent of the model values were higher than 12 mg/L. Presenting modeled results that way should help readers understand the response of the system without allowing the data from extreme events to skew the results. Note that the percent occurrence is the opposite of the percent exceedance, a metric presented for many of the water quantity analyses presented earlier in this section.

It is also important to understand that critical conditions for water quality parameters vary under different flow and water temperature conditions. For example, water temperatures increase in warm weather months and in low stream flow conditions. In wet-weather conditions, nutrient concentrations can increase. For that reason, water quality conditions are defined for representative wet, dry, and normal weather conditions. State and federal agencies also define warm weather months, or the *growing season*, in different ways for regulatory purposes. The figures to follow illustrate annual conditions as well as growing seasons defined by May through October and April through November.

Reservoir operations generally have the greatest effect on water temperature and DO in dam tailraces and some effect on algal growth in reservoir forebays. That can be understood easily downstream of reservoirs with deep forebays and high storage volumes. Carters Lake in the ACT Basin is an example of a system where cold water released from deep lake water can change temperatures downstream. The change is generally the most pronounced in dry-weather years when stream flows are low during the growing season.

Each alternative was compared against the No Action Alternative to determine what effects would occur as a result of various alternatives. The sections to follow define the changes from the No Action Alternative for various pollutants that could be affected by changes in the operation of USACE reservoirs. The operations of alternatives carried forward (Plans D, F, and G) are defined in Section 5.

6.1.2.1 No Action Alternative

Under the No Action Alternative (defined in Section 5.1) water quality would be expected to improve from existing conditions described in Section 2.1.2. In the No Action Alternative, Georgia would be expected to more precisely define the ACT system's assimilative capacity as part of the Georgia SWP. The assimilative capacity is the amount of pollutants a waterbody can handle without violating water quality standards. Models developed as part of the Georgia SWP consider the best available data in quantifying overland and in-stream sources of pollution; use of the latest technology in water quality modeling would be expected to allow states to better define the ACT system's assimilative capacity. Alabama would be expected to continue to manage resources consistent with current regulations by developing wasteload allocations, managing its NPDES program, and controlling nonpoint sources. APC would be expected to continue to comply with its regulatory requirements.

In the No Action Alternative, NPDES facilities would be expected to continue to comply with existing permits. Some NPDES permits limit discharges during low- flow conditions. Georgia's water quality standards indicate "numeric criteria exceedances that occur under streamflows lower than 7Q10 or 1Q10, whichever applies, do not constitute violations of water quality standards as long as all current permit conditions are met" (GAEPD 2008b).

6.1.2.2 Alternative Plan D

Understanding that management of water quality is an adaptive process, the overall effect of Plan D on water quality would be expected to be negligible. Similar to the No Action Alternative, states would be expected to more precisely define the ACT system's assimilative capacity by managing resources consistent with current regulations defined by their NPDES program and water quality standards. The water quality modeling presented in this EIS assumed permitted loads from point source discharges for the model period. That was assumed to predict the change from the No Action Alternative for various alternatives. However, under low-flow conditions, some NPDES permits limit point source discharges, and permit conditions may be temporarily changed during extreme low-flow conditions. As in past years of low-flow conditions, water users can coordinate directly with USACE to notify USACE of their needs. USACE will periodically notify users when releases are made during these low-flow conditions.

6.1.2.2.1 Water Temperature

The effects of proposed operational changes on water temperature between Plan D and other alternatives evaluated would be negligible; little change would be expected and, in many cases, the graph lines overlay each other. Each of the alternatives considered in the ACT Basin, except for the No Action Alternative, include operations for drought management. A series of triggers are included in each alternative to change the way reservoirs are operated and water is released during periods of drought. Changes in modeled water temperature from the No Action Alternative have the greatest variation during periods when drought operations are likely to occur.

The difference between the alternatives evaluated downstream of Allatoona Lake is presented in Figure 6.1-65. Maintaining the current guide curve at Allatoona Lake in Plan D would be expected to keep median water temperatures in the lake similar to conditions in the No Action Alternative. Downstream of Allatoona Dam to the Coosa River at Rome, Georgia, in all the alternatives, the highest water temperatures are also expected to decrease by 0.9 °F (0.5 °C) (Figure 6.1-65). The decrease in water temperature would not be expected to affect activities or species along the reach. The change would be expected from the change in operations at Allatoona Lake. Hydropower generation would continue in conditions similar to 2007 under each of the alternatives; hydropower generation would have been suspended under the No Action Alternative. The continued generation of hydropower influences water temperatures downstream. The longitudinal profile of flow downstream of Allatoona Lake suggests that flows downstream of the dam decrease (Figure 6.1-66).

Median water temperatures downstream of the confluence of the Coosawattee and Oostanaula rivers would be expected to decrease by nearly 0.9 °F (0.5 °C) in dry-weather conditions (Figure 6.1-67) as compared to normal-weather conditions. The health of aquatic species along the reach is a concern for stakeholders. Looking more closely at periods critical to aquatic species, when water temperatures are greatest, a small increase in temperature was modeled downstream of the Oostanaula River around RM 690 between the No Action Alternative and Plans D, F, and G (Figure 6.1-68). Directly downstream of Carters Lake, median water temperatures during the critical period would be expected to decrease slightly by around 0.3 °F (0.2 °C). A decrease in water temperature during the growing season would likely benefit aquatic species. Changes in water temperature in the Coosawattee River would be expected to have negligible effects (Figure 6.1-67 and Figure 6.1-68).

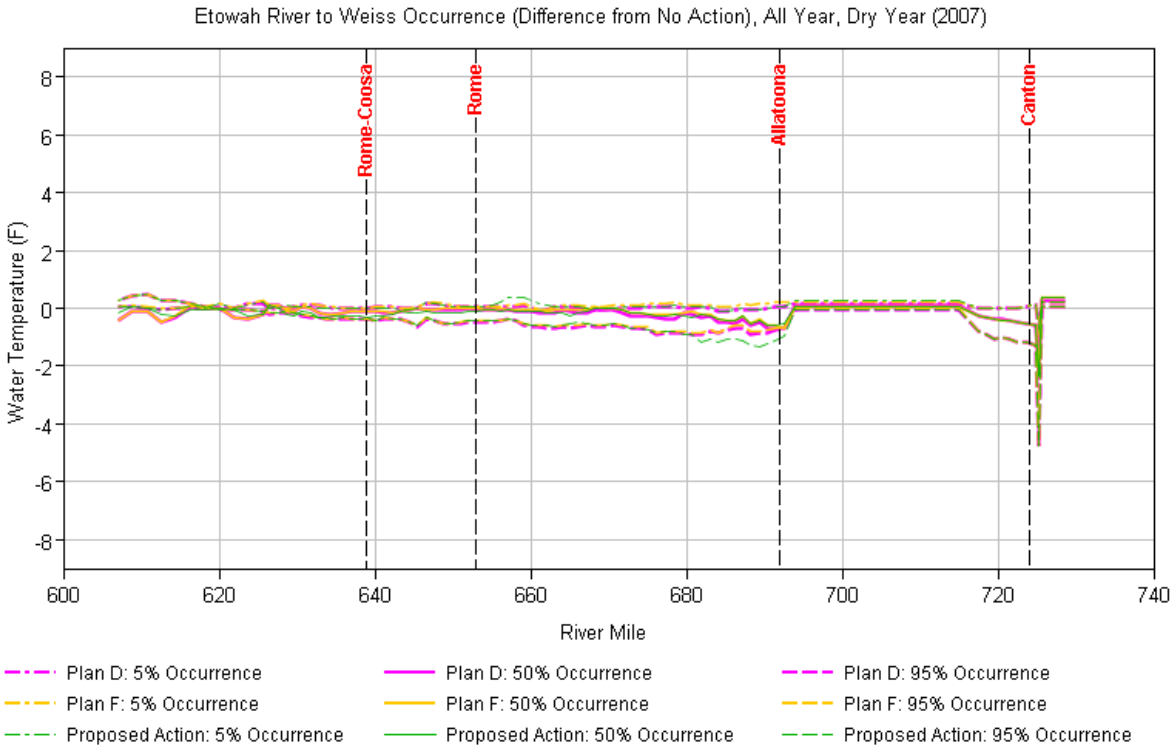


Figure 6.1-65. Etowah River water temperature delta longitudinal profile for a representative dry-weather year (2007).

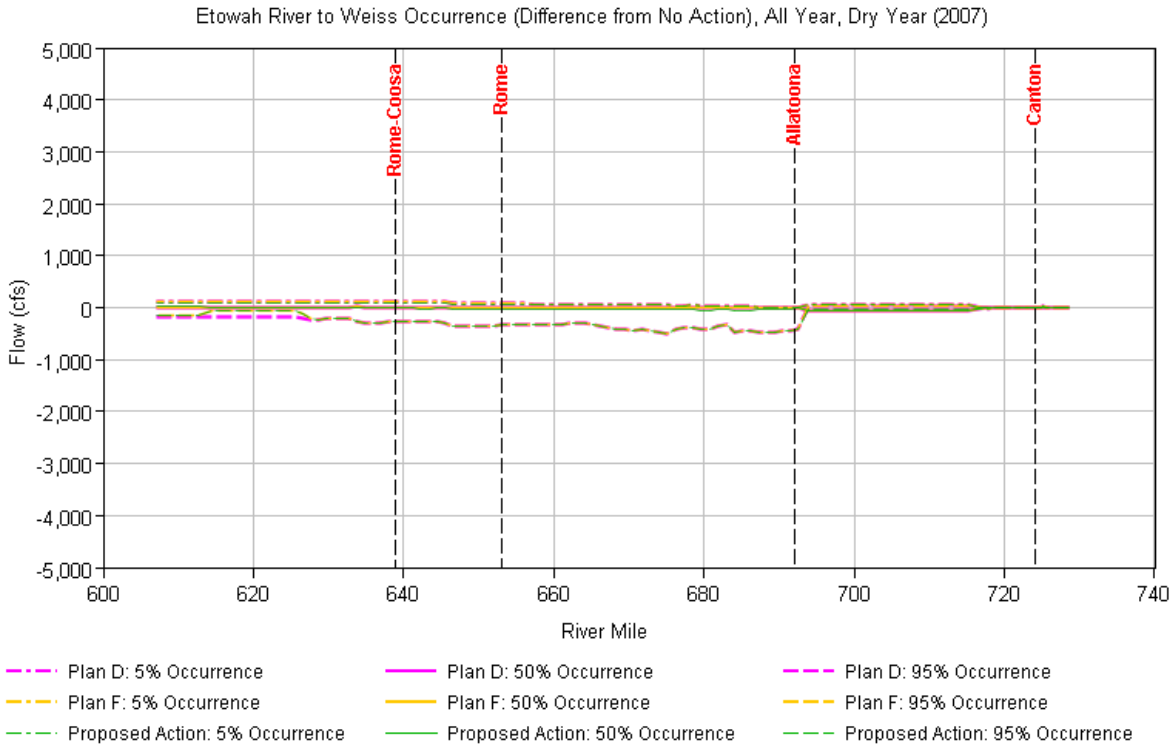


Figure 6.1-66. Etowah River flow delta longitudinal profile for a representative dry-weather year (2007).

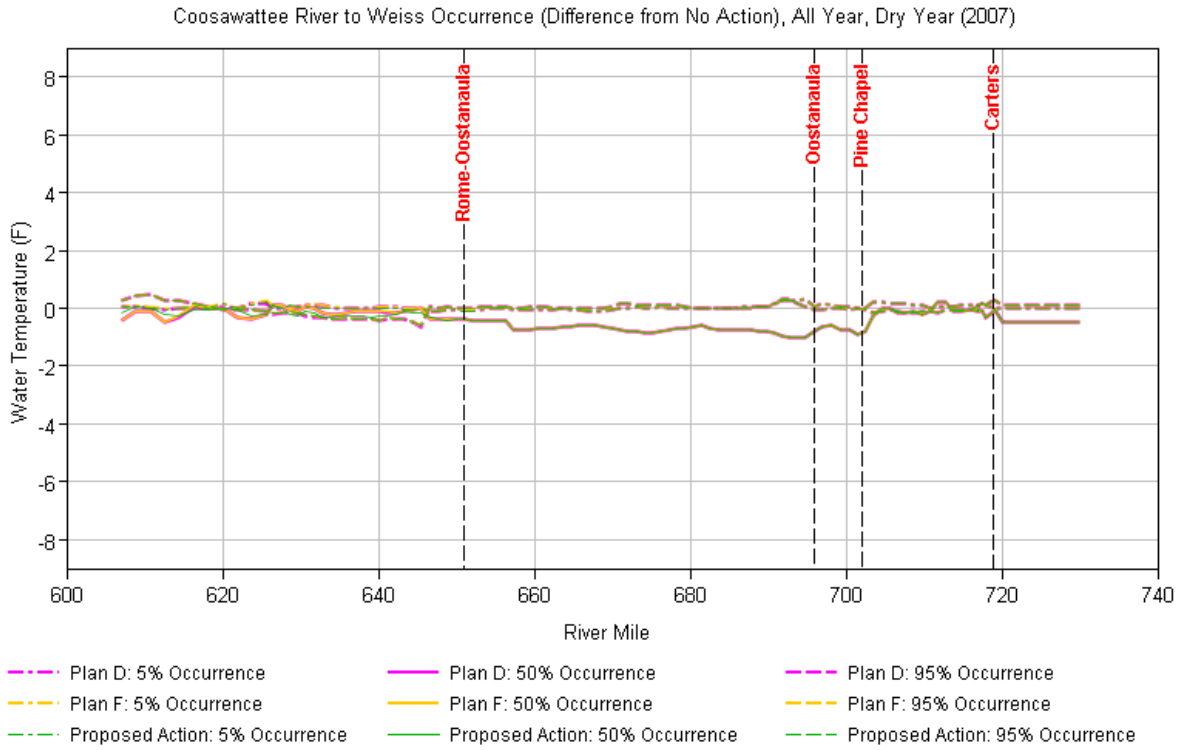


Figure 6.1-67. Carters Lake downstream to Weiss Lake water temperature delta longitudinal profile for a representative dry-weather year (2007).

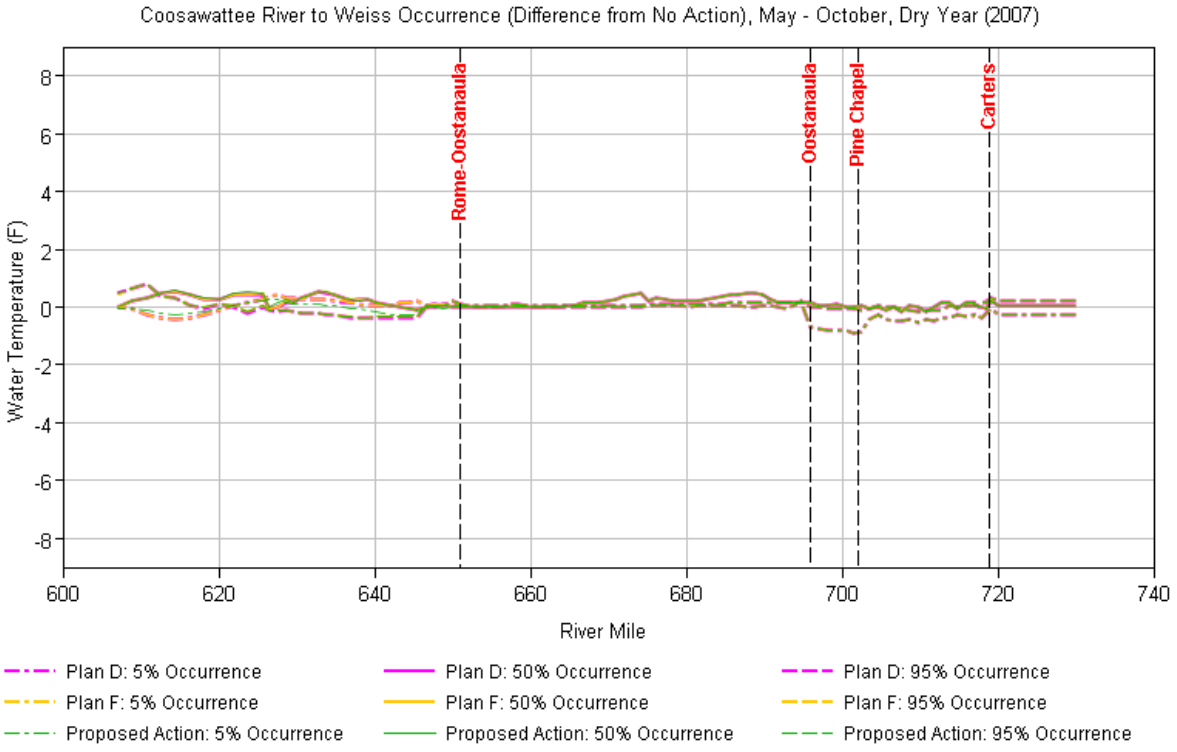


Figure 6.1-68. Carters Lake downstream to Weiss Lake water temperature delta longitudinal profile for a representative dry-weather year during the growing season from May through October (2007).

In a dry-weather period on the Coosa River, little change would be expected. Near the confluence of the Alabama and Coosa rivers immediately downstream of Jordan Dam and Lake the median water temperatures were modeled to increase by more than 1.0 °F (0.6 °C) (Figure 6.1-69). The 95 percent occurrence temperatures in this reach were modeled to decrease slightly, approximately 0.5 °F (0.3 °C). The range of water temperatures predicted by the model as a change between various alternatives and the No Action Alternative along this reach would not be expected to be as great under observed conditions. APC operates Jordan Dam and Lake to ensure minimum flows (2,000 cfs) for protected species, as explained in the modeling report (Appendix C, HEC-ResSim Modeling Report). The HEC-ResSim modeled flows are less than what would actually be released during periods of drought. Therefore, water temperatures would not be expected to increase or decrease as much as shown in the model.

In the Tallapoosa River, over the modeled period, little change in water temperature would be expected (Figure 6.1-70). In reaches downstream of Lake Martin, water temperatures would be expected to decrease.

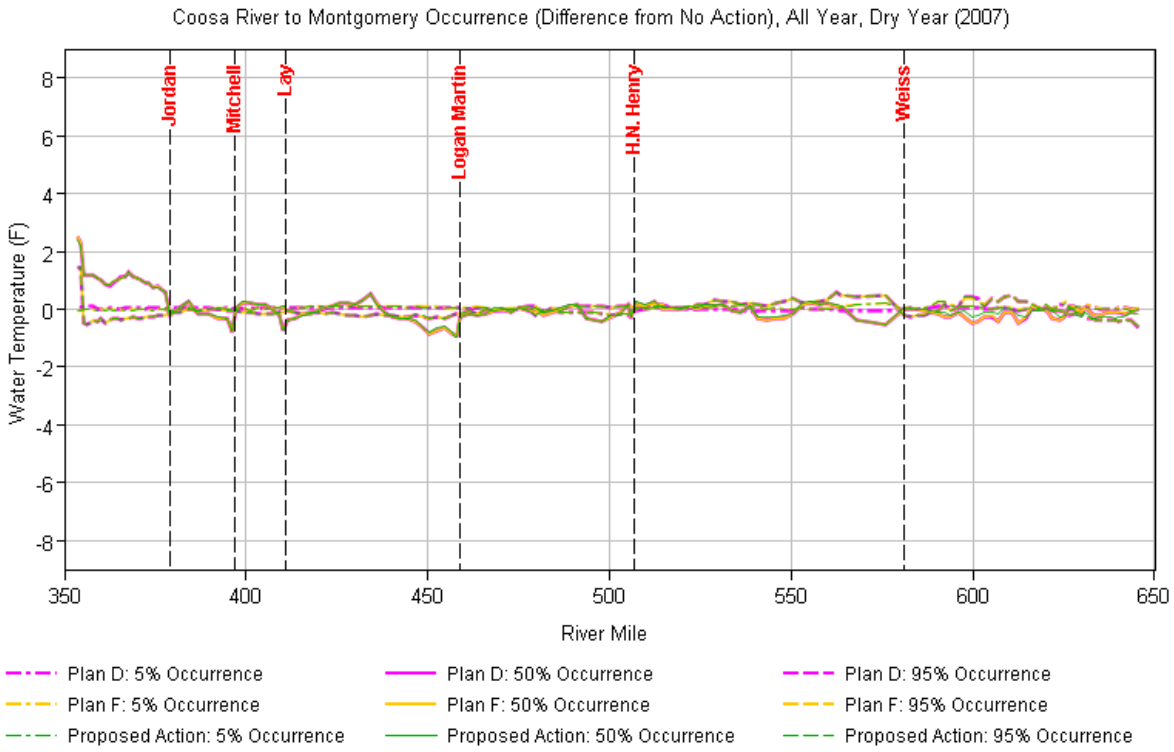


Figure 6.1-69. Coosa River water temperature delta longitudinal profile for a representative dry-weather year (2007).

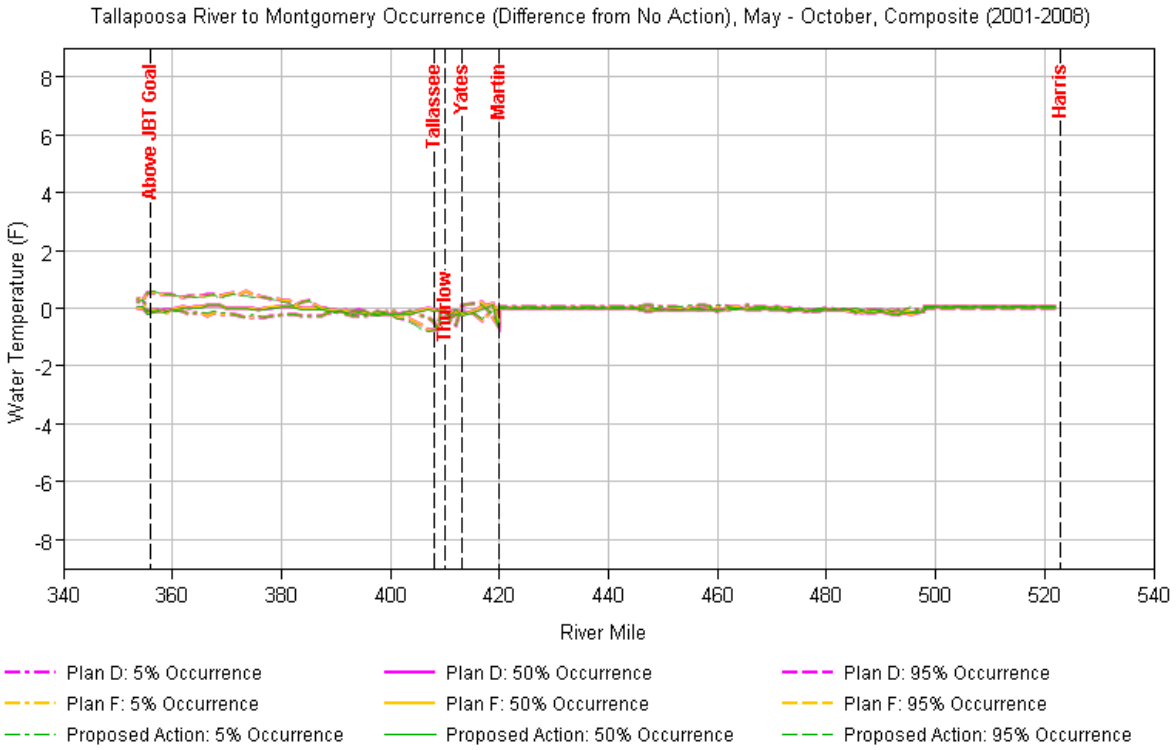


Figure 6.1-70. Tallapoosa River water temperature delta longitudinal profile for the modeled period (2001–2008).

Little change in water temperature would be expected for the modeled period on the Alabama River as seen in Figure 6.1-71. The Alabama River does not have reservoirs with storage but, instead, is dominated by reservoirs with run-of-river operations. However, at the Coosa and Tallapoosa rivers confluence, in dry weather conditions, similar to 2007, median water temperatures would be expected to increase by 3 °F (1.7 °C) (Figure 6.1-72). As previously described, the range of water temperatures predicted by the model, as a change between various alternatives and the No Action Alternative along this reach would not be expected to be as great under observed conditions. APC operates Jordan Dam and Lake to ensure minimum flows (2,000 cfs) for protected species, as explained in the modeling report (Appendix C, HEC-ResSim Modeling Report).

Increasing median water temperature during low-flow periods by 3 °F (1.7 °C) might be expected to affect allowable discharges along the reach and aquatic species. Existing permits for discharges could be restricted during conditions similar to what occurred in 2007. However, for the purpose of quantifying the environmental consequences of various alternatives, loads contributing to the ACT Basin were held at reported loads (Appendix D, HEC-5Q Water Quality Modeling Report).

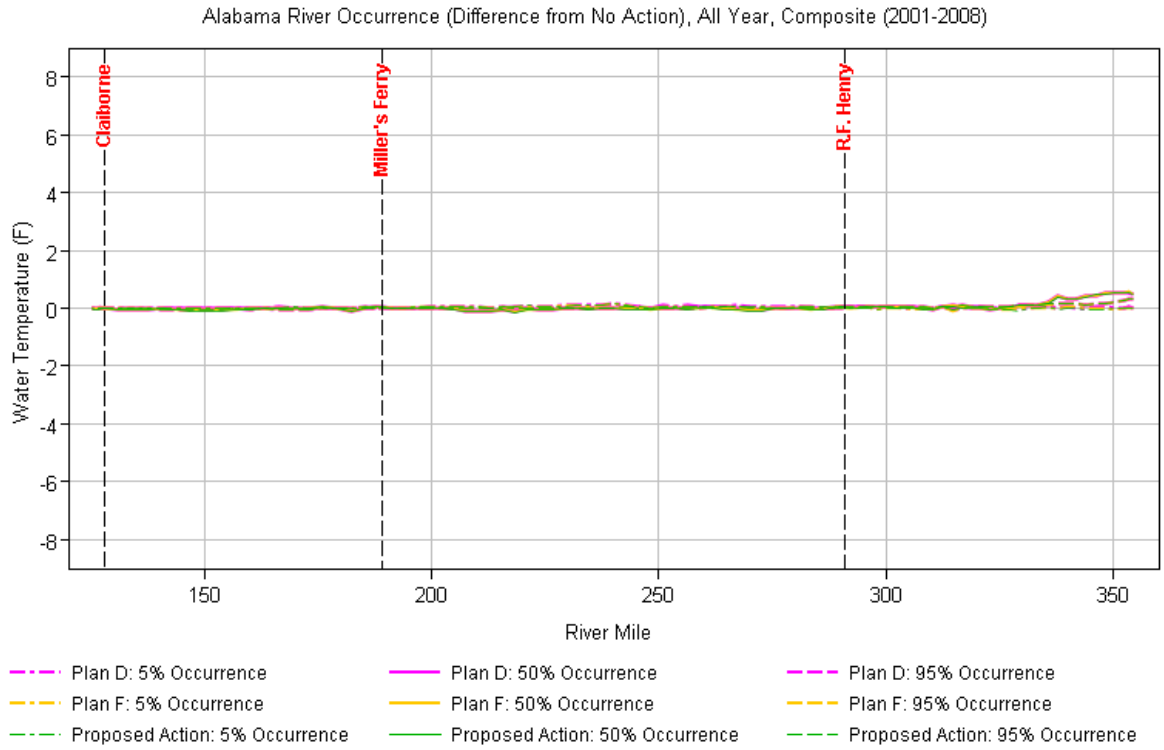


Figure 6.1-71. Alabama River water temperature delta longitudinal profile for the modeled period (2001–2008).

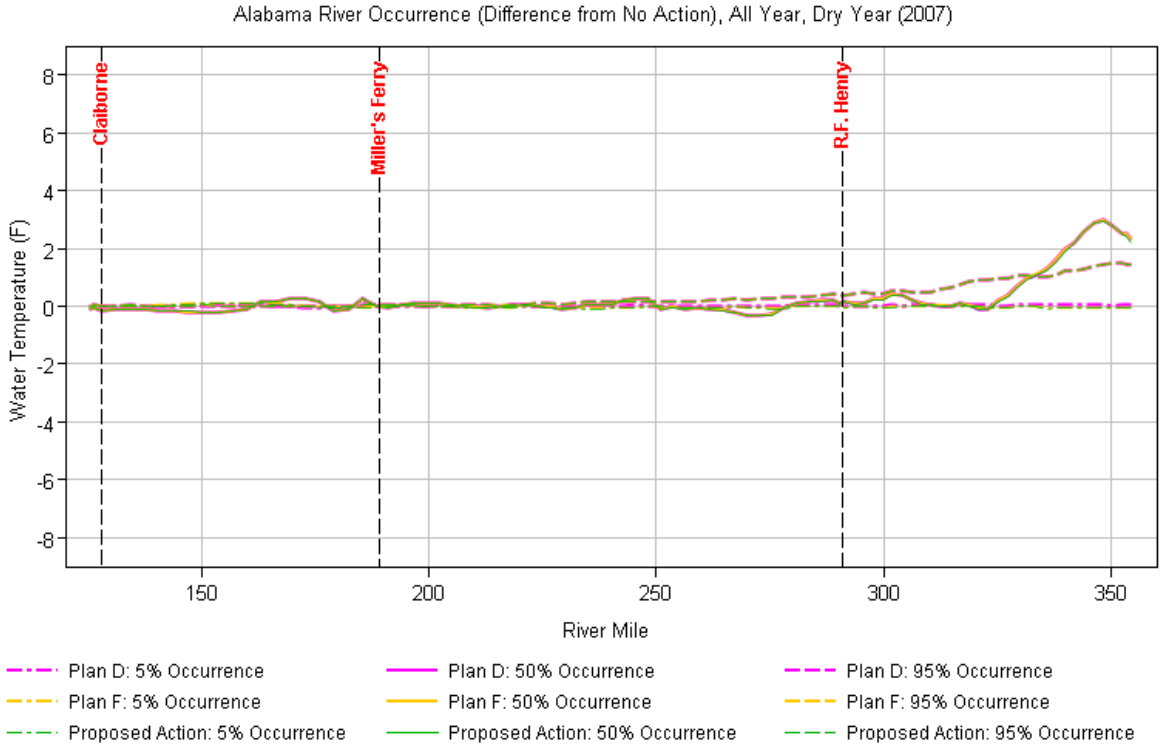


Figure 6.1-72. Alabama River water temperature delta longitudinal profile for a representative dry-weather year (2007).

6.1.2.2.2 Oxygen Demand

The proposed operational changes between Plan D and other alternatives evaluated would be expected to have a negligible effect on DO for much of the ACT Basin. During dry-weather conditions, similar to 2007, DO could be reduced because of changes in stream flow and the ability to assimilate nutrients when compared to the No Action Alternative. In the figures presented in this section, the results generally overlay each other, and the differences between alternatives are indistinguishable.

Maintaining the current guide curve at Allatoona Lake in Plan D would be expected to slightly increase DO concentrations immediately downstream during extreme dry-weather conditions (Figure 6.1-73). Further downstream, at around RM 680, the median DO concentrations are slightly lower in the alternatives compared to the No Action Alternative, but concentrations would be expected to meet or exceed water quality standards. The difference between the alternatives evaluated is the greatest immediately upstream of the confluence with the Coosawattee River, where median concentrations are expected to increase by as much as 1.0 mg/L.

Similar to the Etowah River, the Coosawattee and Oostanaula rivers would be expected to have the greatest variation in DO from the No Action Alternative occur in a representative dry year in May through October. Changes in releases from Carters Lake decrease DO downstream of the dam. DO recovers to concentrations near the No Action Alternative before Pine Chapel, 20 mi downstream (Figure 6.1-74).

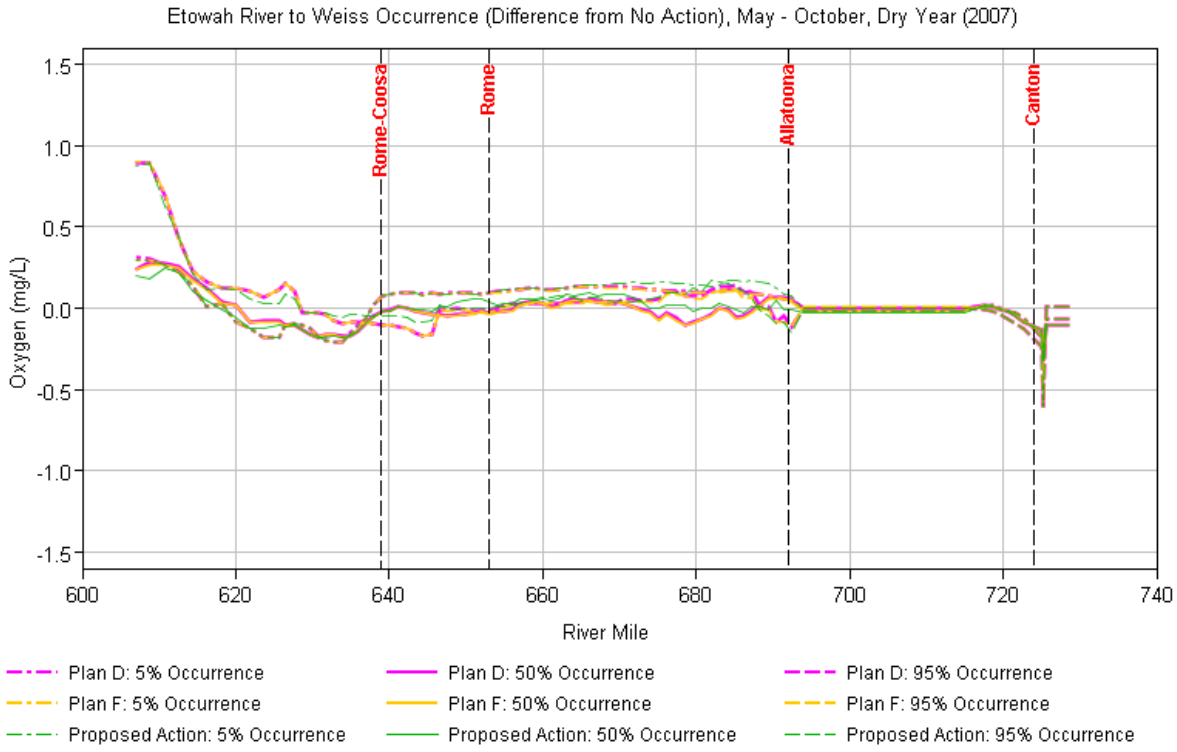


Figure 6.1-73. Etowah River oxygen delta longitudinal profile for May to October in a representative dry-weather year (2007).

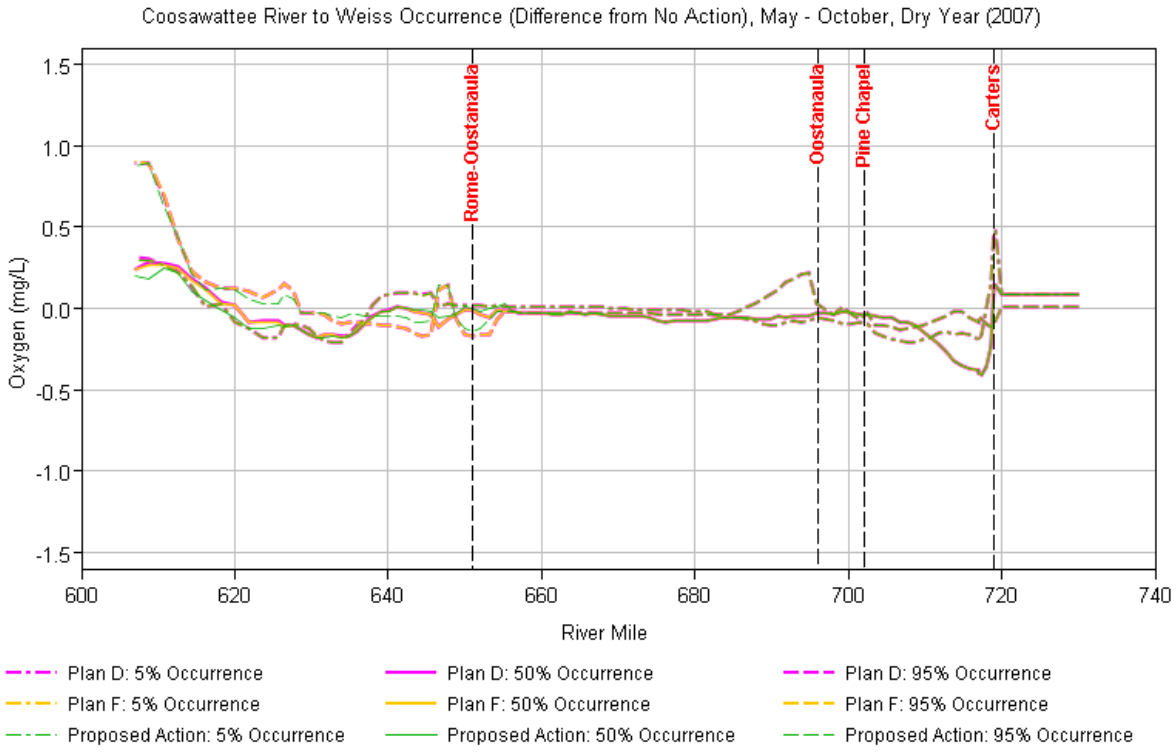


Figure 6.1-74. Oxygen delta longitudinal profile for May to October in a representative dry-weather year (2007) from Carters Lake downstream to Weiss Lake.

In the Coosa River, changes in DO are also the greatest in a dry-weather year (Figure 6.1-75). In dry-weather periods, it would be expected that USACE would operate for drought management. In much of the Coosa River, median DO concentrations during dry-weather periods would be expected to be near conditions similar to the No Action Alternative. However, DO in the forebay of Weiss Lake and downstream of Neely Henry Dam would be expected to be reduced during the growing season in dry-weather years (Figure 6.1-75). Downstream of Weiss Lake, median DO would be expected to decrease by nearly 0.5 mg/L. Median DO decreases by nearly 0.5 mg/L immediately downstream of H. Neely Henry Dam. Immediately downstream of Mitchell Lake and Logan Martin Lake, the median DO concentrations would be expected to increase by as much as 0.7 mg/L in Plan D, Plan F, and the Proposed Action Alternative. Immediately downstream of Jordan Dam and Lake median DO decreases by nearly 0.2 mg/L.

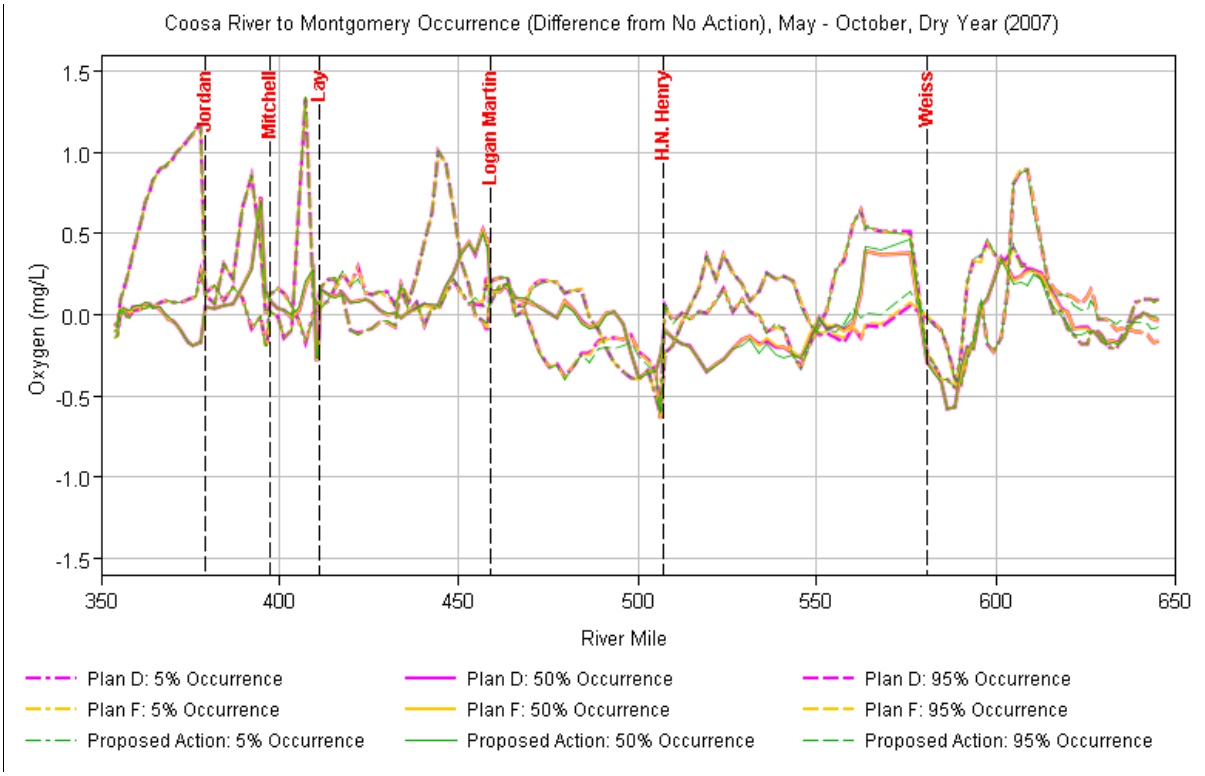


Figure 6.1-75. Coosa River oxygen delta longitudinal profile for May to October in a representative dry-weather year (2007).

Changing the timing and quantity of flow influences the system's ability to assimilate oxygen-demanding pollutants (like total phosphorus, nitrogen, and chlorophyll *a*). The result of these changes in the system can be measured by fluctuations in DO (Figure 6.1-75). The HEC-5Q modeling was used to predict how water quality would be expected to change under various water management activities. To do that, point and nonpoint sources input to the model were held constant between alternatives. Point sources were based on discharge monitoring reports or, when values were not available, on concentrations representative of the type of discharge (municipal or industrial). Some discharges could be required (by their NPDES permit) to change the way they operate during low-flow conditions; this situation occurred during the 2007 drought. Later sections present a similar response in total phosphorus and chlorophyll *a*. As in past years of low-flow conditions, water users can coordinate directly with USACE to notify USACE of their needs. USACE will periodically notify users when releases are made during these low-flow conditions.

Changes in oxygen-demanding pollutants, like BOD, would be expected to have negligible changes from the No Action Alternative for most of the system. The greatest changes from the No Action Alternative in BOD would be expected in the Coosa River upstream of Weiss Lake because of the influence of point sources. In drought years, the model assumption that point source inputs are held constant increases the percent of wastewater in the stream because in-stream flows are less. However, given that assumption, wastewater flows are still less than 10 percent of the total flow into Weiss Lake in a dry-weather year (Figure 6.1-76). Changes to reservoir inflows and retention times between the No Action Alternative and other alternatives cause oxygen-demanding pollutants to settle, and pollutant concentrations to peak, at different locations in the system (Figure 6.1-77). Though little change occurs between the No Action Alternative and other alternatives, delta profiles illustrate large variations because of this shift in the location of the highest concentrations. Figure 6.1-77 presents BOD that would be expected in the Coosa River.

DO in the Tallapoosa River also fluctuates slightly immediately downstream of dams from May through October in a representative dry-weather year (Figure 6.1-78). Those fluctuations would be expected to occur at conditions above water quality standards (4 mg/L downstream of dams) most of the time. In rare occurences, 5 percent occurences, DO may drop below 4 mg/L.

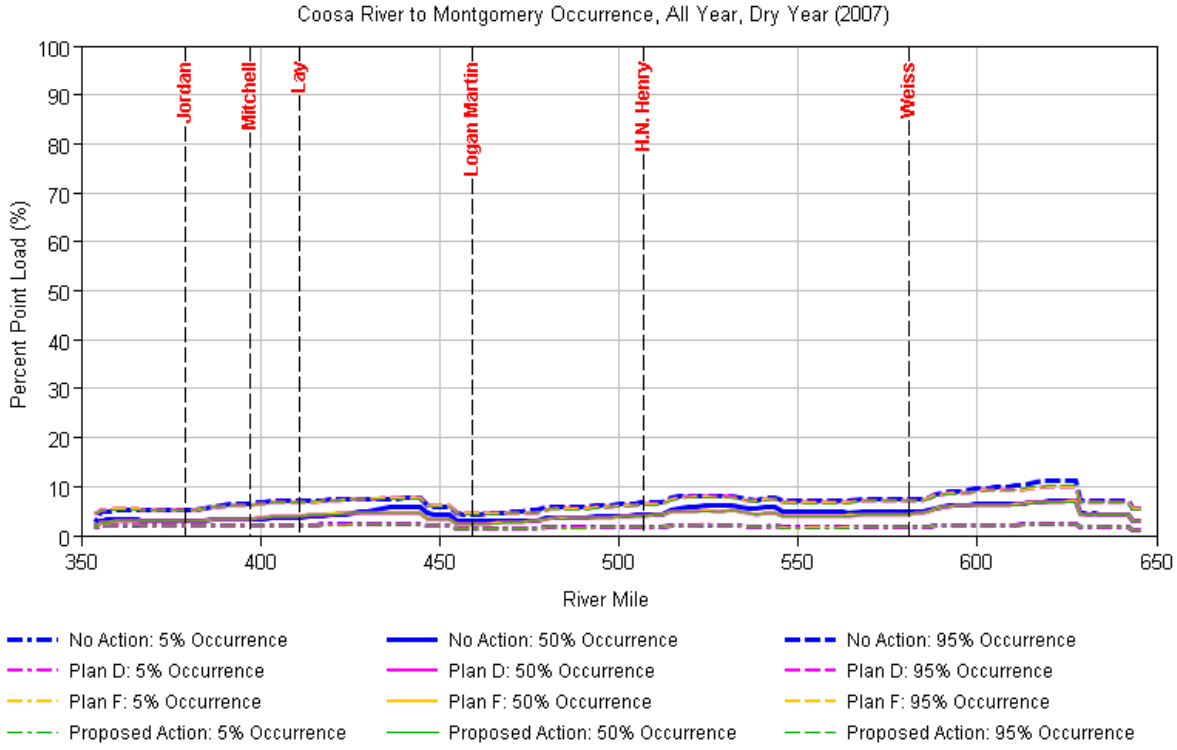


Figure 6.1-76. Coosa River longitudinal profile of the percent of wastewater occurring in stream flow in a representative dry-weather year (2007).

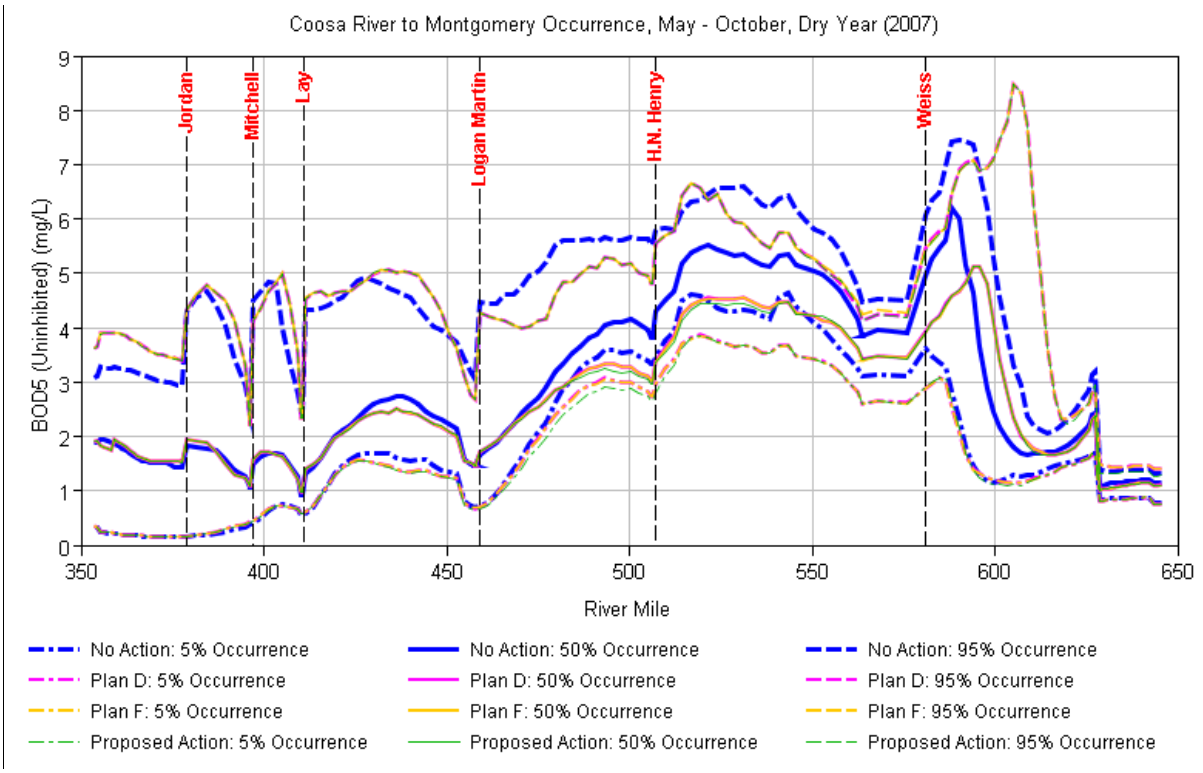


Figure 6.1-77. Coosa River BOD longitudinal profile for May to October in a representative dry-weather year (2007).

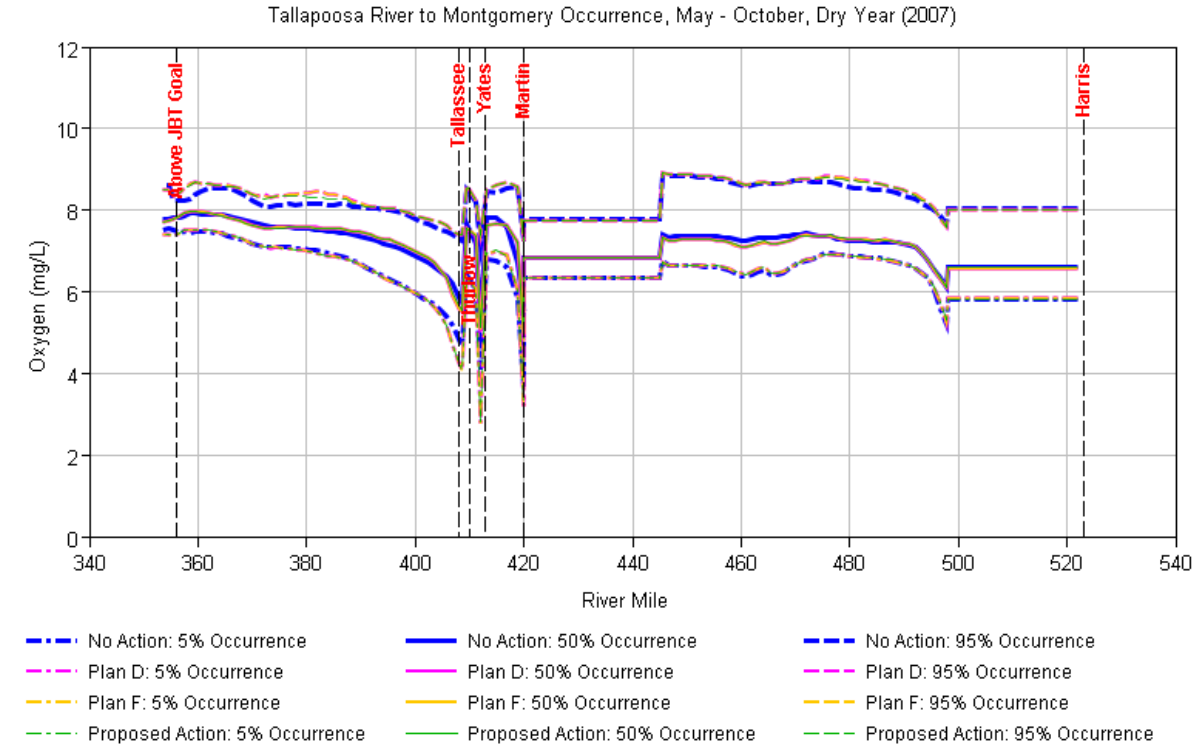


Figure 6.1-78. Tallapoosa River oxygen longitudinal profile for May to October in a representative dry-weather year (2007).

The influence of reservoir operations on DO in the water column is similar to the effect on water temperature. In reservoirs with deep forebays, oxygen is often higher at the water surface and lower with depth through the water column. Reservoirs that release from deep water often release low oxygen water downstream. That is generally more pronounced in dry-weather years when inflows to reservoirs are low and retention times in reservoirs increase. That is illustrated by comparing Figure 6.1-79 and Figure 6.1-80. The plots illustrate the Alabama River in a representative wet- and dry-weather year, respectively. During dry-weather years, the median DO concentrations can be expected to decrease by as much as 0.7 mg/L, although the lower modeled concentrations are still well above the DO water quality standard.

Little change would be expected from the No Action Alternative in BOD along the Alabama River as shown in Figure 6.1-81. Increased BOD could be expected during the most critical dry-weather periods. However, since median concentrations of BOD remain relatively unchanged, they do not appear to be the cause of lower DO levels seen in Figure 6.1-80.

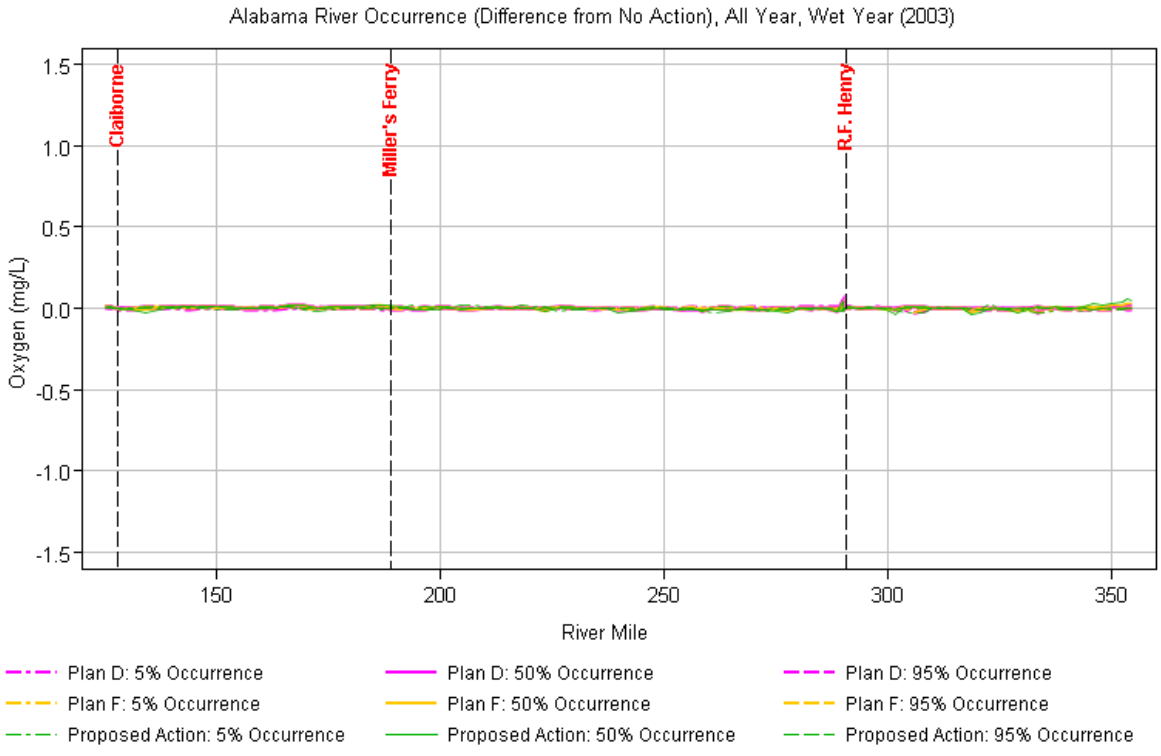


Figure 6.1-79. Alabama River oxygen delta longitudinal profile for a representative wet-weather year (2003).

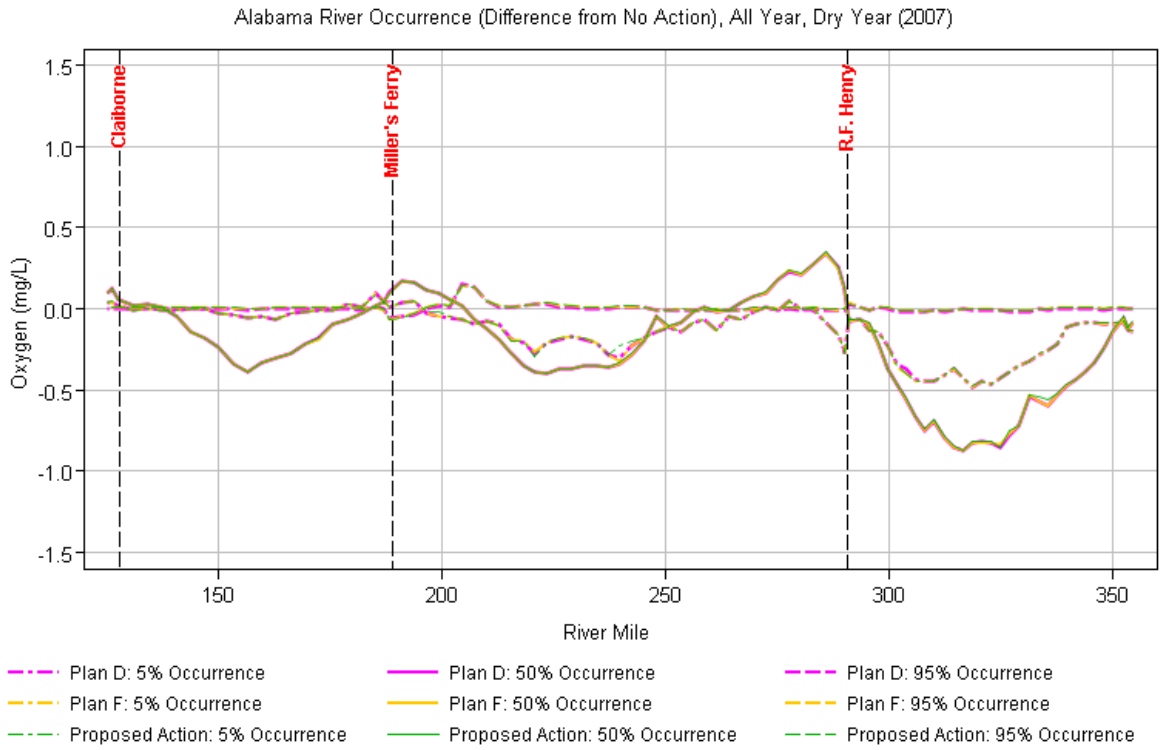


Figure 6.1-80. Alabama River oxygen delta longitudinal profile for a representative dry-weather year (2007).

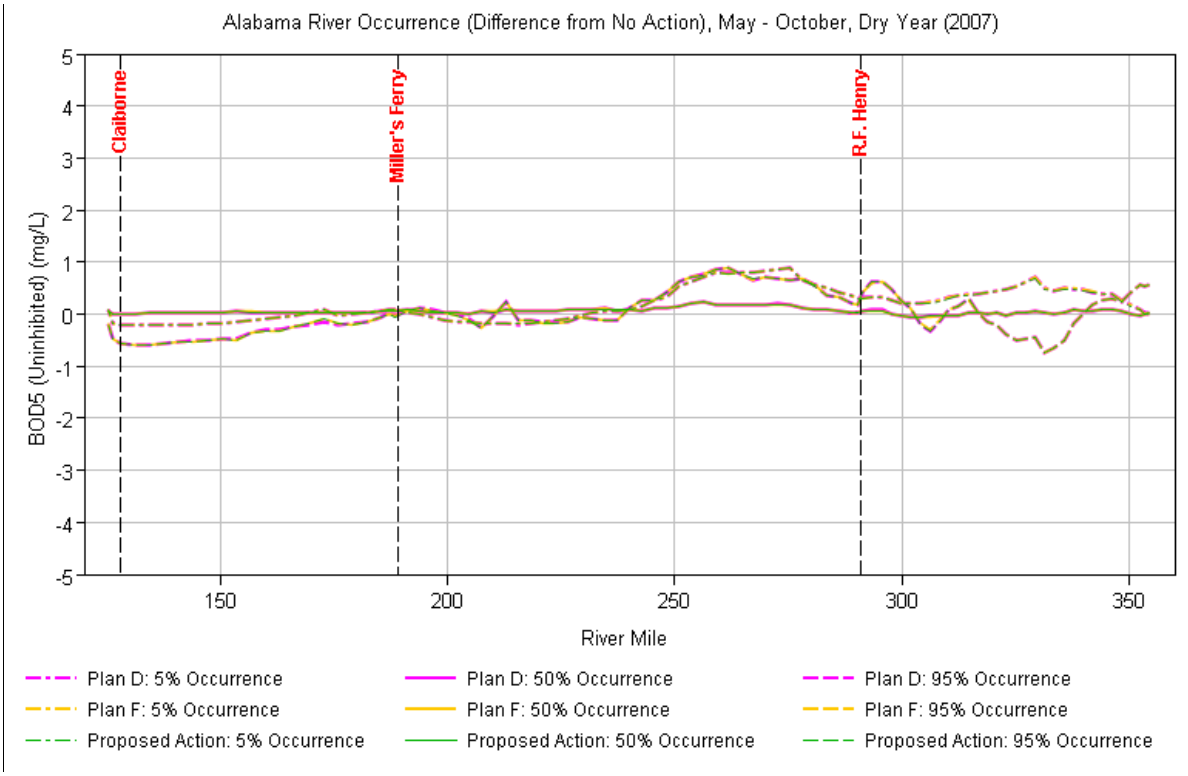


Figure 6.1-81. Alabama River BOD delta longitudinal profile for May to October in a representative dry-weather year (2007).

6.1.2.2.3 Phosphorus

Concentrations of nutrients in streams and reservoirs are largely dependent on in-stream flows. When more water is in the system, concentrations of nutrients—phosphorus and nitrogen—are diluted in-stream and can move through reservoirs faster if more water is being released. Drought conditions, when in-stream flows are low and reservoir retention times are greater, often exacerbate the influence of nutrients in the form of algal growth, measured as chlorophyll *a*.

The effects of proposed operational changes on phosphorous levels between Plan D and other alternatives evaluated would be negligible in much of the ACT Basin. The difference between the alternatives evaluated is first illustrated on the Coosawattee River during a normal year (Figure 6.1-82). Releases made to meet USFWS's request for seasonal varying flows from Carters Reregulation Dam would be expected to decrease phosphorus loads during a normal year when releases mimic those defined in Figure 4.2-8. During a dry year, minimum flows would be held at 240 cfs. Therefore, for a drought year, median concentrations in the Coosawattee River would be expected to increase slightly, by less than 0.005 mg/L (Figure 6.1-83).

Nutrient concentrations in the Coosa River are mainly driven by concentrations coming into Weiss Lake. Nutrients are generally diluted as the water flows downstream from Weiss Lake into the Alabama River.

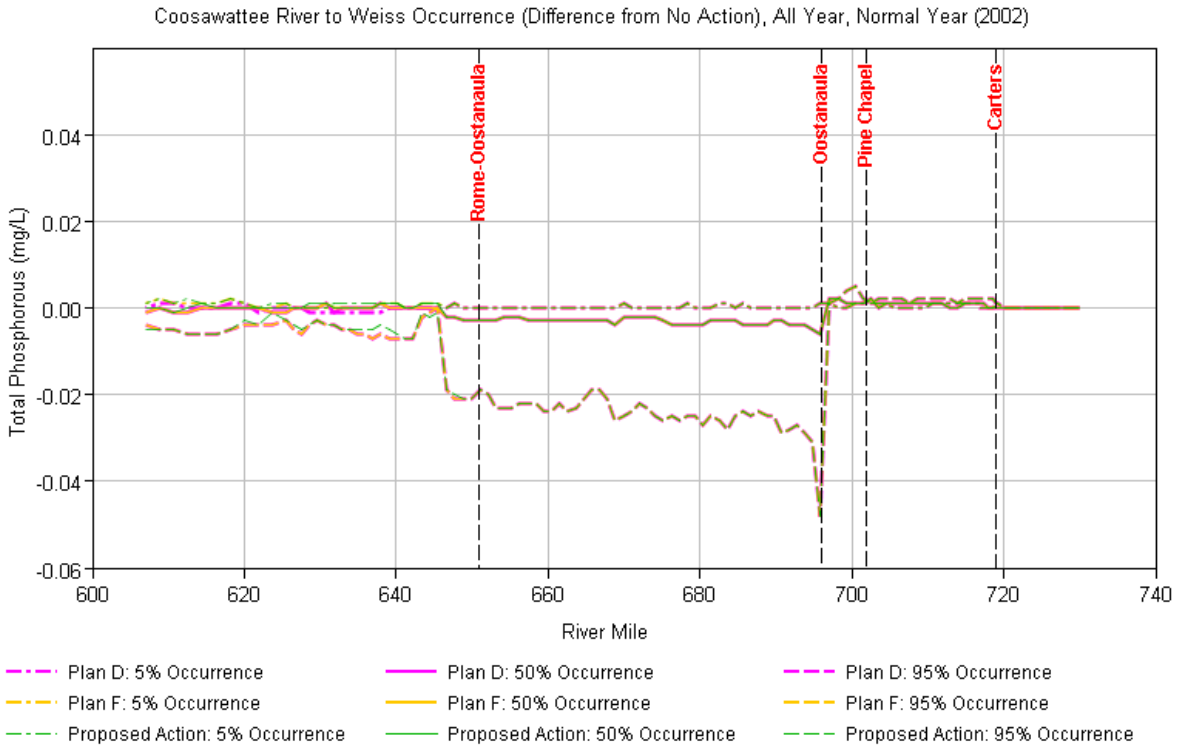


Figure 6.1-82. Coosawattee River total phosphorus delta longitudinal profile for a representative normal-weather year from April through November (2002).

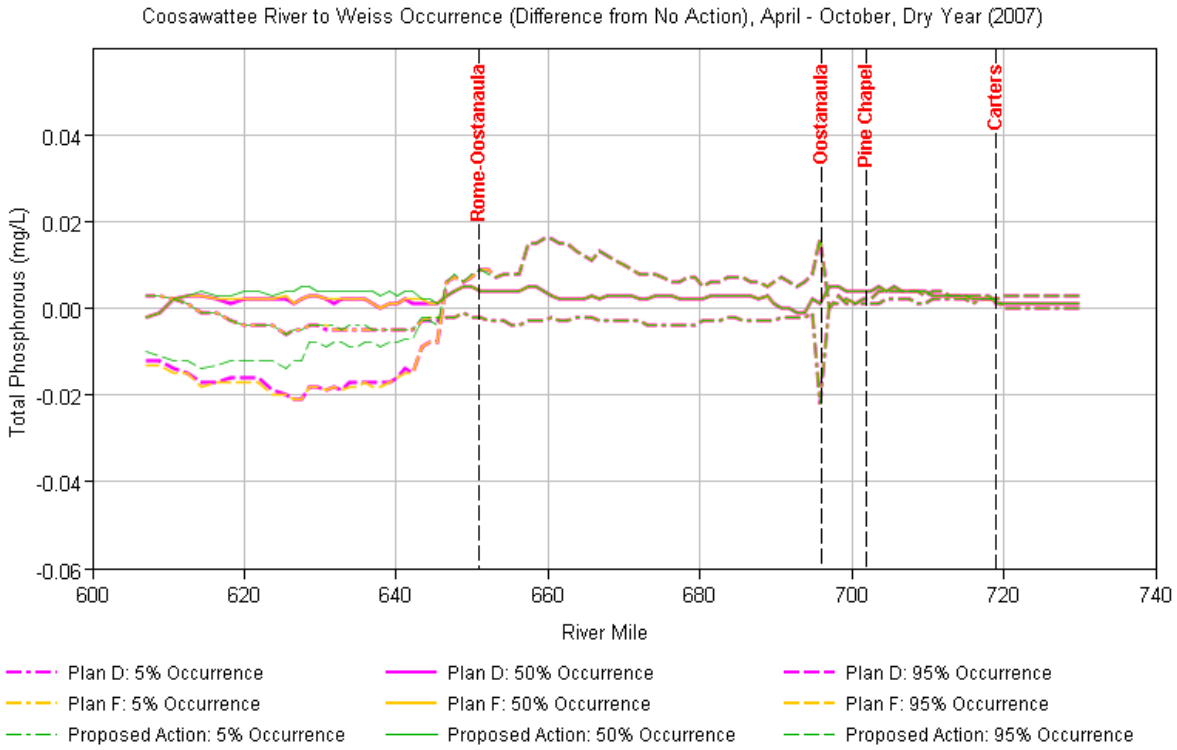


Figure 6.1-83. Coosawattee River total phosphorus delta longitudinal profile for a representative dry-weather year from April through November (2007).

In 2008 USEPA in coordination with ADEM and Georgia EPD developed a TMDL requiring a 30 percent reduction of total phosphorus at the state line. The TMDL also set a median growing season total phosphorus target of 0.06 mg/L at the state line. According to a draft review of Georgia's assimilative capacity, from 2001 through 2007 the Coosa River exceeded its growing season median concentration for total phosphorus (GAEPD 2010c). The total phosphorus that would be expected to contribute to Weiss Lake during critical periods is illustrated in Figure 6.1-83 and Figure 6.1-84 for the Coosawattee-Oostanaula and Etowah rivers, respectively. Modeled results indicate that median total phosphorus concentrations from the Etowah River during the growing season would be expected to increase by up to 0.015 mg/L around RM 680 (Figure 6.1-84). Median concentrations in the Coosawattee and Etowah rivers entering Weiss Lake below Rome would be expected to increase slightly, by less than 0.005 mg/L.

During drought years, retention times in Weiss Lake increase in May and June when compared with the No Action Alternative. Increasing retention times during low-flow conditions increases chlorophyll *a* above Weiss Lake but lowers the chlorophyll *a* in Weiss Lake for the same period (Figure 6.1-85). Review of loads into Weiss Lake and water surface elevations reveal that the changes in water quality are related to a change in Weiss Lake operations from the APC's Drought Curve under the No Action Alternative. Changes to water management in upstream reservoirs would be expected to result in Weiss Lake water levels more closely mimicking the project's Guide Curve. These operational changes only influence water quality during a period of the growing season. Overall, the growing season average total phosphorus loadings to Weiss Lake and Weiss Lake's chlorophyll *a* levels, critical to the TMDL, remain at the same or lower levels than the No Action Alternative.

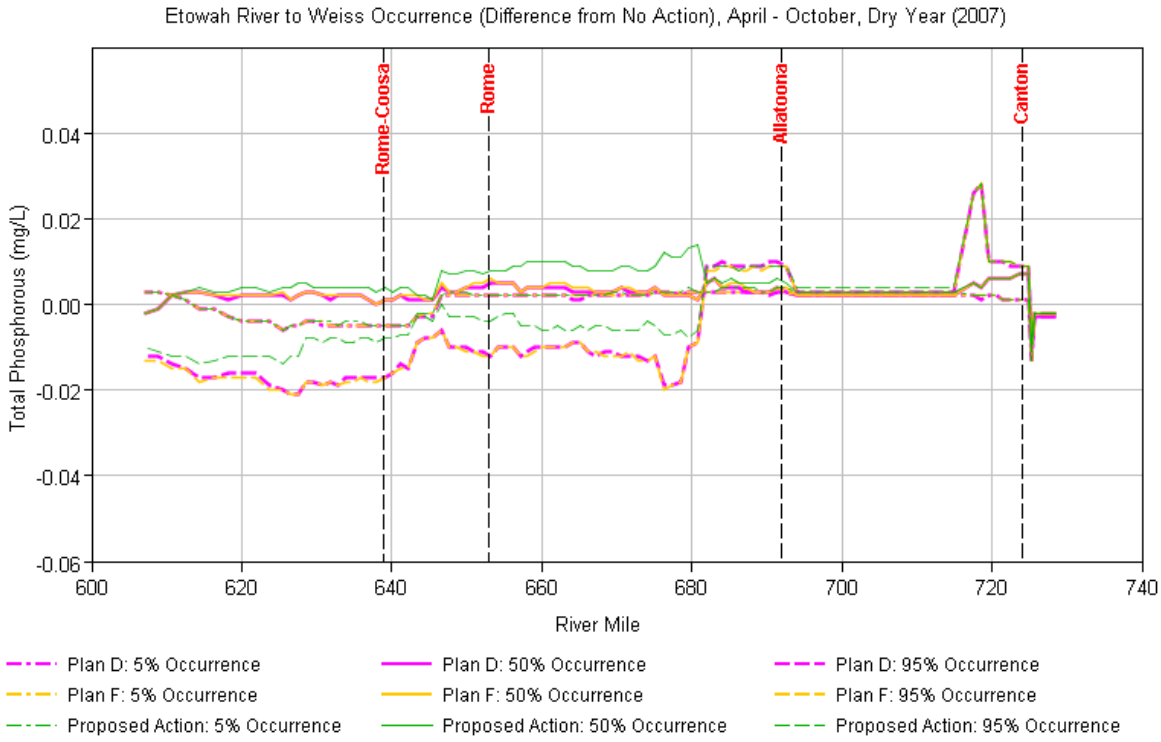


Figure 6.1-84. Etowah River total phosphorus delta longitudinal profile for a representative dry-weather year from April through October (2007).

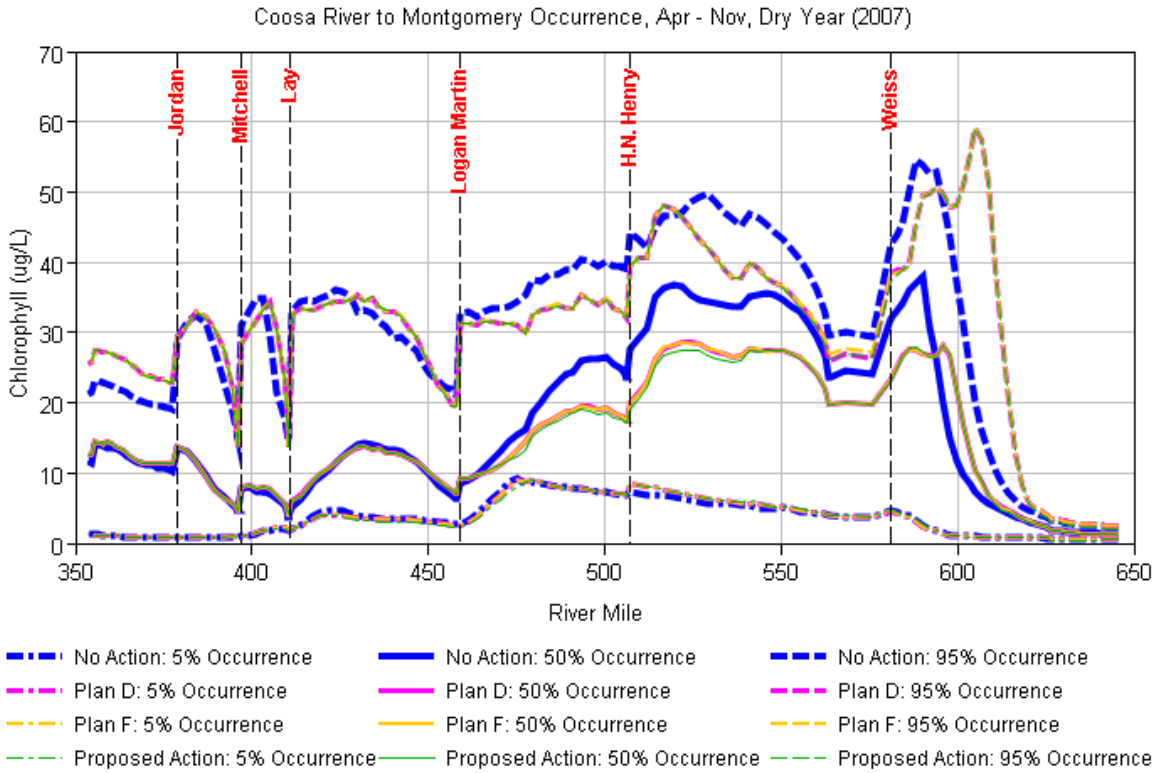


Figure 6.1-85. Coosa River longitudinal profile of chlorophyll *a* for a representative dry-weather year from April through November (2007).

Median concentrations of total phosphorus for the Coosa River would be expected to fluctuate but the alternatives would have very little change from the No Action Alternative (Figure 6.1-86). In periods of dry weather, similar to 2007, concentrations entering Weiss Lake could increase around 0.005 mg/L, but those loads would likely be assimilated and drop below concentrations expected from the No Action Alternative (Figure 6.1-87). Decreased total phosphorus is the likely response of algal growth, as illustrated by modeled chlorophyll *a*. However, average growing season chlorophyll *a* at four stations from 2000 - 2008 stayed the same or decreased from the No Action Alternative average growing season chlorophyll *a* for the same period. For the most critical year (2007 - the year with highest predicted chlorophyll *a*), the growing season median chlorophyll *a* decreased under the Plan D when compared to the No Action Alternative (Figure 6.1-85).

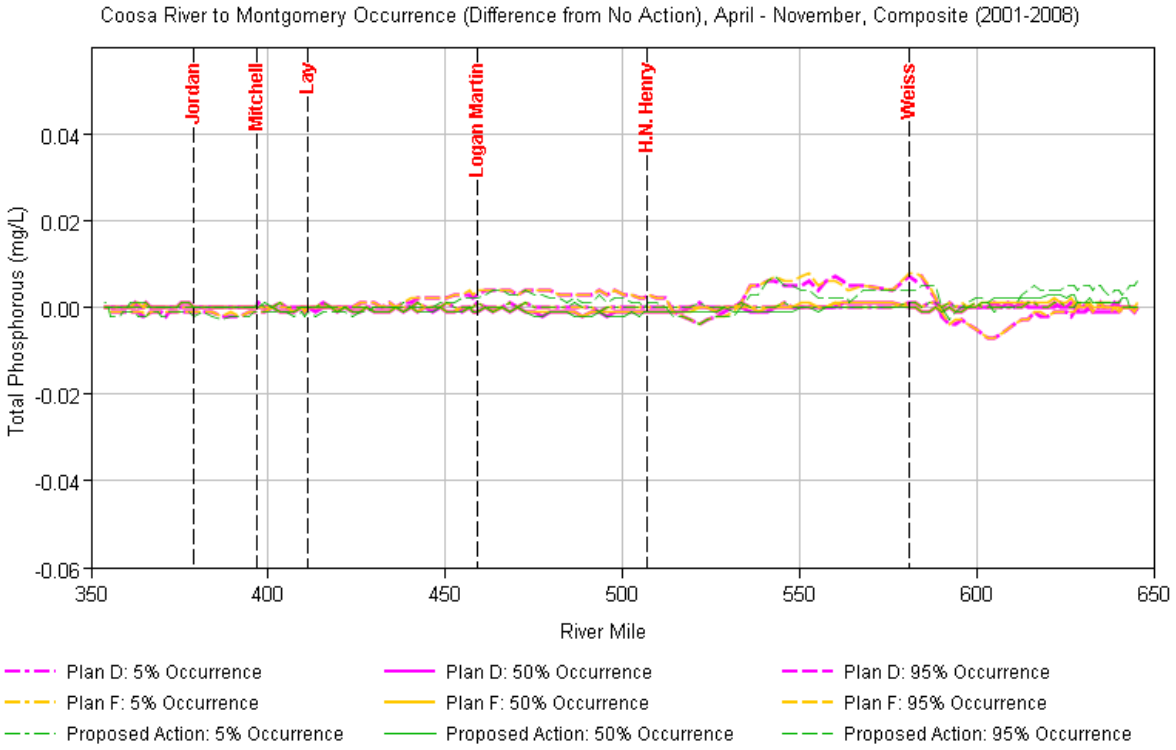


Figure 6.1-86. Coosa River total phosphorus delta longitudinal profile for the modeled period from April through November (2001–2008).

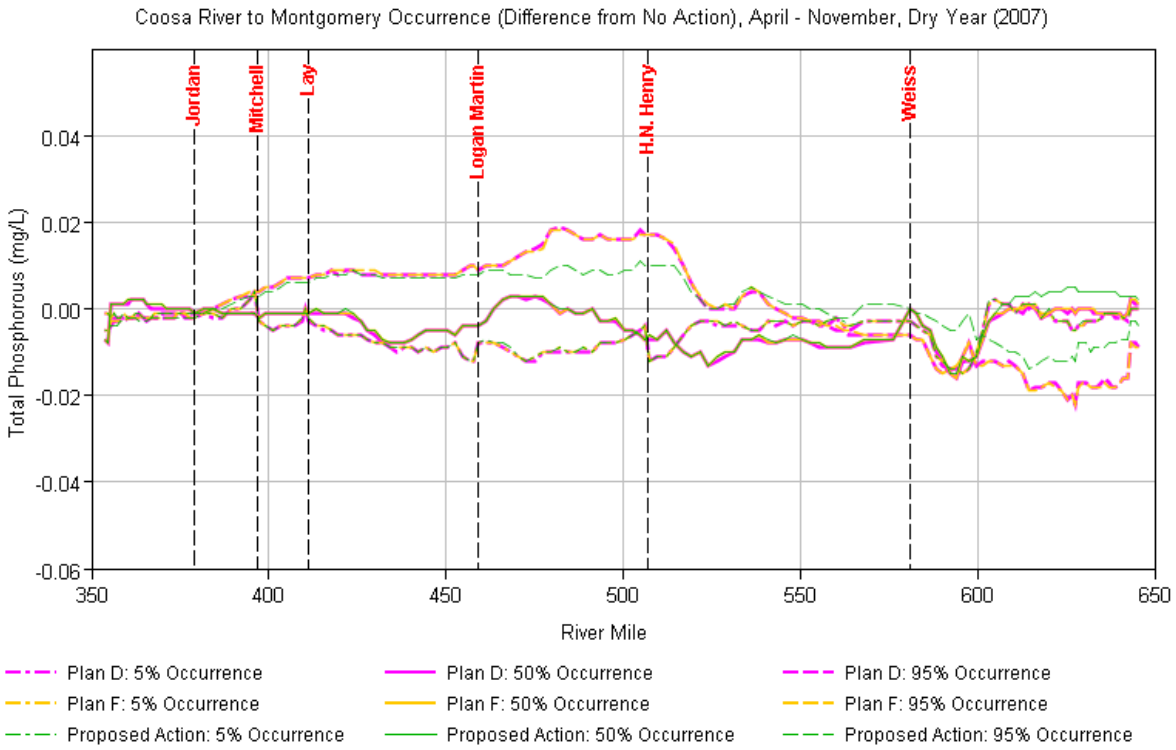


Figure 6.1-87. Coosa River total phosphorus delta longitudinal profile for a representative dry-weather year from April through November (2007).

Total phosphorus is made up of both organic phosphorus and ortho-phosphorus (PO_4-P). PO_4-P is the most readily available for algal growth. During the growing season of dry-weather years, median PO_4-P in the Weiss Lake forebay would be expected to be less than concentrations in the No Action Alternative (Figure 6.1-88). The decrease in PO_4-P is a response to algal growth modeled as chlorophyll *a* (Figure 6.1-85). The changes in algal growth between the various alternatives evaluated and the No Action Alternative are discussed in more detail in Section 6.1.2.2.5.

In the Coosa River, during dry-weather conditions when in-stream flows decrease from the No Action Alternative, some permitted dischargers could be restricted to ensure that their nutrient load could be assimilated to meet the state line target and maintain water quality standards in Weiss Lake. As in past years of low-flow conditions, water users can coordinate directly with USACE to notify USACE of their needs. USACE will periodically notify users when releases are made during these low-flow conditions.

Little change was modeled in median concentrations of total phosphorus in the Tallapoosa River Figure 6.1-89). The increase in total phosphorus likely occurs during dry-weather periods when in-stream flows change from the No Action Alternative as a result of drought management triggers. Over a period where wet, dry, and normal years would be expected, during the growing season from April through November, the concentrations of total phosphorus would be relatively unchanged (Figure 6.1-90).

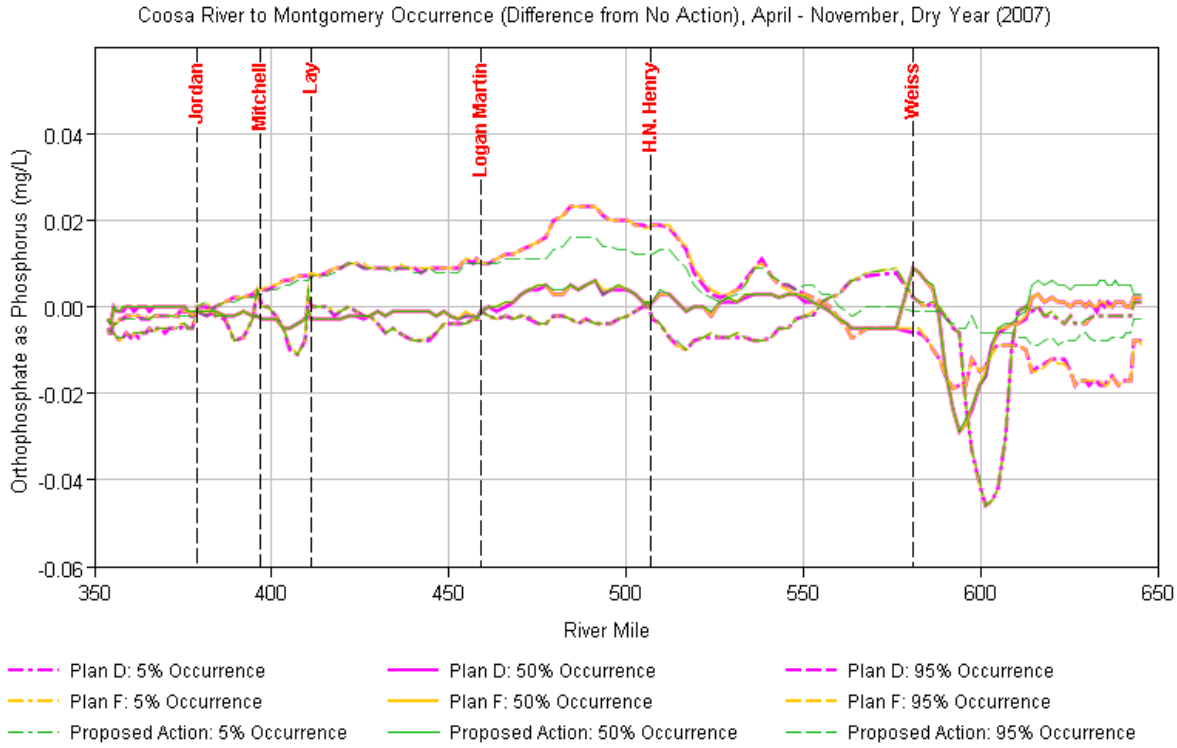


Figure 6.1-88. Coosa River ortho-phosphorus delta longitudinal profile for a representative dry-weather year from April through November (2007).

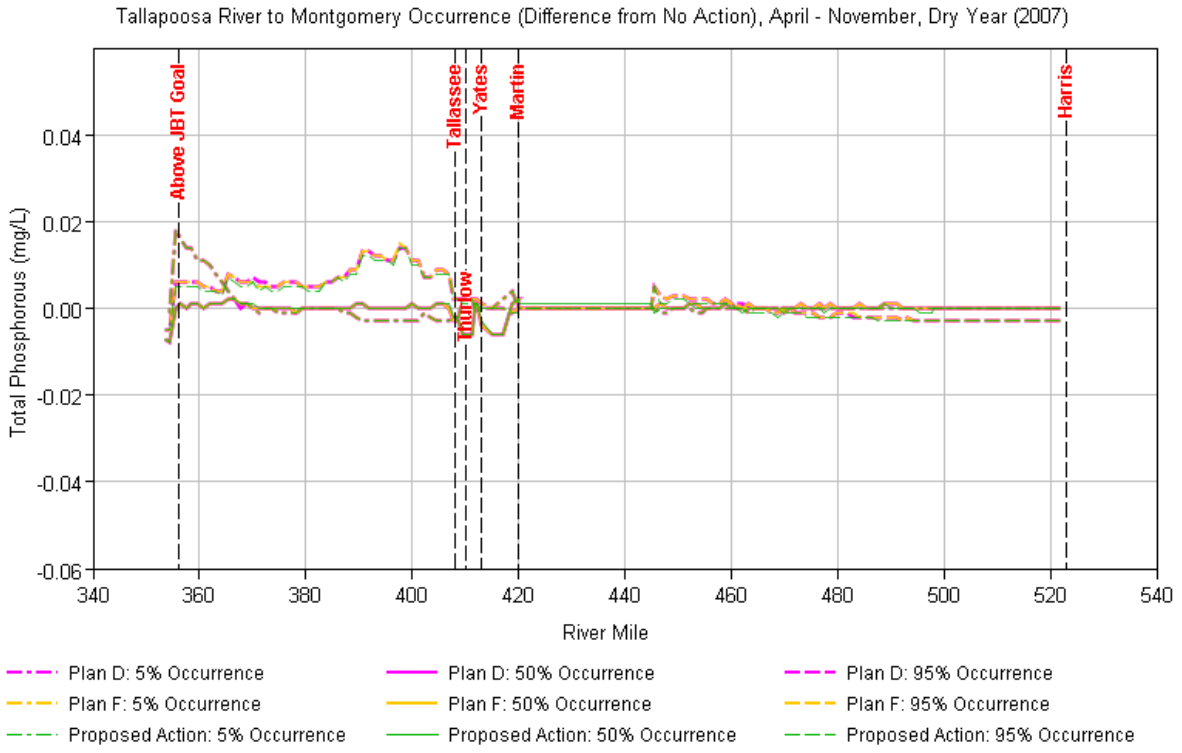


Figure 6.1-89. Tallapoosa River total phosphorus delta longitudinal profile for a representative dry-weather year from April through November (2007).

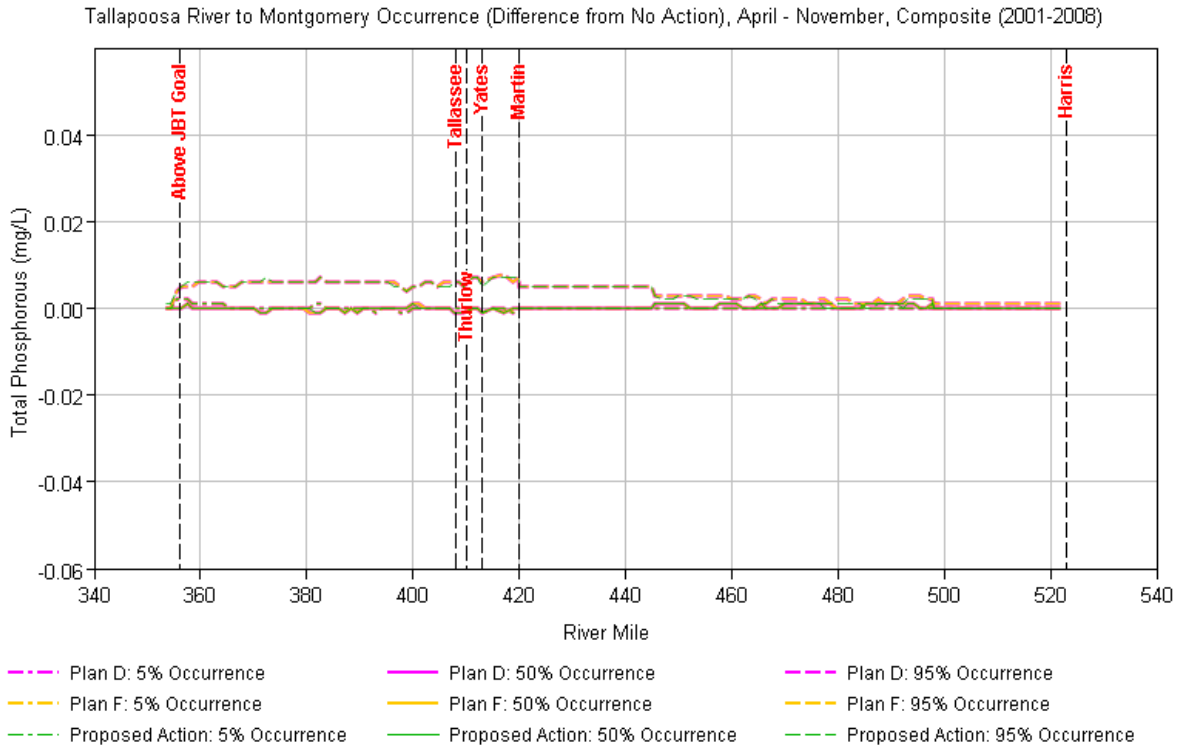


Figure 6.1-90. Tallapoosa River total phosphorus delta longitudinal profile for the modeled period from April through November (2001–2008).

Little change was also modeled in median concentrations of total phosphorus in the Alabama River, with median concentrations increasing and decreasing by less than 0.01 mg/L throughout the reach (Figure 6.1-91). The increase in total phosphorus likely occurs during dry-weather periods when in-stream flows are less than the No Action Alternative. Over a period where wet, dry, and normal flow years would be expected, during the growing season from April through November, concentrations of total phosphorus would be relatively unchanged (Figure 6.1-92).

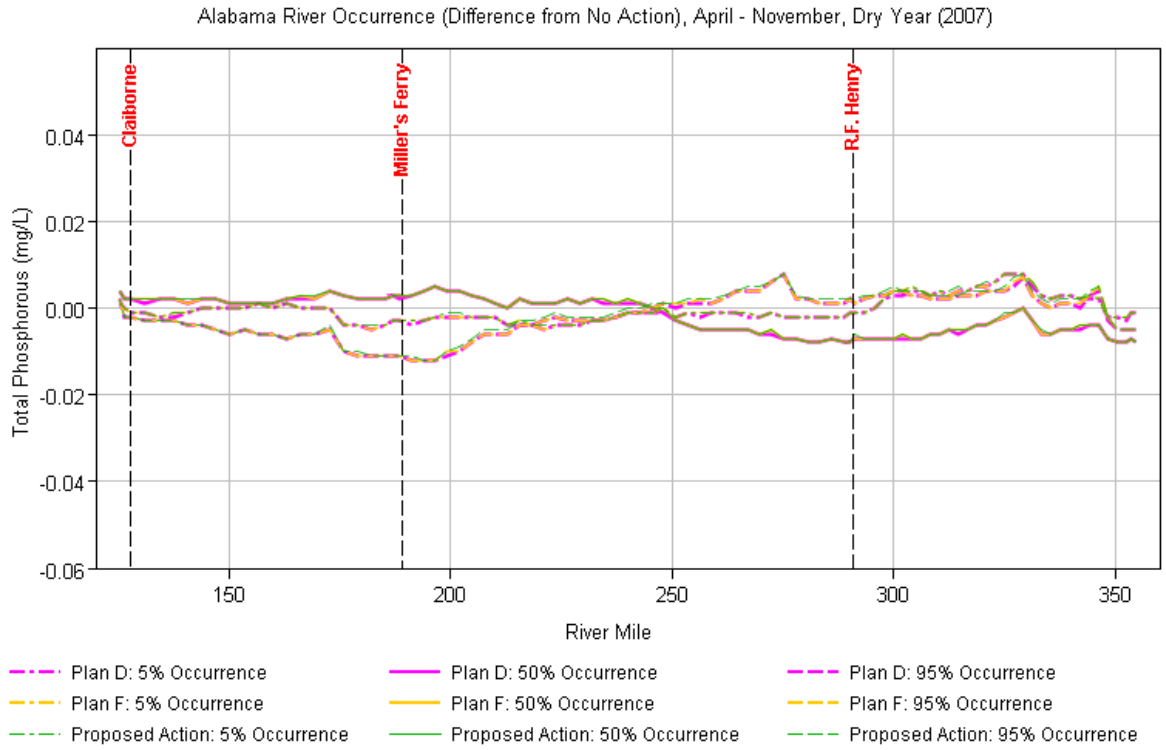


Figure 6.1-91. Alabama River total phosphorus delta longitudinal profile for a representative dry-weather year from April through November (2007).

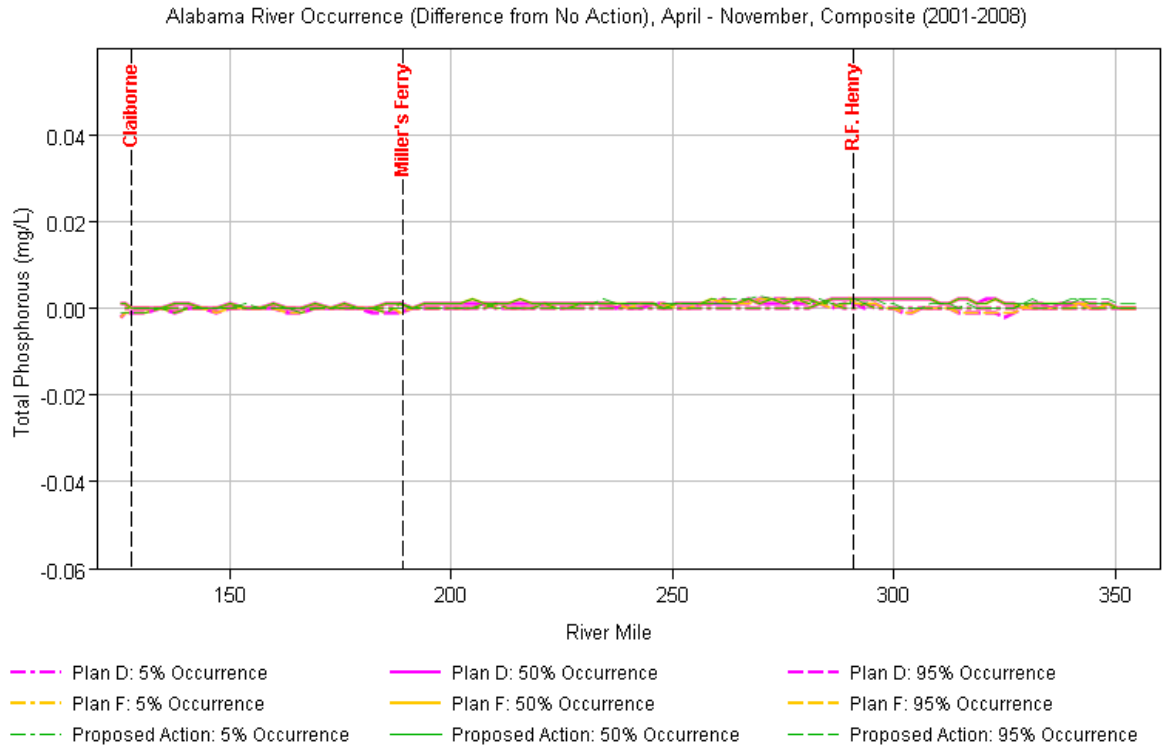


Figure 6.1-92. Alabama River total phosphorus delta longitudinal profile for the modeled period from April through November (2001–2008).

6.1.2.2.4 Nitrogen

The concern for nitrogen is similar to phosphorus because it influences algal growth, but it also more directly influences DO. For that reason, ammonia and nitrate—components of total nitrogen—are often regulated in point source discharges. Generally, the greatest changes in nitrogen would be expected during dry-weather conditions when drought operations are triggered. As in past years of low-flow conditions, water users can coordinate directly with USACE to notify USACE of their needs. USACE will periodically notify users when releases are made during these low-flow conditions.

The response of nitrogen in the Coosawattee-Oostanaula (Figure 6.1-93) and Etowah (Figure 6.1-94) rivers is similar to phosphorus. In the Coosawattee and Oostanaula rivers, nitrogen increases downstream to the confluence with the Etowah River. Nitrogen in the Etowah River shows little change from the No Action Alternative.

Nitrogen on the Coosa River decreases upstream of Weiss Lake and then moves back in line with the No Action Alternative downstream of Weiss Lake (Figure 6.1-95). The decline in total nitrogen is likely the response of algal growth. During dry-weather conditions in a small percent of events during the growing season, increased concentrations would be expected downstream of Weiss Lake and in the H. Neely Henry Lake forebay (Figure 6.1-96).

The response of nitrogen in the Tallapoosa River (Figure 6.1-97) is similar to phosphorus. In the Tallapoosa River, increases could occur during the growing season downstream of Tallassee, Alabama, because of changes in operational releases from the No Action Alternative.

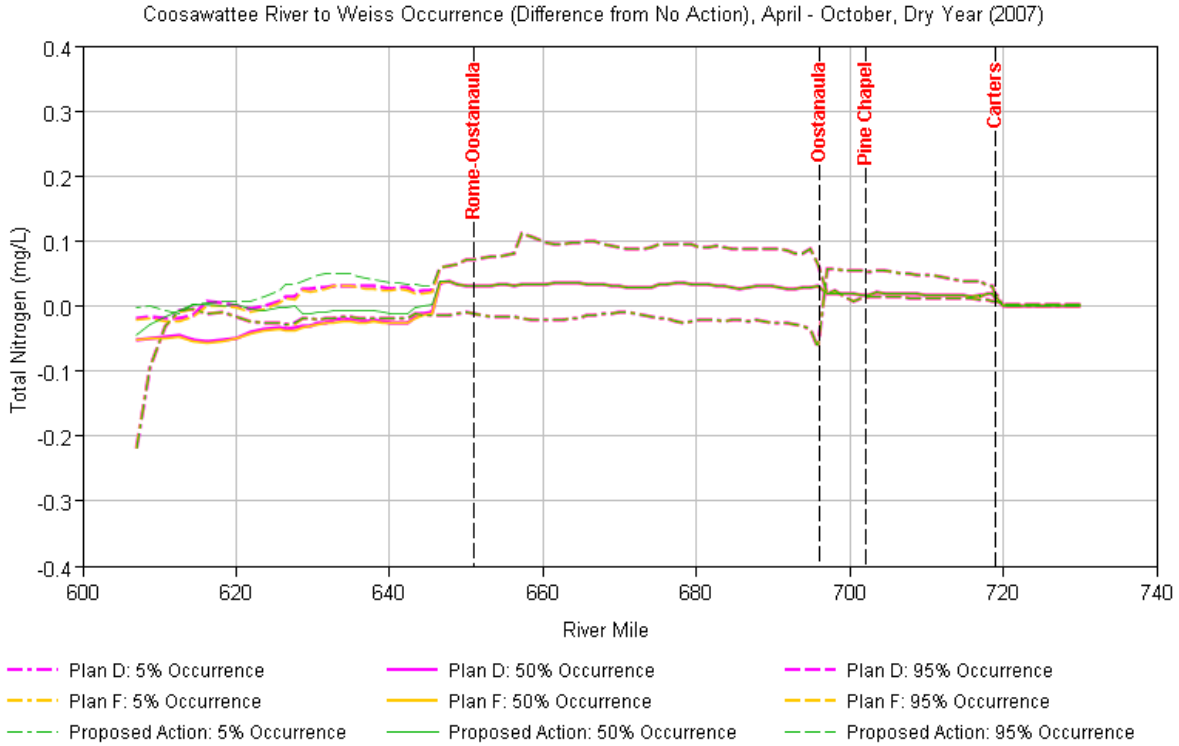


Figure 6.1-93. Carters Lake downstream to Weiss Lake total nitrogen delta longitudinal profile for a representative dry year from April through October (2007).

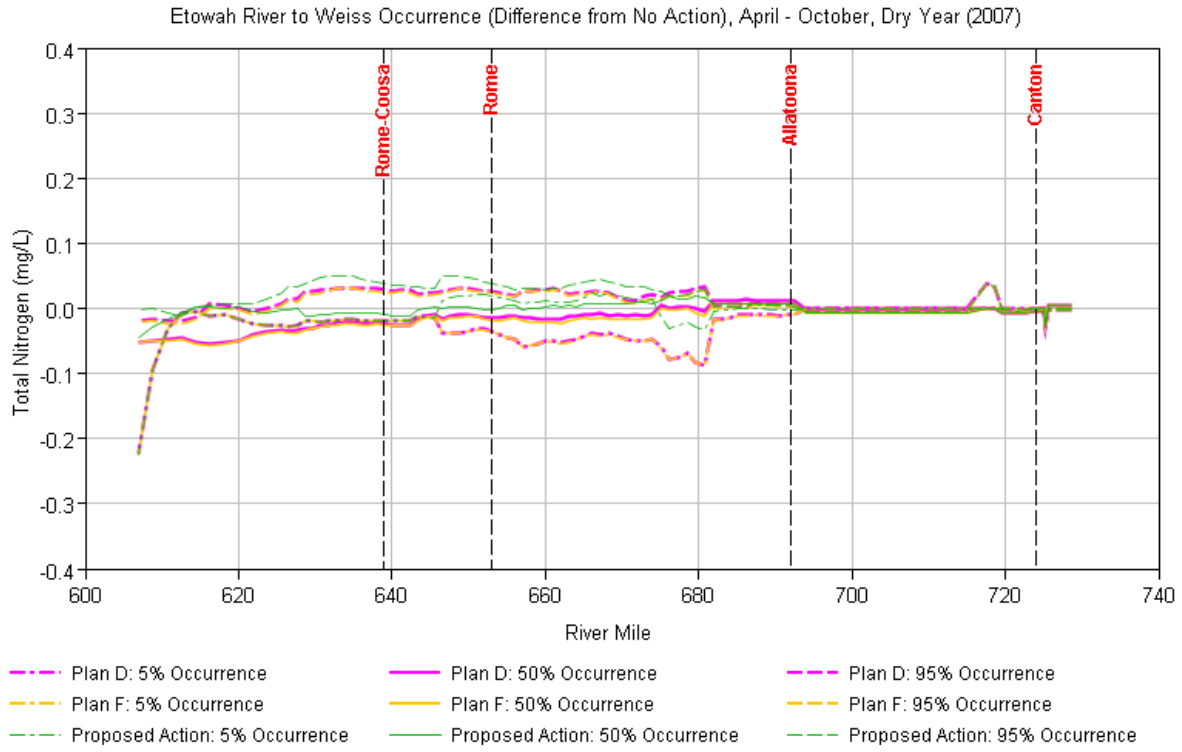


Figure 6.1-94. Etowah River total nitrogen delta longitudinal profile for a representative dry year from April through October (2007).

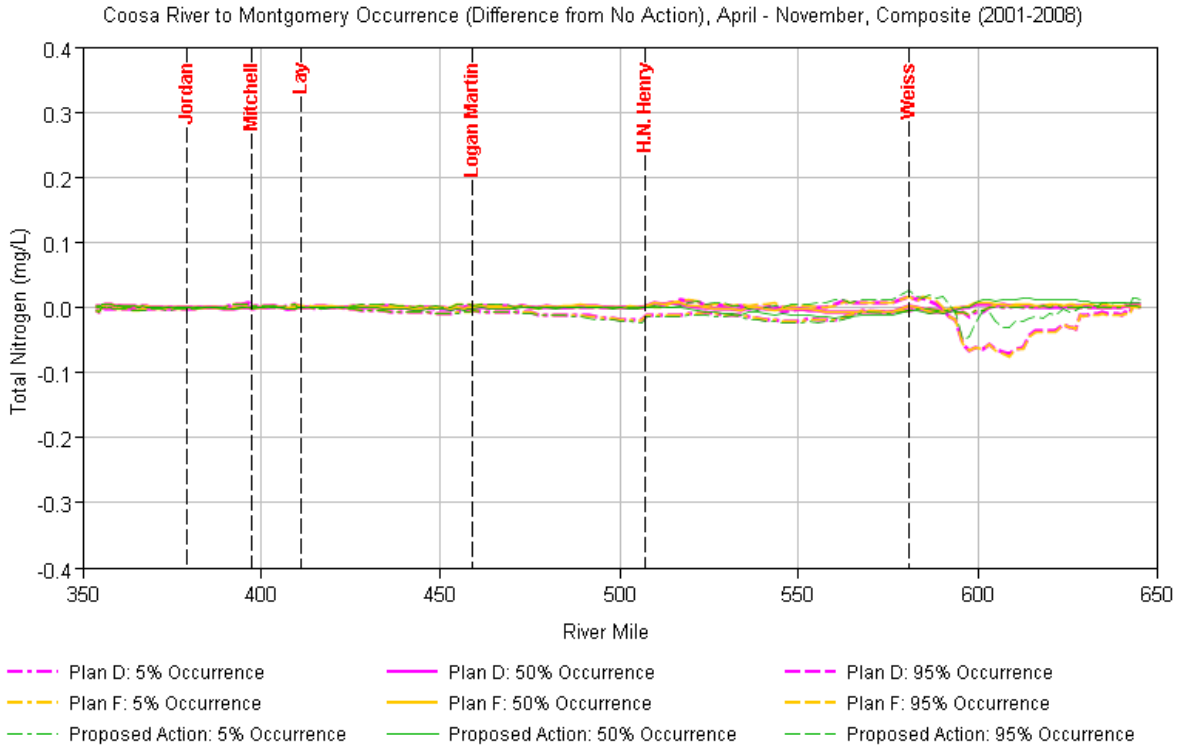


Figure 6.1-95. Coosa River total nitrogen delta longitudinal profile for a representative dry year from April through November (2007).

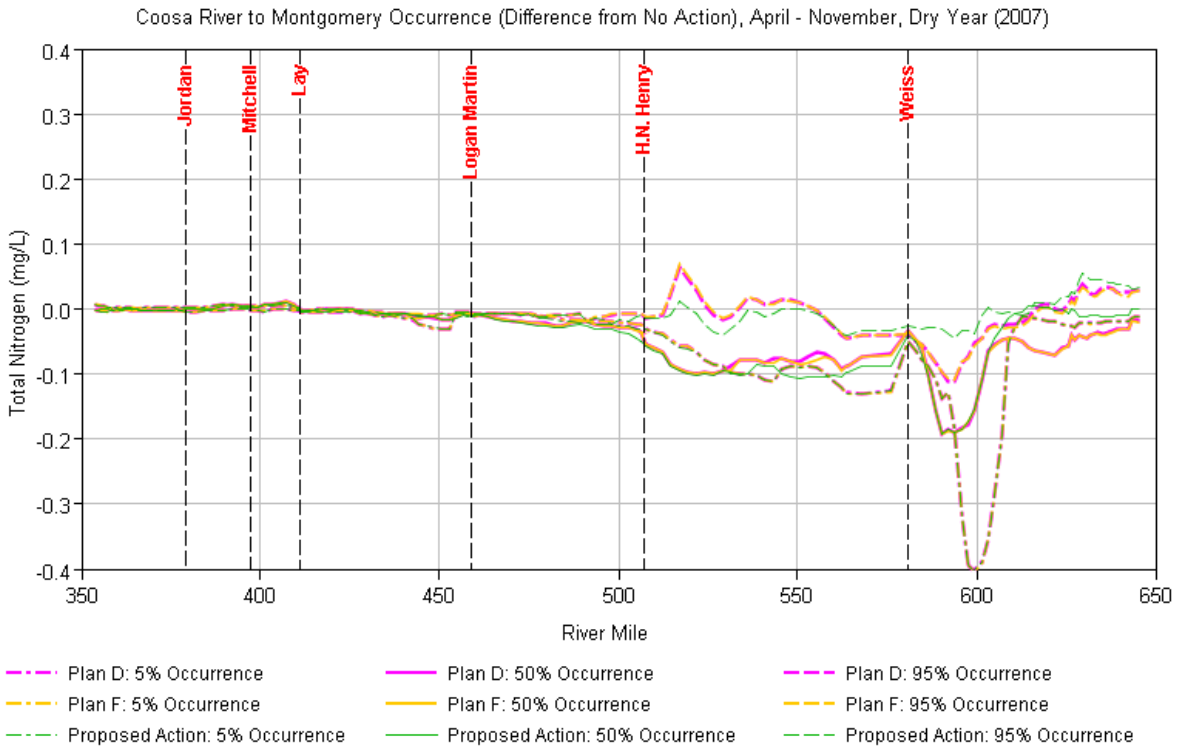


Figure 6.1-96. Coosa River total nitrogen delta longitudinal profile for a representative dry year from April through November (2007).

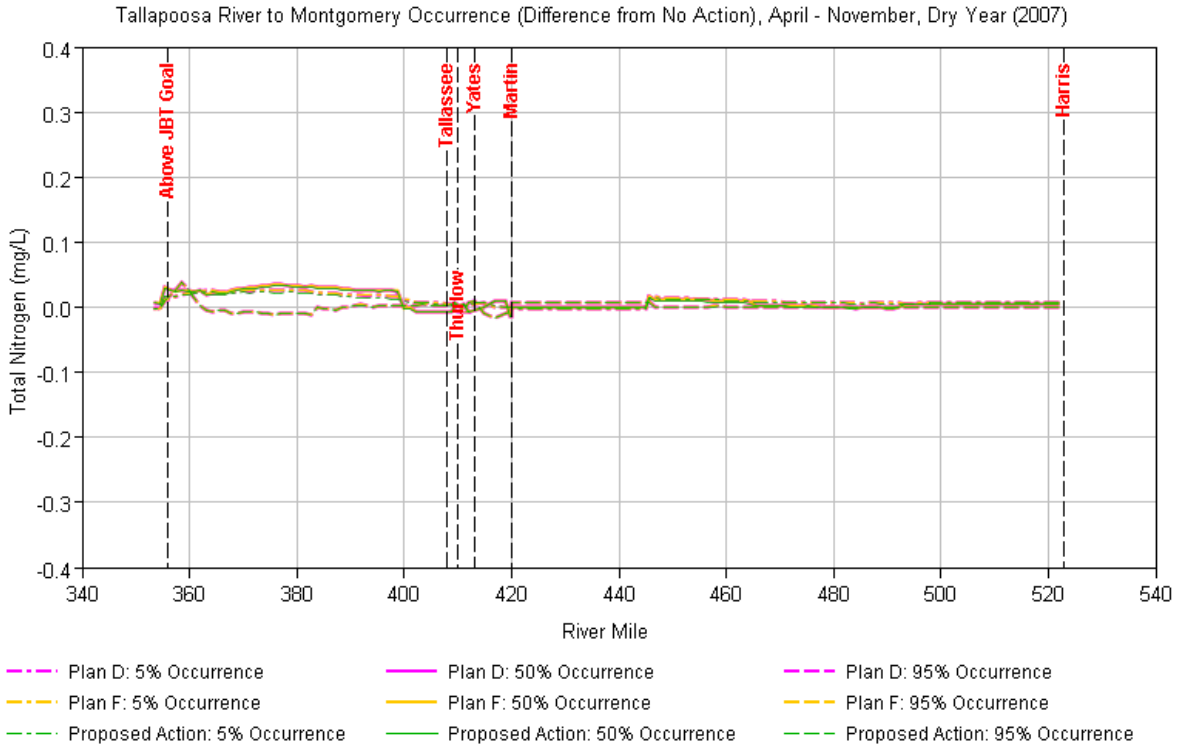


Figure 6.1-97. Tallapoosa River total nitrogen delta longitudinal profile for a representative dry year from April through November (2007).

On the Alabama River, the greatest differences in total nitrogen occur outside the growing season. Figure 6.1-98 presents annual total nitrogen in a representative dry year, and Figure 6.1-99 presents the changes that would be expected during the growing season. Median annual nitrogen concentrations show increases in the alternatives upstream of Miller's Ferry, while annual concentrations decrease in the alternatives downstream of Miller's Ferry.

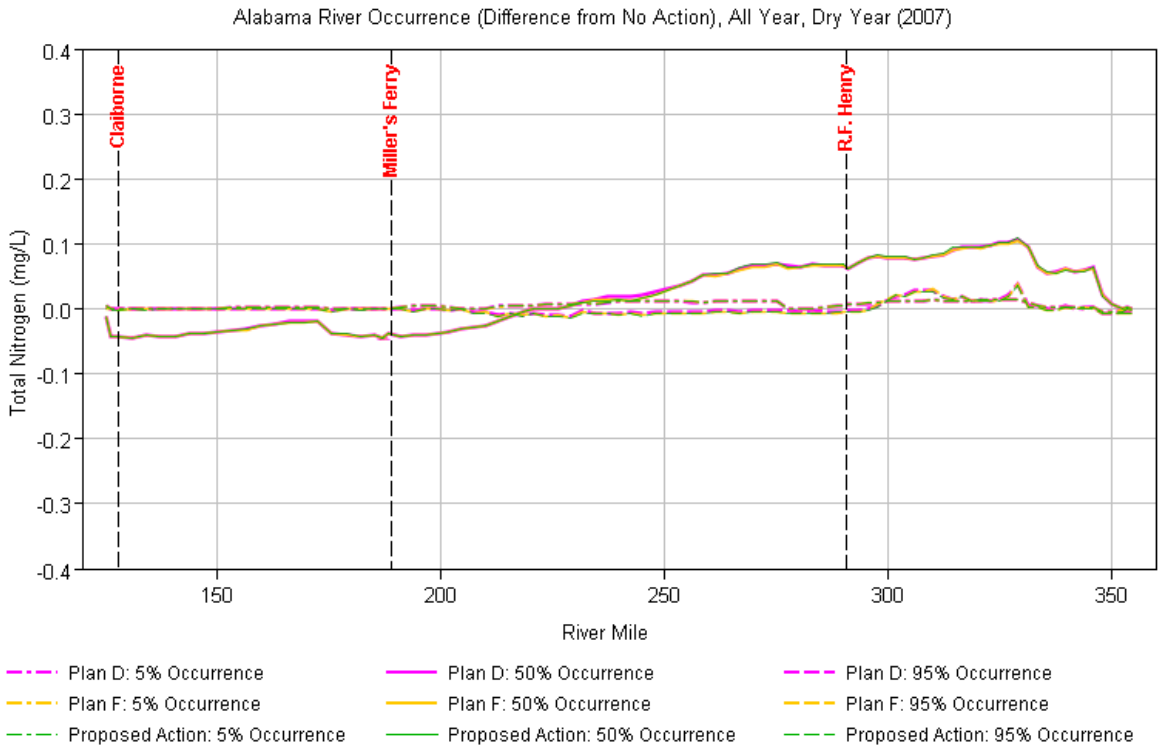


Figure 6.1-98. Alabama River annual total nitrogen delta longitudinal profile for a representative dry year (2007).

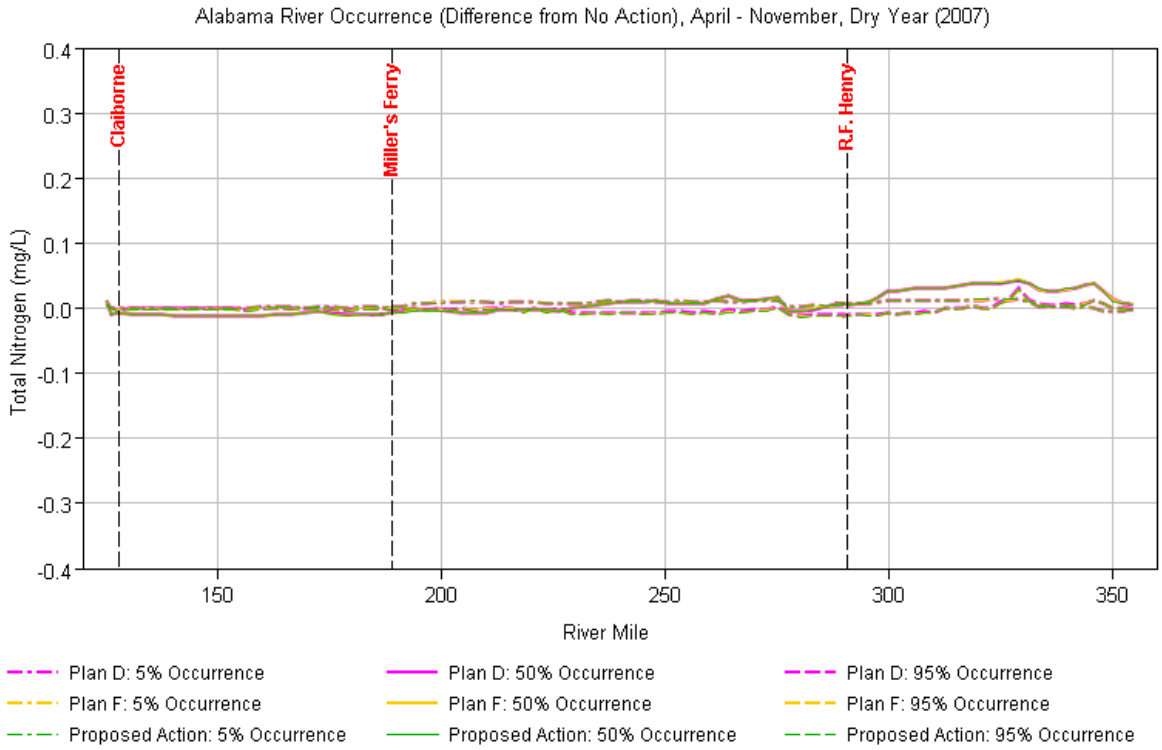


Figure 6.1-99. Alabama River total nitrogen delta longitudinal profile for a representative dry year from April through November (2007).

6.1.2.2.5 Chlorophyll *a*

Little change in chlorophyll *a* would be expected in the ACT Basin over a period of various flow conditions during the growing season as illustrated in Figure 6.1-100 through Figure 6.1-104. Growth in chlorophyll *a* typically varies by less than 1 µg/L from the No Action Alternative over the 2001 through 2008 period. However, under dry-weather conditions, changes in flow from the No Action Alternative would be expected to affect the system's ability to assimilate nutrient loads causing algal growth. In Figure 6.1-105 through Figure 6.1-109, the response of chlorophyll *a* to low flow is illustrated. Algal growth, as measured by chlorophyll *a* is often regulated over time rather than from a single sample. Therefore, it is more appropriate to focus on changes in median chlorophyll *a* concentrations, and more specifically growing season average concentrations, to determine what the effect of various alternatives would be on algal growth.

The effects of proposed operational changes on chlorophyll *a* between Plan D and other alternatives evaluated would be negligible in much of the ACT Basin. The difference between the alternatives evaluated would be the greatest in the Coosa River during periods of dry weather (Figure 6.1-106). In this case, illustrating the change between the No Action Alternative and other alternatives is misleading because of the shift in chlorophyll *a* illustrated in Figure 6.1-85.

In the figures that follow, the changes from the No Action Alternative generally decrease. However, on the basis of modeled results at Weiss Lake, a shift in the location of peaking chlorophyll *a* concentrations would occur. Figure 6.1-85 in Section 6.1.2.2.3 illustrates this shift. An increase in the most extreme 95 percent occurrence would be expected due to a shift of chlorophyll a upstream. The delta increase in the most extreme 95 percent occurrence would be 40 µg/L because of the shift in the location of the peak occurrence (Figure 6.1-106). The modeled difference in the peak however is 5 µg/L.

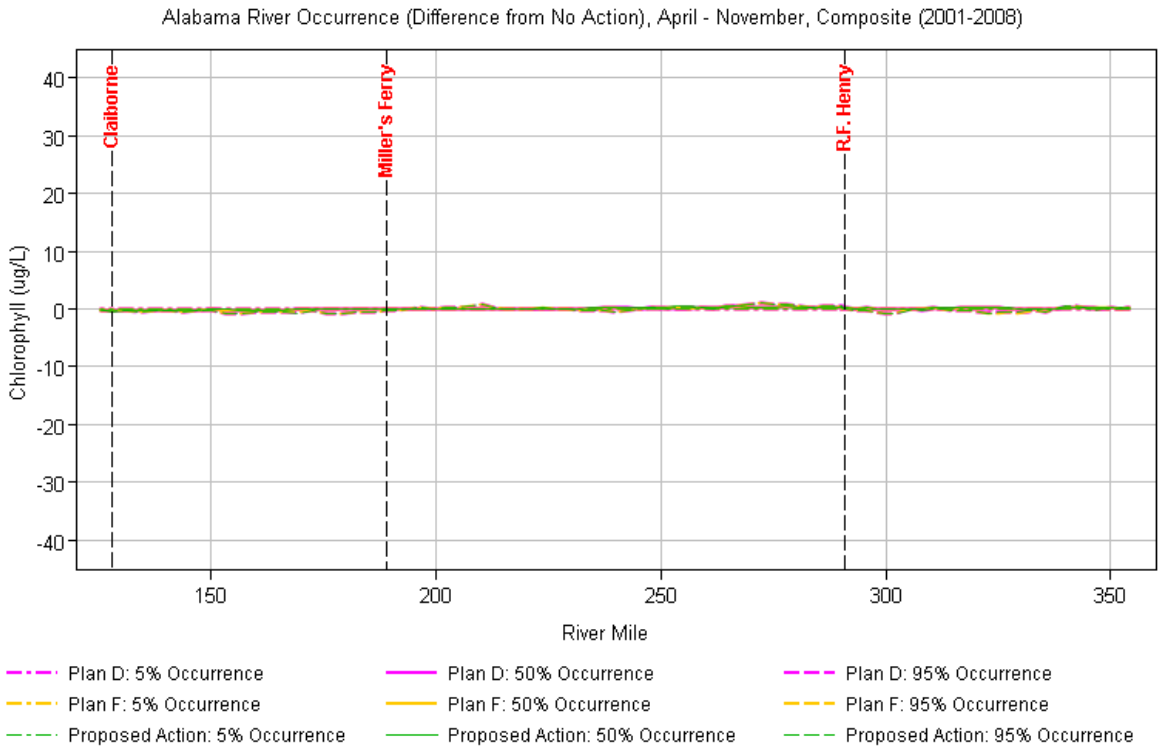


Figure 6.1-100. Alabama River delta longitudinal profile of chlorophyll *a* for the modeled period from April through November (2001–2008).

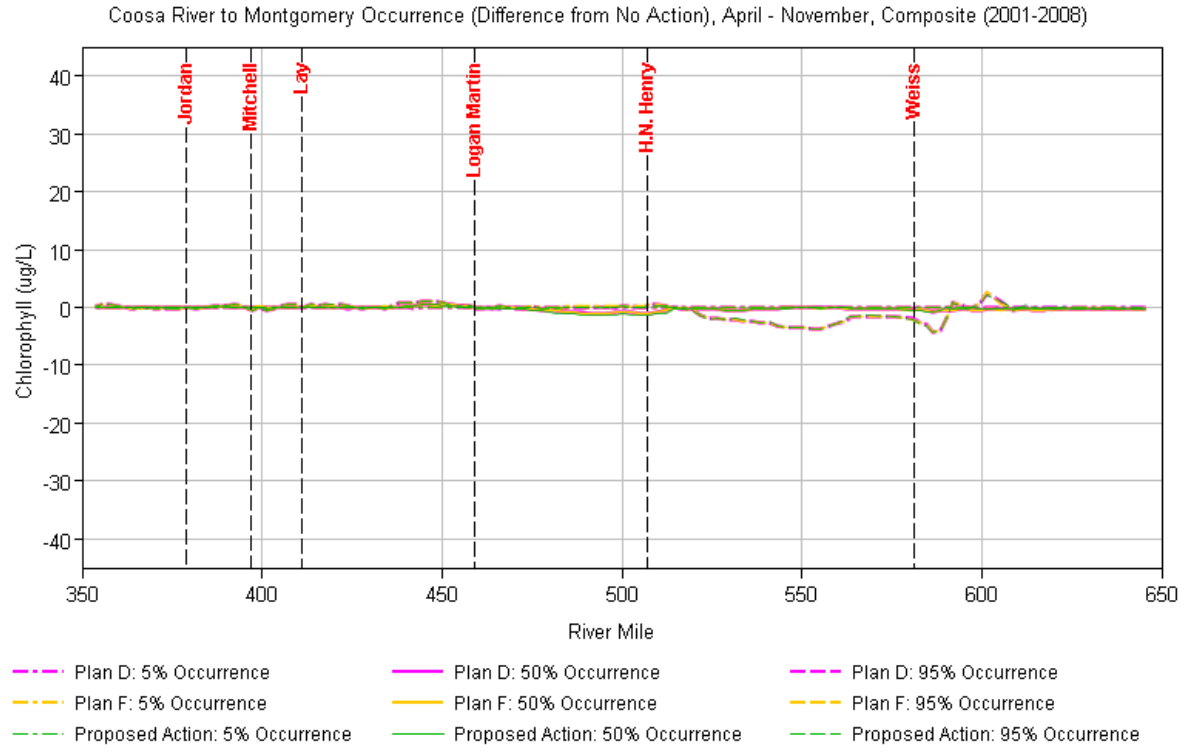


Figure 6.1-101. Coosa River delta longitudinal profile of chlorophyll *a* for the modeled period from April through November (2001–2008).

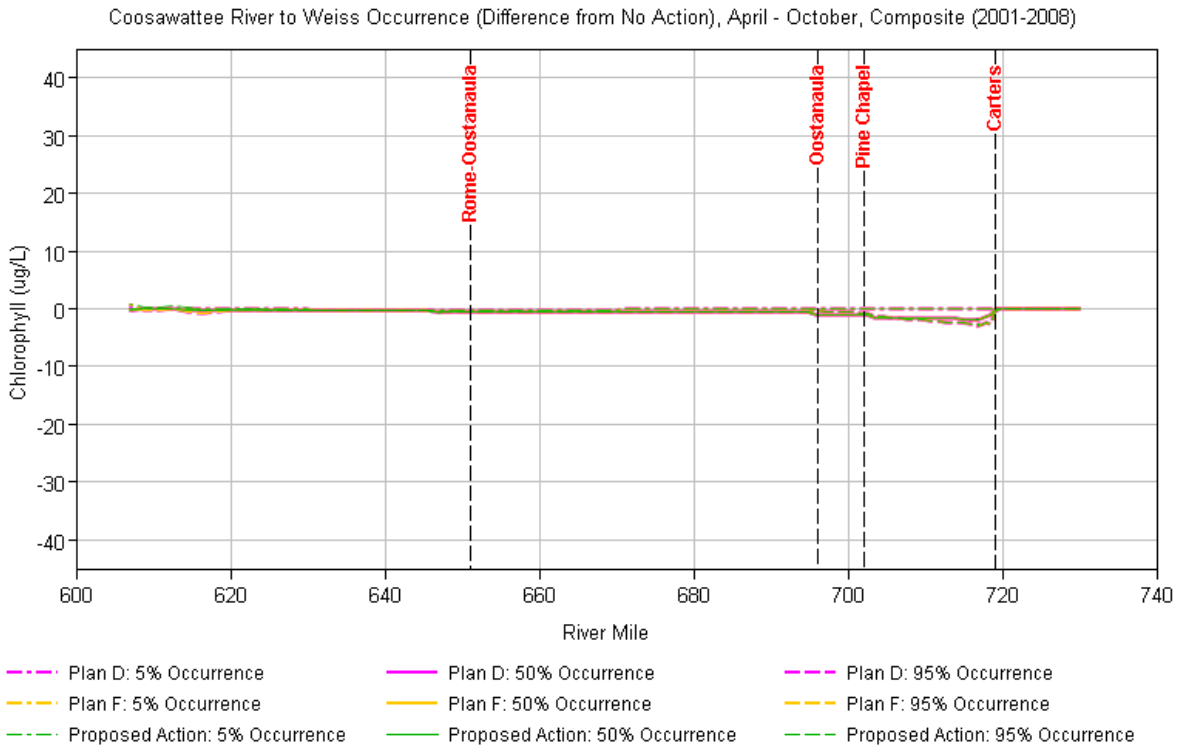


Figure 6.1-102. Carters Lake downstream to Weiss Lake delta longitudinal profile of chlorophyll *a* for the modeled period from April through October (2001–2008).

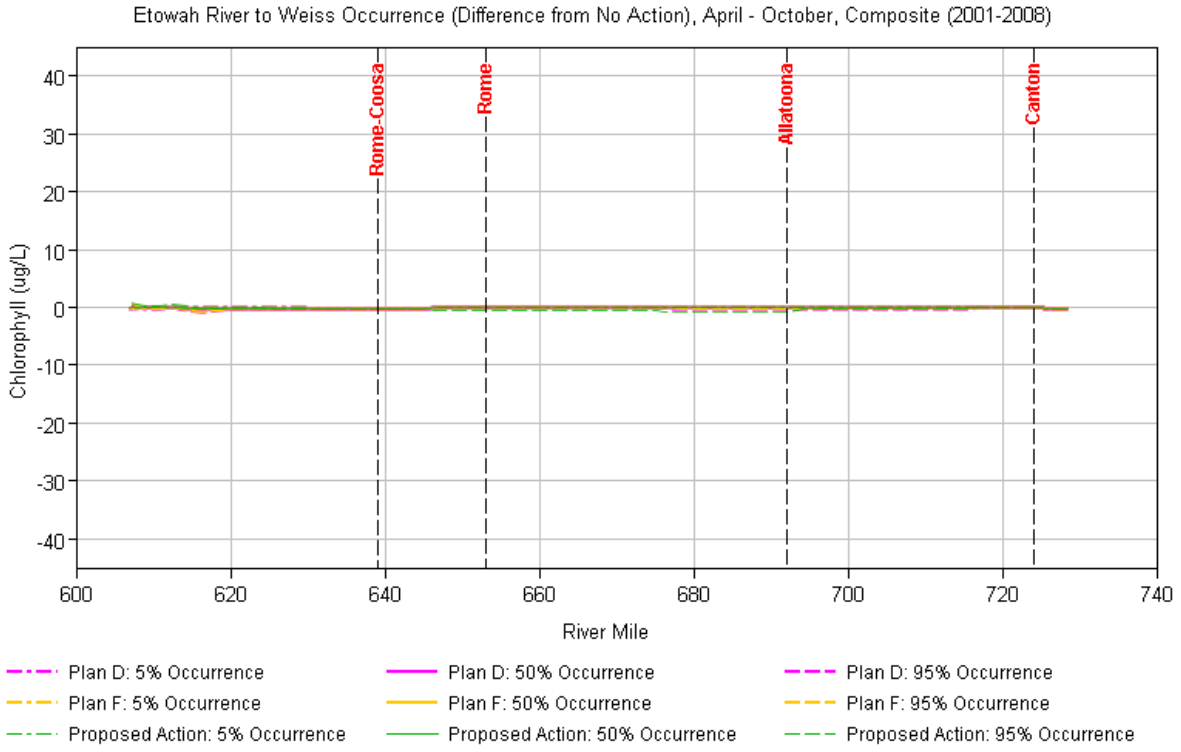


Figure 6.1-103. Etowah River delta longitudinal profile of chlorophyll *a* for the modeled period from April through October (2001–2008).

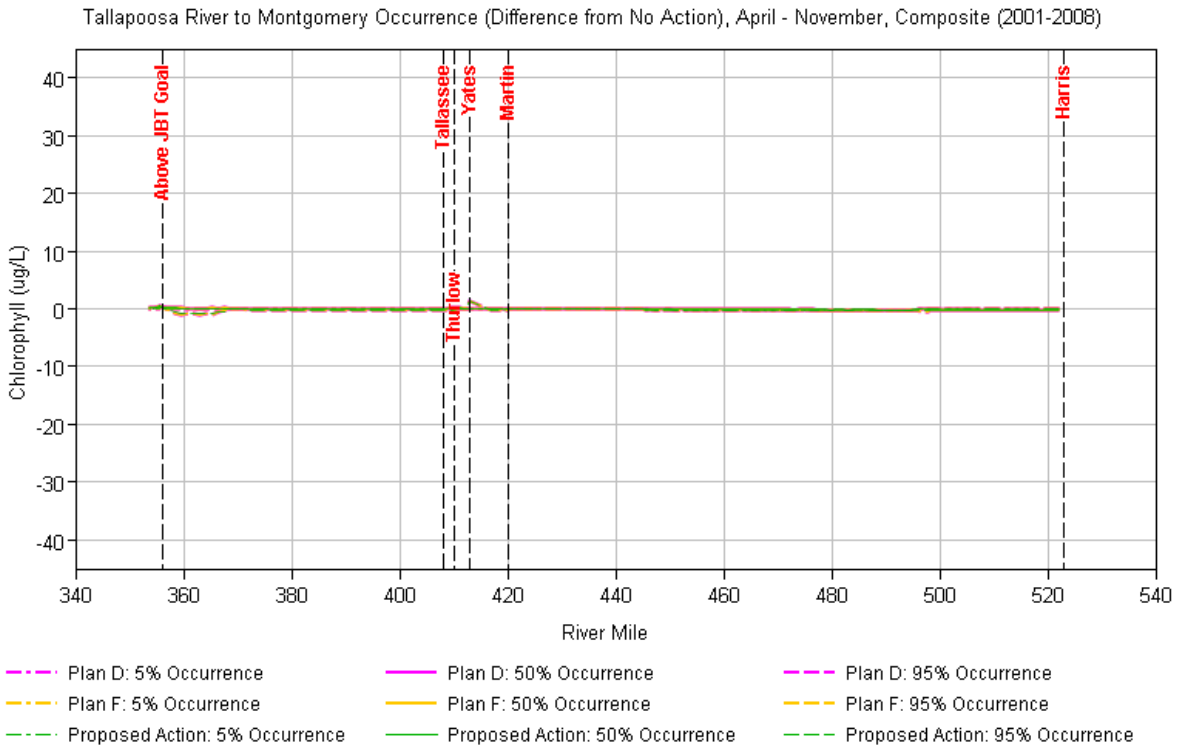


Figure 6.1-104. Tallapoosa River delta longitudinal profile of chlorophyll *a* for the modeled period from April through November (2001–2008).

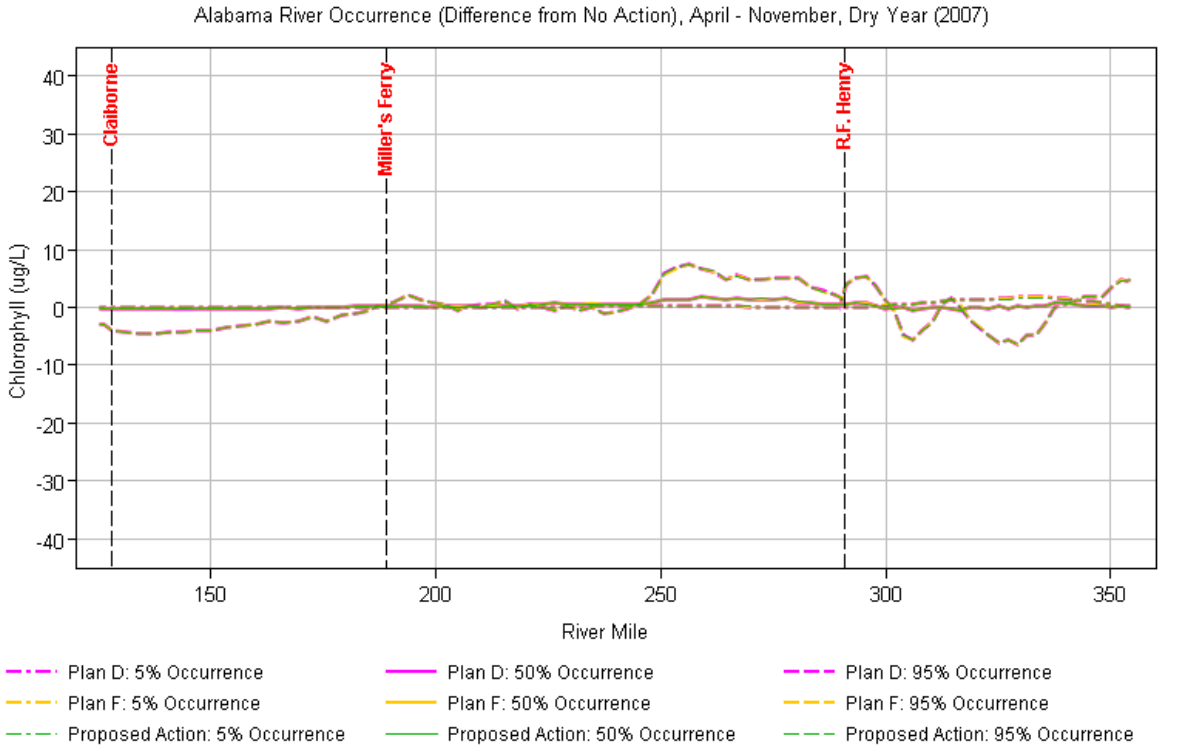


Figure 6.1-105. Alabama River delta longitudinal profile of chlorophyll *a* for a representative dry year from April through November (2007).

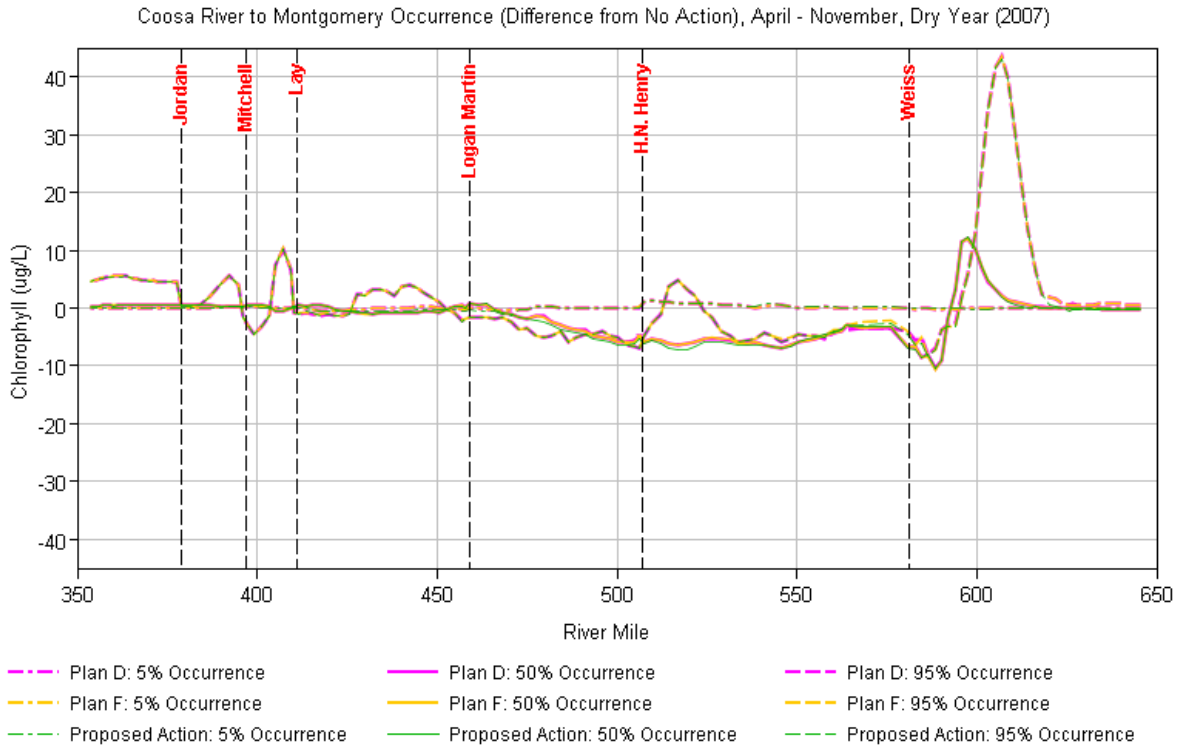


Figure 6.1-106. Coosa River delta longitudinal profile of chlorophyll *a* for a representative dry year from April through November (2007).

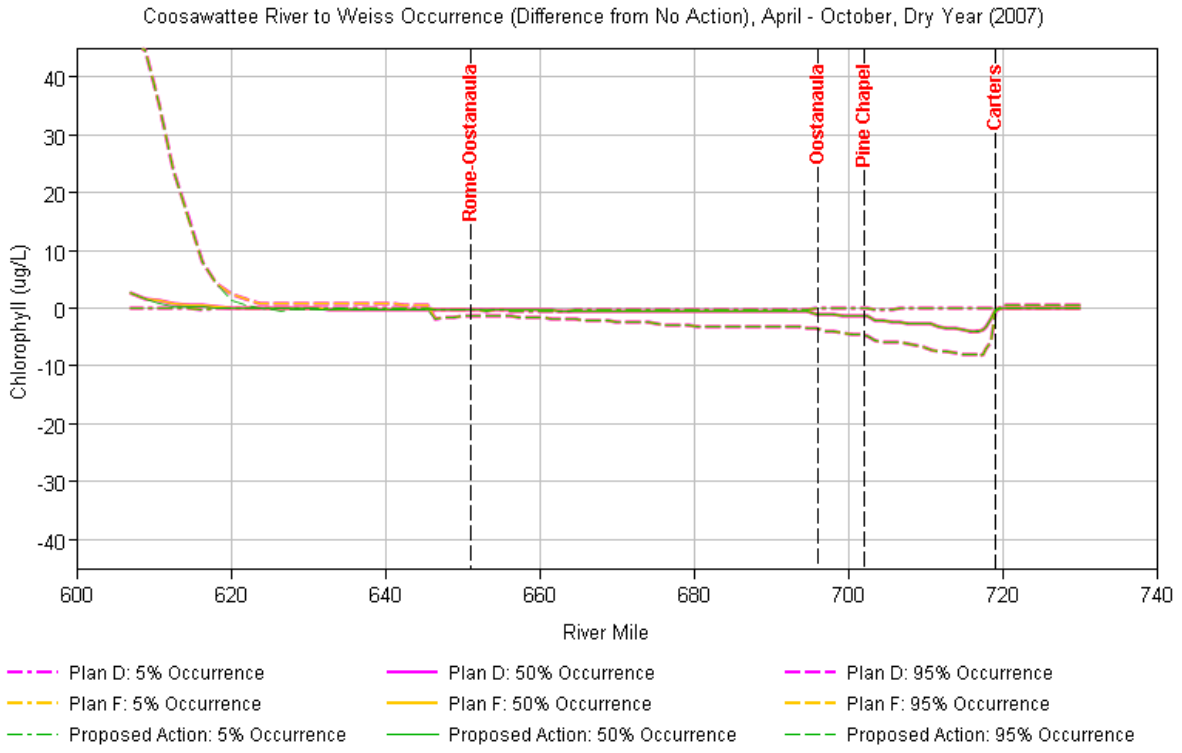


Figure 6.1-107. Carters Lake downstream to Weiss Lake delta longitudinal profile of chlorophyll *a* for a representative dry year from April through October (2007).

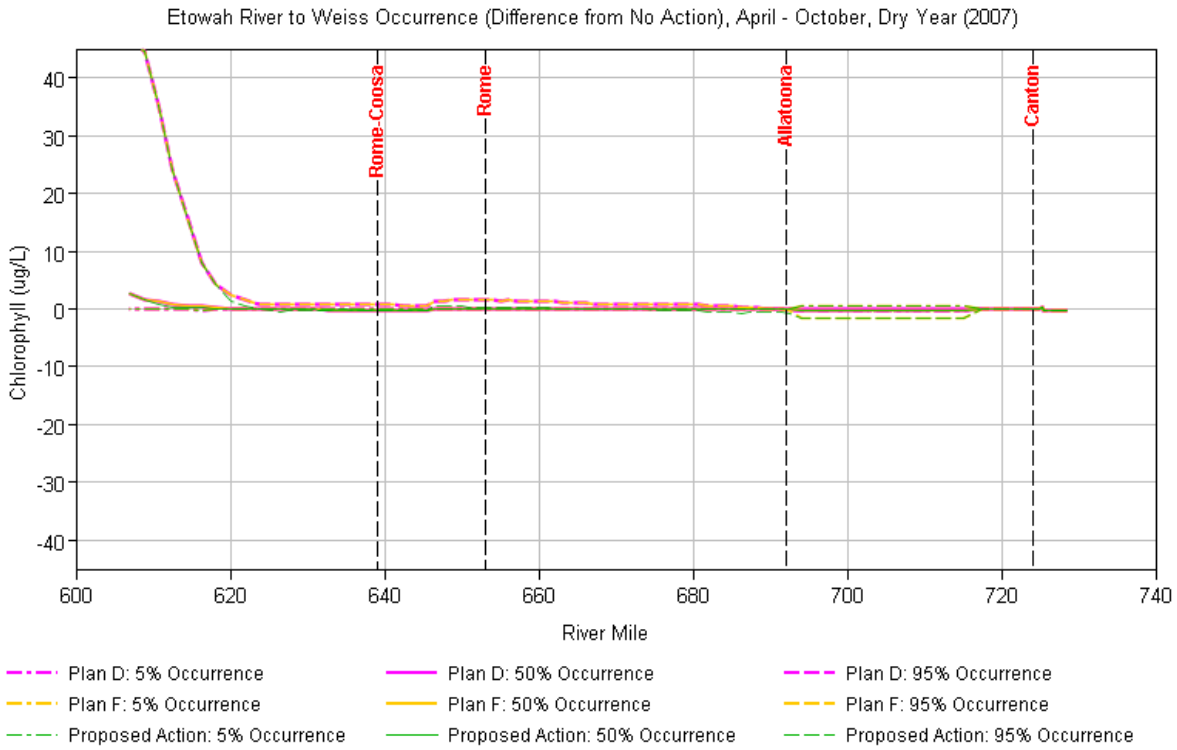


Figure 6.1-108. Etowah River longitudinal profile of chlorophyll *a* for a representative dry year from April through October (2007).

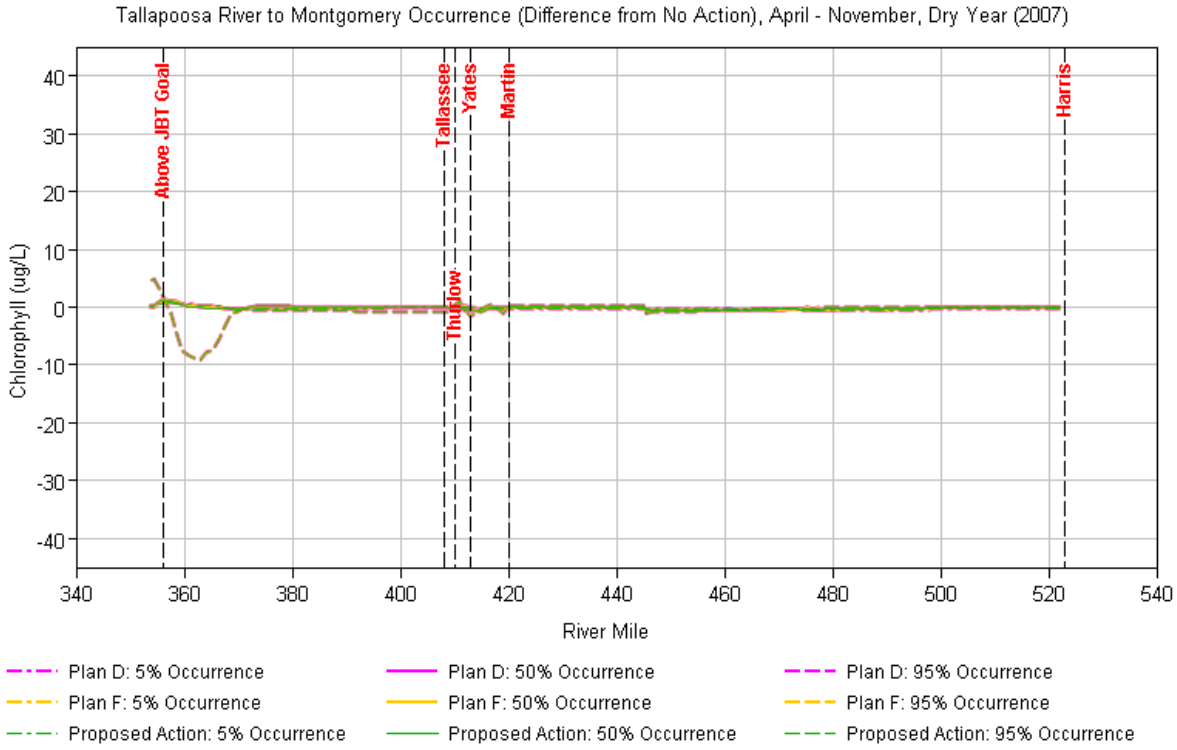


Figure 6.1-109. Tallapoosa River delta longitudinal profile of chlorophyll *a* for a representative dry year from April through November (2007).

The greatest change in median chlorophyll *a* illustrated is the result of a shift in the location of peaking concentrations. Chlorophyll *a* concentrations in and around Weiss Lake would be expected to decrease by as much as 10 µg/L. These changes in chlorophyll *a* illustrate the system's inability to assimilate nutrient loads at certain periods of the growing season. The shift in the location of peaking concentrations generally corresponds to periods when retention times increase because water levels are held to match APC's Drought Curve. Changes to water management in upstream reservoirs would be expected to result in Weiss Lake water levels more closely mimicking the project's Guide Curve. These operational changes only influence water quality during a period of the growing season. Overall, average growing season chlorophyll *a* at four stations from 2000–2008 stayed the same or decreased from the No Action Alternative average growing season chlorophyll *a* for the same period. Weiss Lake site-specific water quality standards are based on a growing season average of 20 µg/L chlorophyll *a* criteria at two locations. For the most critical year (2007 - the year with highest predicted chlorophyll *a*), the growing season chlorophyll *a* decreased under the Proposed Action Alternative when compared to the No Action Alternative.

6.1.2.3 Alternative Plan F

Managing water quality is adaptive. As streamflows change, a waterbody's ability to assimilate pollutants is changed. The overall effect of Plan F on water quality would be expected to be negligible. Similar to the No Action Alternative, the water quality modeling presented in this EIS assumed loads from point source discharges were the same for each alternative. That was assumed to predict the change from the No Action Alternative for various alternatives. However, under low-flow conditions, some NPDES permits limit point source discharges, and permit conditions may be temporarily changed, as occurred in 2007. Water management activities may affect water quality under drought conditions. As in past years of low-flow conditions, water users can coordinate directly with USACE to notify USACE of their needs. USACE will periodically notify users when releases are made during these low-flow conditions.

6.1.2.3.1 Water Temperature

The proposed operational changes in Plan F would be expected to have little effect on water temperature in the ACT Basin with the exception of changes in the Alabama River; median water temperatures during low-flow periods are predicted to increase by as much as 3.1 °F (1.7 °C) (Figure 6.1-72). As previously described, the range of water temperatures predicted by the model, as a change between various alternatives and the No Action Alternative along this reach would not be expected to be as great under observed conditions. APC operates Jordan Dam and Lake to ensure minimum flows (2,000 cfs) for protected species, as explained in the modeling report (Appendix C, HEC-ResSim Modeling Report).The difference between the alternatives evaluated is rarely greater than 0.9 °F (0.4 °C) throughout the system, such as downstream of Allatoona Lake as presented in Figure 6.1-65. Implementing a phased guide curve at Allatoona Lake in Plan F would be expected to have little effect on water temperatures in the lake and in reaches downstream.

6.1.2.3.2 Oxygen Demand

Similar to Plan D, the proposed operational changes in Plan F would be expected to have little effect on DO in the ACT Basin. Depressed DO during extreme dry-weather conditions would be the expected result of changing the timing and quantity of stream flows, which would be expected to affect the system's ability to assimilate nutrients. As in past years of low-flow conditions, water users can coordinate directly with USACE to notify USACE of their needs. USACE will periodically notify users when releases are made during these low-flow conditions.

6.1.2.3.3 Phosphorus

Similar to Plan D, the proposed operational changes between Plan F and other alternatives evaluated would be negligible in much of the ACT Basin. Conditions around Weiss Lake were the focus in understanding the environmental consequence of various alternatives on phosphorus. Total phosphorus concentrations are generally less than the No Action Alternative in Weiss Lake and downstream (Figure 6.1-87). Growing season average total phosphorus loadings to Weiss Lake critical to the TMDL would remain at the same levels, or decrease, from the No Action Alternative levels.

6.1.2.3.4 Nitrogen

Similar to Plan D, the proposed operational changes in Plan F would be expected to have a negligible effect on nitrogen. In the Coosawattee and Oostanaula rivers (Figure 6.1-93), nitrogen increases downstream to the confluence with the Etowah River. Nitrogen in the Etowah River (Figure 6.1-94) shows little change from the No Action Alternative. Nitrogen on the Coosa River decreases upstream of Weiss Lake and then moves back in line with the No Action Alternative downstream of Weiss Lake (Figure 6.1-95). The decline in total nitrogen is likely the response of algal growth. During dry-weather conditions in a small percent of events during the growing season, increased concentrations would be expected downstream of Weiss Lake and in the H. Neely Henry Lake forebay (Figure 6.1-96). In the Tallapoosa River (Figure 6.1-97), increases could occur during the growing season downstream of Tallassee, Alabama, because of changes in operational releases from the No Action Alternative. Median annual nitrogen concentrations in the Alabama River show increases in the alternatives upstream of Miller's Ferry, while annual concentrations decrease in the alternatives downstream of Miller's Ferry.

6.1.2.3.5 Chlorophyll *a*

Similar to Plan D, the proposed operational changes between Plan F and other alternatives evaluated would be negligible in much of the ACT Basin. Increased retention times would be expected to result in increased algal growth in Weiss Lake and a shift of growth upstream (Figure 6.1-85). Growing season median total phosphorus loadings to Weiss Lake critical to the TMDL would remain at the same levels, or decrease, from the No Action Alternative levels.

6.1.2.4 Alternative Plan G (Proposed Action Alternative)

The overall effect of the Proposed Action Alternative on water quality would be expected to be negligible. State agencies would continue to apply adaptive management techniques to more precisely define the ACT system's assimilative capacity. Water management activities may affect water quality under low-flow conditions. As in past years of low-flow conditions, water users can coordinate directly with USACE to notify USACE of their needs. USACE will periodically notify users when releases are made during these low-flow conditions.

6.1.2.4.1 Water Temperature

The proposed operational changes in the Proposed Action Alternative would be expected to have little effect on water temperature in the ACT Basin, Table 6.1-6. The modeled results presented in Table 6.1-6 indicate that at 25-mi increments in the system median changes would be less than 1 °F (0.5 °C).

The river reach immediately downstream of Allatoona Lake and Carters Lake would be expected to experience decreased median water temperatures during periods of dry weather (Figure 6.1-65 and Figure 6.1-67). Implementing a phased guide curve at Allatoona Lake and reducing hydropower during fall drawdown would be expected to have little effect on water temperatures in the lake and in reaches

downstream. In the Etowah River from Allatoona Dam downstream to the Coosa River, median water temperatures would be expected to be slightly less than the No Action Alternative as illustrated in Figure 6.1-65. Those slight decreased water temperatures during dry periods from the No Action Alternative would be expected to have a negligible effect on aquatic species.

Table 6.1-6.
Median water temperature difference from No Action for the Proposed Action (May through October)

River mile	Normal (2002)	Wet (2003)	Dry (2007)
	Median water temperature (degrees F) delta		
Etowah River			
725	-0.9	-0.1	-0.9
694	0.0	0.0	-0.1
675	0.2	0.1	-0.8
650	-0.1	0.0	0.3
Oostanaula and Coosawattee rivers			
730	0.0	0.0	0.0
700	0.1	0.0	0.0
675	0.0	0.0	0.2
650	-0.1	0.0	0.0
Coosa River			
626	0.3	0.1	0.5
600	0.0	0.0	0.1
576	0.0	0.0	0.4
550	0.3	0.0	0.6
524	0.0	0.0	0.6
500	0.2	0.0	0.2
475	0.0	0.0	-0.2
451	0.3	0.0	-0.1
426	0.0	0.0	0.1
399	-0.1	-0.1	-0.2
375	0.1	0.0	-0.3
Tallapoosa River			
498	0.0	0.0	0.0
475	-0.3	0.0	-0.1
450	0.1	0.0	0.0
420	0.5	0.0	0.0
400	0.5	-0.1	0.5
375	0.2	-0.1	0.6
Alabama River			
350	-0.1	0.0	0.6
325	0.2	0.0	0.5
300	0.0	0.0	0.5
275	0.1	0.0	0.5
251	0.0	0.0	0.4
224	0.0	0.0	0.2
199	0.0	0.0	0.1
176	0.0	0.0	0.0
150	-0.1	0.0	0.0
125	-0.1	0.0	0.1

6.1.2.4.2 Oxygen Demand

The proposed operational changes in the Proposed Action Alternative would be expected to have variable results in the ACT Basin, Table 6.1-7. The greatest changes in median DO would be expected during dry-weather conditions. The timing and quantity of flow influence the system's ability to assimilate oxygen-demanding pollutants that results in changes in DO. The HEC-5Q modeling was used to predict how water quality would be expected to change under various water management activities. In this modeling effort, point and nonpoint source inputs to the model were held constant between model scenarios to distinguish the effects of water management activities. However, because the timing and quantity of flow influence a systems ability to assimilate nutrients the actual changes in DO would be expected to be much less than what is presented in Table 6.1-7. Both the point and nonpoint source loads would be expected to vary between wet- and dry-weather conditions. During low-flow conditions, some NPDES permits limit point source discharges, and permit conditions may be temporarily changed during extreme low-flow conditions, as occurred in 2007. As in past years of low-flow conditions, water users can coordinate directly with USACE to notify USACE of their needs. USACE will periodically notify users when releases are made during these low-flow conditions.

Table 6.1-7.
Median DO difference from No Action for the Proposed Action
(May through October)

River mile	Normal (2002)	Wet (2003)	Dry (2007)
	Median oxygen (mg/L) delta		
Etowah River			
725	-0.2	0.0	-0.1
694	0.0	0.0	0.0
675	0.0	0.0	0.0
650	0.0	0.0	0.0
Oostanaula and Coosawattee rivers			
730	0.1	0.0	0.1
700	0.0	0.0	0.0
675	-0.1	0.0	-0.1
650	0.0	0.0	0.0
Coosa River			
626	0.1	0.0	-0.1
600	0.0	0.0	0.2
576	0.1	0.1	0.5
550	0.0	0.0	0.0
524	0.0	0.0	-0.3
500	0.1	0.0	-0.4
475	0.0	0.0	0.0
451	0.0	0.0	0.4
426	0.0	0.0	0.1
399	0.0	0.0	0.0
375	0.0	0.0	-0.2
Tallapoosa River			
498	0.0	0.0	0.0
475	0.0	0.0	0.0
450	0.0	0.0	-0.1
420	0.0	0.0	0.0
400	0.1	0.0	0.1
375	0.0	0.0	0.0

Table 6.1-7. (continued)

River mile	Normal (2002)	Wet (2003)	Dry (2007)
	Median oxygen (mg/L) delta		
Alabama River			
350	0.0	0.0	0.0
325	-0.1	0.0	-0.5
300	0.0	0.0	-0.4
275	0.1	0.0	0.0
251	0.0	0.0	-0.1
224	0.0	0.0	-0.2
199	0.0	0.0	0.0
176	0.0	0.0	0.0
150	0.0	0.0	0.0
125	0.0	0.0	0.0

6.1.2.4.3 Phosphorus

The proposed operational changes in the Proposed Action Alternative would be expected to have a negligible effect on median total phosphorus over a period of various flow conditions (wet, dry, and normal) as presented in Table 6.1-8. As with other alternatives, during periods of dry weather, changes in median total phosphorus from the No Action Alternative would be expected. However, growing season average total phosphorus loadings to Weiss Lake predicted at the state line, and critical to the TMDL, remain at the same levels, or less than, the No Action Alternative levels.

Table 6.1-8.
Median total phosphorus difference from No Action for the Proposed Action (April through October[a] and April through November[b])

River mile	Normal (2002)	Wet (2003)	Dry (2007)
	Median total phosphorus (mg/L) delta		
Etowah River[a]			
725	0.004	0.001	0.007
694	0.001	0.000	0.003
675	0.003	0.000	0.009
650	0.002	0.000	0.008
Oostanaula and Coosawattee rivers[a]			
730	0.000	0.000	0.001
700	0.001	0.000	0.004
675	-0.001	0.000	0.003
650	0.001	0.000	0.005
Coosa River[b]			
626	0.002	0.000	0.005
600	0.000	0.000	-0.011
576	0.001	0.000	-0.007
550	0.001	0.001	-0.007
524	0.001	0.000	-0.013
500	0.000	0.000	-0.005
475	-0.001	0.000	0.003
451	0.002	0.000	-0.005
426	0.001	0.000	-0.003
399	0.000	-0.001	-0.001
375	0.000	0.000	0.000

Table 6.1-8. (continued)

River mile	Normal (2002)	Wet (2003)	Dry (2007)
	Median total phosphorus (mg/L) delta		
Tallapoosa River[D]			
498	0.000	0.000	0.000
475	-0.001	0.000	0.000
450	-0.001	0.000	0.000
420	0.000	0.000	0.001
400	0.001	0.000	0.001
375	-0.001	0.000	0.000
Alabama River[b]			
350	-0.001	0.000	-0.008
325	-0.002	0.000	-0.001
300	-0.001	0.000	-0.007
275	0.000	0.000	-0.007
251	0.000	0.001	-0.003
224	0.001	0.000	0.001
199	0.001	0.000	0.004
176	0.001	0.000	0.003
150	0.000	0.000	0.001
125	0.000	0.000	0.004

6.1.2.4.4 Nitrogen

The proposed operational changes in the Proposed Action Alternative would be similar to Plan D, Table 6.1-9. Nitrogen would be expected to have a negligible effect. In the Coosawattee and Oostanaula rivers (Figure 6.1-93), nitrogen increases downstream to the confluence with the Etowah River. Nitrogen in the Etowah River (Figure 6.1-94) shows little change from the No Action Alternative. Nitrogen on the Coosa River decreases upstream of Weiss Lake and then moves back in line with the No Action Alternative downstream of Weiss Lake (Figure 6.1-95). The decline in total nitrogen is likely the response of algal growth. During dry-weather conditions in a small percent of events during the growing season, increased concentrations would be expected downstream of Weiss Lake and in the H. Neely Henry Lake forebay (Figure 6.1-96). In the Tallapoosa River (Figure 6.1-97), increases could occur during the growing season downstream of Tallassee, Alabama, because of changes in operational releases from the No Action Alternative. Median annual nitrogen concentrations in the Alabama River show increases in the alternatives upstream of Miller's Ferry, while annual concentrations decrease in the alternatives downstream of Miller's Ferry.

Table 6.1-9.
Median total nitrogen difference from No Action for the Proposed Action (April through October[a] and April through November[b])

River mile	Normal (2002)	Wet (2003)	Dry (2007)
	Median total nitrogen (mg/L) delta		
Etowah River[a]			
725	0.00	0.00	0.00
694	0.00	0.00	-0.01
675	0.00	0.00	0.01
650	0.01	0.01	0.00
Oostanaula and Coosawattee rivers[a]			
730	0.00	0.00	0.00
700	0.00	0.00	0.02
675	0.01	0.00	0.03
650	0.00	0.00	0.03
Coosa River[b]			
626	0.02	0.00	-0.01
600	0.03	0.00	-0.16
576	0.00	0.00	-0.09
550	0.01	-0.01	-0.11
524	0.00	0.00	-0.10
500	0.01	-0.02	-0.03
475	0.00	-0.03	-0.02
451	0.00	-0.02	-0.02
426	0.00	-0.01	0.00
399	0.00	0.00	0.00
375	0.00	0.00	0.00
Tallapoosa River[b]			
498	0.00	0.00	0.01
475	0.00	0.00	0.00
450	0.00	0.00	0.01
420	0.00	0.00	0.00
400	0.01	0.00	0.00
375	0.01	0.00	0.03
Alabama River[b]			
350	0.00	0.00	0.01
325	0.01	0.01	0.04
300	0.01	0.00	0.03
275	0.00	0.00	0.02
251	0.00	0.00	0.01
224	0.00	0.00	0.00
199	0.00	0.00	0.00
176	0.01	0.00	-0.01
150	0.00	0.00	-0.01
125	0.00	0.00	0.01

6.1.2.4.5 Chlorophyll *a*

The operational changes in the Proposed Action Alternative would be expected to have a negligible effect on algal growth over a period of various flow conditions (wet, dry, and normal) in the ACT Basin, Table 6.1-10. As with other alternatives, during periods of dry weather, changes in median total phosphorus and increased retention times from the No Action Alternative would be expected to influence algal growth. In periods of dry weather, with low inflows, the Proposed Action Alternative would be expected to increase algal growth in Weiss Lake during certain periods. However, average growing

season chlorophyll *a* at four stations from 2000 - 2008 stayed the same or decreased from the No Action Alternative average growing season chlorophyll *a* for the same period (Table 6.1-11). For the most critical year (2007 - the year with highest predicted chlorophyll *a*), the growing season chlorophyll *a* typically decreased under the Proposed Action Alternative when compared to the No Action Alternative, with some exceptions such as in the Coosa River at Weiss Lake as mentioned previously .

Table 6.1-10.
Median chlorophyll *a* difference from No Action for the Proposed Action (April through October[a] and April through November[b])

River mile	Normal (2002)	Wet (2003)	Dry (2007)
	Median chlorophyll *a* (µg/L) delta		
Etowah River[a]			
725	0.0	0.0	0.0
694	0.1	-0.1	-0.2
675	-0.1	0.0	0.0
650	0.0	0.0	0.0
Oostanaula and Coosawattee rivers[a]			
730	0.1	0.0	0.1
700	-0.9	-0.4	-1.3
675	-0.6	0.0	-0.6
650	-0.6	0.0	-0.3
Coosa River[b]			
626	-0.2	-0.1	-0.1
600	-0.2	-0.1	10.2
576	0.3	-0.4	-3.3
550	0.1	0.7	-5.8
524	-2.0	0.6	-5.8
500	0.4	0.3	-6.5
475	-0.6	-0.3	-2.0
451	0.1	-0.2	-0.8
426	0.5	0.1	-0.5
399	-0.2	0.0	0.6
375	0.0	0.0	0.5
Tallapoosa River[b]			
498	0.2	0.0	0.1
475	0.0	0.0	-0.5
450	0.0	0.0	-0.4
420	0.1	0.0	0.1
400	-0.1	0.0	0.0
375	0.0	0.0	0.3
Alabama River[b]			
350	0.7	0.0	0.1
325	-0.1	0.1	0.3
300	0.1	0.1	-0.3
275	0.2	0.0	1.4
251	0.9	0.0	1.3
224	0.1	0.1	0.5
199	0.1	0.1	0.1
176	0.0	0.1	0.1
150	0.0	0.0	-0.2
125	-0.2	-0.1	-0.2

Table 6.1-11.
Growing season (April through October) average chlorophyll *a* in Weiss Lake

Year	No Action	Plan D	Plan F	Plan G
2000	26.5	28.2	28.2	28.3
2001	24.6	25.1	25.1	25.0
2002	21.5	22.0	22.0	22.0
2003	18.6	18.7	18.6	18.6
2004	23.5	23.2	23.1	23.2
2005	24.9	25.0	25.0	25.0
2006	22.7	22.4	22.4	22.2
2007	33.0	27.2	27.1	27.0
2008	25.1	25.1	25.0	24.9
Average	24.5	24.1	24.1	24.0

Note: Calculated from modeled out WEISS-DAM_486.

6.2 Geology and Soils

Effects on geology and soils that can be influenced by USACE water management activities are limited to sedimentation and erosion of the river and lake beds and shorelines. USACE has no control over the management of soils and underlying geology on land outside USACE jurisdiction; thus, sources of sediment related to agricultural practices, land development, and activities along tributaries are considered a background condition in which the management measures must function.

Prime and unique farmland resources within the ACT Basin would not be appreciably affected under the No Action Alternative or any of the other alternatives.

Sedimentation and erosion activity in river networks modified by locks and dams and hydropower facilities, such as the ACT projects, can be divided into two general types: (1) river bed shoaling and bank erosion, (2) and lake bed sedimentation and shoreline erosion. In general, riverine sedimentation and bank erosion processes are active only during floods. Studies of rivers throughout the world indicate that high flows, with recurrence intervals of about 1.5 years, are dominant in shaping the channel (Dunne and Leopold 1978). Flows of such magnitude are termed the *channel forming discharge*. As a general rule, the typical channel forming discharges can be thought of as the annual peak flood. Additionally, sediments eroded from landscapes during intense rainfalls, and eroded from stream and river banks during high-flow events are transported in the greatest quantities and distances during floods. The sediment becomes deposited as shoals where the rivers and tributaries enter the lakes.

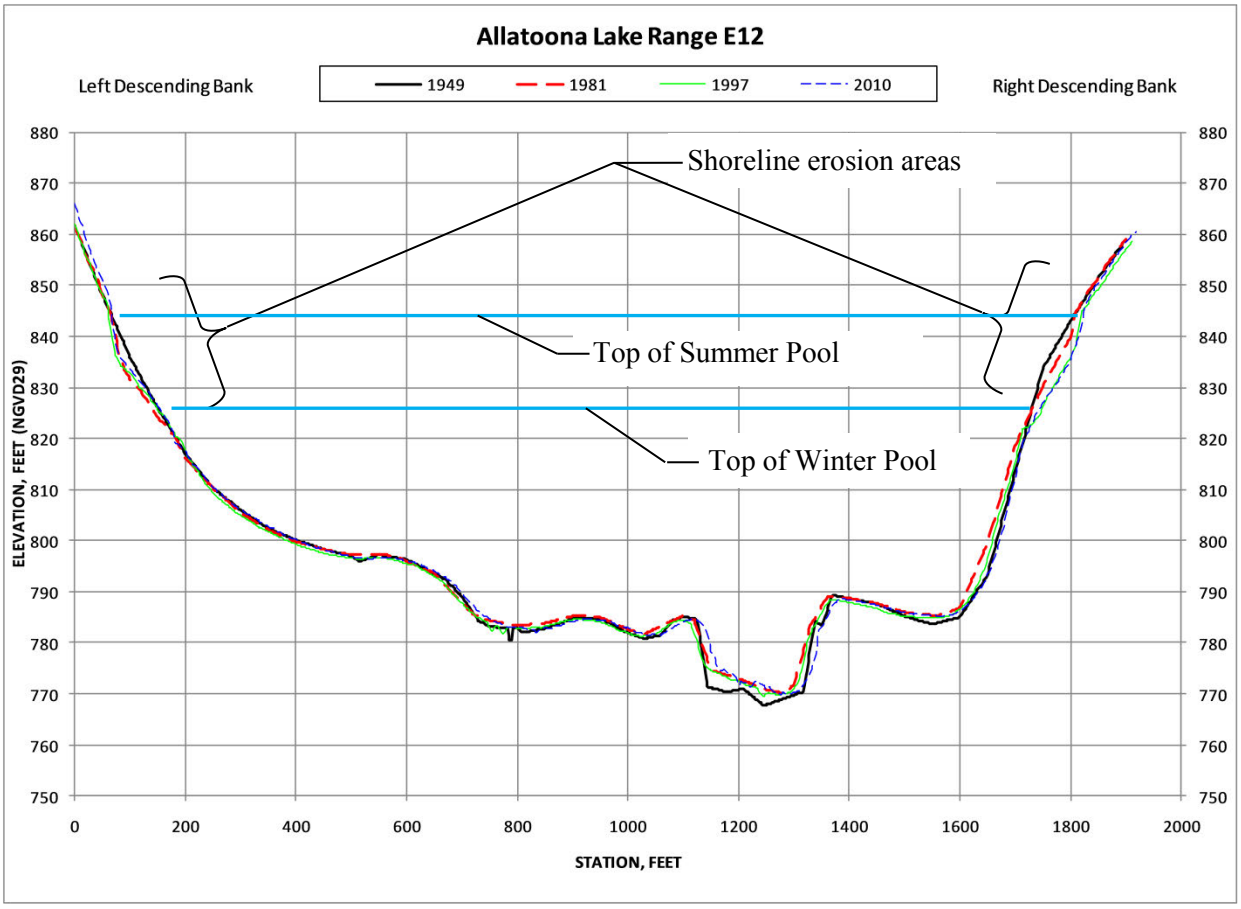
Important channel forming processes, related to the ACT, include tailwater degradation downstream of projects (Section 2.2.1.2.5), and bank erosion within the river portions above the project pools and downstream of Claiborne Lock and Dam. Similarly, lake sedimentation is dominated by flood events when the erosive forces throughout the watershed are most severe and the most sediment is delivered to the lakes and lower Alabama River.

In the ACT, the average annual floods at all locations of interest are far in excess of the typical annual low flows. Because many of the management measures pertain to low-flow conditions experienced during droughts, their potential effect on sedimentation and erosion, when compared to the No Action Alternative, would be considered negligible and unpredictable. Therefore the management measures for drought conditions, listed in Section 4.3.2.1, are not further discussed related to sedimentation and erosion for the No Action Alternative and Alternatives D, F, and the Proposed Action Alternative.

Lake shoreline erosion activity is not limited to times of high flows and can occur at all water levels and flow conditions. The shoreline erosion rate is a balance between the erosive forces versus the stabilizing forces: waves that are driven by wind and boat traffic versus density of shoreline vegetation and durability of shoreline soils. Thus, management measures within control of USACE that influence shoreline erosion include lake elevation and duration at any given elevation. Those management measures are discussed related to their respective alternatives.

6.2.1 No Action Alternative

Figure 6.2-1 shows a typical cross section of Allatoona Lake and the detail of the shoreline. The elevations bounding the winter and summer pools at 823 ft and 840 ft, respectively, show retreating shorelines on both right and left banks. In general, the shoreline erosion trends on Allatoona Lake indicate that the highest rates occurred during the first 30 years since impoundment and have slowed since. The change in rate is due to the winnowing of fine soil particles by wave action over the first several years since impoundment. Left behind are more robust gravel, cobble, and bedrock shorelines that have become more erosion resistant as time passed (Tetra Tech 2011).



Source: Tetra Tech 2011

Figure 6.2-1. Typical sedimentation range cross section.

Under the No Action Alternative, it is likely that Allatoona Lake shorelines would continue to erode at the present rate, and lake sedimentation would continue at the present rate.

Because of the topography and geology/soil conditions at Carters Lake, shoreline erosion and lake sedimentation is not considered to be an appreciable issue under the No Action Alternative. The FERC EA (FERC 2009) in support of the new license for the APC Coosa River reservoirs (June 2013) addresses specific measures the APC will take to address erosion "hot spots" associated with current operations in the basin.

6.2.2 Alternative Plan D

The management measures for Plan D include modifications to Alabama and Coosa rivers' minimum flows during drought conditions (Section 5.2). Plan D would have no quantifiable effect on shoreline erosion or lake sedimentation at Allatoona Lake, Carters Lake, or the APC reservoirs in the basin compared to the No Action Alternative and, thus, would not be a concern for geology and soils.

6.2.3 Alternative Plan F

The management measures for Plan F include modifications to Alabama and Coosa rivers' minimum flows during drought conditions and a phased guide curve at Allatoona Lake (Section 5.3).

That Alabama River and Coosa River minimum flow measure would not have an appreciable effect on shoreline erosion or lake sedimentation at Allatoona Lake, Carters Lake, or the APC reservoirs in the basin compared to the No Action Alternative. The phased guide curve at Allatoona Lake (Figure 4.3-2) would create a longer period, approximately 5 weeks longer than the current condition, where the pool is held at 835 ft. That creates a possibility of increased shoreline erosion at 835 ft and just above that elevation.

Changes in the magnitude of flood flows and corresponding channel forming influence of the flows in the Etowah and Coosa rivers downstream of Allatoona Lake would be considered negligible between the No Action Alternative and the phased guide curve. The specific predicted changes to flood flows are explained in detail in Appendix M of the HEC-ResSim Flood Study (USACE HEC 2011).

6.2.4 Alternative Plan G (Proposed Action Alternative)

The management measures for the Proposed Action Alternative include modifications to Alabama and Coosa rivers' minimum flows during drought conditions, a phased guide curve at Allatoona Lake, and a reduction to the hydropower generation at Allatoona Lake during the phased guide curve draw down (Section 5.4).

This Alabama River and Coosa River minimum flow measure would not have an appreciable effect on shoreline erosion or lake sedimentation at Allatoona Lake, Carters Lake, or the APC reservoirs in the basin compared to the No Action Alternative. The phased guide curve at Allatoona Lake (Figure 4.3-2) would create a longer period, approximately 5 weeks longer than the current condition, where the pool is held at 835 ft. That creates a possibility of increased shoreline erosion at 835 ft and just above that elevation. The reduction in hydropower production at Allatoona Dam from September through November during the phased draw down would have no quantifiable effect on shoreline erosion or lake sedimentation.

Similar to Plan F, changes in the magnitude of flood flows and corresponding channel forming influence of those flows in the Etowah and Coosa rivers downstream of Allatoona Lake would be considered negligible between the No Action Alternative and the phased guide curve. The specific predicted changes to flood flows are explained in detail in Appendix M of the HEC-ResSim Flood Study (USACE HEC 2011).

6.3 Climate Change

None of the alternatives outlined in this EIS would have any direct effects on the climate. There would be no GHG emissions associated with any alternative, nor would any alternative contribute to global warming, changes in climate, or affect the rates of sea level rise.

While project operations would not have direct effects on climate, climate change conditions could have a substantial impact on future project operations. As future conditions may change, USACE would continue periodic reviews of the WCM as needed to ensure that the best use is made of available water resources. At a minimum, the district will review the manual every 5 years to determine whether updates are needed (USACE 2010).

Although the dry-weather patterns that the Southeast has experienced in recent years are not outside the historical norm, the total available precipitation will likely decrease over the next 40 years. Changes in available precipitation are a result of changing precipitation and of changing potential evapotranspiration. For the ACT Basin, the total precipitation is expected to increase 0 to 2 in/yr before 2050. However, potential evapotranspiration is expected to increase greater than twice as fast as precipitation (4 to 5 in/yr). Projected change in available precipitation for 2050 compared to historical records (1934–2000) would range from a decrease of 43 percent to a gain of 29 percent across individual counties in the ACT Basin (Figure 6.3-1). The average available precipitation is expected to decrease 8.7 percent before the year 2050 for individual counties in the ACT Basin (Tetra Tech 2010).

As the total available precipitation decreases, the summer deficit will increase. The projected calendar year 2050 average summer deficits range from 15.9 to negative 4.4 inches for any county in the ACT Basin (Figure 6.3-2). The average projected 2050 summer deficit is 7.2 inches for individual counties in the ACT Basin. That constitutes a 36 percent increase in the summer deficit for counties in the basin when compared to historical conditions.

Based on comments received on the draft EIS, USACE performed additional HEC-ResSim and HEC-5Q simulations and analyses to evaluate the sensitivity of the Proposed Action Alternative (Plan G) to potential decreases in precipitation/basin inflow in the ACT Basin and increases in air temperature associated with climate change. These analyses are presented in Section 6.9.2 (for reduced basin inflow) and Section 6.9.3 (for temperature increases).

6.3.1 No Action Alternative

No GHG emissions would be associated with the No Action Alternative. The alternative would not have any direct impact on the climate, and would not contribute to global warming.

6.3.1.1 Future Precipitation and Water Management

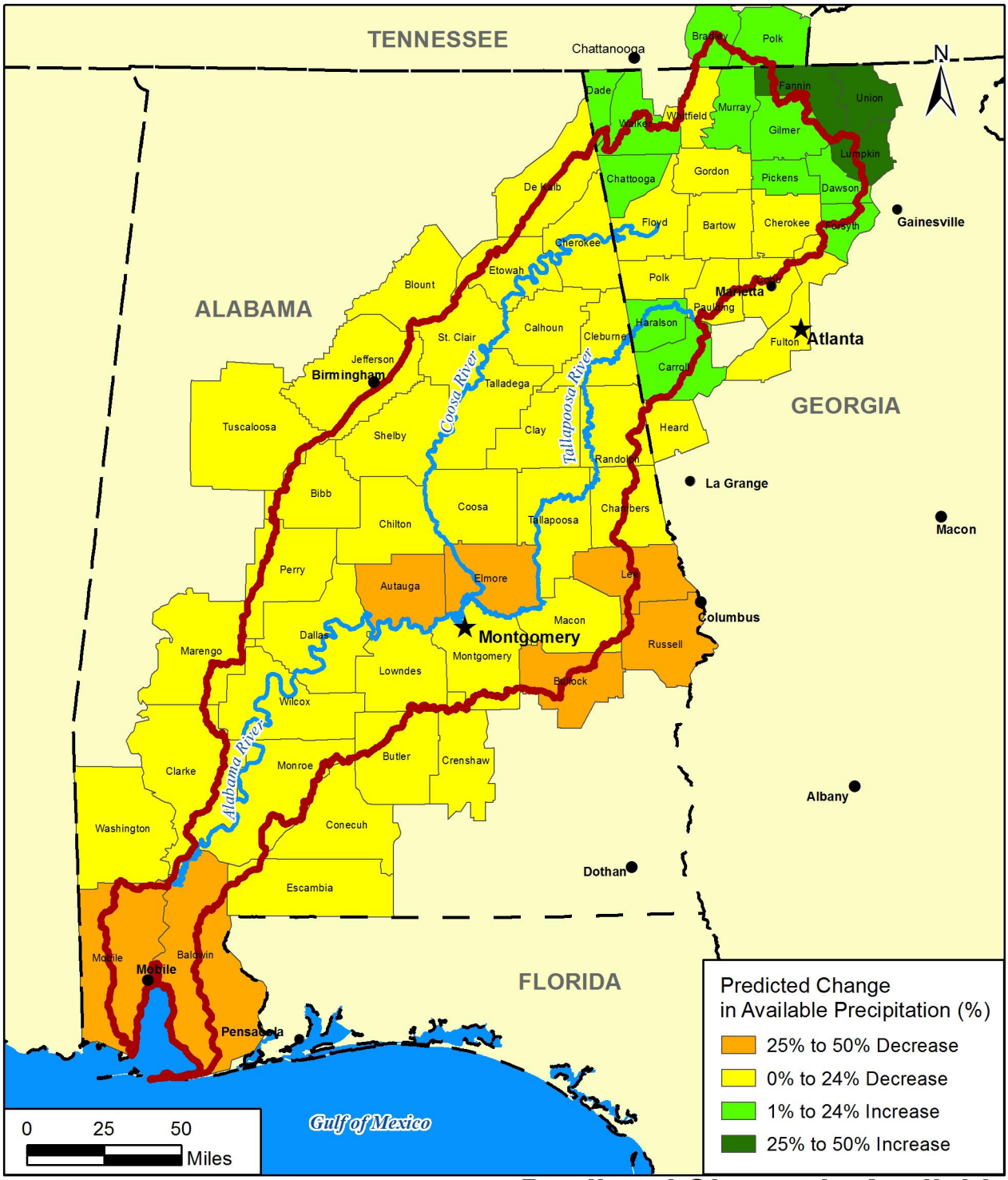
The No Action Alternative would not have any direct or indirect effects on the regional climate, and would not contribute to changes in precipitation.

6.3.1.2 GHG and Global Warming

The No Action Alternative would not generate any GHG, would not have any direct effect on the climate, and would not contribute to global warming.

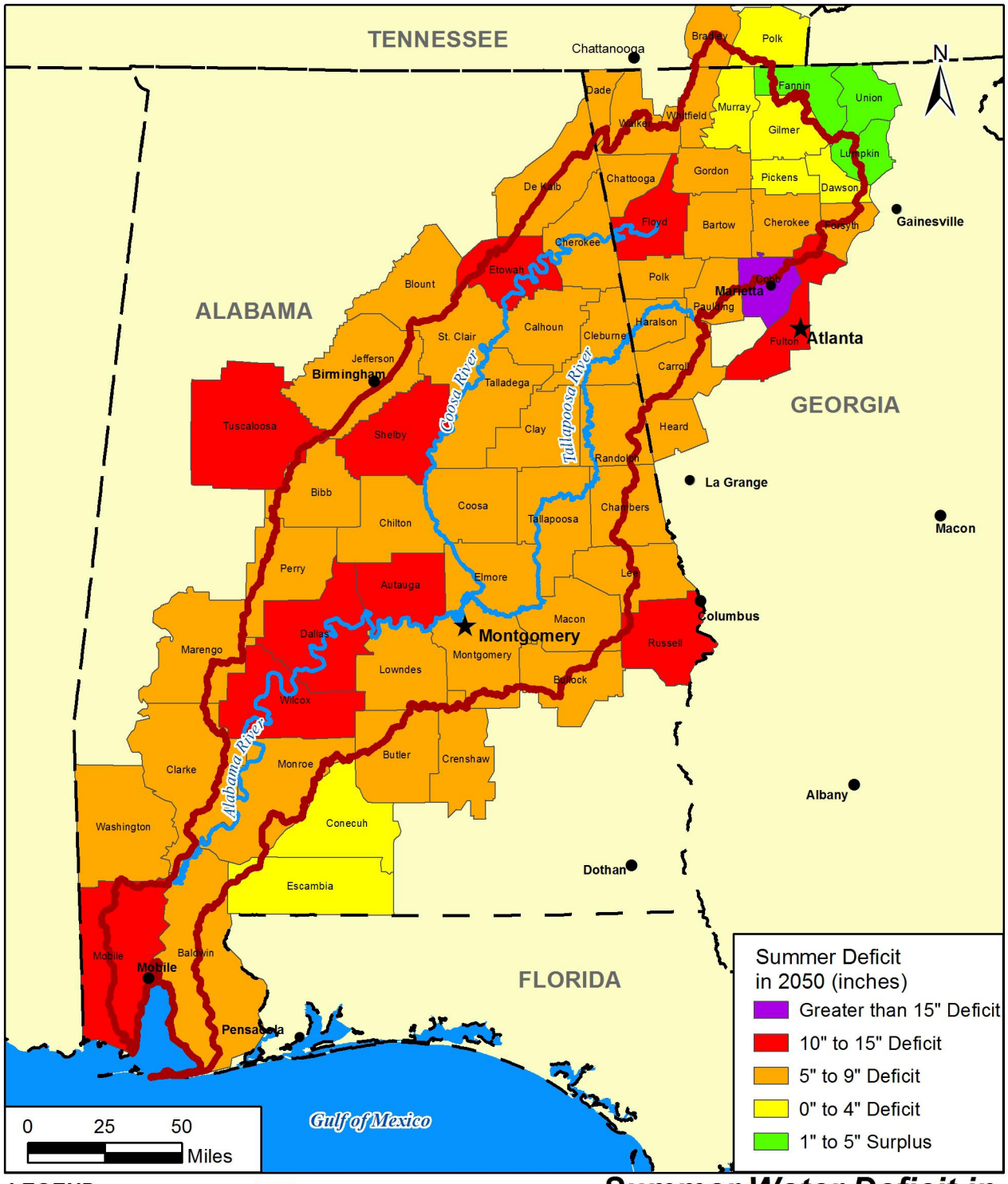
6.3.1.3 Sea Level Rise

The No Action Alternative would have no direct effect on the rate of sea level rise.



Predicted Change in Available Precipitation from CY2005 to CY2050 for Counties in the ACT Basin

Figure 6.3-1



Summer Water Deficit in 2050 for Counties in the ACT Basin (inches)

Figure 6.3-2

6.3.2 Alternative Plan D

There would be no GHG emissions associated with Plan D, and it would not have any direct effect on the climate, or contribute to global warming.

6.3.2.1 Future Precipitation and Water Management

Plan D would not have any direct effect on the regional climate, and would not contribute to changes in precipitation.

6.3.2.2 GHG and Global Warming

Plan D would not generate any GHG, would not have any direct effect on the climate, or contribute to global warming. As described in Section 6.6.3, Plan D would be expected to result in slight reductions in hydropower benefits compared to the No Action Alternative. Replacement sources of power are likely to involve negligible increases in GHG emissions.

6.3.2.3 Sea Level Rise

Plan D would not have any direct effect on the rate of sea level rise.

6.3.3 Alternative Plan F

No GHG emissions would be associated with Plan F, and it would not have any direct effect on the climate, or contribute to global warming.

6.3.3.1 Future Precipitation and Water Management

Plan F would not have any direct effect on the regional climate and would not contribute to changes in precipitation.

6.3.3.2 GHG and Global Warming

Plan F would not generate any GHG, would not have any direct effect on the climate, or contribute to global warming. The indirect effects would be essentially the same as described for Plan D.

6.3.3.3 Sea Level Rise

Plan F would not have any direct effect on the rate of sea level rise. The indirect effects would be essentially the same as described for Plan D.

6.3.4 Alternative Plan G (Proposed Action Alternative)

No GHG emissions would be associated with Plan G, and it would not have any direct effect on the climate or contribute to global warming.

6.3.4.1 Future Precipitation and Water Management

The Proposed Action Alternative would not have any direct effect on the regional climate, and would not contribute to changes in precipitation.

6.3.4.2 GHG and Global Warming

The Proposed Action Alternative would not generate any GHG, would not have any direct effect on the climate, or contribute to global warming. The indirect effects would be essentially the same as described for Plan D.

6.3.4.3 Sea Level Rise

The Proposed Action Alternative would not have any direct effect on the rate of sea level rise. The indirect effects would be essentially the same as described for Plan D.

6.4 Land Use

Adverse effects on land use are a result of land use change that would be incompatible with adjacent land uses. The degree to which the proposed action and alternatives conflict with established land uses in the area, disrupt or divide established land use configurations, represent a substantial change in existing land uses, or are inconsistent with adopted land use plans will determine the severity of adverse effects.

6.4.1 No Action Alternative

No effects would be expected. The No Action Alternative would see the continuation of the current water control operations at each of the federal projects in the ACT Basin; the action zones would be assumed to remain in effect unchanged. Therefore, effects on land use would be expected to be the same as in the past, with deviations in lake elevations caused by seasonal and yearly variations in flow and climatic conditions.

6.4.2 Alternative Plan D

6.4.2.1 Allatoona Lake

Long-term minor beneficial effects would be expected. Under Plan D, USACE would not modify the guide curve (summer pool elevation of 840 ft) but would modify the lake's action zones from two zones to four zones, with the four action zones shaped to mimic the seasonal demands for hydropower. The action zones would be used to manage the lake at the highest level possible for recreation and other purposes. Plan D establishes progressively more conservative water management practices (i.e., conserving reservoir storage) if the lake drops into lower action zones (with the top of Zone 1 being the top of the conservation pool and the surface pool elevation decreasing as it drops in to Zones 2, 3, and 4). The Plan D proposed action zones are shown in Figure 5.2-2. Those are elevation targets that would be maintained as closely as possible, depending on hydrologic and operational conditions at the time. Implementing Plan D would not change Allatoona Lake's shoreline land use allocations or zoning around the lake and, therefore, would not affect land use compatibility.

The amount of rainfall affects the surface water elevations and flow in the ACT Basin and can result in unusually wet or dry years, which has adverse effects on land use. USACE collected data on and modeled changes to flow and the lake's surface water elevation over a 73-year period and collected data on and modeled the lake's surface elevation during wet, dry, and normal conditions between 2000 and 2008. A dry year was experienced in 2007 (the worst recorded drought in the basin). On the basis of those conditions, Plan D modeling projections indicate during a very dry year (i.e., infrequent occurrences representative of drought conditions) the lake elevation could range from a low of about 818 ft during the winter to high of about 834 ft during the spring. Normal pool elevation is 840 ft. The lower lake elevations during a drought have minor to significant effects on land use. Changes in lake elevation would

not change the lake's shoreline land use allocations, they but would make the land use less desirable. Effects would range from minor, where the exposed shoreline and lower water levels would reduce the usability of the areas for their intended land use (such as public recreation and limited development for boat docks), to severe where the shoreline could not be used for its intended public recreation, limited development, or protected shoreline land use because of exposed shoreline and lake bed and impaired water access.

A wet year occurred at Allatoona Lake in 2003. On the basis of those conditions, modeling projections for Plan D indicate that during a wet year, the lake elevation could range from a low of about 823 ft in the winter to about 845 ft in the spring. One of Allatoona Lake's authorized project purposes is flood risk management, and it has operational guidelines during high flow periods to provide flood risk management benefits. The flood risk management capabilities and capacity of the reservoir would not be reduced under the Plan D. The project land was acquired to a contour elevation of 863 ft to provide an area necessary for flood risk management. Temporary minor adverse effects on land use could be expected during periods of high water, as shoreline land uses (e.g., picnic areas, boat ramps, hiking trails) could be inundated. If the lake elevation would fall to the projected lower levels (823 ft) during the winter months, significant adverse effects on land use would be expected, with the exposed shoreline and lower water level reducing or preventing the usability of the shoreline for its intended land use.

On the basis of the data collected, Allatoona Lake had a normal year in 2002. Modeling projections for Plan D indicate that under a normal year, lake levels could range from a low of about 822 ft in the winter to a high of 840 ft (the normal pool elevation) in the spring. If the lake elevation would fall to the lower boundaries (821 ft) during the winter, significant adverse effects on land use would be expected, with the exposed shoreline and lower water level reducing or preventing the usability of the shoreline for its intended land use, negatively affecting recreation and water access.

Allatoona Lake's normal pool elevation is 840 ft. The elevation of 837 ft marks the limit for what is called the *Initial Impact level*, below which minor adverse effects on shoreline land use would occur. The Initial Impact level is generally characterized by minimal effects on USACE boat ramps, minimal effects on private marina and dock owners, and marginal effects on designated public swimming areas. If the lake elevation falls to the Initial Impact level, it would not change the shoreline land use designation but would make the land use less desirable, resulting in minor adverse effects. The scenic appeal of protected shoreline land use would be affected by exposed shoreline and lake bed. Shoreline land use designated for public recreation, such as public boat docks, marinas, and swimming areas, as well as limited development areas with boat docks, would be adversely affected in a similar manner, with the exposed shoreline and lower water level reducing the usability of the areas for their intended shoreline land use. If Allatoona Lake's surface water elevation falls to 834.5 ft, it enters the *Recreation Impact level*. At the Recreation Impact level, major effects on shoreline land uses would begin to occur. The lower water level would further diminish or impair the shoreline for its intended land use of public recreation, limited development, or protected shoreline because of exposed shoreline and lake bed. If the lake elevation falls below 828 ft, it enters the *Water Access Limited level*, where Allatoona Lake's shoreline could not be used for its intended public recreation, limited development, or protected shoreline land use because of exposed shoreline and lake bed and impaired water access.

Plan D would refine operations at Allatoona Lake from two action zones to four action zones. The four action zones would be shaped to mimic the seasonal demands for hydropower (see Figure 5.2-2). Modifications to the hydropower schedule would be put in place to provide greater operational flexibility to meet power demands while conserving storage as variable climate conditions dictate. The proposed establishment of four action zones, reshaping the action zones on the basis of seasonal hydropower demand, and adjustments in the range of power generation hours per day at Allatoona Lake would provide for more effective management of conservation storage and would likely provide for an overall improvement in lake levels, particularly under drier conditions.

6.4.2.2 Carters Lake

No adverse effects on land use would be expected from implementing Plan D. Under Plan D, the proposed WCM measures would not modify the guide curve (normal pool elevation) of 1,074 ft in the summer and 1,072 ft in the winter, but they would include the use of two action zones. The action zones would be to manage downstream releases to improve conditions for fish and wildlife conservation. The Carters Lake proposed action zones are shown in Figure 4.2-8. Those elevation targets would be maintained as closely as possible, dependent on hydrologic and operational conditions at the time. Implementing Plan D would not change Carters Lake shoreline land use or zoning around the lake and, therefore, would not affect land use compatibility.

The amount of rainfall affects the surface water elevations and flow in the ACT Basin and can result in unusually wet or dry years, which has adverse effects on land use. As with Allatoona Lake, USACE collected data on and modeled changes to Carters Lake flow and surface water elevation over a 73-year period and collected data on and modeled the lake's surface elevation during wet, dry, and normal conditions between 2000 and 2008. A dry year was recorded in 2007 (the worst recorded drought in the basin). On the basis of those conditions, Plan D modeling projections indicate that during a very dry year (i.e., infrequent occurrences representative of drought conditions), the lake elevation could range from a low of about 1,057 ft to high of about 1,072 ft. Normal pool elevation is 1,072 ft in the winter, and lake elevations below this would have minor to significant effects on land use. Low lake elevations during a dry year would not change the lake's shoreline land use, but they would make the land use less desirable. Effects would range from minor, where the exposed shoreline and lower water levels would reduce the usability of the areas for their intended land use (such as public recreation), to severe where the shoreline could not be used because of exposed shoreline and lake bed and impaired water access.

A wet year was recorded in the ACT Basin in 2003. On the basis of those conditions, modeling projections for Plan D indicate during a wet year Carters Lake elevation could range from a low of about 1,072 ft in the winter to about 1,080 ft in the spring. Flood risk management is one of the Carters Lake authorized project purposes, and it has operational guidelines during high-flow periods to provide flood risk management benefits. The flood risk management capabilities and capacity of the reservoir would not be reduced under Plan D. The project land was acquired to a contour elevation of 1,099 ft to provide an area necessary for flood storage. Temporary minor adverse effects on land use could occur during periods of high water, as Carters Lake shoreline land uses (e.g., picnic areas, boat ramps, hiking trails) could be inundated.

A normal year was recorded in the ACT Basin in 2002. Modeling projections for Plan D indicate that under a normal year, Carters Lake elevation could range from a low of about 1,070 ft to a high of about 1,074 ft (the normal summer pool elevation). If the lake elevation would fall to the lower boundaries (1,070 ft), minor adverse effects on land use would be expected, with the exposed shoreline and lower water level reducing the usability of the shoreline for its intended land use because of exposed shoreline and lake bed.

The proposed Plan D WCM manual update would refine operations at Carters Lake from no action zones to two action zones. The action zones would provide a basis for implementing seasonal minimum flows from the reregulation dam to improve conditions for fish and wildlife conservation downstream when sufficient basin inflows occur on balance with meeting hydropower and other needs at the project (see Section 4.2.3). The proposed Plan D WCM management measures would not be likely to have an appreciable effect on land use around Carters Lake. The proposed operational changes would have a negligible effect on the frequency the lake elevation would fall to levels that would adversely affect land use by inhibiting water access and diminishing or impairing the shoreline's scenic appeal or use for public recreational uses such as public boat ramps, marinas, fishing, and swimming areas. Lake elevations would be expected to remain comparable to the No Action Alternative conditions.

6.4.2.3 Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake

No effects would be expected. The Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake is a run-of-river project. Lake levels are typically fairly stable with minimal fluctuation. Plan D would not change the operation of the Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake. It would continue to be operated as a run-of-river project with the lake's normal pool elevation maintained at about 125 ft; therefore, there would be no effect on land use. Some deviation in reservoir elevation would continue due to seasonal and yearly variations in flow and climatic conditions.

6.4.2.4 Millers Ferry Lock and Dam and William "Bill" Dannelly Lake

No effects would be expected. The Millers Ferry Lock and Dam and William "Bill" Dannelly Lake is a run-of-river project. Lake levels are typically fairly stable with minimal fluctuation. Plan D would not change the operation of the Millers Ferry Lock and Dam and William "Bill" Dannelly Lake. It would continue to be operated as a run-of-river project with lake's normal pool elevation maintained at about 80 ft; therefore, there would be no effect on land use. Some deviation in lake elevation would continue due to seasonal and yearly variations in flow and climatic conditions.

6.4.2.5 Claiborne Lock and Dam and Lake

No effects would be expected. Claiborne Lock and Dam and Lake is operated as a run-of-river project and remains mostly within the original river banks. Plan D would not change the operation of Claiborne Lock and Dam and Lake. It would continue to be operated as a run-of-river project with normal pool elevation maintained at about 36 ft; therefore, there would be no effect on land use. Minor deviation in the lake elevation would occur throughout the year, as there is now, due to seasonal and yearly variations in flow and climatic conditions. As a result of Plan D, no appreciable change in land use would be expected on the lower Alabama River downstream of Claiborne Lock and Dam where USACE maintains the federally authorized navigation channel between the lock and dam and the confluence of the Alabama River and Tombigbee River.

6.4.2.6 Non-USACE-Owned Projects

6.4.2.6.1 Weiss Lake

Long-term minor beneficial effects would be expected. The WCM management measures proposed under Plan D would not affect land use around Weiss Lake. APC would continue to operate the project with a normal summer pool elevation of about 564 ft, with some deviation due to seasonal and yearly variations in flow and climatic conditions. Plan D drought plan measures would likely provide for improved conditions in Weiss Lake and other downstream APC lakes and USACE projects that would be beneficial to land use during drought occurrences.

6.4.2.6.2 H. Neely Henry Lake

Long-term minor beneficial effects would be expected. The WCM management measures proposed under Plan D would not affect land use around the project. APC would continue to operate the project with a normal summer pool elevation of about 508 ft, with some deviation due to seasonal and yearly variations in flow and climatic conditions. APC also would continue to operate H. Neely Henry Lake under a revised guide curve variance. The purpose of the variance is to maintain higher water levels during the winter by increasing the winter pool level by 2 ft (from 505 to 507 ft). Plan D drought plan measures would likely provide for improved conditions in H. Neely Henry Lake and other downstream APC lakes and USACE projects that would be beneficial to land use during drought occurrences.

6.4.2.6.3 Logan Martin Dam

Long-term minor beneficial effects would be expected. The WCM management measures proposed under Plan D would not affect land use around Logan Martin Dam. APC would continue to operate the project with a normal summer pool elevation of about 465 ft, with some deviation due to seasonal and yearly variations in flow and climatic conditions. Plan D drought plan measures would likely provide for improved conditions in Logan Martin Dam and other downstream APC lakes and USACE projects that would be beneficial to land use during drought occurrences.

6.4.2.6.4 R.L. Harris Lake

Long-term minor beneficial effects would be expected. The WCM management measures proposed under Plan D would not affect land use around R.L. Harris Lake. APC would continue to operate the project with a normal summer pool elevation of about 793 ft, with some deviation due to seasonal and yearly variations in flow and climatic conditions. Plan D drought plan measures would likely provide for improved conditions in R.L. Harris Lake and other downstream APC lakes and USACE projects that would be beneficial to land use during drought occurrences.

6.4.3 Alternative Plan F

Plan F effects on land use would be similar to those stated above in Section 6.4.2. As with Plan D, proposed measures for Allatoona Lake operations would provide for more effective management of conservation storage and would likely provide for an overall improvement in lake levels, particularly under drier conditions. The Plan F proposal to implement a phased guide curve during the fall season would further benefit land use by extending the fall lake drawdown over a longer period, sustaining the lake at a higher level through mid-November, as compared to the No Action Alternative. Plan F proposed management measures would not be likely to have an appreciable effect on land use of Carters Lake, as the Carters Lake daily average elevation would be expected to be about the same as under the No Action Alternative. Plan F drought plan measures would likely provide for improved conditions in APC lakes and USACE projects downstream of Allatoona Lake and Carters Lake that would be beneficial to land use during drought occurrences.

6.4.4 Alternative Plan G (Proposed Action Alternative)

Under the Proposed Action Alternative, effects on land use would be similar to those stated above in Section 6.4.3. As with Alternative F, proposed measures for Allatoona Lake operations would provide for more effective management of conservation storage and would likely provide for an overall improvement in lake levels, particularly under drier conditions. The Proposed Action Alternative would implement a phased guide curve during the fall season, which would further benefit land use by extending the fall lake drawdown over a longer period, sustaining the lake at a higher level through mid-November, as compared to the No Action Alternative. The Proposed Action Alternative's additional measure to reduce hydropower production for September through November to facilitate implementing the fall phased drawdown would likely provide additional improvement to fall lake levels, as compared to the No Action Alternative. The Proposed Action Alternative management measures would not likely have an appreciable effect on land use of Carters Lake, as the Carters Lake daily average elevation would be expected to be about the same as under the No Action Alternative. The Proposed Action Alternative drought plan measures would likely provide for improved conditions in APC lakes and USACE projects downstream of Allatoona Lake and Carters Lake that would be beneficial to land use during drought occurrences.

6.5 Biological Resources

The following sections described the environmental consequences on the No Action Alternative and Plan D, Plan F, and Plan G (Proposed Action Alternative) on biological resources in the ACT Basin, including vegetation, wildlife, fish and aquatic resources, protected species, and fish and wildlife management facilities.

Throughout the entire ACT WCM update process, USACE has coordinated its activities closely with the U.S. Fish and Wildlife Service in accordance with the Fish and Wildlife Coordination Act and Endangered Species Act (ESA). Proposed operational modifications for ACT projects to benefit fish and wildlife resources were formally provided by USFWS to USACE as early as June 2003. USFWS input was obtained during the EIS scoping process for the ACT WCM update in October 2008. As agency and public input was considered and alternative water management plans were developed and evaluated, further USFWS input was requested during the process. The USFWS provided a Planning Aid Letter in May 2010, and subsequently a draft Fish and Wildlife Coordination Report (FWCAR) was submitted to USACE Mobile District in December 2012. All of these documents and USACE responses are included in Appendix B (Part 2) of the EIS. The final FWCAR was provided to USACE Mobile District by letter dated April 17, 2014. It contained only minor changes as described below and was substantively the same as the draft FWCAR. Therefore, USACE provided no direct response to the USFWS. The minor changes included USFWS comments and recommendations as summarized below.

USFWS recommended that the USACE study fish passage at other ACT locations, not just Claiborne and Millers Ferry projects. Fish passage operations are currently conducted at these two projects. Additional studies or implementation of fish passage operations were determined to be outside the scope of the WCM update.

The FWCAR stated that (1) impacts of the completed Hickory Log Creek reservoir should be considered in USACE modeling and (2) two proposed projects, Richland Creek Reservoir and Russell Creek Reservoir should be considered in the modeling if sufficient information was available in a timely manner. The Hickory Log Creek reservoir was incorporated into the ACT HEC-ResSim model following public coordination of the draft EIS, and the associated effects are reflected in the model results presented in the FEIS. Detailed plans for the other projects are still under development, sufficient information for modeling them with HEC-ResSim was not available. Consequently, the proposed Richland Creek and Russell Creek reservoir projects were not included in the ACT HEC-ResSim model.

The USFWS stated in the final FWCAR that opportunities may still exist to provide more natural flow conditions downstream of Allatoona Dam despite information previously provided by USACE outlining design and operational limitations to implementing a more natural flow regime. Within the context of previously provided information by USACE on these limitations, no new specific suggestions were offered by USFWS.

In the final FWCAR, USFWS stated that, based on model output provided by USACE, noticeable changes in dissolved oxygen may be expected to occur at discrete locations as a result of the proposed action (Plan G), with increased DO at some locations and decreased DO at others. According to the USFWS, these results should not be considered to balance each other out. While USACE agrees that actual DO decreases are not "balanced" by actual increases at other locations, the lack of difference throughout the basin with variable results at discrete locations demonstrates both model variability and lack of significant differences between the No Action Alternative and Plan G. Also, many of the DO decreases occur when the modeled DO levels are well above the standard.

USFWS also stated that providing flow upstream of the Weiss Bypass would help APC meet their flow release targets for the federally endangered interrupted rocksnail. All inflows into Weiss Lake are

available for release into the Weiss Bypass. APC, not the USACE, is responsible for release decisions regarding the Weiss Bypass consistent with their FERC license and associated ESA Section 7 compliance, The USFWS had already indicated in their separate ESA Section 7 correspondence (referenced below and discussed in Section 6.5.4) that Plan G for ACT WCM update was not likely to adversely affect threatened or endangered species. Nonetheless, when extreme drought conditions are encountered in the ACT Basin that will affect flow conditions throughout the system, USACE will coordinate closely with the APC, USFWS, and stakeholders throughout the basin to assure that authorized project purposes are balanced and listed species requirements are met.

Consultation activities with the USFWS in accordance with Section 7 of the ESA regarding potential effects on listed species in the ACT Basin that may be affected by the WCM update are discussed in Section 6.5.4, and all pertinent documentation is provided in Appendix B (Part 3) of the EIS.

6.5.1 Vegetation

6.5.1.1 Etowah River from Allatoona Lake to Rome

6.5.1.1.1 No Action Alternative

There would be no change in the degree of floodplain (lateral) connectivity under the No Action Alternative, and thus, no adverse effects on riparian, wetland, or submerged aquatic vegetation on the lake or downstream of the lake.

6.5.1.1.2 Alternative Plan D

Under Plan D, the median water surface elevation in Allatoona Lake would vary slightly from the No Action elevation at different times of the year (Figure 6.1-4). The elevation under Plan D would sometimes be higher and sometimes be lower than No Action, but never varies from the No Action elevation by more than two feet. Median daily flows in the Etowah River downstream of Allatoona Dam for Plan D would generally be expected to follow a similar pattern within a range of similar values as the No Action Alternative throughout the year. Exceptions would include lower median flows from mid-December through January and in the month of March and slightly higher flows in portions of September, October, and early December. The greatest difference under Plan D is when flows would decrease by about 800 cfs from the No Action flow for a portion of December (Figure 6.1-40). Median daily discharge during that period would range from about 1,100 to 1,500 cfs, which is similar to the unimpaired flow at that time of year. The Etowah River downstream of Allatoona Lake is generally deep and slow moving, and an occasional reduction of daily flows from the dam by up to 800 cfs would not be expected to adversely affect the riparian, wetland, or submerged aquatic vegetation in this portion of the ACT Basin.

6.5.1.1.3 Alternative Plan F

The modeled results for surface elevation in Allatoona Lake and average daily discharge in the Etowah River downstream of Allatoona Lake to Rome, Georgia, under Plan F would be similar to those for Plan D, with minor differences. Figure 6.1-4 shows that Plan F would produce a slightly higher lake surface elevation in November and December than Plan D and the No Action Alternative, with a maximum difference of about 5 ft. Plan F includes the four-action zone configuration and the phased fall drawdown guide curve for Allatoona Lake. As depicted in Figure 6.1-40, median daily flows downstream of Allatoona Dam for Plan F, with minor deviations, would likely follow the same seasonal pattern and similar values as Plan D from January through mid-August. Through the rest of the year, flows vary from the No Action alternative by up to 400 cfs. Under extreme low flow conditions, as reflected by the

90 percent exceedance flow levels (Figure 6.1-41), Plan F would perform similarly to Plan D. Daily flows under Plan F would likely be notably higher in portions of the months December and January and higher in portions of the months of February through May (in the typical range of 400 cfs). Otherwise, flow conditions from June through November at the 90 percent exceedance level would be essentially the same as the No Action Alternative. Given the nature of the Etowah River downstream of the dam, the anticipated changes in average daily discharge would not be expected to adversely affect riparian, wetland, or submerged aquatic vegetation in this portion of the basin.

6.5.1.1.4 Alternative Plan G (Proposed Action Alternative)

Median daily pool elevations in Allatoona Lake under Plan G are within one foot of the No Action alternative from January through mid-September, at which point the lake elevation under Plan G falls at a much slower rate than under the No Action alternative (Figure 6.1-4). By late November, Plan G median daily pool elevations would be about six ft higher than the No Action Alternative and five ft higher than Plans D and F. Plan G elevations match the fall phased drawdown guide curve from late November through December. Median daily flows downstream of Allatoona Dam for Plan G, with minor deviations, would likely follow the same seasonal pattern and similar values as Plan D from January through mid-August. Flows would be expected to be 100 to 500 cfs lower than the No Action Alternative and Plans D and F during the months of September through late November. From late November through December, flows would range higher than No Action and Plans D and F by about 200 to 400 cfs. Under extreme low flow conditions, as reflected by the 90 percent exceedance flow levels (Figure 6.1-41), Plan G would perform similarly to Plans D and F, except that daily flows under Plan G would likely be notably higher in portions of the months December and January. Otherwise, flow conditions from June through November at the 90 percent exceedance level would be essentially the same as the No Action Alternative. Given the current annual variation in lake level (greater than 17 feet), a seasonal change in lake elevation of six feet (within the existing range of lake elevations) will not adversely affect vegetation on and along the lake. Changes in flow in the Etowah River downstream of Allatoona Lake would not be enough to produce a change in the degree of floodplain (lateral) connectivity. Effects on riparian, wetland, and submerged aquatic vegetation would be expected to be negligible.

6.5.1.2 Coosawattee and Oostanaula Rivers from Carters Lake to Rome

6.5.1.2.1 No Action Alternative

There would be no change in the degree of floodplain (lateral) connectivity under the No Action Alternative, and thus, no adverse effects on riparian, wetland, or submerged aquatic vegetation would be expected.

6.5.1.2.2 Alternative Plan D

Plan D would produce essentially the same median daily surface elevation level in Carters Lake in most months of the year when compared to the No Action Alternative, with minor decreases by a few inches at various times from August through October (Figure 6.1-1). Downstream of Carters Lake, the median daily discharge to the Coosawattee River, and subsequently into the Oostanaula River, under Plan D would be nearly identical throughout the year to that of the No Action Alternative (Figure 6.1-35). At the 90 percent exceedance level, flows for Plan D would slightly exceed No Action during several months (July through October and December through April), principally because of the inclusion of seasonal minimum flow targets. No effects on riparian, wetland, or submerged aquatic vegetation at Carters Lake, the Carters reregulation pool, and downstream of the reregulation dam would be expected to result from changes in lake level and downstream releases attributable to Plan D.

6.5.1.2.3 Alternative Plan F

The effects of Plan F on surface elevation in Carters Lake and discharge to the Coosawattee River, and subsequently into the Oostanaula River, from the lake would be nearly identical to those discussed above for Plan D. No effects on vegetative resources would be expected to result from changes in lake level and downstream releases attributable to Plan F.

6.5.1.2.4 Alternative Plan G (Proposed Action Alternative)

The effects of Plan G on surface elevation in Carters Lake and discharge to the Coosawattee River, and subsequently into the Oostanaula River, from Carters Lake would be nearly identical to those discussed above for Plan D. No effects on vegetative resources would be expected to result from changes in lake level and downstream releases attributable to Plan G.

6.5.1.3 Coosa River

As stated in Section 6.1.1.2.3, the alternative WCM revisions considered in this EIS result in effects on water surface elevations in APC reservoirs on the Coosa River that include conservation storage (Weiss, H. Neely Henry, and Logan Martin lakes). Median daily water surface elevations at these reservoirs for Plans D, F, and G are sometimes higher or lower than for the No Action Plan, but never differ from the No Action Plan by more than two ft. The other APC projects on the Coosa River (Jordan Dam and Lake, Bouldin Dam, Lay Lake, and Mitchell Lake) essentially operate as run-of-river facilities, and the alternative WCM revisions would have a negligible effect on the water surface elevations of those reservoirs.

6.5.1.3.1 No Action Alternative

There would be no change in the degree of floodplain (lateral) connectivity under the No Action Alternative, and thus, no adverse effects on riparian, wetland, or submerged aquatic vegetation are expected in the APC reservoirs in the Coosa River or downstream of those reservoirs.

6.5.1.3.2 Alternative Plan D

Plan D would produce similar results in median daily discharge to the Coosa River at Rome, Georgia, as the No Action Alternative, with some variation occurring from October to December (Figure 6.1-45). The alternative would not appreciably alter the median daily water surface elevation in Weiss Lake (Figure 6.1-8). No effects on riparian, wetland, or submerged aquatic vegetation in the APC reservoirs in the Coosa River or downstream of those reservoirs would be expected from implementing Plan D.

6.5.1.3.3 Alternative Plan F

The effects of implementing Plan F on median daily discharge of the Coosa River at Rome, Georgia, and the median daily water surface elevation in Weiss Lake would be nearly identical to those of Plan D. The modeled results indicate a minor effect of implementing the alternative on river dynamics. No effects on the vegetative resources of the Coosa River would be expected from implementing Plan F.

6.5.1.3.4 Alternative Plan G (Proposed Action Alternative)

Plan G would result in minor decreases in median daily discharge of the Coosa River at Rome, Georgia, and the median daily water surface elevation in Weiss Lake compared to No Action, Plan D, and Plan F.

A minor effect on river dynamics could be produced by implementing Plan G, but no effects on the vegetative resources of the Coosa River would be expected.

6.5.1.4 Alabama River

6.5.1.4.1 No Action Alternative

There would be no change in the degree of floodplain (lateral) connectivity under the No Action Alternative, and thus, no adverse effects on riparian, wetland, or submerged aquatic vegetation would be expected in, or downstream of, the USACE reservoirs in the Alabama River.

6.5.1.4.2 Alternative Plan D

The modeled results for Plan D on median daily discharge in the Alabama River at Montgomery, Alabama, and downstream of Claiborne Lock and Dam are nearly identical to those of the No Action Alternative (Figure 6.1-51 and Figure 6.1-54). In October and November, the median daily flows under Plan D would be slightly lower than flows under the No Action Alternative. During most of the remainder of the year, flows would tend to be almost equal to or slightly higher than flows under the No Action Alternative. No effects on riparian, wetland, or submerged aquatic vegetation in, or downstream of, the USACE reservoirs in the Alabama River would be expected from implementing Plan D.

6.5.1.4.3 Alternative Plan F

The effects of implementing Plan F on the Alabama River would be virtually the same as those of implementing Plan D. The discussion in Section 6.5.1.4.2 applies equally to Plan F. No effects on the vegetative resources of the Alabama River would be expected from implementing Plan F.

6.5.1.4.4 Alternative Plan G (Proposed Action Alternative)

The effects of implementing Plan G on the Alabama River would be virtually the same as those of implementing Plan D. The discussion in Section 6.5.1.4.2 applies equally to Plan G. No effects on the vegetative resources of the Alabama River would be expected from implementing Plan G.

6.5.1.5 Tallapoosa River

As stated in Section 6.1.1.2.3, the alternative WCM revisions considered in this EIS result in effects on water surface elevations in APC reservoirs on the Tallapoosa River that include conservation storage (R.L. Harris Lake and Lake Martin). Median daily water surface elevations in R.L. Harris Lake over the modeled period of record would be essentially equivalent to the median daily elevations for the No Action Alternative and median daily water surface elevations at Lake Martin for Plans D, F, and G are sometimes lower than for the No Action Plan, but never differ from the No Action Plan by more than 0.5 ft. The other APC projects on the Tallapoosa River (Yates and Thurlow lakes) essentially operate as run-of-river facilities, and the alternative WCM revisions would have a negligible effect on the water surface elevations of those reservoirs.

6.5.1.5.1 No Action Alternative

There would be no change in the degree of floodplain (lateral) connectivity under the No Action Alternative, and thus, no adverse effects on riparian, wetland, or submerged aquatic vegetation are expected in, or downstream of, the APC reservoirs on the Tallapoosa River.

6.5.1.5.2 Alternative Plan D

Median daily water surface elevation in R.L. Harris Lake and in Lake Martin on the Tallapoosa River were modeled, and the modeling results indicate that under Plan D the median water surface elevation in the lakes would be essentially the same for Harris Lake in all months, the same at Lake Martin from November through June, and slightly lower (0.5 to one ft) from July through October. (Figure 6.1-23 and Figure 6.1-28). Surface elevation in other lakes on the Tallapoosa River would not be affected by the WCM revisions under Plan D. Median daily flows on the Tallapoosa River were not modeled, but it can be inferred from the negligible difference in water surface elevations on the reservoirs that changes in flows downstream of the reservoirs would also be negligible for Plan D. No effects on riparian, wetland, or submerged aquatic vegetation in, or downstream of, the APC reservoirs on the Tallapoosa River would be expected from implementing Plan D.

6.5.1.5.3 Alternative Plan F

The effects of implementing Plan F on the Tallapoosa River would be virtually the same as those of implementing Plan D. The discussion in Section 6.5.1.5.2 applies equally to Plan F. No effects on the vegetative resources of the Tallapoosa River would be expected from implementing Plan F.

6.5.1.5.4 Alternative Plan G (Proposed Action Alternative)

The effects of implementing Plan G on the Tallapoosa River would be virtually the same as those of implementing Plan D. The discussion in Section 6.5.1.5.2 applies equally to Plan G. No effects on the vegetative resources of the Tallapoosa River would be expected from implementing Plan G.

6.5.2 Wildlife

Wildlife, for the purposes of this report, refers to non-aquatic animals including birds, mammals, reptiles, amphibians, and insects. These animals use lakes and rivers to some extent, but are generally not as sensitive to flow and water quality as aquatic animals. The effects of implementing the No Action Alternative and Plans D, F, and G (the Proposed Action Alternative) on wildlife resources would be expected to be negligible. Because flows and lake levels would be minimally affected by the alternatives throughout the ACT Basin, as discussed above in Section 6.5.1, the primary mechanism by which wildlife resources could be affected by implementing the alternative WCM revisions is through an effect on water quality, discussed in Section 6.1.2. The analyses of effects on wildlife resources below, therefore, rely on the analysis of water quality, and adverse effects would not be expected from minor changes in water quality.

6.5.2.1 Etowah River from Allatoona Lake to Rome

6.5.2.1.1 No Action Alternative

There would be negligible change in water quality conditions under the No Action Alternative, and thus, any effects on wildlife resources in the Etowah River to Rome, Georgia reach are not expected to be adverse.

6.5.2.1.2 Alternative Plan D

The evaluations of water quality conducted for the EIS indicate that some changes in water quality parameters in the Etowah River could be expected under Plan D. Compared to conditions under the No Action Alternative, the highest water temperatures downstream of Allatoona Lake would be expected to

change little or decrease by up to 0.9 °F (0.5 °C) (Figure 6.1-65), and DO concentrations immediately downstream of the Lake would be expected to increase slightly during extreme dry-weather conditions. Further downstream, at around RM 680, the median DO concentrations are slightly lower in the alternatives compared to the No Action Alternative, but concentrations would be expected to meet or exceed water quality standards.

According to the modeled water temperature changes, implementing Plan D would not be expected to affect wildlife in the Etowah River to Rome, Georgia. Changes in phosphorus would be expected to have little to no effect on algal growth (Figure 6.1-86) and oxygen dynamics, and thus, on wildlife resources. Overall changes in water quality in the Etowah River under Plan D would be expected to have little effect on wildlife resources.

6.5.2.1.3 Alternative Plan F

The assessment of effects of implementing the alternatives on water quality shows very similar results across the proposed alternatives. The assessment of effects stated above for Plan D applies equally to Plan F, and thus, would be expected to have no adverse effect on wildlife resources.

6.5.2.1.4 Alternative Plan G (Proposed Action Alternative)

The assessment of effects of implementing the alternatives on water quality shows very similar results across the proposed alternatives. The assessment of effects above for Plan D apply equally to Plan G, and thus, would be expected to have no adverse effect on wildlife resources.

6.5.2.2 Coosawattee and Oostanaula Rivers from Carters Lake to Rome

6.5.2.2.1 No Action Alternative

There would be negligible change in water quality conditions under the No Action Alternative, and thus, no adverse effects on wildlife resources are expected in the Coosawattee and Oostanaula rivers from Carters Lake to Rome, Georgia.

6.5.2.2.2 Alternative Plan D

In periods critical to aquatic species—when water temperatures are greatest—modeling indicates little to no change in water temperature in the Coosawattee River (Figure 6.1-74). Directly downstream of Carters Lake, median water temperatures during the critical period would be expected to decrease slightly by around 0.3 °F (0.2 °C). Changes in water temperature in the Coosawattee and Oostanaula rivers would be expected to have no adverse effects on wildlife resources. The Coosawattee and Oostanaula rivers would be expected to have the greatest variation in DO from the No Action Alternative occur in a representative dry year in May through October. Changes in releases from Carters Lake under the drought plan decrease DO downstream of the dam to 6 mg/L in the lowest concentrations (5 percent occurrences). The lowest concentrations of DO downstream of Carters Lake would be expected to remain above concentrations critical to biological resources. DO recovers to concentrations near the No Action Alternative before Pine Chapel, 20 mi downstream (Figure 6.1-74).

6.5.2.2.3 Alternative Plan F

The assessment of effects of implementing the alternatives on water quality shows very similar results across the proposed alternatives. The assessment of effects stated above for Plan D applies equally to Plan

F, and thus, no adverse effects on wildlife resources would be expected in the Coosawattee and Oostanaula rivers from Carters Lake to Rome, Georgia.

6.5.2.2.4 Alternative Plan G (Proposed Action Alternative)

The assessment of effects of implementing the alternatives on water quality shows very similar results across the proposed alternatives. The assessment of effects stated above for Plan D applies equally to Plan G, and thus, no adverse effects on wildlife resources would be expected in the Coosawattee and Oostanaula rivers from Carters Lake to Rome, Georgia.

6.5.2.3 Coosa River

6.5.2.3.1 No Action Alternative

There would be negligible change in water quality conditions under the No Action Alternative, and thus, no adverse effects on wildlife resources are expected in the Coosa River.

6.5.2.3.2 Alternative Plan D

Wildlife resources under Plan D would not be expected to experience adverse effects from the changes in water quality described in Section 6.1.2. Median water quality conditions in Plan D are within standards for waterbodies designated for fish and wildlife. Little change in water temperature would be expected in most of the Coosa River, although near the confluence of the Alabama and Coosa rivers downstream of Jordan Dam and Lake, the median water temperatures were modeled to increase by more than 1.0 °F (0.6 °C) (Figure 6.1-69). Changes in DO are the greatest in a dry-weather year (Figure 6.1-75). In dry-weather periods, it would be expected that USACE would operate for drought management. In much of the Coosa River, median DO concentrations during dry-weather periods would be expected near conditions similar to the No Action Alternative. However, DO downstream of Weiss Dam and Neely Henry Dam would be expected to be reduced during the growing season in dry-weather years. Downstream of Weiss Lake, median DO would be expected to decrease by nearly 0.6 mg/L. Median DO decreases by nearly 0.6 mg/L immediately downstream of H. Neely Henry Dam. Median DO concentrations would be expected to remain above 4 mg/L even during the most critical growing season in dry-weather years. Standards for waterbodies designated for fish and wildlife indicate that DO concentrations between 4 to 5 mg/L under extreme conditions due to natural causes, like drought, would not be expected to affect wildlife. Immediately downstream of Mitchell Lake and Logan Martin Lake, the median DO concentrations would be expected to increase by as much as 0.7 mg/L in Plan D, Plan F, and the Proposed Action Alternative. Immediately downstream of Jordan Dam and Lake median DO decreases by nearly 0.2 mg/L. Changes in oxygen-demanding pollutants, like BOD, would be expected to change negligibly under Plan D from the No Action Alternative for most of the system. The greatest changes from the No Action Alternative in BOD would be expected in the Coosa River upstream of Weiss Lake. Nitrogen on the Coosa River decreases upstream of Weiss Lake and then moves back in line with the No Action Alternative downstream of Weiss Lake (Figure 6.1-95), most likely in response to algal growth.

6.5.2.3.3 Alternative Plan F

The proposed operational changes between Plan D and Plan F evaluated would be negligible in much of the ACT Basin. The difference between the alternatives evaluated is the greatest in the Coosa River during periods of dry weather, but they still would be expected to have no adverse effects on wildlife resources.

6.5.2.3.4 Alternative Plan G (Proposed Action Alternative)

The effects discussed under Plan D apply equally to Plan G. No adverse effects on wildlife resources would be expected under Plan G.

6.5.2.4 Alabama River

6.5.2.4.1 No Action Alternative

There would be negligible change in water quality conditions under the No Action Alternative, and thus, no adverse effects on wildlife resources are expected in the Alabama River.

6.5.2.4.2 Alternative Plan D

Little change in water temperature would be expected in the Alabama River (Figure 6.1-71). The Alabama River reservoirs have limited storage capacity and operate essentially as run-of-river projects. No adverse effects on wildlife resources under Plan D would be expected.

6.5.2.4.3 Alternative Plan F

The effects discussed under Plan D would apply equally to Plan F. No adverse effects would be expected on wildlife resources under Plan F.

6.5.2.4.4 Alternative Plan G (Proposed Action Alternative)

The effects discussed under Plan D apply equally to Plan G. No adverse effects would be expected on wildlife resources under Plan G.

6.5.2.5 Tallapoosa River

6.5.2.5.1 No Action Alternative

There would be negligible change in water quality conditions under the No Action Alternative, and thus, no adverse effects on wildlife resources are expected in the Tallapoosa River.

6.5.2.5.2 Alternative Plan D

Little change in water temperature would be expected in the Tallapoosa River under Plan D (Figure 6.1-70). Water temperatures would be expected to decrease downstream of Lake Martin. DO in the Tallapoosa River fluctuates slightly immediately downstream of dams from May through October in a representative dry-weather year (Figure 6.1-78). Those fluctuations would be expected to occur at conditions above water quality standards; 4 mg/L downstream of dams. Such changes would be expected to have no effect on wildlife resources in the Tallapoosa River.

6.5.2.5.3 Alternative Plan F

The effects discussed under Plan D apply equally to Plan F. No adverse effect would be expected on wildlife resources under Plan F.

6.5.2.5.4 Alternative Plan G (Proposed Action Alternative)

The effects discussed under Plan D apply equally to Plan G. No adverse effects would be expected on wildlife resources under Plan G.

6.5.3 Fish and Aquatic Resources

Fish and aquatic resources, for the purposes of this report, include fish, mussels, aquatic snails, and other animals that are heavily dependent on aquatic resources. These animals would, in general, be more sensitive to changes in flow, water quality, and lake levels, than other wildlife.

6.5.3.1 Rivers

This section summarizes the effects of alternative water management plans on biological resources in riverine portions of the ACT Basin. Results largely follow the summaries of HEC-ResSim model outputs presented in water quantity and water quality sections (Sections 6.1.1.3 and 6.1.2, respectively), which are based on simulations of project operations under the alternative plans over a 73-year period of record (1939–2011). Descriptions of the likely effects of the No Action Alternative and Alternative Plans D, F, and G on riverine biota are presented for the following locations in the basin: (1) Coosawattee River downstream of Carters Reregulation Dam; (2) Etowah River downstream of Allatoona Lake; (3) Coosa River at Rome, Georgia; (4) Alabama River at Montgomery, Alabama; and (5) Alabama River downstream of Claiborne Lock and Dam.

6.5.3.1.1 Coosawattee River downstream of Carters Reregulation Dam

The following subsections describe the effects of the No Action Alternative and Alternative Plans D, F, and G on stream flow and water quality conditions as they relate to biological resources in the Coosawattee River downstream of Carters Reregulation Dam. The No Action Alternative provides a requirement for a continuous minimum flow of 240 cfs downstream of Carters Reregulation Dam. The alternative plans include seasonally variable minimum flow targets consistent with recommendations made by the USFWS, as described in Section 4.2.3. Any fish and aquatic resources inhabiting this reach would be expected to experience no adverse effects.

6.5.3.1.1.1 No Action Alternative

The required minimum flow from the Carters Reregulation Dam for all months of the year under the No Action Alternative is 240 cfs. The No Action Alternative would always meet that minimum flow requirement. Compared to the seasonal minimum flow recommendations made by the USFWS beginning in 2003, the No Action Alternative would be expected to achieve those recommended monthly targets to varying degrees, ranging from 76 percent of the time during October to as much as 100 percent of the time during September.

Water quality conditions are expected to improve under the No Action Alternative as states adhere to defined regulations regarding wasteload allocation and managing NPDES facilities and nonpoint sources. As such, there would be no adverse effects on fish and aquatic resources.

6.5.3.1.1.2 Alternative Plan D

As described in Section 4.2.3, Plan D includes USFWS-recommended seasonal minimum flow targets ranging from 250 cfs to 865 cfs (see Table 6.1-1). HEC-ResSim model results indicate that adding the seasonally variable minimum flow targets in Plan D would not yield significant changes in the mean daily

flows over the period of record (see Section 6.1.1.3.1.2). However, notable improvements would be expected during low-flow events. Plan D would be expected to meet the USFWS-recommended monthly minimum flows targets at least 94 percent of the time during all months of the year and as high as 98 percent during six months of the year (October through March) (Table 6.1-1). Changes in releases from Carters Lake under the drought plan decrease DO downstream of the dam. DO recovers to concentrations near the No Action Alternative before Pine Chapel, 20 mi downstream (Figure 6.1-74). Changes with respect to temperature would be expected to be slight under Plan D, compared to the No Action Alternative.

Compared to the No Action Alternative, the effects of operational features on flow and water quality conditions under Plan D would be negligible and would be expected to have no adverse effect on fish and aquatic resources in the Coosawattee River downstream of Carters Reregulation Dam.

6.5.3.1.1.3 Alternative Plan F

The effects of operational features on flow and water quality conditions with Alternative Plan F would be similar to those of Plan D. Thus, compared to the No Action Alternative, the effects of operational features on flow and water quality conditions under Plan F would be negligible and not expected to exert adverse effects on fish and aquatic resources in the Coosawattee River downstream of Carters Reregulation Dam.

6.5.3.1.1.4 Alternative Plan G (Proposed Action Alternative)

The effects of operational features on flow and water quality conditions with Plan G would be similar to those of Plan D. Thus, compared to the No Action Alternative, the effects of operational features on flow and water quality conditions under Plan G would be negligible and not expected to adversely affect fish and aquatic resources in the Coosawattee River downstream of Carters Reregulation Dam.

6.5.3.1.2 Etowah River downstream of Allatoona Lake

The following subsections describe the effects of the No Action Alternative and Alternative Plans D, F, and G on stream flow and water quality conditions as they relate to biological resources in the Etowah River downstream of Allatoona Lake. Flow conditions are directly influenced by water management activities at Allatoona Lake. Under all alternatives, the Allatoona Lake project must meet the requirement to provide a continuous minimum release of 240 cfs (synonymous with a modeled minimum flow of 290 cfs, per the discussion in Section 6.1.1.3.2). There would be no adverse effects on fish and aquatic resources inhabiting the Etowah River downstream of Allatoona Lake.

6.5.3.1.2.1 No Action Alternative

HEC-ResSim modeling over the 73-year period of hydrologic record (1939–2011) indicates that median daily flows would likely range between 1,000 to 2,000 cfs through the year. The months of May through November exhibit a much more uniform range of median daily flows (from about 1,200 to 1,800 cfs,), indicating relatively consistent patterns of hydropower generation during those months. The highest median daily flows (about 2,000 cfs) over the modeled period of record would occur during the months of January, March, and mid-November through December. With the exception of the month of May and early December over the period of record, the 90 percent exceedance values for the No Action Alternative would be equal to the modeled minimum flow value downstream of Allatoona Dam, which is 290 cfs. In May, that value would be in the range of 700 to 800 cfs. In early December, that value would reach as high as 1,100 cfs. An evaluation of a flow duration curve suggests that modeled minimum flow would be at least 310 cfs at all times. The Etowah River flow duration curves in September and December, periods

in which key operational changes to Allatoona Lake are proposed, indicate that flows would be at the modeled minimum level of 290 cfs about 20 percent of the time in September (Figure 6.1-43) and 15 percent of the time in December (Figure 6.1-44).

Water quality conditions are expected to improve under the No Action Alternative as states adhere to defined regulations regarding wasteload allocation and managing NPDES facilities and nonpoint sources. Overall, there would be no adverse effects on fish and aquatic resources.

6.5.3.1.2.2 Alternative Plan D

Plan D proposes a revision to the number (from two to four) and shape of action zones in Allatoona Lake's operation, with an expected result of tempering full peaking hydropower releases during dry conditions to conserve storage.

Median daily flows in the Etowah River downstream of Allatoona Dam for Plan D would generally be expected to follow a similar pattern within a range of similar values as the No Action Alternative throughout the year (Figure 6.1-40). Compared to the No Action Alternative, flows at the 90 percent exceedance level for Plan D would be notably higher in portions of the months December and January and higher (in the typical range of 400 cfs) in portions of the months of February through May. Otherwise, flow conditions from June through November at the 90 percent exceedance level would be essentially the same as the No Action Alternative (Figure 6.1-41). On an annual basis, the flow-duration curve for Plan D for the Etowah River downstream of Allatoona Dam would generally align, with minor deviations, with the curve for the No Action Alternative (Figure 6.1-42). For Plan D, flows above 1,000 cfs over the period of record for September would be expected to occur four percent less often than the No Action Alternative, with no change in the percent of days where 290 cfs would be exceeded. December flows at or above the 1,000 and 290 cfs levels would increase by six and seven percent, respectively, above those for the No Action Alternative.

Compared to conditions under the No Action Alternative, the highest water temperatures downstream of Allatoona Lake would be expected to change little or decrease by up to 0.9 °F (0.5 °C) (Figure 6.1-65), and DO concentrations immediately downstream of the Lake would be expected to increase slightly during extreme dry-weather conditions (Figure 6.1-73); that would be expected to benefit aquatic life during critical periods. Further downstream, around RM 680, the median DO concentrations are slightly lower in the alternatives compared to the No Action Alternative, but this would not be expected to result in DO levels below the water quality standard.

The magnitude of the expected changes in both flow and water quality would be relatively minor and not cause adverse effects on fish or aquatic resources.

6.5.3.1.2.3 Alternative Plan F

Plan F incorporates the four action zone configuration and phased drawdown for Allatoona Lake presented in Plan D. Median daily flows downstream of Allatoona Dam for Plan F, with minor deviations, would likely follow the same seasonal pattern and similar values as Plan D from January through mid-August. Adding the phased fall drawdown feature coupled with the four-action zone configuration would result in daily flows in September ranging slightly higher than those for the No Action Alternative and Plan D, slightly lower overall in October and November, and higher in December by up to 400 cfs. Under extreme low flow conditions, as reflected by the 90 percent exceedance flow levels (Figure 6.1-41), Plan F would perform similarly to Plan D. Daily flows under Plan F would likely be notably higher in portions of the months December and January and higher in portions of the months of February through May (in the typical range of 400 cfs). Otherwise, flow conditions from June through November at the 90 percent

exceedance level would be essentially the same as the No Action Alternative. Additionally, no significant change in water temperature or DO would be expected.

With respect to the No Action Alternative, the effects of operational features on flow and water quality conditions under Plan F would not be expected to adversely affect fish and aquatic resources on the Etowah River downstream of Allatoona Lake.

6.5.3.1.2.4 Alternative Plan G (Proposed Action Alternative)

The proposed revision of the number (from two to four) and shape of the action zones under Plan G would be expected to temper full peaking hydropower releases during dry conditions to conserve storage. The phased guide curve and reduction of hydropower generation during the fall drawdown period would shift the timing of releases over an extended drawdown period between September and December. That would result in higher water levels in Allatoona Lake in September through December compared to the No Action Alternative. Median daily flows in the Etowah River under Plan G would be expected to be lower than the No Action Alternative and Plans D and F during the months of September through late November. The daily flows during this period may generally range from 100 to 500 cfs lower. From late November through December, flows would range higher than No Action and Plans D and F by about 200 to 400 cfs. Under extreme low flow conditions, as reflected by the 90 percent exceedance flow levels (Figure 6.1-41), Plan G would perform similarly to Plan D. Daily flows under Plan G would likely be notably higher in portions of the months of December and January and higher in portions of the months of February through May (in the typical range of 400 cfs). Otherwise, flow conditions from June through November at the 90 percent exceedance level would be essentially the same as the No Action Alternative.

Implementing the phased guide curve at Allatoona Lake and reduction of hydropower generation during fall drawdown would be expected to have little effect on downstream water temperature and DO concentrations (see Section 6.1.2.4).

With respect to the No Action Alternative, the effects of operational features on flow and water quality conditions under Plan G would not be expected to adversely affect fish and aquatic resources on the Etowah River downstream of Allatoona Lake.

6.5.3.1.3 Coosa River at Rome, Georgia

The following subsections describe the effects of the No Action Alternative and Alternative Plans D, F, and G on stream flow and water quality conditions as they relate to fish and aquatic resources in the Coosa River at Rome, Georgia. Flow conditions at that location are affected by water management activities at Carters Lake and Allatoona Lake. The proposed operational changes of Plans D, F, and G could change the quantity or timing of the downstream flow regime. Fish and aquatic resources inhabiting the Coosa River at Rome would experience only minimal adverse effects.

6.5.3.1.3.1 No Action Alternative

Median daily flows under the No Action Alternative in the Coosa River peak at about 10,300 cfs by the early April and decrease through late spring and summer to a minimum of approximately 2,000 cfs in September and October (Figure 6.1-45). The flow-duration curves for September and December were selected to help determine the effects of alternative water management measures for Carters Lake and Allatoona Lake (Figure 6.1-48 and Figure 6.1-50). September values coincide with the low-flow period for the Coosa River at Rome and the beginning of fall drawdown at Allatoona Lake. The median flow value for the month of September over the modeled over the period of record is about 2,460 cfs.

December presents higher flows, coinciding with the end of the drawdown period at Allatoona Lake. The median flow for the month of December is about 4,860 cfs.

Water quality conditions are expected to improve under the No Action Alternative as states adhere to defined regulations regarding wasteload allocation and managing NPDES facilities and nonpoint sources. Overall, there would be no adverse effects on fish and aquatic resources.

6.5.3.1.3.2 Alternative Plan D

Model outputs of Plan D over the 73-year period of record suggest that upstream changes in reservoir operations at Allatoona Lake and Carters Lake would not result in appreciable change in flows characteristics in the Coosa River at Rome compared to the No Action Alternative. Median daily flows and flow-duration curves would be nearly identical between the plans. Also, the percent of days during which flows in the Coosa River at Rome would likely exceed 7Q10 would be similar among the two plans, with both in the range of 90 percent or higher. The greatest change offered by Plan D would occur in August and September, when the percent of days exceeded would decline by two and three percent, respectively, compared to the No Action Alternative.

Water temperature and DO levels would not be expected to have an appreciable change under Plan D. Near the confluence of the Alabama and Coosa rivers immediately downstream of Jordan Dam and Lake the median water temperatures were modeled to increase by more than 1.0 °F (0.6 °C) (Figure 6.1-69). The high water temperatures in this reach, for the 5 percent occurrence, were modeled to decrease slightly, approximately 0.5 °F (0.3 °C). In the Coosa River, changes in DO are the greatest in a dry-weather year (Figure 6.1-75). In dry-weather periods, it would be expected that USACE would operate for drought management. In much of the Coosa River, median DO concentrations during dry-weather periods would be expected near conditions similar to the No Action Alternative. However, DO downstream of Weiss Dam and Neely Henry Dam would be expected to be reduced during the growing season in dry-weather years. Downstream of Weiss Lake, median DO would be expected to decrease by nearly 0.6 mg/L. Median DO decreases by nearly 0.6 mg/L immediately downstream of H. Neely Henry Dam. Immediately downstream of Mitchell Lake and Logan Martin Lake, the median DO concentrations would be expected to increase by as much as 0.7 mg/L in Plan D, Plan F, and the Proposed Action Alternative. Immediately downstream of Jordan Dam and Lake median DO decreases by nearly 0.2 mg/L.

With respect to the No Action Alternative, the effects of operational features on flow and water quality conditions under Plan D would not be expected to adversely affect fish or aquatic resources on the Coosa River at Rome.

6.5.3.1.3.3 Alternative Plan F

The effects of Plan F on flow characteristics in the Coosa River at Rome would be expected to be similar to those of Plan D. Average daily flows and flow-duration curves, both annual and for September and December, indicate few changes between the plans. Similarly, the percent of days over the modeled period of record that flows would exceed 7Q10 values would be about the same for Plan D and Plan F. Thus, with respect to the No Action Alternative, the effects of operational features on flow and water quality conditions under Plan F would not be expected to adversely affect fish or aquatic resources on the Coosa River at Rome.

6.5.3.1.3.4 Alternative Plan G (Proposed Action Alternative)

Over the modeled period of record, the percent of days that Plan G and the No Action Alternative would likely exceed 7Q10 values is in the range of 87 percent or higher (Table 6.1-2). From January through

July, values between the plans would be about the same. During August to November, Plan G reduces the number of days the Coosa River flows at Rome would exceed 7Q10 values from two to five percent below the No Action Alternative. In December, Plan G would likely increase the number days the 7Q10 values would be exceeded by three percent over the No Action Alternative. Thus, the operational changes of Plan G, particularly the reduction in hydropower generation at Allatoona Lake during fall drawdown, would be expected to shift releases from September through December. However, the model suggests those changes would not significantly affect flow characteristics in the Coosa River at Rome compared to the No Action Alternative.

With respect to the No Action Alternative, the effects of operational features on flow and water quality conditions under Plan G would not be expected to adversely affect fish or aquatic resources on the Coosa River at Rome.

6.5.3.1.4 Alabama River at Montgomery, Alabama

The following subsections describe the effects of the No Action Alternative and Alternative Plans D, F, and G on stream flow and water quality conditions as they relate to fish and aquatic resources in the Alabama River at Montgomery, Alabama. Flow conditions at that location are mainly controlled by water management activities at APC projects upstream on the Coosa and Tallapoosa rivers and are minimally affected by projects in the upper portion of the basin (e.g., Carters Lake and Allatoona Lake). A minimum release target of 4,640 cfs (weekly average) from APC's JBT projects, just upstream of the confluence of the Coosa and Tallapoosa rivers to form the Alabama River, was established to meet downstream navigation objectives as well as provide waste assimilation, hydropower generation, and other downstream benefits. The minimum release target is also an important component of the drought management plan (see Section 6.1.1.3.4). Fish and aquatic resources inhabiting the Alabama River at Montgomery would experience no adverse effects.

6.5.3.1.4.1 No Action Alternative

Median daily flows over the 73-year modeled period of record indicate peak flows slightly above 39,000 cfs by the end of March, followed by a rapid decline to 10,000 cfs by the end of June, and a minimum level of about 7,500 cfs in early September (Figure 6.1-51). In the fall, average flows gradually increase to about 24,000 cfs by the end of December. Flow levels would be expected to range from a modelled maximum flow of about 221,000 cfs to a modelled minimum flow of about 2,140 cfs (Figure 6.1-53). Under the No Action Alternative, the JBT minimum flow target would be met 99 percent of the time.

Water quality conditions are expected to improve under the No Action Alternative as states adhere to defined regulations regarding wasteload allocation and managing NPDES facilities and nonpoint sources. Therefore, there would be no adverse effects on fish and aquatic resources.

6.5.3.1.4.2 Alternative Plan D

Implementing Plan D would result in adjustments designed to meet navigational needs when sufficient flows are available and would provide progressively more stringent drought management plans under dry conditions. Those objectives would be at least partially met by Plan D with little change on overall flow characteristics of the Alabama River at Montgomery. Under the alternative, the minimum flow target would be expected to be met 96 percent of the time.

Little change in water temperature would be expected for the modeled period on the Alabama River as seen in Figure 6.1-71. The Alabama River does not have reservoirs with storage but, instead, is dominated

by reservoirs with run-of-river operations. However, in the Alabama River upstream of Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake, in dry weather conditions, similar to 2007, median water temperatures would be expected to increase by 3 °F (1.7 °C) (Figure 6.1-72). As previously described, the range of water temperatures predicted by the model, as a change between various alternatives and the No Action Alternative along this reach would not be expected to be as great under observed conditions. APC operates Jordan Dam and Lake to ensure minimum flows (2,000 cfs) for protected species, as explained in the modeling report (Appendix C, HEC-ResSim Modeling Report). Increasing median water temperature during low-flow periods by 3 °F (1.7 °C) might be expected to affect allowable discharges along the reach and aquatic species. Existing permits for discharges could be restricted during conditions similar to what occurred in 2007. As in past years of low-flow conditions, water users can coordinate directly with USACE to notify USACE of their needs. USACE will periodically notify users when releases are made during these low-flow conditions.

With respect to the No Action Alternative, the effects of operational features on flow and water quality conditions under Plan D would not be expected to adversely affect fish and aquatic resources on the Alabama River at Montgomery.

6.5.3.1.4.3 Alternative Plan F

With respect to the No Action Alternative, the effects of operational features on flow and water quality conditions under Plan F would be similar to those of Plan D and not expected to adversely affect fish and aquatic resources on the Alabama River at Montgomery.

6.5.3.1.4.4 Alternative Plan G (Proposed Action Alternative)

With respect to the No Action Alternative, the effects of operational features on flow and water quality conditions under Plan G would be similar to those of Plan D and not expected to adversely affect fish or aquatic resources on the Alabama River at Montgomery.

6.5.3.1.5 Alabama River downstream of Claiborne Lock and Dam and Lake

The following subsections describe the effects of the No Action Alternative and Alternative Plans D, F, and G on stream flow and water quality conditions as they relate to biological resources in the Alabama River downstream of Claiborne Lock and Dam and Lake. A minimum flow target of 6,600 cfs, representing the 7Q10 flow at that location, is designated for waste assimilation purposes. That flow also collaterally supports navigational uses, but the minimum flow alone is not sufficient to maintain a viable navigation channel in the lower Alabama River downstream of Claiborne Lock and Dam, with or without maintenance dredging in that reach. Fish and aquatic resources inhabiting the Alabama River at Claiborne Lock and Dam and Lake, as well as downstream of the lock and dam, would experience no adverse effects.

6.5.3.1.5.1 No Action Alternative

Median daily flows in the Alabama River downstream of Claiborne Lock and Dam and Lake over the 73-year modeled period of record are presented in Figure 6.1-54. Peak flows occur at just below 66,000 cfs by early April and rapidly decline, falling to a minimum of about 9,000 cfs by mid-September. The ability of Robert F. Henry Lock and Dam and Millers Ferry Lock and Dam to reregulate flows is limited and, thus, do not exert an effect on flows downstream of Claiborne Lock and Dam and Lake. Flows levels would be expected to range from a modelled maximum flow of 268,000 cfs to a modelled minimum flow of about 4,000 cfs (Figure 6.1-56). Under the No Action Alternative, the 6,600 cfs minimum flow target would be met about 97 percent of the time over the period of record.

Water quality conditions are expected to improve under the No Action Alternative as states adhere to defined regulations regarding wasteload allocation and managing NPDES facilities and nonpoint sources. Overall, no adverse effects would be expected on fish and aquatic resources.

6.5.3.1.5.2 Alternative Plan D

Implementing Plan D would result in adjustments designed to meet navigational needs when sufficient flows are available and would provide progressively more stringent drought management plans under dry conditions. Those objectives would be at least partially met by Plan D with little change to overall flow characteristics downstream of Claiborne Lock and Dam and Lake. Under Plan D, the minimum flow target would be expected to be met 95 percent of the time.

Water temperatures and DO concentrations would have a negligible difference from No Action Alternative values downstream of Claiborne Lock and Dam and Lake.

With respect to the No Action Alternative, the effects of operational features on flow and water quality conditions under Plan D would not be expected to adversely affect fish and aquatic resources on the Alabama River at Claiborne Lock and Dam and Lake and on the lower Alabama River downstream of the lock and dam.

6.5.3.1.5.3 Alternative Plan F

With respect to the No Action Alternative, the effects of operational features on flow and water quality conditions with Plan F would be similar to those of Plan D and not expected to adversely affect fish and aquatic resources on the Alabama River at Claiborne Lock and Dam and Lake and on the lower Alabama River downstream of the lock and dam.

6.5.3.1.5.4 Alternative Plan G (Proposed Action Alternative)

With respect to the No Action Alternative, the effects of operational features on flow and water quality conditions under Plan G would be similar to those of Plan D and would not be expected to adversely affect fish and aquatic resources on the Alabama River at Claiborne Lock and Dam and Lake and on the lower Alabama River downstream of the lock and dam.

6.5.3.2 Reservoirs

This section describes the general effects on reservoir fisheries and other aquatic resources associated with operational changes to reservoir management in the ACT Basin. As reviewed in Section 6.1.1., the proposed changes would most notably affect lake levels in the upper portion of the basin, particularly at Allatoona Lake. Thus, a detailed assessment of modeled surface water elevation data at Allatoona Lake was conducted. The assessment uses a performance measure developed by USFWS and is based on work products of the Comprehensive Study (USACE, Mobile District 1998a) to characterize the potential effect of the alternative water management scenarios on habitat suitability of select recreationally important species. The lack of any substantive change in habitat in response to the operational alternatives at Allatoona Lake confirms the exclusion of further analyses of downstream reservoirs, where modeled water quantity and water quality data suggest that changes would be minimal (see Sections 6.1.1 and 6.1.2).

Operational flow changes affect habitat for reservoir fisheries and other aquatic resources mainly through changes in water levels, changes in reservoir flushing rates (retention times), and associated changes in water quality parameters, such as primary productivity, nutrient loading, DO concentrations, and vertical stratification. Seasonal water level fluctuations can substantially influence littoral (shallow-water)

habitats, decreasing woody debris deposition, restricting access to backwaters and wetlands, and limiting seed banks and stable water levels necessary for native aquatic vegetation (Miranda 2008).Those limitations, in turn, significantly influence the reproductive success of resident fish populations. High water levels inundating shoreline vegetation during spawning periods frequently have been associated with enhanced reproductive success and strong year class development for largemouth bass, spotted bass, bluegill, crappie, and other littoral species (Ploskey and Reinert 1995; Ryder et al. 1995). Conversely, low or declining water levels can adversely affect reproductive success by reducing the area of available littoral spawning and rearing habitats.

In a study of 11 Alabama reservoirs, which included 6 reservoirs in the ACT Basin, Maceina and Stimpert (1998) found consistent relations between the production of strong crappie year classes and wet winters before crappie spawning. Wet winters resulted in shorter retention time (i.e., higher flushing rates) in reservoirs with stable water levels, and higher water levels in fluctuating reservoirs. High winter inflows might favor crappie production by increasing nutrient loading, which in turn stimulates primary and secondary production later in the growing season (Maceina and Stimpert 1998; Ploskey and Reinert 1995). In reservoirs with stable water levels and low retention, longer post-winter retention also was associated with greater crappie production, possibly related to reduced flushing of young-of-year fish in the discharge from the impoundment and more stable feeding conditions (Maceina and Stimpert 1998).

Fish passage is provided at Claiborne Lock and Dam and Millers Ferry Lock and Dam through the manipulation of lock schedules during February through May to benefit migratory fish (see Section 2.5.3.2.1). Monitoring the effectiveness of those operations and determining the species using the locks is part of an ongoing collaborative study between The Nature Conservancy, Auburn University, ADCNR, USFWS, and others. The continued operation of the locks for the purposes of providing passage is anticipated to remain unchanged and, thus, will not be affected under the No Action or Proposed Action Alternatives.

6.5.3.2.1 Allatoona Lake

Performance measures developed by USFWS during the Comprehensive Study were used in the evaluation of surface water elevations at Allatoona Lake. The performance measures assess reservoir fisheries habitat on the basis of the premise that greater departure of reservoir levels from optimum levels for critical guilds of fishes (e.g., littoral spawning, rearing) results in greater effects on their habitats. The performance measure uses modeled output of daily reservoir elevations over the 73-year period of record and *acceptability levels* of reservoir elevations (i.e., suitability criteria) for critical guilds as identified for each reservoir by regional fisheries experts in an iterative questionnaire survey developed by Ryder et al. (1995). The performance measure also incorporates day-to-day reservoir level stability over critical spawning and rearing periods as a weighting factor, with stable or rising levels having a positive effect and falling levels having a negative effect on fish habitat. Performance measure scores were computed for each year in the period of record at Allatoona Lake. Scores range between 0 for least acceptable and 1.0 for most acceptable reservoir level habitat conditions (USACE, Mobile District 1998a). A graphical example for Allatoona Lake is given in Figure 6.5-1.

Median performance measure values (50^{th} percentile) of all modeled alternatives in Allatoona Lake were low (0.24 to 0.26), indicating a lack of suitable fisheries habitat (Table 6.5-1). However, the range of values over the period of record shows little change among the operational alternatives. The subtle differences in performance measures can be attributed to operational changes of the fall drawdown and are most notable between the No Action and Proposed Action Alternatives (Plan G) during the rearing and summer habitat critical periods. Acceptability levels track closely during the spawning period (Figure 6.5-2). Values remain below 0.5 until the latter half of April, reaching suitable levels for spawning of recreationally important species, such as largemouth bass, spotted bass, and crappie. Rearing

habitat values for both alternatives decrease steadily throughout the critical period of June 1 to November 1, dropping below 0.5 in late July, with Plan G exhibiting a greater decline and falling below the No Action Alternative in response to drawdown levels during late September and October, and both alternatives falling to 0 by late October (Figure 6.5-3). Acceptability level scores of summer habitat follow a similar trajectory, falling below 0.2 for both alternatives by late August (Figure 6.5-4).

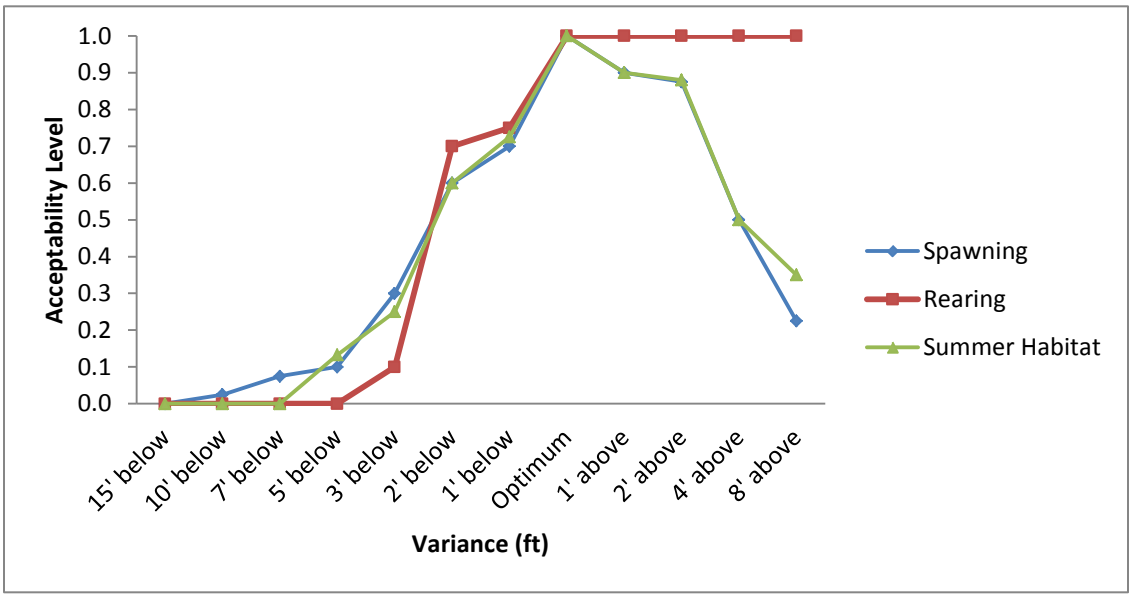


Figure 6.5-1. Example of acceptability scores for varying surface water elevations at Allatoona Lake.

Table 6.5-1.
Range of annual performance measure values of fisheries habitat (at Allatoona Lake over the modeled period (1939–2011)

	No Action Alternative	Alternative Plan D	Alternative Plan F	Alternative Plan G (Proposed Action Alternative)
10th Percentile	0.11	0.09	0.09	0.09
25th Percentile	0.18	0.16	0.16	0.16
50th Percentile	0.26	0.24	0.24	0.24
75th Percentile	0.31	0.30	0.29	0.30
90th Percentile	0.38	0.37	0.37	0.38
Minimum	0.00	0.01	0.01	0.01
Maximum	0.54	0.56	0.49	0.51

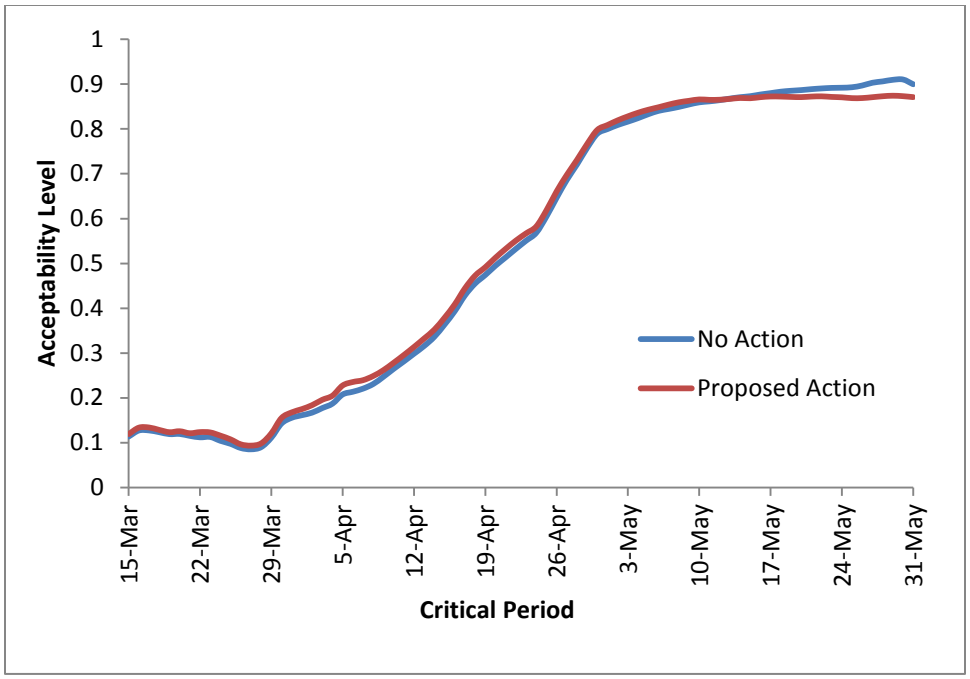


Figure 6.5-2. Mean daily spawning habitat acceptability level values of the No Action Alternative and the Proposed Action (Plan G) at Allatoona Lake over the modeled period (1939–2011).

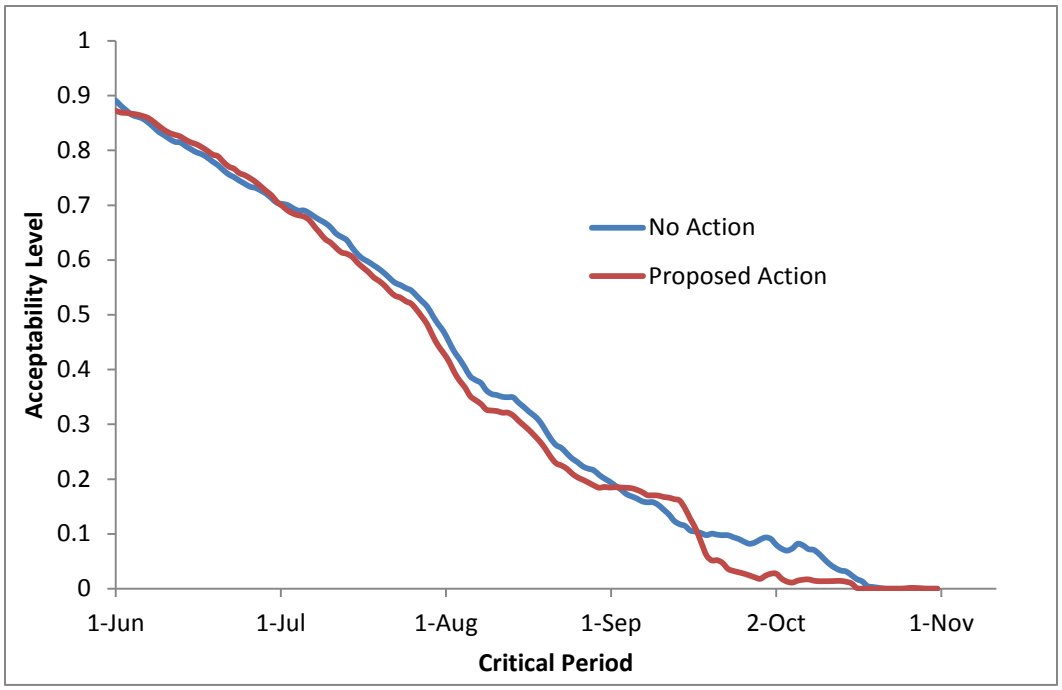


Figure 6.5-3. Mean daily rearing habitat acceptability level values of the No Action Alternative and the Proposed Action (Plan G) at Allatoona Lake over the modeled period (1939–2011).

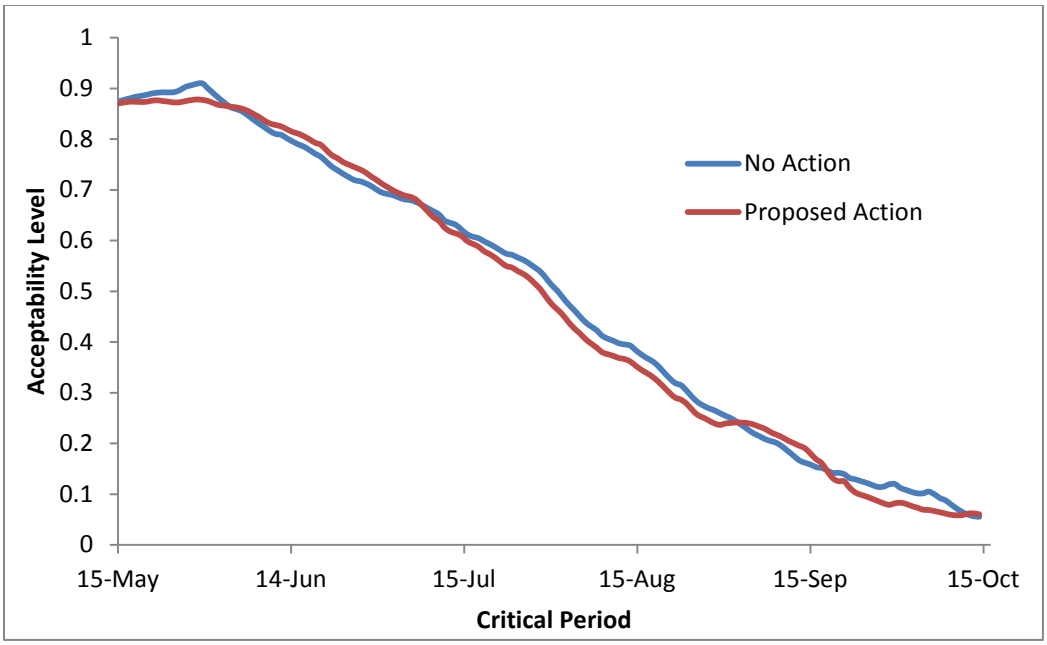


Figure 6.5-4. Mean daily summer habitat acceptability level values of the No Action Alternative and the Proposed Action (Plan G) at Allatoona Lake over the modeled period (1939–2011).

6.5.3.2.1.1 No Action Alternative

The No Action Alternative would maintain marginally higher performance measure values than Plans D, F, and G (Proposed Action Alternative). Differences would be attributable to proposed operational changes during the fall drawdown period and is most noticeable in rearing habitat acceptability level values in September and October. Overall, the differences are negligible compared to the overall range of mean daily acceptability level values that are observed over the course of these critical periods. The differences would not result in any appreciable change in fish habitat among alternatives. Because operational changes would be most significant at Allatoona Lake, the lack of any notable change in fish habitat is applicable to other facilities in the ACT Basin, where the influence of the proposed modifications would be dampened. No adverse effects on fish or aquatic resources are expected.

6.5.3.2.1.2 Alternative Plan D

On the basis of modeled water surface elevations over the 73-year period of record, implementing Plan D would offer no significant change to fish habitat over the No Action Alternative. Operational changes would be most pronounced at Allatoona Lake. Thus, the lack of any notable change in fish habitat is applicable to other facilities in the ACT Basin, where the influence of the proposed modifications would be dampened. No adverse effects on fish or aquatic resources would be expected.

6.5.3.2.1.3 Alternative Plan F

Plan F effects would be the same as those stated above in Section 6.5.3.2.1.2 for Plan D. No adverse effects on fish or aquatic resources would be expected.

6.5.3.2.1.4 Alternative Plan G (Proposed Action Alternative)

Effects would be the same as those stated above in Section 6.5.3.2.1.2 for Alternative Plan D. No adverse effects on fish or aquatic resources would be expected.

6.5.3.3 Estuaries

Estuaries exist at the junction between freshwater and salt water, and their function is integrally linked to freshwater inputs. Principal consequences of managing freshwater flow to estuaries are related to the magnitude and timing of flows (Mann and Lazier 1991). Freshwater flows are important in maintaining the delivery of material and energy critical to estuarine productivity and in providing habitat conditions conducive to maintaining the diversity and abundance of the estuarine community.

Oyster fisheries can be threatened by both drought and flood, and there is evidence of beneficial and detrimental effects of each (Livingston 1991; Wilber 1992; Livingston et al. 2000; Turner 2006; Wang et al. 2008; Buzan et al. 2009). Flow management can exacerbate those conditions, although it is also possible that it decreases flood magnitudes (through peak suppression and decreased drought severity through required releases) thereby mitigating some of the effects. However, flow management operations could result in more frequent and longer-duration periods of low flow if flows are retained upstream for required uses, forcing downstream management of a lower flow scenario than would be natural. Extended periods of low flow increase estuarine salinity. Some authors suggest that increased salinities threaten oyster fisheries (e.g., Livingston et al. 2000), whereas others indicate the opposite might be true (e.g., Turner 2006). More explicit hydrodynamic models of oyster population processes indicate more dramatic effects on oyster growth at lower salinities (higher flow) than under increased salinities, where growth rates are stable (Wang et al. 2008). Salinity and, therefore, freshwater discharge are important to oyster production. Many other factors, however, also affect oyster production. Little evidence suggests that the proposed operational changes, as opposed to drought or those other factors, would have a detrimental effect on oyster productivity in Mobile Bay.

In general, flow alteration in the watershed could potentially affect the estuary, including commercial fisheries. The following paragraphs below assess the impacts of current water management activities in the ACT Basin as well as proposed modifications under the WCM update process. For all alternatives evaluated in detail, the hydrodynamic changes within Mobile Bay and contiguous estuarine areas are expected to be minimal or non-detectable, and impacts on estuarine fish and wildlife resources should be minor and inconsequential. The ACT Basin contributes roughly 50 percent of the total flow to the Mobile River/Bay, and the balance is contributed by uncontrolled inflow from the Black Warrior-Tombigbee Basin. Additionally, modeling of the water management alternatives indicates that differences in the flow regime at the most downstream points in the ACT Basin (e.g., Claiborne Lock and Dam) compared to current conditions would be negligible.

Consultation with the ALDCNR and appropriate federal resource agencies (USFWS and NMFS) under the Fish and Wildlife Coordination Act, Magnuson-Stevens Fishery Conservation and Management Act, and other pertinent laws affecting estuarine living resources have been completed in conjunction with the public review of the draft EIS and the subsequent development of the final EIS for the proposed WCM update.

6.5.3.3.1 No Action Alternative

As reviewed in section 6.1.1.3.5.1, flows modeled over the 73-year period of record in the Alabama River downstream of Claiborne Lock and Dam and Lake peak at just below 66,000 cfs at the end of March, declining to a minimum of approximately 9,000 cfs by mid-September. Under the No Action Alternative,

the established 6,600 cfs minimum flow target downstream of Claiborne Lock and Dam would be met 97 percent of the time over the period of record.

Water quality conditions (presented in Section 6.1.2.1) are expected to improve under the No Action Alternative as states adhere to defined regulations regarding wasteload allocation and managing NPDES facilities and nonpoint sources. There would be no adverse effects on fish or aquatic resources under the No Action Alternative.

6.5.3.3.2 Alternative Plan D

Changes in flow characteristics and water quality as far downstream as the Mobile Bay estuary would be expected to be minimal or non-detectable under Plan D (see Sections 6.1.1.3.5.2 and 6.1.2.2). Both flow magnitude and timing would be expected to be similar for wet, dry, and normal years. Thus, with respect to the No Action Alternative, the flow management operations for flow and water quality conditions under Plan D would not be expected to affect fish or aquatic resources in Mobile Bay.

6.5.3.3.3 Alternative Plan F

With respect to the No Action Alternative, the flow management operations for flow and water quality conditions under Plan F would be similar to those of Plan D and would not be expected to affect fish or aquatic resources in Mobile Bay.

6.5.3.3.4 Alternative Plan G (Proposed Action Alternative)

With respect to the No Action Alternative, the flow management operations for flow and water quality conditions under Plan G would be similar to those of Plan D and would not be expected to affect fish or aquatic resources in Mobile Bay.

6.5.4 Protected Species

Reservoir operations can influence two types of direct or indirect actions that could affect the habitats of federally and state protected species listed in Table 2.5-11:

- Alteration of flow regimes in reservoirs and downstream of dams
- Water quality degradation

The USACE is responsible for determining the project-specific effects on protected species, because the effects depend largely on where and how the actions occur. The USACE is further responsible for pursuing consultation with the USFWS in accordance with Section 7 of the ESA regarding any expected effects on these species.

The USACE prepared a Biological Assessment (BA) pursuant to the informal consultation procedures of Section 7 of the ESA for the Proposed Action Alternative (Plan G). The BA was prepared in accordance with the criteria for analysis as defined in the ESA Section 7 Consultation Handbook (USFWS and NMFS 1998). The environmental baseline for the analysis in the BA considered the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem, within the project area. The baseline included anticipated effects of all proposed federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of state or private actions which were contemporaneous with the consultation in process (USFWS and NMFS 1998). The flow regime used for the environmental baseline for the BA was described using post-1983 flow records, because this period represented the complete hydrology of the current configuration of the federal and non-federal reservoir projects in the ACT Basin

that influence the river flows in the action area. The simulation for the Proposed Action Alternative (Plan G) with HEC-ResSim and HEC-5Q was performed using "actual withdrawals" which are represented by actual water use reported throughout the basin in 2006, except that the withdrawals from USACE reservoirs were limited for purposes of modeling to the amount of storage available according to the USACE storage accounting methodology. Since consumptive demands in locations other than federal reservoirs are not controlled by the USACE and vary over time, the highest observed consumptive demands (year 2006) were imposed as a conservative estimate of potential M&I demands.

Per the Section 7 Consultation Handbook guidance, the modeled period of record (1983 – 2011) and other assumptions defined the environmental baseline as the basis for analysis of effects of Plan G on protected species. This environmental baseline condition differs somewhat from the hydrologic condition (73-year period of record [1939-2011]) which defines the basis for simulation of the No Action Alternative and Plan D, Plan F, and Plan G for the overall NEPA analysis. Nonetheless, the modeled flow and water quality conditions resulting from the simulations with the Section 7 environmental baseline and with the full hydrologic period of record are not likely to be dramatically different. In the following sections, discussions about the effects of Plan G on protected species are based upon the analysis in the BA. Discussions of the potential effects of Plan D and Plan F are qualitative and based upon the determination (from HEC ResSim and HEC-5Q model outputs) that these plans generally would change flow and water quality conditions throughout the ACT Basin less than the Proposed Action Alternative (Plan G) when compared to the No Action Alternative.

The BA was provided to the U.S. Fish and Wildlife Service (USFWS) on February 18, 2014. The assessment found that several of the species listed in Table 2.5-11 are present in areas outside the range of aquatic habitats potentially affected by flow regime or water quality changes (i.e., nearby upland areas). Accordingly, Plan G would not be expected to affect these species, including: Mitchell's satyr butterfly; red cockaded woodpecker; Alabama beach mouse; Kemp's ridley sea turtle; eastern indigo snake; black pine snake; Price's potato bean; Alabama leather flower; whorled sunflower; Mohr's Barbara's buttons; white fringeless orchid; Michaux's sumac; and Georgia aster. For the remaining federally listed species in the ACT Basin in Table 2.5-11 that could potentially be affected by Plan G, the BA concluded that Plan G may affect, but would not likely adversely affect, those species. The BA also concluded that the Plan G would not have a cumulative effect on listed species, and for some species the Plan G could represent a minor improvement.

During informal consultation with USFWS, USACE made minor amendments to the BA, including a proposal to conduct characterization and assessment of stream conditions and habitat features for the amber darter and mussels in the Coosawattee River below the Carters Reregulation Dam. The habitat assessment will provide additional data to support the conclusions of the BA. On March 20, 2014, USFWS concurred with the USACE BA, as amended. The complete BA, as amended, and the USFWS concurrence letter are included in Appendix B (Part 3).

6.5.4.1 Alteration of Flow Regimes in Reservoirs and Downstream of Dams

Little information is available on the linkages between flow regime characteristics and the life histories of protected species occurring in the basin. While this is beyond the scope of the current effort, it might be possible to quantify optimal flow regimes for some of or all the riverine-dependent species, or even minimum flow regimes that would ensure each species' survival and persistence in the basin. Such an effort would show that some species do best in wet years and others do best in dry years. However, overall biological diversity and ecosystem function benefit from inter-annual variations in species success (Tilman et al. 1994). Previous efforts at riverine ecosystem restoration have demonstrated that it is not possible to simultaneously optimize conditions for all species (Sparks 1992, 1995; Toth 1995). Therefore, the best strategy for protecting the ecology and biodiversity of the basin, including its protected species, is

to maintain or restore to some extent the natural patterns of variability of flow regimes throughout the basin.

6.5.4.2 Water Quality Degradation

Riverine communities generally require clean water with sufficiently high dissolved oxygen concentration and appropriate temperatures. Although water quality has improved in the ACT Basin since the 1970s because of controls on point source pollutant discharges under the CWA, water quality problems related largely to nonpoint source sedimentation and other contaminants continue in many river reaches. Biological conditions in the ACT Basin are most severely degraded in the urbanized reaches of the basin (Frick et al. 1998). Water quality degradation is a frequently cited concern for the riverine-dependent species included in the *Comprehensive Study's Protected Species Report* (Ziewitz et al. 1997). It is quite likely that water quality is a limiting factor for several of the species, including many of the 16 federally listed mussels listed in Table 2.5-11. Any actions that could alter water quality must address effects on the protected species.

6.5.4.3 Coosawattee River downstream of Carters Reregulation Dam

The following subsections describe the effects of the No Action Alternative and Alternative Plans D, F, and G on protected species in the Coosawattee River downstream of Carters Reregulation Dam. Modeled stream flow and water quality conditions for the environmental baseline, as described in Section 6.5.4, were compared to modeled outputs for the Proposed Action Alternative (Plan G) over the same period of record. These results were used to evaluate the expected effects on federally listed species and designated critical habitat units within the subbasin.

This segment of the ACT Basin is inhabited by several federally listed species of freshwater mussels, fish and a single snail species (see Section 2.5.4). Critical habitat has been designated for mussels, including the southern acornshell, ovate clubshell, southern clubshell, upland combshell, triangular kidneyshell, Alabama moccasinshell, Coosa moccasinshell, southern pigtoe and fine-lined pocketbook (Figure 2.5-2). The federally threatened goldline darter and federally endangered amber darter and interrupted rocksnail also exist along this reach.

6.5.4.3.1 No Action Alternative

As presented in Section 4.2.3, USFWS has recommended seasonal minimum flow targets ranging from 240 cfs to 865 cfs beginning as far back as 2003. The No Action Alternative would maintain the current year-round minimum flow requirement of 240 cfs. USACE would maintain the minimum flow requirement in all months. Further, releases from the Carters Reregulation Dam under the No Action Alternative would generally meet the USFWS-recommended seasonal minimum flow targets most of the time. For example, March and December targets (selected as examples to represent seasonality and months during which USFWS-recommended minimum flows are higher than the current 240 cfs requirement) are already met approximately 88 and 81 percent of the time, respectively, under the No Action Alternative. Water quality conditions are expected to improve under the No Action Alternative, as states continue to adhere to defined regulations regarding wasteload allocation, management of NPDES facilities and nonpoint sources. Conditions under the No Action Alternative are generally consistent with the environmental baseline condition established for evaluation of effects on protected species in the BA. Thus, the No Action Alternative would not be expected to adversely affect protected species on the Coosawattee River downstream of Carters Reregulation Dam.

6.5.4.3.2 Alternative Plan D

The addition of the seasonally variable minimum flow targets in Plan D would not yield significant changes in the mean daily flows over the period of record (see Section 6.1.1.3.1.2). However, notable improvements would be observed during low flow events. Flows at the minimum levels of 240 cfs would be expected to occur approximately four percent of the time under Plan D, compared to eight percent for the No Action Alternative. Changes in flow and water quality, with respect to temperature and dissolved oxygen values, would be expected to be minor under Plan D (see Section 6.1.2.2) and of less magnitude than would likely occur under Plan G (Proposed Action Alternative), which was evaluated in the USACE BA for Section 7 consultation. Thus, compared to the No Action Alternative, the effects of Plan D on flow and water quality conditions would not be expected to have adverse effects on protected species of the Coosawattee River downstream of Carters Reregulation Dam.

6.5.4.3.3 Alternative Plan F

The effects of Plan F on flow and water quality conditions would be similar to those for Plan D. Therefore, Plan F would not be expected to adversely affect protected species on the Coosawattee River downstream of Carters Reregulation Dam.

6.5.4.3.4 Alternative Plan G (Proposed Action Alternative)

The effects of Plan G on flow and water quality conditions would be similar to those for Plan D. Therefore, Plan G would not be expected to adversely affect protected species on the Coosawattee River downstream of Carters Reregulation Dam. The USACE BA compared Plan G to the environmental baseline condition, as described in Section 6.5.4 above, and adverse effects to listed species would not be expected. The BA noted that critical habitats for the amber darter and Conasauga logperch occur upstream of Carters Dam, and they would not be affected by implementing Plan G. During informal Section 7 consultation with USFWS, the USACE agreed, subject to currently available and future funding, to implement several conservation measures to more conclusively confirm that there would be no adverse effect on the amber darter and mussel habitat downstream of the reregulation dam. The measures were included in an addendum to the BA (included in Appendix B, Part 3 of the EIS) and are summarized in Section 6.5.4. The USFWS concurred with the BA, as amended, by letter dated March 20, 2014.

6.5.4.4 Etowah River downstream of Allatoona Dam

The following subsections describe the effects of the No Action Alternative and Alternative Plans D, F, and G on protected species in the Etowah River downstream of Allatoona Dam. Modeled stream flow and water quality conditions for the environmental baseline, as described in Section 6.5.4, were compared to modeled outputs for the Proposed Action Alternative (Plan G) over the same period of record. These results were used to evaluate the expected effects on federally listed species and designated critical habitat units within the subbasin.

Federally listed species in the Etowah River downstream of Allatoona Dam include eight freshwater mussel species, three fish species and two snail species (see Section 2.5.4). Critical habitat has not been established along this reach (Figure 2.5-2). With exception to two mussel species and one fish species, which are federally threatened, all are currently listed as endangered.

6.5.4.4.1 No Action Alternative

The No Action Alternative generally reflects flow conditions over the hydrologic period of record that would be consistent with current operations. Water quality conditions are expected to improve as states

continue to adhere to defined regulations regarding wasteload allocation, management of NPDES facilities, and nonpoint sources (see Sections 6.1.1.3.2.1 and 6.1.2.1). Conditions under the No Action Alternative are generally consistent with the environmental baseline condition established for evaluation of effects on protected species in the BA. The No Action Alternative is not expected to adversely affect protected species on the Etowah River downstream of Allatoona Lake.

6.5.4.4.2 Alternative Plan D

Plan D would be expected to slightly decrease flows in September and increase flows in December (see Section 6.1.1.3.2.2). Additionally, downstream of Allatoona Dam water temperature and dissolved oxygen is expected to slightly decrease (see Section 6.1.2.2). Changes in both flow and water quality would be expected to be minor under Plan D and of even less magnitude than would likely occur under Plan G (Proposed Action Alternative), which was evaluated in the USACE BA for Section 7 consultation. Plan D would not be expected to adversely affect protected species on the Etowah River downstream of Allatoona Dam.

6.5.4.4.3 Alternative Plan F

The effects of Plan F on flow and water quality conditions would be similar to those for Plan D. Thus, compared to the No Action Alternative, Plan F would not be expected to adversely affect protected species on the Etowah River downstream of Allatoona Dam.

6.5.4.4.4 Alternative Plan G (Proposed Action Alternative)

Plan G proposes a revision in the number and shape of action zones in Allatoona Lake to operate more conservatively for peaking hydropower production during dry conditions. Plan G also includes a phased guide curve and reduction of hydropower generation at Allatoona Dam during the fall drawdown period, shifting the timing of some releases from September to December. However, the overall effect of these actions would be negligible as increased flows during December should offset lower releases earlier in the phased drawdown period. Changes in water temperature and dissolved oxygen would be minor (Section 6.1.2.4).

The USACE BA compared Plan G to the environmental baseline condition, as described in Section 6.5.4 above. As a result, adverse effects to listed species would not be expected on the Etowah River downstream of Allatoona Dam. By letter dated March 20, 2014, the USFWS concurred with the determination in the USACE BA that Plan G may affect, but is not likely to adversely affect, federally listed endangered or threatened species in the project area.

6.5.4.5 Coosa River at Rome, Georgia

The following subsections describe the effects of the No Action Alternative and Alternative Plans D, F, and G on protected species in the Coosa River in the vicinity of Rome, Georgia, and downstream. Modeled stream flow and water quality conditions for the environmental baseline, as described in Section 6.5.4, were compared to modeled outputs for the Proposed Action Alternative (Plan G) over the same period of record. These results were used to evaluate the expected effects on federally listed species and designated critical habitat units within the subbasin.

Federally listed species in the Coosa River at Rome includes eleven freshwater mussel species, two fish species and two snail species (see Section 2.5.4). Critical habitat has not been established along this reach (Figure 2.5-2). All species are federally endangered, except two species of mussels which are federally threatened.

6.5.4.5.1 No Action Alternative

The No Action Alternative would not involve an appreciable change to current conditions. Conditions under the No Action Alternative would generally be consistent with the environmental baseline condition established for evaluation of effects on protected species in the BA. The No Action Alternative would not be expected to adversely affect protected species on the Coosa River at Rome.

6.5.4.5.2 Alternative Plan D

Changes in reservoir operations at Allatoona Dam and Carters Dam/Reregulation Dam, as proposed under Plan D, do not result in an appreciable change in flow characteristics in the Coosa River at Rome and points downstream compared to the No Action Alternative (see Section 6.1.1.3.3.2). Similarly, the median water temperature and DO show relatively minor change over the modeled period of record. Changes in both flow and water quality under Plan D would be of even less magnitude than would likely occur under Plan G (Proposed Action Alternative), which was analyzed in detail in the USACE BA for Section 7 consultation. Consequently, Plan D would not be expected to adversely affect protected species on the Coosa River at Rome and downstream.

6.5.4.5.3 Alternative Plan F

The effects of Plan F on flow and water quality conditions would be similar to those for Plan D. Thus, compared to the No Action Alternative, Plan F would not be expected to adversely affect protected species on the Coosa River at Rome.

6.5.4.5.4 Alternative Plan G (Proposed Action Alternative)

Operational changes under Plan G, particularly the reduction in hydropower generation at Allatoona Dam during fall drawdown, would be expected to shift the timing of releases from September through December. However, HEC-ResSim model runs suggest that these changes will not significantly affect flow characteristics in the Coosa River at Rome compared to the No Action Alternative (see Section 6.1.1.3.3.4). HEC-5Q model outputs indicate that Plan G would have negligible effects on water quality (see Section 6.1.2.4).

The USACE BA compared Plan G to the environmental baseline condition, as described in Section 6.5.4 above. As a result, adverse effects to listed species would not be expected on the Coosa River at Rome. By letter dated March 20, 2014, the USFWS concurred with the determination in the USACE BA that Plan G may affect, but is not likely to adversely affect, federally listed endangered or threatened species in the project area.

6.5.4.6 Alabama River at Montgomery, Alabama

The following subsections describe the effects of the No Action Alternative and Alternative Plans D, F, and G on protected species in the Alabama River in the vicinity of Montgomery, Alabama, and downstream. Modeled stream flow and water quality conditions for the environmental baseline, as described in Section 6.5.4, were compared to modeled outputs for the Proposed Action Alternative (Plan G) over the same period of record. These results were used to evaluate the expected effects on federally listed species and designated critical habitat units within the subbasin.

This segment of the ACT Basin is inhabited by several federally listed species, including three species of freshwater mussels (inflated heelsplitter, heavy pigtoe and southern clubshell), one fish species (Alabama sturgeon) and a single snail species (tulotoma snail) (see Section 2.5.4). Critical habitat has been

designated for the Alabama sturgeon (Figure 2.5-2). Although the flow requirements for the habitat of the endangered Alabama sturgeon are poorly understood, the potential effects of the Proposed Action Alternative (Plan G) were evaluated in the BA by considering the extent of changes in flow conditions in the critical habitat area resulting from Plan G compared to the existing flow conditions in the river (see Section 6.5.4.6.4 below). All of the plans would have minimal effects on existing flow conditions in the Alabama River, and these findings were reflected in the ESA Section 7 consultation process with the USFWS.

6.5.4.6.1 No Action Alternative

The No Action Alternative would not involve an appreciable change to current conditions (see Sections 6.1.1.3.4.1 and 6.1.2.1). Conditions under the No Action Alternative would generally be consistent with the environmental baseline condition established for evaluation of effects on protected species in the BA. The No Action Alternative would not be expected to adversely affect protected species on the Alabama River downstream of Montgomery.

6.5.4.6.2 Alternative Plan D

Implementation of Plan D would result in adjustments to meet navigational needs when sufficient flows are available, but also would provide drought management provisions that would become progressively more stringent to conserve reservoir conservation storage as drought conditions worsen. However, these features of Plan D would not be expected to substantially affect flow conditions in the Alabama River below Montgomery compared to the No Action Alternative. Water quality parameters would not be expected to change appreciably in response to Plan D. The minimum JBT flow target under Plan D would likely be met 96 percent of the time and the influence on water temperature and dissolved oxygen would be minor (see Sections 6.1.1.3.4.2 and 6.1.2.2).

The effects of Plan D on flow and water quality conditions would not be expected to adversely affect protected species on the Alabama River downstream of Montgomery.

6.5.4.6.3 Alternative Plan F

The effects of Plan F on flow and water quality conditions would be similar to those for Plan D. Thus, compared to the No Action Alternative, Plan F would not be expected to adversely affect protected species on the Alabama River downstream of Montgomery.

6.5.4.6.4 Alternative Plan G (Proposed Action Alternative)

Flow and water quality conditions under Plan G would likely be similar to those of Plan D. Compared to the No Action Alternative, Plan G would not be likely to adversely affect protected species on the Alabama River downstream of Montgomery. The simulation for the BA, performed in accordance with the Section 7 Consultation Handbook, indicated that the simulated Plan G flow regime is nearly identical to the environmental baseline flow regime with the exception that Plan G would result in higher flows during drought periods than the environmental baseline condition. This is likely a beneficial effect to sturgeon and is not likely to adversely affect other protected species.

By letter dated March 20, 2014, the USFWS concurred with the determination in the USACE BA that Plan G may affect, but is not likely to adversely affect, federally listed endangered or threatened species in the project area.

6.5.4.7 Alabama River downstream of Claiborne Lock and Dam and Lake

The following subsections describe the effects of the No Action Alternative and Alternative Plans D, F, and G on protected species in the Alabama River downstream of Claiborne Lock and Dam and Lake. Modeled stream flow (see Section 6.1.1.3.5) and water quality (see Section 6.1.2) conditions for the environmental baseline, as described in Section 6.5.4, were compared to modeled outputs for the Proposed Action Alternative (Plan G) over the same period of record. These results were used to evaluate the expected effects on federally listed species and designated critical habitat units within the subbasin.

Federally listed species in the Alabama River downstream of Claiborne Lock and Dam and Lake include the inflated heelsplitter and heavy pigtoe (mussels), Alabama sturgeon (fish) and tulotoma snail. Critical habitat for Alabama sturgeon extends down to Mobile Bay (Figure 2.5-2). Although the flow requirements for the habitat of the endangered Alabama sturgeon are poorly understood, the potential effects of Plan G were evaluated by considering the extent of changes in flow conditions in the critical habitat area compared to the environmental baseline condition (as defined in the Section 7 Consultation Handbook). USACE concluded in the BA that the Proposed Action Alternative (Plan G) would have minimal effects compared to the environmental baseline for the Alabama River, and consequently would not be likely to have adverse effects on listed species. USFWS concurred with this finding by letter dated March 20, 2014.

6.5.4.7.1 No Action Alternative

The No Action Alternative would not involve an appreciable change to current conditions. Conditions under the No Action Alternative would generally be consistent with the environmental baseline condition established for evaluation of effects on protected species in the BA. The No Action Alternative would not be expected to adversely affect protected species on the Alabama River downstream of Claiborne Lock and Dam.

6.5.4.7.2 Alternative Plan D

Implementation of Plan D would result in adjustments to meet navigational needs when sufficient flows are available, but also would provide drought management provisions that would become progressively more stringent as drought conditions worsen in order to conserve storage. However, these features of Plan D would not be expected to substantially affect flow conditions in the Alabama River below Claiborne Lock and Dam compared to the No Action Alternative. Water quality parameters would not be expected to change appreciably in response to Plan D. The minimum flow target would likely be met 95 percent of the time and the influence on water temperature and dissolved oxygen would be minor (see Sections 6.1.1.3.5.2 and 6.1.2.2).

Compared to the No Action Alternative, the effects of Plan D on flow and water quality conditions are not expected to adversely affect protected species on the Alabama River downstream of Claiborne Lock and Dam.

6.5.4.7.3 Alternative Plan F

The effects of Plan F on flow and water quality conditions would be similar to those for Plan D. Thus, compared to the No Action Alternative, Plan F would not be expected to adversely affect protected species on the Alabama River below Claiborne Lock and Dam.

6.5.4.7.4 Alternative Plan G (Proposed Action Alternative)

The effects of Plan G on flow and water quality conditions in the Alabama River below Claiborne Lock and Dam are similar to those of Plan D. The BA notes the same potential effects from flow that are noted under Plan G for the Alabama River at Montgomery, Alabama, and downstream. As discussed in the second paragraph of Section 6.5.4.2.5, implementation of Plan G would not likely affect federally listed endangered or threatened species in the project area. By letter dated March 20, 2014, the USFWS concurred with this determination in as presented in the USACE BA.

6.5.5 Fish and Wildlife Management Facilities

6.5.5.1 William "Bill" Dannelly Lake

6.5.5.1.1 No Action Alternative

William "Bill" Dannelly Lake on the Alabama River is operated for hydropower generation, but storage is a minor component of its function. It essentially serves as a run-of-river facility. As a result, changes in water surface elevations under the No Action Alternative would be negligible (see section 6.1.1.2.4) and would not be expected to adversely affect water withdrawals necessary for management of the facilities (see section 2.5.5).

6.5.5.1.2 Alternative Plan D

As described for the No Action Alternative in Section 6.5.5.1.1, Plan D would be expected to have no adverse effect on William "Bill" Dannelly Lake fish and wildlife management facilities.

6.5.5.1.3 Alternative Plan F

As described for the No Action Alternative in Section 6.5.5.1.1, Plan F would be expected to have no adverse effect on William "Bill" Dannelly Lake fish and wildlife management facilities.

6.5.5.1.4 Alternative Plan G (Proposed Action Alternative)

As described for the No Action Alternative in Section 6.5.5.1.1, Plan G would be expected to have no adverse effect on William "Bill" Dannelly Lake fish and wildlife management facilities.

6.5.5.2 Arrowhead Game Management Office and Fishing Area

6.5.5.2.1 No Action Alternative

The Arrowhead Game Management Office and Arrowhead Public Fishing Area collectively withdraw approximately 0.35 mgd of surface water from Armuchee Creek, a tributary to the Oostanaula River. Both facilities are well upstream of the confluence the Oostanaula River and, therefore, would not likely be adversely affected by the No Action Alternative.

6.5.5.2.2 Alternative Plan D

As described for the No Action Alternative in Section 6.5.5.2.1, Plan D would be expected to have no adverse effect on the Arrowhead Game and Management Office and Fishing Area facilities.

6.5.5.2.3 Alternative Plan F

As described for the No Action Alternative in Section 6.5.5.2.1, Plan F would be expected to have no adverse effect on the Arrowhead Game and Management Office and Fishing Area facilities.

6.5.5.2.4 Alternative Plan G (Proposed Action Alternative)

As described for the No Action Alternative in Section 6.5.5.2.1, Plan G would be expected to have no adverse effect on the Arrowhead Game and Management Office and Fishing Area facilities.

6.5.5.3 Fish Hatcheries

6.5.5.3.1 No Action Alternative

The fish hatcheries in operation in the ACT Basin include Eastboga Fish Hatchery, Alabama Aquatic Diversity Center, and Summerville Fish Hatchery. All three facilities use groundwater in their operations and thus would not be adversely affected by the No Action Alternative.

6.5.5.3.2 Alternative Plan D

As described for the No Action Alternative in Section 6.5.5.3.1, Plan D would be expected to have no adverse effect on the ACT Basin fish hatcheries.

6.5.5.3.3 Alternative Plan F

As described for the No Action Alternative in Section 6.5.5.3.1, Plan F would be expected to have no adverse effect on the ACT Basin fish hatcheries.

6.5.5.3.4 Alternative Plan G (Proposed Action Alternative)

As described for the No Action Alternative in Section 6.5.5.3.1, Plan G would be expected to have no adverse effect on the ACT Basin fish hatcheries.

6.6 Socioeconomics

Impacts analyses were evaluated on socioeconomic resource areas relative to project purposes in the ACT Basin. It was decided to complete a preliminary economic analysis using a qualitative level of detail to determine if greater detailed analysis was required. Based on the preliminary analysis results, more detailed analysis was not warranted or yield additional information. The results of the analyses by project purpose and/or resource area are presented below.

6.6.1 M&I Water Supply

6.6.1.1 No Action Alternative

Under the No Action Alternative, the operation of USACE projects in the ACT Basin would be expected to remain unchanged. Therefore, effects on M&I water supply would be expected to be the same as they have been in the past. The No Action Alternative reflects the M&I water withdrawals that were actually made in 2006 from the ACT reservoirs and along the primary rivers of the ACT basin. However, as discussed in section 4.2.6 and Appendix C, the available storage under existing water supply agreements

at USACE reservoirs may not be sufficient under all conditions to accommodate the 2006 level of water supply withdrawals.

6.6.1.2 Alternative Plan D

Table 4.3-1 in Section 4.3 presents the basin-wide water management alternatives developed to meet the study objectives and insure that flood operations would not be compromised. The formulation strategy employed to develop alternatives involved adding one measure at a time, determining the operation for that measure that might best satisfy the objectives, and then developing another alternative by adding another measure or, in some instances, considering a variation of the last added management measure. Accordingly, those alternatives build one on another, ultimately establishing the recommended plan for water management in the ACT Basin. During evaluation of the alternatives, ResSim modeling was conducted to determine if each alternative would meet the objectives and not increase basin flooding. A more detailed description of the proposed alternatives is in Section 4.3 of this EIS.

The following Table 6.6-1 and Table 6.6-2 display the difference in the anticipated pool elevations for Plans D, F, and the Proposed Action Alternative as compared to the No Action Alternative. It was determined that the most accurate way to evaluate the M&I water supply available from Allatoona Lake and Carters Lake for each alternative was to evaluate the differences between the pool elevations for Allatoona Lake and Carters Lake. The following Table 6.6-1 and Table 6.6-2 display the average pool elevation, by month, for Allatoona Lake and Carters Lake under each scenario evaluated. The data are based on the ResSim model output over the modeled period of record (1939 through 2011).

Table 6.6-1.
Median pool elevation (ft) by month for Allatoona Lake

	No Action Alternative	Plan D	Plan F	Proposed Action Alternative (Plan G)
January	823.0	823.2	823.2	823.2
February	827.7	827.8	827.8	827.8
March	832.3	832.8	832.8	832.8
April	837.4	837.5	837.5	837.5
May	840.0	840.0	840.0	840.0
June	839.6	839.7	839.7	839.7
July	838.5	838.6	838.6	838.6
August	836.7	836.4	836.4	836.4
September	834.0	833.4	833.4	834.5
October	831.2	830.7	830.7	833.5
November	827.2	827.5	828.2	832.0
December	823.0	823.0	824.9	826.3

Table 6.6-2.
Median pool elevation by month for Carters Lake

	Pool Elevation (ft)			
	No Action Alternative	**Plan D**	**Plan F**	**Proposed Action Alternative (Plan G)**
January	1,072.0	1,072.0	1,072.0	1,072.0
February	1,072.0	1,072.0	1,072.0	1,072.0
March	1,072.0	1,072.0	1,072.0	1,072.0
April	1,073.1	1,073.0	1,073.0	1,073.0
May	1,074.0	1,074.0	1,074.0	1,074.0
June	1,074.0	1,074.0	1,074.0	1,074.0
July	1,074.0	1,074.0	1,074.0	1,074.0
August	1,073.9	1,073.8	1,073.8	1,073.8
September	1,073.7	1,073.7	1,073.7	1,073.7
October	1,073.7	1,073.7	1,073.7	1,073.7
November	1,072.7	1,072.7	1,072.7	1,072.7
December	1,072.0	1,072.0	1,072.0	1,072.0

Table 6.6-3 and Table 6.6-4 display the percent change for each alternative compared to the No Action Alternative baseline condition.

Table 6.6-3.
Percent change—pool elevation for Allatoona Lake

	Pool Elevation (ft) Percent Change			
	No Action Alternative	**Plan D**	**Plan F**	**Proposed Action Alternative (Plan G)**
January	--	0.02%	0.02%	0.02%
February	--	0.01%	0.01%	0.01%
March	--	0.06%	0.06%	0.06%
April	--	0.01%	0.01%	0.01%
May	--	0.00%	0.00%	0.00%
June	--	0.01%	0.01%	0.01%
July	--	0.01%	0.01%	0.01%
August	--	-0.04%	-0.04%	-0.04%
September	--	-0.07%	-0.07%	0.06%
October	--	-0.06%	-0.06%	0.28%
November	--	0.04%	0.12%	0.58%
December	--	0.00%	0.23%	0.40%

Table 6.6-4.
Percent change—pool elevation for Carters Lake

Pool Elevation (ft) Percent Change				
	No Action Alternative	Plan D	Plan F	Proposed Action Alternative (Plan G)
January	--	0.00%	0.00%	0.00%
February	--	0.00%	0.00%	0.00%
March	--	0.00%	0.00%	0.00%
April	--	-0.01%	-0.01%	-0.01%
May	--	0.00%	0.00%	0.00%
June	--	0.00%	0.00%	0.00%
July	--	0.00%	0.00%	0.00%
August	--	-0.01%	-0.01%	-0.01%
September	--	0.00%	0.00%	0.00%
October	--	0.00%	0.00%	0.00%
November	--	0.00%	0.00%	0.00%
December	--	0.00%	0.00%	0.00%

As demonstrated by the previous tables, Plan D would be expected to have a minimal effect on the M&I water supply available in Allatoona Lake or Carters Lake. The amount of storage made available by USACE in its reservoirs for water supply is unchanged under the alternative, and the alternative assumes that water supply users would make full use of that storage to satisfy anticipated water supply needs. However, as discussed in section 4.2.6 and Appendix C, the available storage under existing water supply agreements at USACE reservoirs may not be sufficient under all conditions to accommodate the current (2006) level of water supply withdrawals from those reservoirs. Alternative Plan D assumes that withdrawals from USACE reservoirs would be limited to the amount available in water supply storage under existing agreements, as measured by the storage accounting methodology that the USACE currently employs at those reservoirs.

6.6.1.3 Alternative Plan F

As demonstrated by the tables presented above in Section 6.6.1.2, Plan F would be expected to have a minimal effect on the M&I water supply available in Allatoona Lake or Carters Lake. The amount of storage made available by USACE in its reservoirs for water supply is unchanged under the alternative, and the alternative assumes that water supply users would make full use of that storage to satisfy anticipated water supply needs. However, as discussed in section 4.2.6 and Appendix C, the available storage under existing water supply agreements at USACE reservoirs may not be sufficient under all conditions to accommodate the current (2006) level of water supply withdrawals from those reservoirs. Alternative Plan F assumes that withdrawals from USACE reservoirs would be limited to the amount available in water supply storage under existing agreements, as measured by the storage accounting methodology that the USACE currently employs at those reservoirs.

6.6.1.4 Alternative Plan G (Proposed Action Alternative)

As demonstrated by the tables presented above in Section 6.6.1.2, the Proposed Action Alternative would be expected to have a minimal effect on the M&I water supply available in Allatoona Lake or Carters

Lake. The Proposed Action Alternative would be expected to provide an increase in the median pool elevation for Allatoona Lake for the majority of the year, along with a negligible decrease in the median pool elevation for Carters Lake in April and August. These slight changes in median pool elevations indicate that the reliability of water supply for the existing water storage agreements would not be expected to be affected.

The amount of storage made available by USACE in its reservoirs for water supply is unchanged under the alternative, and the alternative assumes that water supply users would make full use of that storage to satisfy anticipated water supply needs. However, as discussed in section 4.2.6 and Appendix C, the available storage under existing water supply agreements at USACE reservoirs may not be sufficient under all conditions to accommodate the current (2006) level of water supply withdrawals from those reservoirs. The Proposed Action Alternative assumes that withdrawals from USACE reservoirs would be limited to the amount available in water supply storage under existing agreements, as measured by the storage accounting methodology that the USACE currently employs at those reservoirs

6.6.2 Navigation

6.6.2.1 No Action Alternative

The No Action Alternative (baseline) flow scenario was modeled to evaluate two channel depths: 7.5 ft and 9.0 ft, on the basis of the availability for the flows to maintain those depths throughout the year. The evaluation for the No Action Alternative as well as subsequent evaluations for Plans D, F, and G is based upon model outputs over the period of record in the ACT Basin during which all navigation structures were completed and operational (1939–2011 or 73 years). For the 7.5-ft channel, the No Action Alternative would have the required flows to provide the depth needed about 96 percent of the period of record for January and about 60 percent of the time in September. Because of higher flows in the winter and spring, channel availability is much higher from December through May (Figure 6.6-1).

For the 9-ft channel, the No Action Alternative would have the required flows to provide the depth needed about 94 percent of the period of record for January and about 53 percent of the time in September. Because of higher flows in the winter and spring, channel availability is much higher from December through May (Figure 6.6-2).

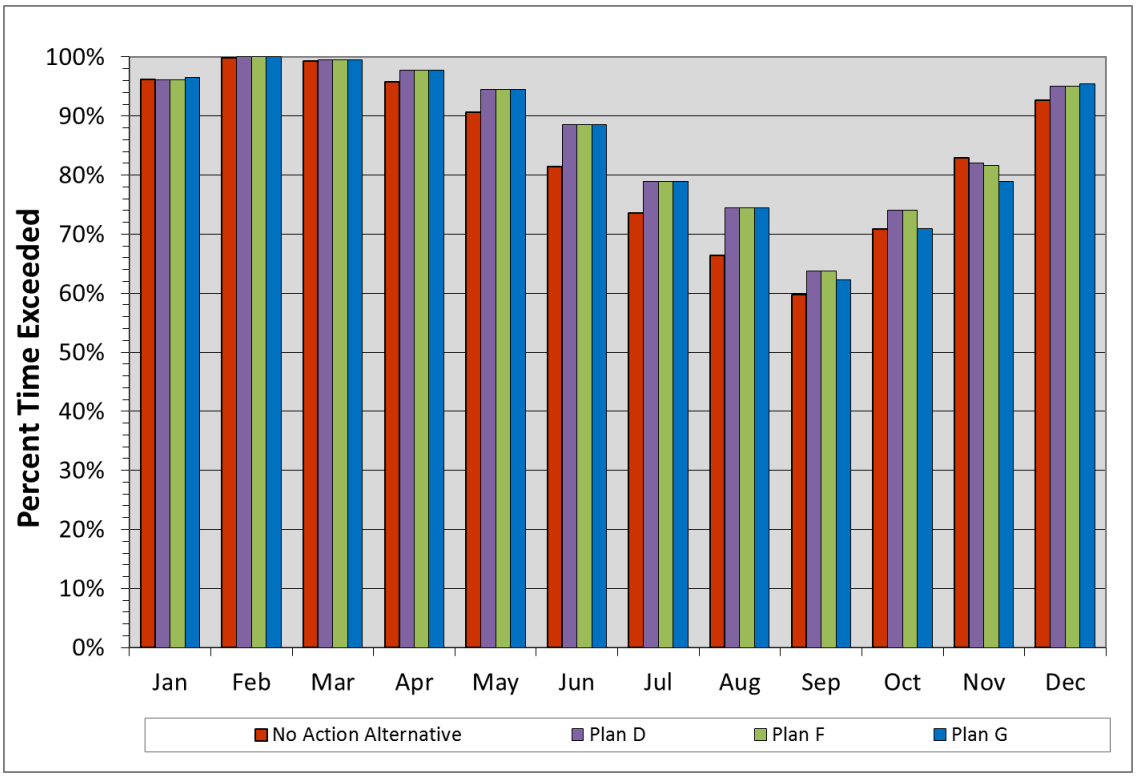


Figure 6.6-1. Percent of time the 7.5-ft navigation target flow is exceeded by month (1939–2011).

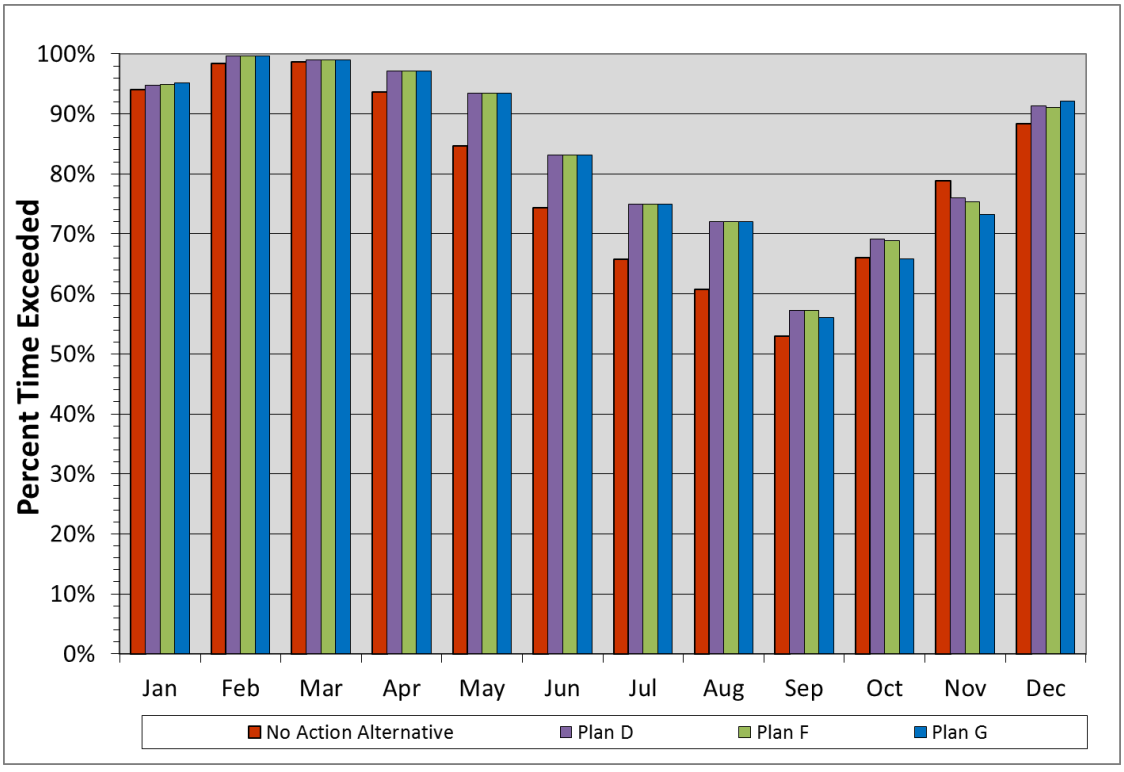


Figure 6.6-2. Percent of time the 9-ft navigation target flow is exceeded by month (1939–2011).

6.6.2.2 Alternative Plan D

Plan D flow scenarios were modeled to include both USACE and APC navigational releases, revised drought plan, and seasonal releases at Carters Lake. Plan D differs from Plan F and the Proposed Action Alternative in the operation of Allatoona Lake.

Two channel depths were evaluated: 7.5 ft and 9.0 ft on the basis of the availability for the flows to maintain those depths throughout the year. In the evaluation of the 7.5-ft channel, Plan D provided similar availability to the No Action Alternative in January (about 96 percent) and 64 percent availability in September. Because of higher flows in the winter and spring, channel availability is much higher from December through May under Plan D, similar to the No Action Alternative (Figure 6.6-1).

In the evaluation of the 9-ft channel, Plan D would provide similar availability to the No Action Alternative in January (about 95 percent) and over 57 percent availability in September. Because of higher flows in the winter and spring, channel availability is much higher from December through May under Plan D, similar to the No Action Alternative (Figure 6.6-2).

6.6.2.3 Alternative Plan F

As with the No Action Alternative and Plan D, Plan F flow scenarios were modeled to evaluate two channel depths of 7.5 ft and 9 ft (see Figure 6.6-1 and Figure 6.6-2). Effects similar to those described above in Section 6.6.2.2 would be expected.

6.6.2.4 Alternative Plan G (Proposed Action Alternative)

As with the No Action Alternative and Plan D, the Proposed Action Alternative flow scenarios were modeled to evaluate two channel depths of 7.5 ft and 9 ft (see Figure 6.6-1 and Figure 6.6-2). Effects similar to those described above in Section 6.6.2.2 would be expected.

6.6.3 Hydropower

This section presents an analysis of the effects on hydropower benefits that would be expected to result from proposed changes to system water control operations in the ACT Basin. The system hydropower benefits for energy and capacity were computed for the No Action Alternative (baseline condition), representing current water control operations, and for three alternative flow scenarios associated with the recommended ACT Water Control Plan described in previous sections of this EIS (Plans D, F, and G). The calculations of hydropower energy and capacity benefits are based on a 73-year simulation period using the HEC-ResSim model. The complete reports of this analysis, prepared by the USACE Hydropower Analysis Center (HAC) are included in Appendix E of this EIS.

To understand how system operations can affect hydropower generation, the first consideration would be the mathematics used to approximate the amount of power produced from a hydropower facility, the power equation (Equation 1). The equation shows that power is directly proportional to three variables—the efficiency of the plant turbines, the amount of flow going through the turbines, and the head (the height of the water in the reservoir relative to its height after discharge):

$$P = e * g * Q * H \qquad \text{(Equation 1)}$$

where P = power (kw) , e = turbine efficiency, g = gravitational constant (m/s^2), h = head (m), Q = flow (m^3/s), and ρ = density (*grams/m^3)*.

Reservoir operations can affect all these variables. Higher or lower operational reservoir elevations change the head. Maximum or minimum flow requirements used for flood risk management and environmental purpose can affect the flow. Although power is linear in both head and flow, the relationship quickly becomes nonlinear with the inclusion of efficiency, which is both a nonlinear function of head and flow.

In general the hydropower benefits resulting from generation can be divided into two components: *energy benefits* and *capacity benefits*. A change in energy benefits is the result of a change in the amount of water that is available to pass through the turbines. The value of this benefit changes both daily and seasonally as a function of the system's electrical load. For example, energy may be more valuable during the height of the summer heat while businesses and residents are attempting to cool their environments, as opposed to the fall or winter when air conditioners may be turned off. The capacity benefit is a measure of the amount of capacity that the project can reliably contribute toward meeting system peak power demands.

The value of the hydropower benefits calculated in this section is based on the cost of using the most likely alternative source for power. For example, if an operational strategy reduces hydropower storage or flow, the loss in energy benefits is equivalent to the cost of replacing the lost power with the most likely alternative source of power. In addition, it may decrease the amount of capacity that the hydropower plant can contribute to the peak system load, making it necessary to replace this lost capacity with a thermoelectric alternative.

The following subsections describe the process of calculating the energy and capacity benefits of the ACT system.

6.6.3.1 Energy Benefits

Energy benefits are computed as the product of the energy loss in MW hours (MWh) and an energy unit value price ($/MWh). The energy price is based on the cost of energy from a combination of thermoelectric generating plants that would replace the lost energy from the hydropower plant due to operational or structural changes.

6.6.3.1.1 Energy Price Computation

The energy prices used for this analysis reflect the daily differences in peak and off-peak operations, the seasonal dynamics related to demand and availability, and the annual forecasted changes due to modifications in capacity and overall demand. The following paragraphs describe the process of obtaining those values.

Future and historical energy values in this analysis are based on Department of Energy, U.S. Energy Information Administration (EIA) forecasts from the supplemental tables of "Annual Energy Outlook" (AEO 2013). The EIA forecasts are developed with the Electricity Market Model (EMM) as part of the National Energy Modeling System (NEMS). The following description is from the model documentation report available on the EIA website:

> *The National Energy Modeling System (NEMS) was developed to provide 20-to-25 year forecasts and analyses of energy-related activities. The NEMS uses a central database to store and pass inputs and outputs between the various components. The NEMS Electricity Market Module (EMM) provides a major link in the NEMS framework. In each model year, the EMM receives electricity demand from the NEMS demand modules, fuel prices from the NEMS fuel supply modules, expectations from the NEMS system module, and macroeconomic parameters from the NEMS macroeconomic module. The EMM estimates the actions taken by electricity producers (electric utilities and nonutilities) to meet demand in the most economical manner. The EMM then outputs electricity prices to the demand*

modules, fuel consumption to the fuel supply modules, emissions to the integrating module, and capital requirements to the macroeconomic module. The model iterates until a solution is reached for each forecast year.

In addition to providing average annual energy forecasts of electrical generation prices through 2040, AEO 2013 also includes regional forecasts corresponding to North American Electric Reliability Corporation regional entity sub-regions. Federal ACT hydropower plants are located in the southeastern sub-region of the Southeastern Reliability Corporation (SERC/S). Discussions with SEPA confirmed that most of the electric power generation from ACT plants is marketed through SERC/S, and that EIA forecasts of thermal generation prices for the SERC/S region was appropriate for this analysis.

Because EIA provides only a single average energy value for each future year through 2040, the EIA forecasts values are used to shape system λ values acquired from FERC Form 714 reports. For utilities generating electricity from thermal plants, Form 714 requires reporting of hourly energy demand (load) and the hourly marginal cost (lambda) of generating one additional MW of electrical energy.

The following explanation of how lambda (λ) was calculated is from the FERC Form 714 report, Part II, Schedule 6, filed for 2010 by Southern Company:

The Southern Company system lambda is determined hourly and is based on the variable costs of the resources that serve the load obligations of the Operating Companies plus any sales to third parties. The variable costs of the resources include the components listed below, and may also reflect the cost of purchases. The economic dispatch formula used to dispatch Southern's generating resources on the basis of their variable cost components is as follows:

$$\lambda = [\{ (2aP + b) * (FC + EC) \} + VOM + FH] * TPF$$

Where:

λ = *System lambda*

a, b = *Incremental heat rate coefficients*

P = *Generation level*

FC = *Marginal replacement fuel costs*

EC = *Marginal replacement emission allowance costs*

VOM = *Variable operations and maintenance expenses*

FH = *In-plant fuel handling expenses*

TPF = *Incremental transmission losses (penalty factors)*

Form 714 reports are available online for the five Southern Company utilities that generate thermal power in SERC/S for the years 2008 through 2012: Alabama Power, Georgia Power, Gulf Power, Mississippi Power, and Southern Power. The five Southern Company utilities represent about three quarters of the fossil fuel generating capacity in the SERC/S sub-region and about 92 percent of the fossil generation for which system lambda is reported to FERC. While system lambda and load were also reported during this period by Southern Mississippi Electric Power Cooperative and Alabama Electric Cooperative, formatted data from these companies was not available for the entire period and therefore was not included in the calculations described below.

6.6.3.1.2 Methodology for energy price shaping

To forecast the system λ using the EIA forecasted generation values, the following ratio is assumed:

$$\frac{\lambda_{Future}}{\lambda_{Past}} = \frac{EIA_Generation_{Future}}{EIA_Generation_{Past}}$$

This can be rewritten as:

$$\lambda_{Future} = EIA_Generation_{Future} * \frac{\lambda_{Past}}{EIA_Generation_{Past}}$$

Future system λ values can then be computed by the product of the EIA generation forecast and a shaping ratio defined as:

$$ShapingRatio = \frac{\lambda_{Past}}{EIA_Generation_{Past}}$$

To replicate the peak and off -peak variation, daily system λ values are sorted from high to low and are averaged using the peak and off-peak periods described in the Energy Benefits Calculation section below. Seasonal variability is taken into account by computing shaping ratios for each month. These shaping ratios are computed as averages among dates with like month and peak and off-peak classification using the equation:

$$\text{ShapingRatio(Peak/offpeak designation, month)} = \text{Average}\left(\frac{\text{LMP}_{\text{Past}}\text{ (Peak/offpeak designation, month)}}{\text{EIA_Generation}_{\text{Past}}\text{ (year)}}\right)$$

The proportions in Table 6.6-5 were then multiplied by the EIA forecast energy value for each year to obtain estimates of monthly on-peak and off-peak values. To develop the annualized prices for each calendar month, the present values of on-peak and off-peak prices for each month of the 50-year period of analysis were calculated using the federal discount rate of four percent. The resulting 50 present values were then summed and amortized over the 50-year period of analysis at the federal discount rate. The resulting annualized prices are shown in Table 6.6-6.

Table 6.6-5.
Peak and off-peak shaping factors for SERC/S sub-region using Southern Company system λ values.

Month	Peak	Off-peak
Jan	0.92	0.60
Feb	0.79	0.58
Mar	0.74	0.56
Apr	0.75	0.53
May	0.76	0.54
Jun	0.98	0.64
Jul	1.00	0.67
Aug	0.87	0.61
Sep	0.76	0.56
Oct	0.72	0.55
Nov	0.68	0.52
Dec	0.70	0.54

Table 6.6-6.
Annualized forecasted monthly energy prices ($/MWh)

Month	Peak	Off-Peak
January	$55.90	$36.44
February	$48.00	$35.39
March	$45.12	$34.27
April	$45.51	$32.24
May	$46.25	$33.06
June	$59.83	$38.98
July	$60.56	$40.60
August	$52.73	$36.79
September	$46.27	$33.94
October	$43.60	$33.47
November	$41.36	$31.89
December	$42.48	$32.52

That shaping distribution was applied to the EIA forecast for the entire 35-year forecast period creating monthly time series for peak and off-peak prices. Monthly values for each year following the forecast period (analysis period years 30 through 50) were assumed to be the same as the monthly value in the last year of the forecast. The federal discount rate of 3.50 percent was applied to the time series and then summed to create the present value for each month. As shown in Table 6.6-6, the present value of the monthly energy prices was amortized to produce annualized monthly prices for peak and off-peak energy prices.

6.6.3.1.3 Carters Pumped Storage

The Carters Dam facility is operated as a pump storage plant. In the operational strategy, water from Carters Lake is released through turbines into a lower reregulation reservoir during peak hours. On off-peak hours, water is pumped from the lower reservoir back into the upper Carters Lake. To calculate the energy benefit value for that operation, the average annual energy cost required to pump the water back into Carters Lake must be subtracted from the average annual energy benefit calculated above.

The equation (Equation 2) for estimating the power required to pump water from the reregulation dam to Carters Lake is structurally similar to the power equation (Equation 1) with power inversely proportional to efficiency. In other words, the more efficient the pump, the less power it takes to pump the water to Carters Lake.

$$P = \frac{g * Q * H}{e} \qquad \text{(Equation 2)}$$

The HEC-ResSim model outputs the average flow being pumped, the number of hours the pump is on, and elevations of both Carters Lake and the reregulation lake to estimate head (H) on a daily time step. The only variable left is efficiency, which, like for generation, is a nonlinear function of both head and flow. For the sake of the estimate, an efficiency of 75 percent was assumed.

6.6.3.1.4 Energy Benefit Calculations

Although all plants in the system are defined as peaking plants, the actual hydropower operations of the individual power plants can vary significantly. For example some plants can turn completely off and then back on again during peak demand periods, while others can have a minimum flow requirement that constantly generates a small amount of electricity with a maximum generation occurring during peak demand periods. Unfortunately, the detailed hourly generation information required from each plant to determine the daily peak and off-peak percentage of total generation is not available. To calculate the energy benefits, the method assumes that plants will operate to maximize energy benefits—that is, to generate the maximum amount of energy during periods of peak demand.

SEPA confirmed the seasonal variation of peak hours for the region. Eleven daily peaking hours were defined for the winter period from October 1 through March 31: 5:00 a.m. to 9:00 a.m. and 3:00 p.m. to 10:00 p.m., Monday through Friday. Six daily peaking hours were defined for the summer period from April 1 through September 30: 1:00 p.m. to 7:00 p.m., Monday through Friday. The maximum daily amount of peak generation for each plant was then defined as the product of the number of daily peaking hours times the installed capacity of the plant.

6.6.3.2 Capacity Benefits

Capacity benefits are defined as the product of the change in dependable capacity and a capacity unit value, which represents the capital cost of constructing replacement thermoelectric capacity.

The dependable capacity of a hydropower project is a measure of the amount of capacity that the project can reliably contribute toward meeting system peak power demands. If a hydropower project always maintains approximately the same head, and there is always an adequate supply of stream flow so that there is enough generation for the full capacity to be usable in the system load, the full installed generator capacity can be considered dependable. In some cases, even the overload capacity is dependable.

At storage projects, normal reservoir drawdown can result in a reduction of capacity because of a loss in head. At other times, diminished stream flows during low-flow periods can result in insufficient generation to support the available capacity in the load. Dependable capacity accounts for these factors by giving a measure of the amount of capacity that can be provided with some degree of reliability during peak demand periods.

6.6.3.2.1 Dependable Capacity Calculation Procedure

Dependable capacity can be computed in several ways. The method that is most appropriate for evaluating the dependable capacity of a hydropower plant in a predominantly thermoelectric-based power system, like the ACT Basin, is the average availability method. The method is described in Section 6-7g of EM 1110-2-1701, Hydropower, dated December 31, 1985. The occasional unavailability of a portion of a hydropower project's generating capacity due to hydrologic variations should be treated in the same manner as the occasional unavailability of all or part of a thermoelectric plant's generating capacity due to forced outages.

In order to evaluate the average dependable capacity for a project, a long-term record of project operation must be used. Actual project operating records would be most desirable; however, certain factors might preclude the use of those records. The period of operation might not be long enough to give a statistically reliable value. Furthermore, operating changes could have occurred over the life of the project, which would make actual data somewhat inconsistent. To assure the greatest possible consistency in the calculation, the 73-year HEC-ResSim simulation for the ACT Basin was used.

The dependable capacity calculation procedure for the ACT Basin projects began by approximating each project's contribution (weekly hours operating on-peak) in meeting the system capacity requirements demand for the regional critical year. That contribution estimate was determined by first calculating each project's weekly average energy produced (MWh) for the peak demand months of mid-May through mid-September of 1981, the critical year from the HEC-ResSim No Action Alternative model run. That number was then divided by SEPA's defined marketable capacity (MW). The result provided an estimate of weekly hours on-peak for each project. Coordination with SEPA confirmed marketable capacity values for the USACE hydropower plants and the critical water year of 1981. Marketable capacity was assumed to be equivalent to installed capacity for all non-USACE plants (Table 6.6-7).

Table 6.6-7.
Plant marketable and installed capacity calculations

Project	Owner	Number of units	Marketable capacity (MW)
Allatoona Lake	USACE	3	72
Carters Lake	USACE	4	575
Weiss Lake	APC	3	81
H. Neely Henry Lake	APC	3	70
Logan Martin Lake	APC	3	135
Lay Lake	APC	6	180
Mitchell Lake	APC	4	166
Jordan Dam and Lake	APC	4	100
Bouldin Dam	APC	3	225
R.L. Harris Lake	APC	2	132
Lake Martin	APC	4	182
Yates Lake	APC	2	47
Thurlow Lake	APC	3	78
Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake	USACE	4	82
Millers Ferry Lock and Dam and William "Bill" Dannelly Lake	USACE	3	90
Total		51	2215

Next, each project's weekly average energy (MWh) produced during the peak demand months was calculated for each simulated year. Dividing those values by each project's weekly average hours (H) on-peak determined in the previous step, yielded an array of yearly dependable capacity values. The average across the array is each project's average dependable capacity.

This process is repeated for the No Action Alternative and the three alternative flow scenarios using the HEC-ResSim model runs. The total system difference between the No Action Alternative and the three flow scenarios (Plans D, F, and G) is the gain or loss in dependable capacity caused by changes in system water control operations.

6.6.3.2.2 Capacity Unit Value Calculation

Capacity unit values represent the capital cost and the fixed operating and maintenance cost of the most likely thermoelectric generation alternative that would carry the same increment of load as the proposed hydropower project or modification. As discussed below in the screening curve analysis description, the cost-effectiveness of the thermoelectric resources depends on how and when the resource is used. For example, coal fired plants might be used to replace a base loading hydropower plant, while a gas-fired turbine plant could be used to replace a peaking hydropower operation. A combined cycle plant would be used in an intermediate mode of load-following. This section describes the process of determining the least costly, most likely combination of thermoelectric generation resources that compose the thermoelectric alternative to hydropower. It also presents the method to calculate the capacity unit value.

6.6.3.2.2.1 Typical Hourly System Generation

To establish the most likely thermoelectric alternative, an analysis of how the hydropower system is currently operated was performed. The goal of this analysis was to show how much capacity can be defined as base load, how much can be defined as intermediate load, and how much can be defined as peaking. Typically, the process of computing a capacity value is done on a plant-by-plant basis; however, the necessary data, hourly generation for a typical year, was available for the four USACE plants only. In this regard, a total system typical hourly generation exceedance curve was developed.

To produce the total system exceedance curve, two assumptions were made. First, it was assumed that the non-USACE plants act similarly in operation to the four USACE plants. This assumption is reasonable because the non-USACE plants are similarly defined as peaking plants. Secondly, a further assumption was made that the USACE hydropower plants' typical year occurred concurrently. With these assumptions, the typical hourly generations for the USACE plants were combined and then divided by the total nameplate capacity of all four USACE plants. This allows for an exceedance curve for percent of nameplate capacity (Figure 6.6-3). This can then be made to represent the entire system by simply multiplying the y-axis in Figure 6.6-3 by the total system capacity of the ACT system (Figure 6.6-4).

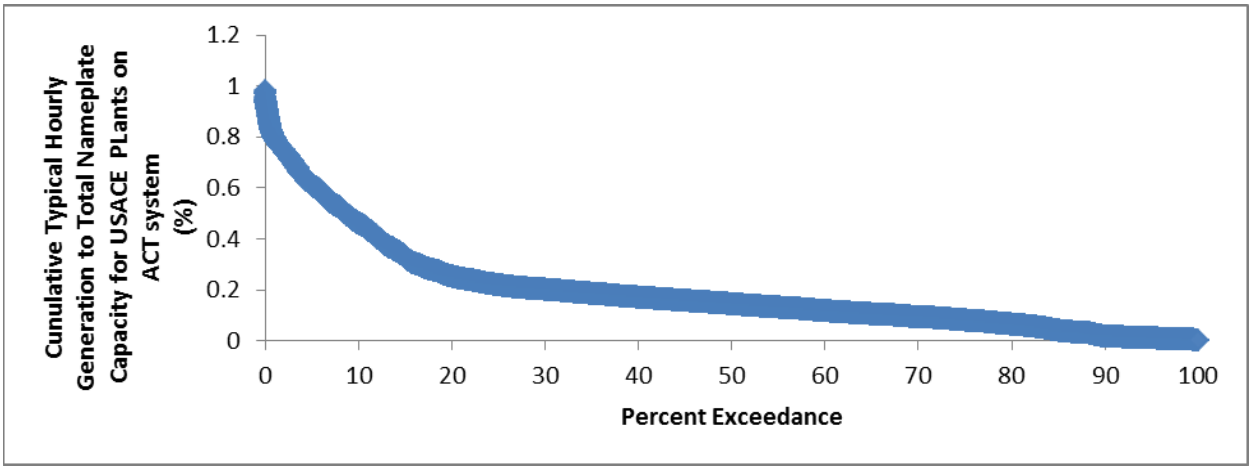


Figure 6.6-3. Percent of nameplate capacity exceedance curve for USACE plants.

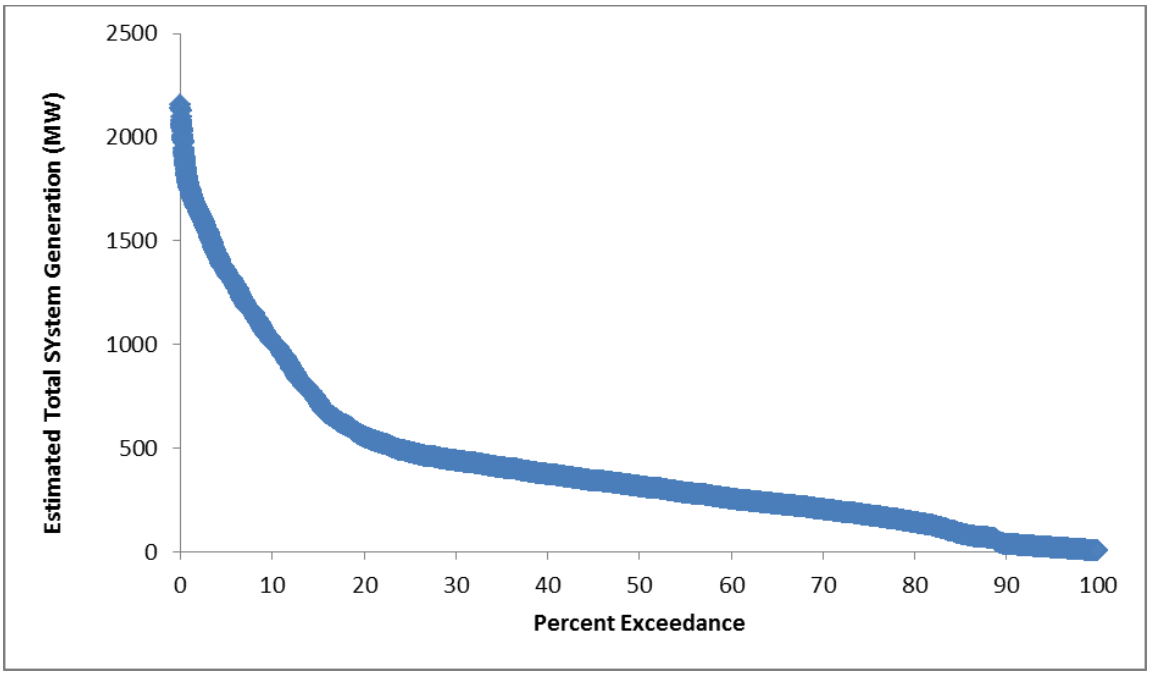


Figure 6.6-4. Load duration curve for ACT watershed hydropower system.

6.6.3.2.2.2 Screening Curve Analysis

A screening curve is a plot of annual total plant costs for a thermoelectric generating plant [fixed (capacity) cost plus variable (operating) cost] versus annual plant factor. When that is applied to multiple types of thermoelectric generation resources, the screening curve provides an algebraic way to show which type of thermoelectric generation is the least-cost alternative for each plant factor (*PF*) range.

The screening curve assumes a linear function defined by Equation 3:

$$\text{Equation 3: } AC = CV + (EV \times 0.0876 \times PF)$$

where

AC = annual thermoelectric generating plant total cost ($/kW-year)

CV = thermoelectric generating plant capacity cost ($/KkW-year)

EV = thermoelectric generating plant operating cost ($/MWh)

Capacity unit values for coal-fired steam, gas-fired combined cycle, and combustion turbine plants were computed using procedures developed by the FERC. Capacity values were computed for the SEPA region on the basis of a 3.50 percent interest rate and 2013 price levels. Adjusted capacity values are shown in Table 6.6-8. The adjusted capacity values incorporate adjustments to account for differences in reliability and operating flexibility between hydropower and thermoelectric generating power plants. For further discussion of the capacity value FERC adjustments, see EM 1110-2-1701, Hydropower, Section 9-5c.

Table 6.6-8.
Adjusted capacity and operating costs for the SEPA region

Thermoelectric generating plant type	Adjusted capacity cost ($/KW-year)	Operating cost ($/MWh)
Coal-fired steam	$271.16	$35.71
Combined cycle (CC)	$165.54	$33.82
Combustion turbine (CT)	$86.53	$52.67

Operating costs for coal-fired steam, gas-fired combined cycle (CC), and gas-fired combustion turbine (CT) plants were developed using information obtained from *EIA Electric Power Monthly* (DOE/EIA-0226) and other sources. The information obtained included fuel costs, heat rates, and variable operating and maintenance costs. The resulting values, based on 2013 price levels, are shown in Table 6.6-8. Because current USACE policy does not allow the use of real fuel cost escalation, the values were assumed to apply over the entire period of analysis.

The plot for each thermoelectric generation type was developed by computing the annual plant cost for various plant factors ranging from zero to 100 percent. The plots are shown in Figure 6.6-5.

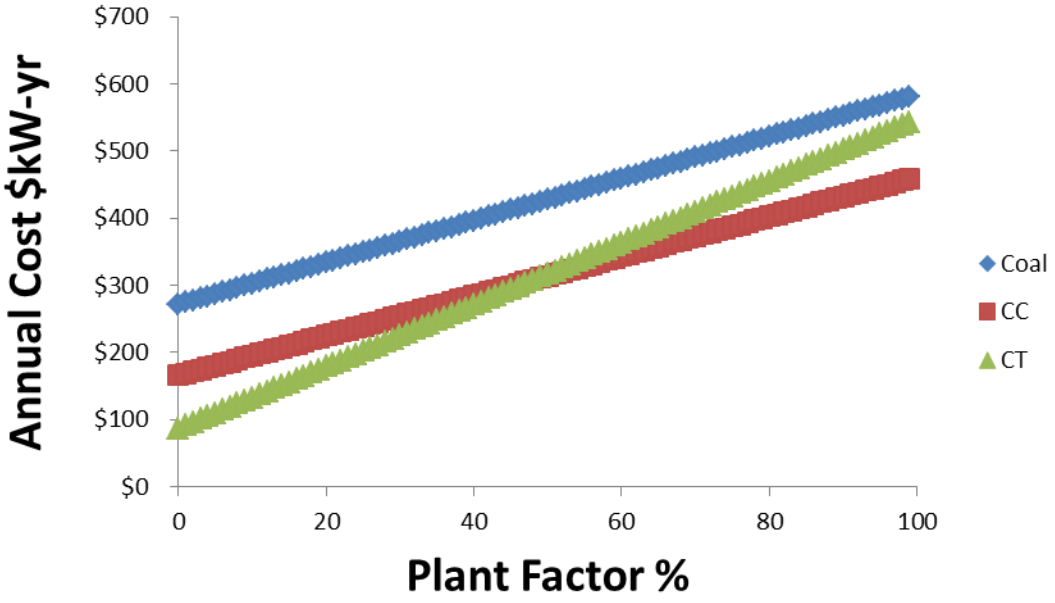


Figure 6.6-5. Screening curve for various thermoelectric alternatives in the SEPA region.

6.6.3.2.2.3 Composite Unit Capacity Value

The process for calculating the composite unit capacity value for the ACT Basin system is described by the following algorithm and is illustrated in Figure 6.6-6.

The following is the algorithm used to compute composite unit capacity.

1. From the screening curve, determine the *breakpoints* (the plant factors at which the least cost plant type changes).

2. Find the points on the generation-duration curve where the percent of time generation is numerically identical to the plant factor breakpoints defined in the preceding step; these intersection points define the portion of the generation that would be carried by each thermoelectric generation plant type.
3. Calculate percent of total generating capacity for each thermoelectric alternative using the portions defined in step 2.
4. Calculate the composite unit capacity of the system as an average of each the thermoelectric alternative's capacity cost weighted by their percent of total generating capacity defined in step 3.

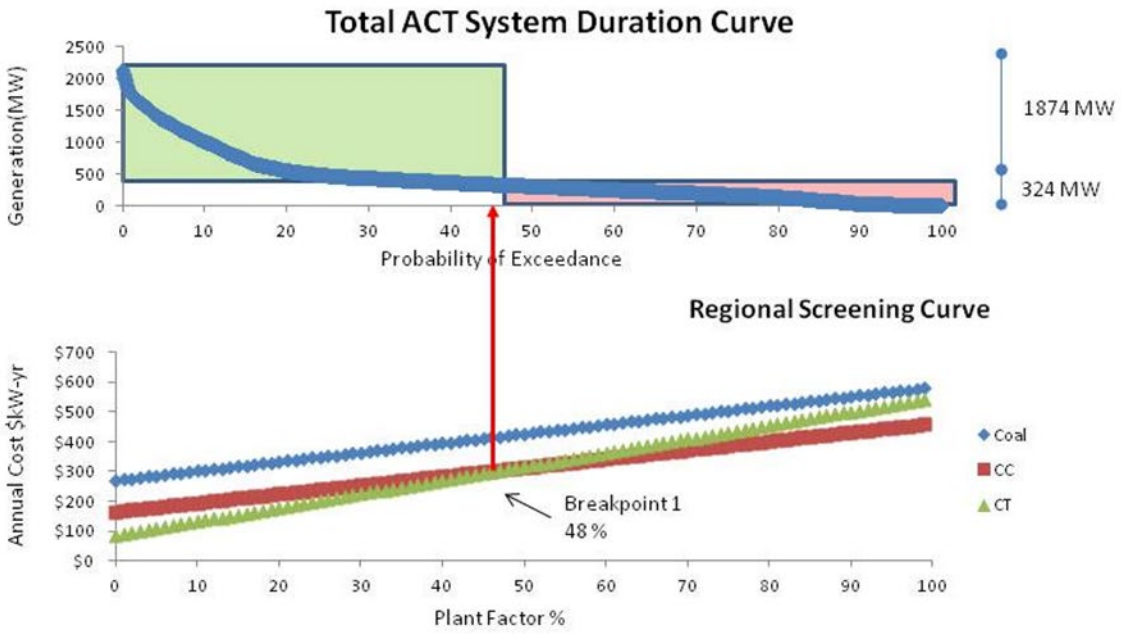


Figure 6.6-6. Illustrative example of composite unit capacity value for the ACT Basin hydropower system.

The composite unit (total weighted) capacity value computation for the ACT Basin system is presented in Table 6.6-9.

Table 6.6-9.
Composite unit capacity value for the ACT system

	Estimated replacement generation (MW)	Percent of total generating capacity	Capacity cost ($/KW-yr)	Weighted value ($/KW-yr)
Combustion turbine	1,874	85%	$86.53	$73.77
Combined-cycle	324	15%	$166.54	$24.55
Coal	0	0%	$271.16	$0.00
Total weighted capacity value				$98.32

6.6.3.3 No Action Alternative

Under the No Action Alternative, the operation of USACE projects in the ACT Basin would be expected to remain unchanged. Therefore, effects on hydropower would be expected to be the same as they have been in the past. Under the No Action Alternative, 5,701,466 MWh (Figure 6.6-7) would be generated by system hydropower plants with an energy benefit of $234.1 million. The dependable capacity under the No Action Alternative is estimated to be 2,147.55 MW. Table 6.6-10 shows the energy benefits per project, and Table 6.6-11 shows the estimated dependable capacity for each project.

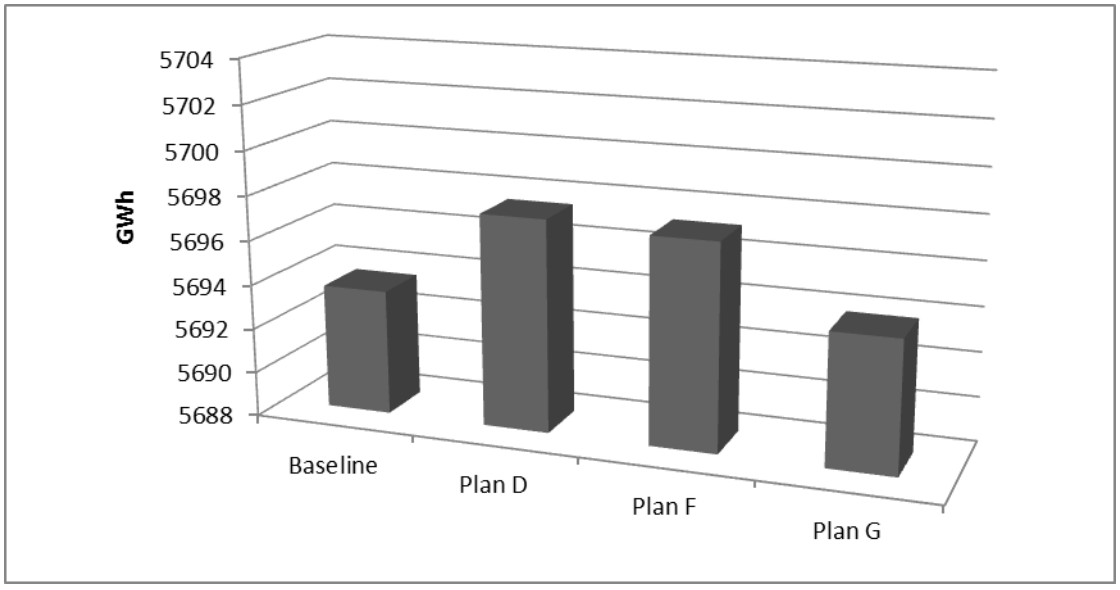


Figure 6.6-7. Average annual hydropower system generation by alternatives.

Table 6.6-10.
Individual plant and total system energy benefits

Plant	No Action Alternative
Allatoona Lake	$5,081,000
Weiss Lake	$8,694,000
H. Neely Henry Lake	$8,331,000
Logan Martin Lake	$17,829,000
Lay Lake	$26,949,000
Mitchell Lake	$22,909,000
Jordan Dam and Lake	$11,550,000
Bouldin Dam	$34,823,000
R.L. Harris Lake	$8,454,000
Lake Martin	$17,890,000
Yates Lake	$6,730,000
Thurlow Lake	$11,530,000
Robert F. Henry Lock and Dam and R.E. “Bob” Woodruff Lake	$13,286,000
Millers Ferry Lock and Dam and William “Bill” Dannelly Lake	$15,321,000
Carters Lake	$31,785,000
Carters Pumping cost (value in parentheses is negative)	($18,840,000)
Total	$222,304,000

Table 6.6-11.
Plant and system-dependable capacity calculations

Project	No Action Alternative (MW)
Allatoona Lake	76.87
Carters Lake	576.59
Weiss Lake	73.06
H. Neely Henry Lake	57.05
Logan Martin Lake	127.57
Lay Lake	159.09
Mitchell Lake	160.60
Jordan Dam and Lake	108.09
Bouldin Dam	210.29
R.L. Harris Lake	127.76
Lake Martin	181.48
Yates Lake	45.29
Thurlow Lake	77.76
Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake	77.33
Millers Ferry Lock and Dam and William "Bill" Dannelly Lake	88.36
Total	2147.08

The estimated cost of pumping at the Carters Dam facility represents a negative energy benefit as shown in Table 6.6-9 (see also Section 6.6.3.1.3). The average annual energy requirement for pumping for the No Action Alternative was determined to be 243,053,000 KWh. To approximate the monetary value of the energy requirement, an estimated value of $0.03 per KWh was used. This value represents an annualized value calculated using the historical cost received from SEPA.

6.6.3.4 Alternative Plan D

To determine the change in energy generation resulting from implementing various alternatives including the No Action Alternative and Plans D, F, and G (the Proposed Action Alternative), an analysis was performed to determine the average annual energy generated in the No Action Alternative and for each of the alternative flow scenarios using a 50-year period of economic analysis. As shown in Figure 6.6-8, less than a one percent increase in average annual energy would be expected with Plan D (5,697,520 MWh) when compared to the No Action Alternative (5,693,615 MWh)—an increase of 3,905 MWh. The term "baseline" in Figure 6.6-8 is equivalent to the No Action Alternative.

The value of the replacement energy has a seasonal trend following the demand and generating resource availability through the year. Therefore, in calculating annual benefits, it was necessary to look at how the generated energy is distributed on a monthly basis. Figure 6.6-8 shows both the average monthly energy generated and the percent difference between the No Action Alternative and the three alternative flow scenarios: Plans D, F, and G. From January through August, the simulation shows a two percent or less increase in power generation for all three alternative flow scenarios compared to the No Action Alternative. The majority of the loss in generation for the alternatives would occur between September and November, with a peak increase in October, amounting to almost six percent. All alternative flow scenarios would be expected to show an increase in generation in December.

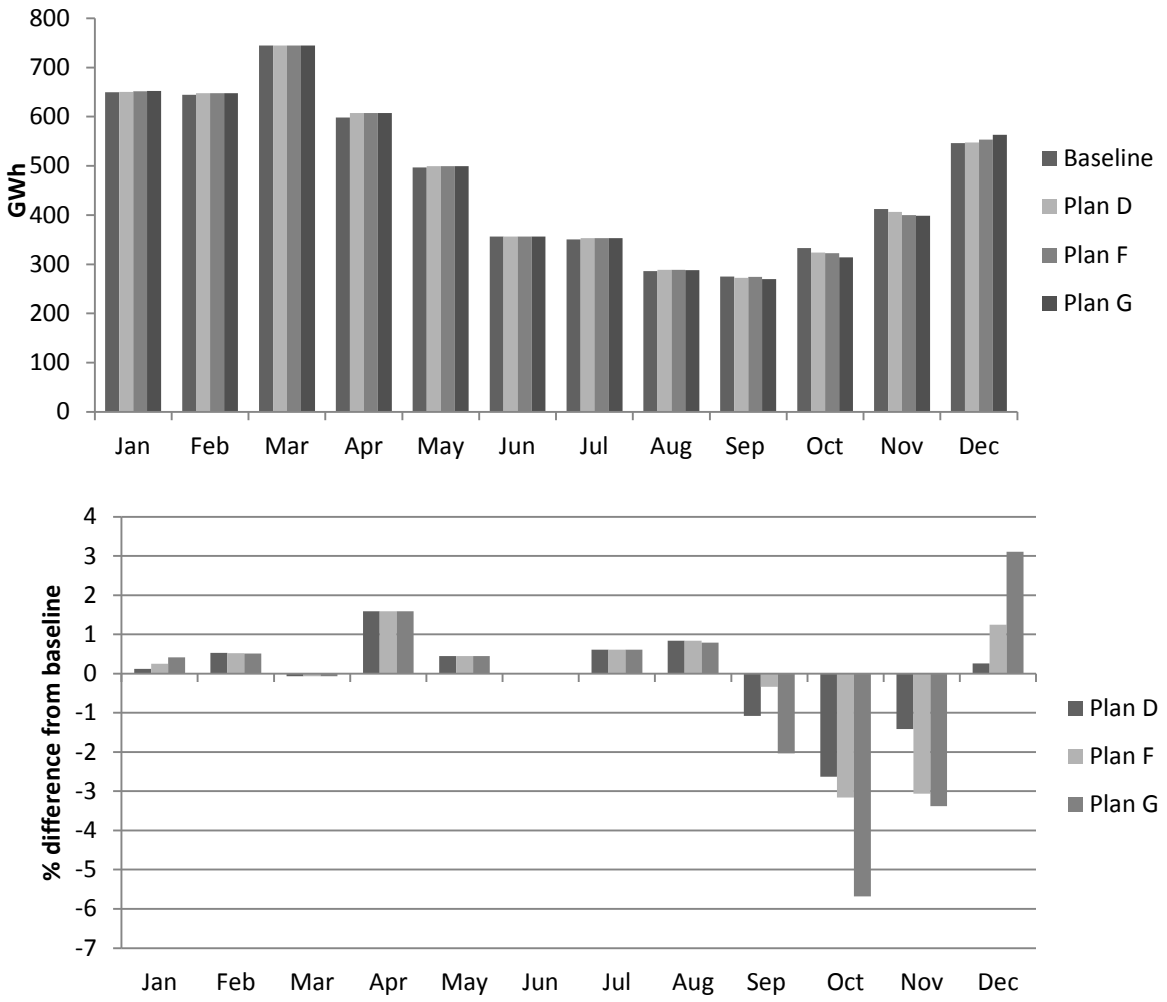


Figure 6.6-8. Monthly generation, No Action Alternative and alternative flow scenarios.

In Table 6.6-12, the annual average pumping costs for the Carters Dam facility are presented for the No Action Alternative and Plans D, F, and G. The No Action Alternative would use approximately one GWh less annually than the three alternatives. To approximate the monetary value of the MWh for pumping, an estimated value of $0.03 per KWh is used, this represents an annualized value calculated using the historical cost received from SEPA. The pumping costs represent a negative energy benefit (see Section 6.6.3.1.3).

Table 6.6-12.
Estimated pumping cost for Carters Dam for Alternatives D, F, and G

	No Action Alternative	Plan D	Plan F	Plan G
Average annual energy consumed by pump (KWh)	628,000,000	627,000,000	627,000,000	627,000,000
Estimated wholesale cost of energy ($/KWh)	$0.03	$0.03	$0.03	$0.03
Estimated annual cost	$ 18,840,000	$ 18,810,000	$ 18,810,000	$ 18,810,000

Table 6.6-13 illustrates each plant's average annual energy benefits. In general the majority of the plants would show no noteworthy differences between the No Action Alternative and Alternative Plans D, F, and the Proposed Action Alternative (Plan G). However, some significant disparities would be expected in Jordan Dam and Lake and Bouldin Dam. In the Jordan Dam and Lake facility, the alternatives would be expected to produce an energy value increase, while for Bouldin Dam there would be an energy value decrease. As shown in Table 6.6-14, comparing Alternative Plan D to the No Action Alternative, a 0.04 percent reduction in total system energy benefits of $83,000 would be expected.

Table 6.6-13.
Individual plant and total system energy benefits

Plant	No Action Alternative	Plan D	Plan F	Proposed Action Alternative
Allatoona Lake	$5,081,000	$5,077,000	$5,094,000	$5,062,000
Weiss Lake	$8,694,000	$8,688,000	$8,687,000	$8,669,000
H. Neely Henry Lake	$8,331,000	$8,551,000	$8,551,000	$8,543,000
Logan Martin Lake	$17,829,000	$17,798,000	$17,797,000	$17,785,000
Lay Lake	$26,949,000	$26,909,000	$26,906,000	$26,886,000
Mitchell Lake	$22,909,000	$22,883,000	$22,882,000	$22,875,000
Jordan Dam and Lake	$11,550,000	$11,522,000	$11,526,000	$11,534,000
Bouldin Dam	$34,823,000	$34,826,000	$34,821,000	$34,782,000
R.L. Harris Lake	$8,454,000	$8,444,000	$8,444,000	$8,443,000
Lake Martin	$17,890,000	$17,818,000	$17,819,000	$17,817,000
Yates Lake	$6,730,000	$6,704,000	$6,705,000	$6,704,000
Thurlow Lake	$11,530,000	$11,487,000	$11,488,000	$11,487,000
Robert F. Henry Lock and Dam and R.E. "Bob" Woodruff Lake	$13,286,000	$13,258,000	$13,255,000	$13,235,000
Millers Ferry Lock and Dam and William "Bill" Dannelly Lake	$15,321,000	$15,279,000	$15,276,000	$15,251,000
Carters Lake	$31,768,000	$31,785,000	$31,785,000	$31,785,000
Carters Pumping cost	($18,840,000)	($18,810,000)	($18,810,000)	($18,810,000)
Total	$222,304,000	$222,221,000	$222,226,000	$222,048,000

NOTE: Values shown in parentheses are negative values

Table 6.6-14.
Energy benefits for the ACT River Basin hydropower system

	Energy value	Energy benefit
No Action	$222,304,000	$0
Plan D	$222,221,000	($83,000)
Plan F	$222,226,000	($78,000)
Proposed Action Alternative	$222,048,000	($255,000)

NOTE: Values shown in parentheses are negative values

The total system difference between the three alternatives and the No Action Alternative is the gain or loss in dependable capacity caused by changes in system water control operations. Those results are shown in Table 6.6-15. Alternative Plan D would be expected to have a slightly smaller system-dependable capacity (9.55 MW) than the No Action Alternative. As shown in Table 6.6-16, that reduction in system capacity would results in a reduction in capacity benefits of $881,000.

Table 6.6-15.
Plant and system-dependable capacity calculations

Project	No Action Alternative (MW)	Plan D (MW)	Plan F (MW)	Proposed Action Alternative (MW)
Allatoona Lake	76.87	76.87	76.86	76.51
Carters Lake	576.59	576.79	576.79	576.79
Weiss Lake	73	73.12	73.12	73.07
H. Neely Henry Lake	57.05	57.11	57.11	57.08
Logan Martin Lake	127.57	127.13	127.13	127.05
Lay Lake	159.09	158.93	158.93	158.87
Mitchell Lake	160.6	160.28	160.28	160.2
Jordan Dam and Lake	108.09	107.24	107.25	107.22
Bouldin Dam	210.29	210.58	210.57	210.38
R.L. Harris Lake	127.72	126.23	126.23	126.26
Lake Martin	181.48	177.97	177.97	178.12
Yates Lake	45.29	44.35	44.35	44.39
Thurlow Lake	77.76	76.49	76.49	76.55
Robert F. Henry Lock and Dam and R.E. “Bob” Woodruff Lake	77.33	76.96	76.96	76.96
Millers Ferry Lock and Dam and William “Bill” Dannelly Lake	88.36	88.07	88.07	88.07
Total	2,147.08	2,138.12	2,138.12	2,137.53

Table 6.6-16.
Capacity benefits for the ACT Basin hydropower system

Alternative	Capacity value (MW)	Difference from baseline (MW)	Capacity value ($MW/yr)	Capacity benefit
No Action Alternative	2,147.08	0		
Plan D	2,138.12	(8.96)	$98,320	($881,000)
Plan F	2,138.12	(8.96)	$98,320	($881,000)
Proposed Action Alternative	2,137.53	(9.55)	$98,320	($939,000)

NOTE: Values shown in parentheses are negative values

6.6.3.5 Alternative Plan F

Effects of Plan F on energy benefits and dependable capacity are shown above in Table 6.6-13, Table 6.6-14, Table 6.6-15, and Table 6.6-16.

Hydropower generation under Plan F is shown in Figure 6.6-8 and Figure 6.6-9. When compared to the No Action Alternative, Alternative Plan F would result in an increase of system generation of 3,609 MWh. From January through August, the simulation shows a two percent or less increase in power generation for all the alternative flows scenarios compared to the No Action Alternative. The majority of the loss in generation for the alternatives occurs between September and November with a peak decrease occurring in October, amounting to almost six percent. All alternative flow scenarios show an increase in generation in December.

Projected average annual energy benefits at each project under Plan F are listed in Table 6.6-14, which shows a reduction of $78,000, or 0.04 percent, from the No Action Alternative. At the majority of the plants, no noteworthy differences would be expected between the No Action Alternative and Plan F.

Dependable capacity for the ACT Basin hydropower system would be expected to decrease from the No Action Alternative by about 8.96 MW under Plan F. As shown in Table 6.6-16, that reduction in system capacity would result in a reduction in capacity benefits of $881,000.

6.6.3.6 Alternative Plan G (Proposed Action Alternative)

Effects of the Proposed Action Alternative on energy benefits and dependable capacity are shown above in Table 6.6-13, Table 6.6-14, Table 6.6-15, and Table 6.6-16. Effects under the Proposed Action Alternative would be similar to those under Plan F.

Hydropower generation under the Proposed Action Alternative is shown in Figure 6.6-8 and Figure 6.6-9. When compared to the No Action Alternative, the Proposed Action Alternative would result in an increase of system generation of 282 MWh or about 0.1 percent. From January through August, the simulation shows a two percent or less increase in power generation for all alternative flows scenarios compared to the No Action Alternative. There is a loss in generation from September through November. With the Proposed Action Alternative, an increase in generation in December would be expected.

Projected average annual energy benefits at each project under the Proposed Action Alternative are listed in Table 6.6-14 and show a reduction of $255,000 or 0.11 percent. At the majority of plants, no noteworthy differences would be expected between the No Action Alternative and the Proposed Action Alternative.

Dependable capacity for the ACT Basin hydropower system would be expected to decrease from the No Action Alternative by about 9.51 MW under the Proposed Action Alternative, similar to Plan F. As shown in Table 6.6-15, such a reduction in system capacity would be expected to reduce capacity benefits by $939,000.

6.6.3.7 Summary of Hydropower Benefits

Table 6.6-17 presents a summary of the energy, capacity, and total hydropower benefits of the flow scenarios evaluated for the recommended ACT Water Control Plan compared to the No Action Alternative condition.

Table 6.6-17.
Total hydropower benefits for the ACT Basin hydropower system

Alternative	Capacity benefit	Energy benefit	Total benefits
No Action Alternative		$0.00	$0.00
Plan D	($881,000)	($83,000)	($964,000)
Plan F	($881,000)	($78,000)	($959,000)
Proposed Action Alternative	($939,000)	($255,000)	($1,194,000)

NOTE: Values shown in parentheses are negative values

6.6.4 Agricultural Water Supply

6.6.4.1 No Action Alternative

Under the No Action Alternative, the operation of USACE projects in the ACT Basin would be expected to remain unchanged. Therefore, effects on agricultural water supply would be expected to be the same as they have been in the past.

6.6.4.2 Alternative Plan D

As part of the ACT/ACF Comprehensive Study, the NRCS, in 1995, completed the agricultural water demand element of the study. In performing that element of the study, NRCS evaluated the agricultural water demand in the ACT Basin for five broad agricultural categories: crops and orchards, turf farms, nurseries, aquaculture, and livestock and poultry. Approximately 79 percent of the water used for agricultural purposes in the ACT Basin is for irrigating crops and orchards. NRCS found that in the ACT Basin, surface water supplied the majority of the water used for agricultural irrigation. The primary sources of surface water for agricultural use in the ACT Basin are smaller tributaries to the Alabama, Coosa, and Tallapoosa rivers or from farm ponds constructed for that purpose. The proposed changes to the water control operations in the ACT Basin would not be expected to affect water availability for agricultural irrigation purposes in the basin.

6.6.4.3 Alternative Plan F

Effects would be the same as those stated above in Section 6.6.4.2.

6.6.4.4 Alternative Plan G (Proposed Action Alternative)

Effects would be the same as those stated above in Section 6.6.4.2.

6.6.5 Flood Risk Management

6.6.5.1 No Action Alternative

Under the No Action Alternative, the operation of USACE projects in the ACT Basin would be expected to remain unchanged. Therefore, effects on flood risk management would be expected to be the same as they have been in the past.

6.6.5.2 Alternative Plan D

6.6.5.2.1 Introduction

The following information should be considered before reading the evaluation text. A requirement of the ACT WCM update is that no change in the level of flood protection capabilities occurs to those provided by the dams, and therefore that no significant effect on flood risk management occurs. Because of time, funding, and the nature of the report, the structure and content inventory values presented are directly from the *Water Allocation for the Alabama-Coosa-Tallapoosa (ACT) River Basin, Alabama and Georgia, Draft Environmental Impact Statement*, Appendices Volume 2 (USACE, Mobile District 1998a).

6.6.5.2.2 Flood Risk Management Analysis

The HEC-ResSim modeling report for the ACT WCM update process (EIS Appendix C) includes the following document: *Appendix M—Flood Modeling above Rome, Georgia of the Alabama Coosa Tallapoosa Watershed HEC-ResSim Modeling of Reservoir Operations in Support of Water Control Manual Update*. This report documents the flood modeling performed to support the Allatoona Lake guide curve change scenarios (USACE HEC 2011). A HEC-ResSim flood model for the upper ACT Basin was developed as part of the ACT WCM Update Study. Figure 6.6-9 shows the sites where the modeling was conducted.

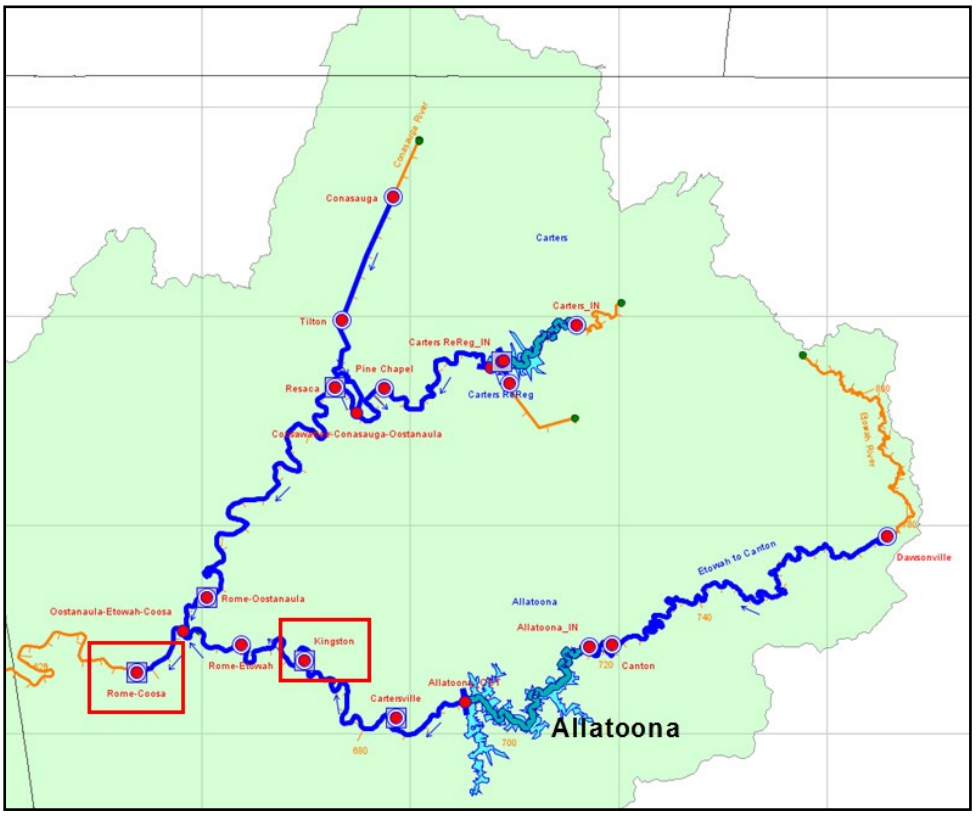


Figure 6.6-9. Map of flood impact sites.

Procedures to develop combined regulated flood frequency curves were used to determine flows downstream of Allatoona Lake. For the analysis, hypothetical hydrographs were developed and used for the historic events of December 1961, March 1979, and March 1990 because they had distinctively different storm patterns in the upper ACT Basin. Using those hypothetical hydrographs with the Baseline condition and the three alternative conditions, a series of simulation alternatives were created in HEC-ResSim to determine monthly regulated hypothetical hydrographs. For each month, the peak discharges of the 0.2, 0.5, 1.0, 2.0, and 5.0 percent regulated hydrographs at Kingston and Rome-Coosa define the regulated flood frequency curves for Baseline, September Drawdown, Phased Drawdown, and November Drawdown. Table 6.6-18 through Table 6.6-23 show the combined regulated flood frequency flows in cfs at the Kingston and Rome-Coosa sites for the three hydrographs for the 0.2, 0.5, 1.0, 2.0, and 5.0 percent flood flows.

Table 6.6-18.
Combined regulated flood frequency flows in cfs at Kingston based on 1961 hydrograph shapes

Exceedance Probability (%)	Baseline	September drawdown	Phased drawdown	November drawdown
0.2	15,874	15,874	15,874	15,874
0.5	14,520	14,520	14,520	14,520
1.0	13,471	13,471	13,471	13,471
2.0	12,412	12,412	12,412	12,412
5.0	10,976	10,976	10,976	10,976

Table 6.6-19.
Combined regulated flood frequency flows in cfs at Kingston based on 1979 hydrograph shapes

Exceedance Probability (%)	Baseline	September drawdown	Phased drawdown	November drawdown
0.2	38,136	37,895	37,885	38,386
0.5	34,579	34,450	34,445	34,713
1.0	31,896	31,844	31,842	31,949
2.0	29,238	29,238	29,238	29,238
5.0	25,774	25,774	25,774	25,774

Table 6.6-20.
Combined regulated flood frequency flows in cfs at Kingston based on 1990 hydrograph shapes

Exceedance Probability (%)	Baseline	September drawdown	Phased drawdown	November drawdown
0.2	25,114	25,114	25,114	25,114
0.5	23,124	23,124	23,124	23,124
1.0	21,601	21,601	21,601	21,601
2.0	20,051	20,051	20,051	20,051
5.0	17,526	17,526	17,526	17,526

Table 6.6-21.
Combined regulated flood frequency flows in cfs at Rome-Coosa based on 1961 hydrograph shapes

Exceedance Probability (%)	Baseline	September drawdown	Phased drawdown	November drawdown
0.2	82,878	82,878	82,878	82,878
0.5	75,812	75,812	75,812	75,812
1.0	70,336	70,336	70,336	70,336
2.0	64,786	64,786	64,786	64,786
5.0	57,256	57,256	57,256	57,256

Table 6.6-22.
Combined regulated flood frequency flows in cfs at Rome-Coosa based on 1979 hydrograph shapes

Exceedance Probability (%)	Baseline	September drawdown	Phased drawdown	November drawdown
0.2	79,909	79,583	79,643	80,645
0.5	71,958	71,830	71,846	72,222
1.0	66,660	66,591	66,599	66,801
2.0	61,315	61,302	61,304	61,342
5.0	54,540	54,540	54,540	54,540

Table 6.6-23.
Combined regulated flood frequency flows in cfs at Rome-Coosa based on 1990 hydrograph shapes

Exceedance Probability (%)	Baseline	September drawdown	Phased drawdown	November drawdown
0.2	80,362	80,311	80,311	80,514
0.5	73,429	73,429	73,429	73,449
1.0	68,229	68,229	68,229	68,241
2.0	62,968	62,968	62,968	62,972
5.0	55,230	55,230	55,230	55,230

Table 6.6-24 and Table 6.6-25 show the percent change that would be expected with the alternative operation compared to the baseline.

Table 6.6-24.
Change in percent from baseline at Kingston

	1961 hydrograph shape			1979 hydrograph shape			1990 hydrograph shape		
Exceedance probability (%)	September	Phased	November	September	Phased	November	September	Phased	November
0.2	0.000	0.000	0.000	-0.631	-0.656	0.657	0.000	0.000	0.000
0.5	0.000	0.000	0.000	-0.374	-0.389	0.388	0.000	0.000	0.000
1.0	0.000	0.000	0.000	-0.162	-0.168	0.167	0.000	0.000	0.000
2.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 6.6-25.
Change in percent from baseline at Rome-Coosa

Exceedance probability (%)	1961 hydrograph shape			1979 hydrograph shape			1990 hydrograph shape		
	September	Phased	November	September	Phased	November	September	Phased	November
0.2	0.000	0.000	0.000	-0.408	-0.333	0.921	-0.063	-0.063	0.190
0.5	0.000	0.000	0.000	-0.178	-0.156	0.367	0.000	0.000	0.027
1.0	0.000	0.000	0.000	-0.103	-0.090	0.212	0.000	0.000	0.017
2.0	0.000	0.000	0.000	-0.021	-0.019	0.044	0.000	0.000	0.007
5.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

The results indicate that the September Drawdown operation and the Phased Drawdown operation would have no impact on flood frequency flows at Kingston for the 1961 and 1990 hydrograph shapes and would slightly reduce the flood frequency flows at Kingston for the 1979 hydrograph shape. The September Drawdown operation and the Phased Drawdown operation would have no impact on flood frequency flows at Rome-Coosa for the 1961 hydrograph shape and would slightly reduce the flood frequency flows at Rome-Coosa for the 1979 and 1990 hydrograph shapes. The November Drawdown operation would have no impact on flood frequency flows at Kingston for the 1961 and 1990 hydrograph shapes and would slightly increase the flood frequency flows at Kingston for the 1979 hydrograph shape. The November Drawdown operation would have no impact on flood frequency flows at Rome-Coosa for the 1961 hydrograph shape and would slightly increase the flood frequency flows at Rome-Coosa for the 1979 and 1990 hydrograph shapes.

6.6.5.2.3 Flood Damages Prevented

According to the ER1105-2-100, flood damages are potential dollar damages to activities affected by flooding. On the basis of the structure and content inventory, average annual damages are computed using standard damage-frequency integration techniques and computer programs that relate hydrologic and hydraulic flood variables such as discharge and stage to damages and to the probability of occurrence of such variables. Flood reduction benefits are computed as the difference in flood damages with and without the project. By having a project in place, the flood damages that would have occurred without the project are prevented.

The USACE Mobile District Water Management Office developed an Annual Damage Reduction Summary that estimates the flood damages prevented by the Allatoona Lake project. Table 6.6-26 shows the flood damages prevented by year for the ACT projects from 1986 to 2011.

Table 6.6-26.
Flood damages prevented by year

Year	Allatoona Lake
1986	$0
1987	$2,626,000
1988	$0
1989	$0
1990	$14,620,100
1991	$0
1992	$142,580
1993	$0
1994	$0
1995	$433,046
1996	$33,200
1997	$0
1998	$628,127
1999	$0
2000	$0
2001	$0
2002	$0
2003	$937,653
2004	$11,002,375
2005	$20,033,559
2006	$0
2007	$0
2008	$0
2009	$8,721
2010	$20,330,262
2011	$18,354,891

6.6.5.2.4 Summary

USACE, Mobile District operates Allatoona Lake for flood risk management, one of its primary missions. Flood risk management has long been an important focus of USACE and the reservoirs it operates. No proposed changes to operations would significantly affect flood risk management at Allatoona Lake. The flood risk management capabilities of the USACE reservoirs on the ACT Basin would not be affected.

6.6.5.3 Alternative Plan F

Effects would be the same as those stated above in Section 6.6.5.2.

6.6.5.4 Alternative Plan G (Proposed Action Alternative)

Effects would be the same as those stated above in Section 6.6.5.2.

6.6.6 Recreation

6.6.6.1 No Action Alternative

Under the No Action Alternative, the operation of USACE projects in the ACT Basin would be expected to remain unchanged. Therefore, effects on recreation would be expected to be the same as they have been in the past.

Section 2.1.1.2.1.4 of the EIS, the Master WCM, and the individual project WCMs outline current communication measures to promote and maintain public safety at USACE projects, both in the reservoirs and the tailrace areas below the dams, including automated warning systems associated with rapid changes in flow and stage condition that occur downstream of the dams when hydropower generation is initiated and/or spillway gates are opened.

6.6.6.2 Alternative Plan D

6.6.6.2.1 Methodology

The HEC-ResSim model was used to evaluate effects of modifications of water control operations on the USACE reservoirs in the ACT Basin. The recreation analysis was completed by comparing differences in model simulations over the period of record (January 06, 1939 to December 31, 2011) in the baseline condition (No Action Alternative) and the three alternative flow conditions evaluated. The three alternative flow conditions are Plans D, F, and the Proposed Action Alternative (Plan G). Plans D, F, and the Proposed Action Alternative flow scenarios were modeled to include both USACE and APC navigational releases, revised drought plan, and seasonal releases at Carters Lake. Plans D, F, and the Proposed Action Alternative differ in the operation of Allatoona Lake. Qualitative impact parameters were established on the basis of the guidelines from the Low Water Action Plans for Allatoona Lake and Carters Lake.

6.6.6.2.2 Impact Levels

6.6.6.2.2.1 Allatoona Lake

Allatoona Lake has impact levels defined at pool elevations of 837 ft, 835 ft, and 828 ft. The elevation level of 837 ft to 835 ft is defined as the Initial Impact Range. Thirteen USACE beaches, one state park beach, one county park beach, two city park beaches, and one concessionaire beach will be affected by a 50 percent reduction in swim area. Beach use will decline, and other users will tend to use water areas outside swim area buoy lines. Buoy lines are set at 840 ft during normal operation and cannot be moved out because of uncertainty of the lake bottom (i.e., unacceptable gradient, hidden hazards, and proximity to boating traffic areas). Sixteen USACE-operated launching ramp areas with 31 total ramp lanes will remain unusable. Approximately 889 private docks will be minimally affected—some will have to be moved out; however, many cannot be moved. Eight marinas are operated by concessionaires, with approximately 2,748 wet slips affected minimally. Also, seven marinas will have to let out docks.

Pool elevations ranging from 835 to 828 ft are defined as the Recreation Impact Range. All USACE beaches, one concession beach, one state park beach, one county park beach, and two city beaches are unusable. Little or no water is in delineated swim areas, which results in little or no visitation at beach areas. Of the 16 USACE-operated launching ramp areas, 7 percent will be closed. Forty percent of private boat docks will go aground. All hazards down to 830 ft in major boating areas are permanently marked. Stumps and rock areas will continue to be exposed in upper reaches of creeks and rivers. There is a major

effect on seven of eight marinas. Wet slip docks will continue to be moved outward. Basin areas will become unusable for sailboats.

Elevation 828 ft and below is defined as the Water Access Limited Range. All 13 beach areas become unusable. No swim areas are available. Unusable USACE boat ramps will reach 50 percent. All private docks will be affected; they will be moved out or become unusable. Significant boating hazards appear above or just below water surface. Boating on Allatoona Lake becomes extremely limited. There is a significant effect on seven of eight marinas. Boat slips will be pushed out to their maximum capacity, which causes severe crowding and decreased maneuverability in and out of the marina.

The results show that with the No Action Alternative and Plan D, the Allatoona Lake pool level would be within the Initial Impact Range between 9 percent and 10 percent of the time (Table 6.6-27). For the No Action Alternative, Allatoona Lake pool levels would be within the Recreation Impact Range 28.4 percent over the period of record. Under Plan D operations, Allatoona Lake levels would be within the Recreation Impact Range approximately 30.7 percent over the period of record. Allatoona Lake levels would reach the Water Access Limited Range approximately 28.7 percent of the time over the period of record under the No Action Alternative and about 26.8 percent of the time over the period of record under Plan D, slightly less often than the No Action Alternative.

Table 6.6-27.
Allatoona Lake recreation impacts (reflected by number of days and percent of time over the 73-year modeled period of record that lake levels fall within recreation impact ranges)

	No Action Alternative (no. of days)	% of time pool level falls within range	Plan D (no. of days)	% of time pool level falls within range	Plan F (no. of days)	% of time pool level falls within range	Proposed Action Alternative (no. of days)	% of time pool level falls within range
Initial Impact range	2,526	9.5%	2,587	9.7%	2,508	9.4%	2,701	10.1%
Recreation Impact range	7,568	28.4%	8,197	30.7%	8,990	33.7%	10,046	37.7%
Water Access Limited range	7,641	28.7%	7,149	26.8%	6,586	24.7%	5,225	19.6%

Current risk communication and public safety measures for the reservoir and tailrace areas would continue as described in Section 2.1.1.2.1.4. As technological advances in communication, changing demographics, and other related factors may dictate, USACE will continue to seek innovative ways to reach out to the public and share information on public safety and other project-related matters.

6.6.6.2.2.2 Carters Lake

Carters Lake has impact levels defined at elevations of 1,068 ft, 1,060 ft, and 1,055 ft. The Initial Impact Range is defined to be between 1,068 ft and 1,060 ft. Swim buoys are set at 1,068 ft during normal pool of 1,074 ft. The swim area becomes reduced at Harris Branch Beach. No unmarked hazards to navigation are at this level or effects on the marina. Private docks are not permitted at Carters Lake. The Recreation Impact Range is between 1,060 ft and 1,055 ft. Swim areas are completely unusable because buoy lines cannot be moved further out. Harris Branch Beach is closed. Boating and other water recreation activities become increasingly hazardous as unmarked navigational hazards continue to emerge. Two day-use boat ramp areas are closed to the public. The Water Access Limited Range is defined to be below 1,055 ft. Harris Branch Beach is closed and swim areas remain unusable. Navigational hazards will begin to

appear. Boat slips at marinas are still usable, but docks to shoreline are extremely sloped. Five boat ramp areas are closed.

Table 6.6-28 shows the number of days for the period of record (73 years) at Carters Lake that each recreation impact range was triggered. The results show that with the No Action Alternative, Carters Lake levels would be in the Initial Impact range about 0.5 percent of the time over the period of record. Plan D would result in Carters Lake levels reaching the Initial Impact Range about 2.5 percent of the time. The Carters Lake levels would not decline into the Recreation Impact Range under the No Action Alternative, compared with 0.2 percent of the time for Plan D. The Carters Lake levels would not decline into the Water Access Limited Range.

Table 6.6-28.
Carters Lake recreation impacts (reflected by number of days and percent of time over the 73-year modeled period of record that lake levels fall within recreation impact range)

	No Action Alternative (no. of days)	% of time pool level falls within range	Plan D (no. of days)	% of time pool level falls within range	Plan F (no. of days)	% of time pool level falls within range	Proposed Action Alternative (no. of days)	% of time pool level falls within range
Initial Impact Range	124	0.5%	668	2.5%	668	2.5%	668	2.5%
Recreation Impact Range	0	0.0%	64	0.2%	64	0.2%	64	0.2%
Water Access Limited Range	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Current risk communication and public safety measures for the reservoir and tailrace areas would continue as described in Section 2.1.1.2.1.4. As technological advances in communication, changing demographics, and other related factors may dictate, USACE will continue to seek innovative ways to reach out to the public and share information on public safety and other project-related matters.

6.6.6.2.2.3 Alabama River Lakes (Woodruff, Dannelly, and Claiborne)

The Alabama River lakes were established by three USACE lock and dam projects in the southern portion of the ACT Basin: R.F. Henry Lock and Dam ("Bob" Woodruff Lake), Millers Ferry Lock and Dam ("Bill" Dannelly Lake), and Claiborne Lock and Dam (Claiborne Lake). These projects have minimal pool fluctuations as they are run of the river projects. Median pool elevations (for all months) for the three lakes are as follows: Woodruff Lake (elevation 125 ft); Dannelly Lake (elevation 80.4 ft); and Claiborne Lake (elevation 36 ft).

The analysis showed that there are no changes to median pool levels between the No Action Alternative and Plan D at any of the three projects. It follows that due to no changes in pool elevations there is likely to be minimal to no recreation impacts at any of the three projects.

Current risk communication and public safety measures for the reservoir and tailrace areas would continue as described in Section 2.1.1.2.1.4. As technological advances in communication, changing demographics, and other related factors may dictate, USACE will continue to seek innovative ways to reach out to the public and share information on public safety and other project-related matters.

6.6.6.3 Alternative Plan F

6.6.6.3.1 Allatoona Lake

The results show that with the No Action Alternative and Plan F, Allatoona Lake pool levels would be within the Initial Impact range between 9 percent and 10 percent of the time (Table 6.6-26). Allatoona Lake levels would be in the Recreation Impact Range approximately 28.4 percent of the time over the period of record for the No Action Alternative and approximately 33.7 percent of the time for Plan F. Allatoona Lake levels would be within the Water Access Limited Range approximately 28.7 percent of the time over the modeled period of record under the No Action Alternative and about 24.7 percent of the time under Plan F, about four percent less than the No Action Alternative. Therefore, implementation of Plan F would be expected to avoid declines of lake levels into the Water Access Limited Range (the most severe recreational impact level) on an additional 1,055 days over the 73-year modeled period of record compared to the No Action Alternative.

Risk communication and public safety effects would be the same as for Alternative D (Section 6.6.6.2.2.1).

6.6.6.3.2 Carters Lake

Effects would be the same as those stated above for Alternative D in Section 6.6.6.2.2.2 and Table 6.6-27.

6.6.6.3.3 Alabama River Lakes (Woodruff, Dannelly and Claiborne)

Effects would be the same as those stated above for Alternative D in Section 6.6.6.2.2.3.

6.6.6.4 Alternative Plan G (Proposed Action Alternative)

6.6.6.4.1 Allatoona Lake

The results show that with the No Action Alternative and the Proposed Action Alternative, Allatoona Lake pool levels would be within the Initial Impact Range 9.5 percent and 10.1 percent of the time, respectively (Table 6.6-26). Allatoona Lake levels would be in the Recreation Impact range approximately 28.4 percent over the period of record for the No Action Alternative and approximately 37.7 percent of the time for the Proposed Action Alternative. Allatoona Lake levels would be within the Water Access Limited range approximately 28.7 percent of the time over the modeled period of record under the No Action Alternative and only about 19.6 percent of the time under the Proposed Action Alternative. Therefore, implementation of the Proposed Action Alternative would be expected to avoid declines of lake levels into the Water Access Limited range (the most severe recreational impact level) on an additional 2,416 days over the 73-year modeled period of record compared to the No Action Alternative.

Risk communication and public safety effects would be the same as for Alternative D (Section 6.6.6.2.2.1)

6.6.6.4.2 Carters Lake

Effects would be the same as those stated above for Alternative D in Section 6.6.6.2.2.2 and Table 6.6-27.

6.6.6.4.3 Alabama River Lakes (Woodruff, Dannelly, and Claiborne)

Effects would be the same as those stated above for Alternative D in Section 6.6.6.2.2.3.

6.6.7 Property Values and Taxes

With respect to the entire ACT Basin area, water management activities for the USACE and Alabama Power Company reservoir projects have a minor overall impact on property values and property tax revenues. However, in the counties and communities where these reservoir projects reside, lands bordering the reservoirs generally have relatively high values and often represent a significant local economic base and an important source of property tax revenue for local and state governments. Consequently, lake level maintenance is an important issue to local residents in these areas under existing conditions because of its important link to property values. Modified water management activities at the USACE reservoirs in the ACT Basin under Alternatives D, F, and G would have inconsequential effects on lake levels compared to the No Action Alternative under normal conditions and would generally provide for improved lake levels under extreme drought conditions compared the No Action Alternative. Therefore, these alternatives would be expected to have a neutral to minor positive impact with respect to property values and tax revenues in the immediate vicinity of the reservoirs.

6.6.8 Environmental Justice

EO 12898 requires federal agencies to consider and address the impacts of their activities on minority and low-income populations (for more details, see Section 2.6.1.11). Water management activities at the reservoirs in the ACT Basin for the No Action Alternative and Alternative Plans D, F, and G (Proposed Action Alternative) were reviewed with respect to environmental justice considerations.

As U.S. Census Bureau data indicate (Table 2.6-23), about 28.3 percent of the 5.4 million people residing in the ACT Basin are classified as minority in accordance with EO 12898; about 24.2 percent of the population is identified as black or African American. About 63 percent of the total population in the ACT Basin resides in Alabama, and about 33 percent of those residents are classified by Census Bureau statistics as minority. About 37 percent of the basin's population resides in Georgia, and a much lower percentage (about 7.1 percent) is classified as minority. Therefore, most of the minority population in the basin would be associated with rural and small to medium-sized towns in Alabama. Suburban communities of the larger cities of Birmingham, Alabama, and Atlanta, Georgia, slightly encroach into the ACT Basin.

As shown in Table 2.6-24, about 19.6 percent of the people residing in the ACT Basin live below the poverty level. The poverty rate in the Alabama portion of the ACT Basin is about 21.1 percent, and the rate for the Georgia portion of the basin is about 16.6 percent.

During the scoping process for this EIS, significant environmental justice concerns relative to reservoir water management operations in the ACT Basin were not identified. Access and use of the USACE and APC reservoirs in the basin by minority and low-income populations would most likely focus on shoreline access activities like picnicking, wading/swimming, and recreational and subsistence fishing, primarily from the bank or public docks/piers, rather than boating-related activities that might be somewhat less dependent on high lake levels. Low water levels in the lakes would adversely affect the access and usability of the lake resources for all users but potentially more for low-income and minority citizens.

6.6.8.1 No Action Alternative

Seasonal fluctuations in the water surface elevations under the No Action Alternative, even with relatively normal rainfall conditions in the basin, could create minor inconveniences for local residents, including low-income and minority populations, who use the USACE and APC reservoirs for fishing and other forms of recreation. Those uses might be more constrained during extreme drought years, but those constraints and associated effects are not likely to be disproportionately higher for low-income and minority populations. All lake users could be affected under those conditions, which might last for months at a time but are temporary. USACE resource managers at the lakes work closely with the public under such circumstances and pursue reasonable temporary measures to maintain at least a minimum level of access to the lakes until the extreme conditions improve.

Section 2.1.1.2.1.4 of the EIS, the Master WCM, and the individual project WCMs outline current communication measures to promote and maintain public safety at USACE projects, both in the reservoirs and the tailrace areas below the dams, including automated warning systems associated with rapid changes in flow and stage condition that occur downstream of the dams when hydropower generation is initiated and/or spillway gates are opened.

6.6.8.2 Alternative Plan D

Plan D would incorporate a new action zone at Carters Lake, revisions to the actions zones at Allatoona Lake and specific drought management measures for the APC lakes and USACE lakes downstream of Montgomery. Those measures in Plan D would likely provide for more effective management of water surface levels and conservation storage in USACE and APC lakes during drought conditions. Under Plan D, lake levels during extreme drought conditions generally would not be expected to decline as much as they would for the No Action Alternative. That effect is discussed in more detail in Section 6.1.1.2. Overall, public access and use of the lakes would be improved for a greater portion of the time for all users, including minority and low-income users.

Current risk communication and public safety measures for the reservoir and tailrace areas would continue as described in Section 2.1.1.2.1.4. As technological advances in communication, changing demographics, and other related factors may dictate, USACE will continue to seek innovative ways to reach out to the public and share information on public safety and other project-related matters.

6.6.8.3 Alternative Plan F

Plan F would have essentially the same effects as described for Plan D in Section 6.6.8.2 with respect to minority and low-income populations.

6.6.8.4 Alternative Plan G (Proposed Action Alternative)

Plan G would have essentially the same effects as described for Plan D in Section 6.6.8.2 with respect to minority and low-income populations.

6.6.9 Protection of Children

EO 13045 requires federal agencies to consider and address the impacts of their activities on children with respect to environmental health and safety risks (see Section 2.6.12 for more details). Operation of large reservoir projects provide increased opportunities for public access and use, particularly in the form of water-based recreation. Public use of the projects inherently includes a level of health and safety risk to both adults and children. USACE pursues extensive measures at operating projects to minimize such risks

by implementing water safety and other education programs, providing clear signage, marking designated uses areas, removing hazards where appropriate, restricting public access to certain areas designed for authorized personnel only, and other activities designed to promote safe use, many of which are directly focused on children who visit the projects.

6.6.9.1 No Action Alternative

The environmental health and safety activities at USACE projects as described above in Section 6.6.9 would be expected to continue and would be adjusted over time as needs might change. Existing water management activities at the reservoirs do not impose any undue risks to children that are not effectively addressed by the above activities.

Section 2.1.1.2.1.4 of the EIS, the Master WCM, and the individual project WCMs outline current communication measures to promote and maintain public safety at USACE projects, both in the reservoirs and the tailrace areas below the dams, including automated warning systems associated with rapid changes in flow and stage condition that occur downstream of the dams when hydropower generation is initiated and/or spillway gates are opened.

6.6.9.2 Alternative Plan D

Plan D would have the same effects relative to protection of children as described for the No Action Alternative in Section 6.6.9.1. No additional risks would be imposed by the proposed updates to water management practices. As technological advances in communication, changing demographics, and other related factors may dictate, USACE will continue to seek innovative ways to reach out to the public and share information on public safety and other project-related matters.

6.6.9.3 Alternative Plan F

Plan F would have the same effects relative to protection of children as described for the No Action Alternative in Section 6.6.9.2. No additional risks would be imposed by the proposed updates to water management practices.

6.6.9.4 Alternative Plan G (Proposed Action Alternative)

Plan G would have the same effects relative to protection of children as described for the No Action Alternative in Section 6.6.9.2. No additional risks would be imposed by the proposed updates to water management practices.

6.7 Aesthetic Resources

Under the No Action Alternative, both the USACE and APC reservoirs serve as valuable aesthetic assets in the ACT Basin. WCM update alternatives D, F, and G would have a negligible overall impact on lake levels, an important aesthetic consideration, under normal operating conditions. Under more extreme drought conditions, lake levels for the USACE and under alternatives D, F, and G would generally be improved compared to the No Action Alternative. The exception would be Carters Lake, which could range from zero to six feet lower depending on the severity of the drought conditions.

Deviations in flows downstream of the USACE projects in the ACT Basin under Alternatives D, F, and G would be visually imperceptible compared to flow levels under the No Action Alternative.

6.8 Cultural Resources

Site assessments conducted as part of this EIS confirmed that, under the No Action Alternative, access issues are common at many of the known sites. Looting (and other human-induced effects) occurs more often in sites eligible for NRHP status. Sites in the Coastal Plain are more likely to be vulnerable to erosion. However, more significant sites are most likely to be affected because they provide the most incentive for looters. Deposition is a site-specific phenomenon and affected the fewest sites in the basin. Observations and data collected during the limited site assessments are assumed to be representative of other sites in the basin.

6.8.1 No Action Alternative

Under the No Action Alternative, the operation of USACE projects in the ACT Basin would be expected to remain unchanged. Therefore, effects on cultural resource sites would be expected to be the same as they have been in the past. On the basis of a 2009 study (Brockington 2010), 53 percent of sites are expected to experience erosion, and 27 percent of sites are expected to experience deposition.

Sites that have not been preserved in the past could be lost in the future. In areas where conservation measures have not been implemented along the shoreline, the effect of continued exposure would expect to continue to affect the site.

As erosion over time could pose risks to specific sites, options to mitigate effects would be evaluated and implemented, as needed, on the basis of the nature of the cultural resource and engineering and cost-effectiveness considerations. Potential options range from protection by way of structural measures (fill, riprap, sheet pile, and such) to excavating the site(s), all in consultation with the State Historic Preservation Office and tribal interests (as appropriate).

The leading adverse effect to sites under the No Action Alternative is site access. Solutions to the adverse effects of access to sites in the ACT Basin are currently being explored. These solutions include creating a tool that includes a real-time remote access map available for District Archaeologists illustrating culturally sensitive areas and the effects of USACE water management practices. Email alerts can be configured to notify District Archaeologists when water level factors contribute to the adverse effect of site access. This notification will allow the District Archaeologists to notify local resource offices to the exposure and increase monitoring.

6.8.2 Alternative Plan D

Under Plan D, the rate of erosion at cultural resources sites would be expected to increase at some sites and decrease at others. It is unlikely that implementing Plan D would reduce the percentage of sites (53 percent of the sites known and unknown) undergoing erosion or deposition from the No Action Alternative. The percentage of sites that undergo the effects of erosion and deposition would be expected to remain about the same as for the No Action Alternative. As illustrated in Figure 6.8-1 and Figure 6.8-2, in some reservoirs the extreme low water surface elevations might be greater than the No Action Alternative (Figure 6.8-1) and in others (Figure 6.8-2) low water surface elevations might be less than the No Action Alternative. As with the No Action Alternative, under Plan D, mitigation measures would be pursued, either protection or excavation, when a cultural site is at risk for adverse impact.

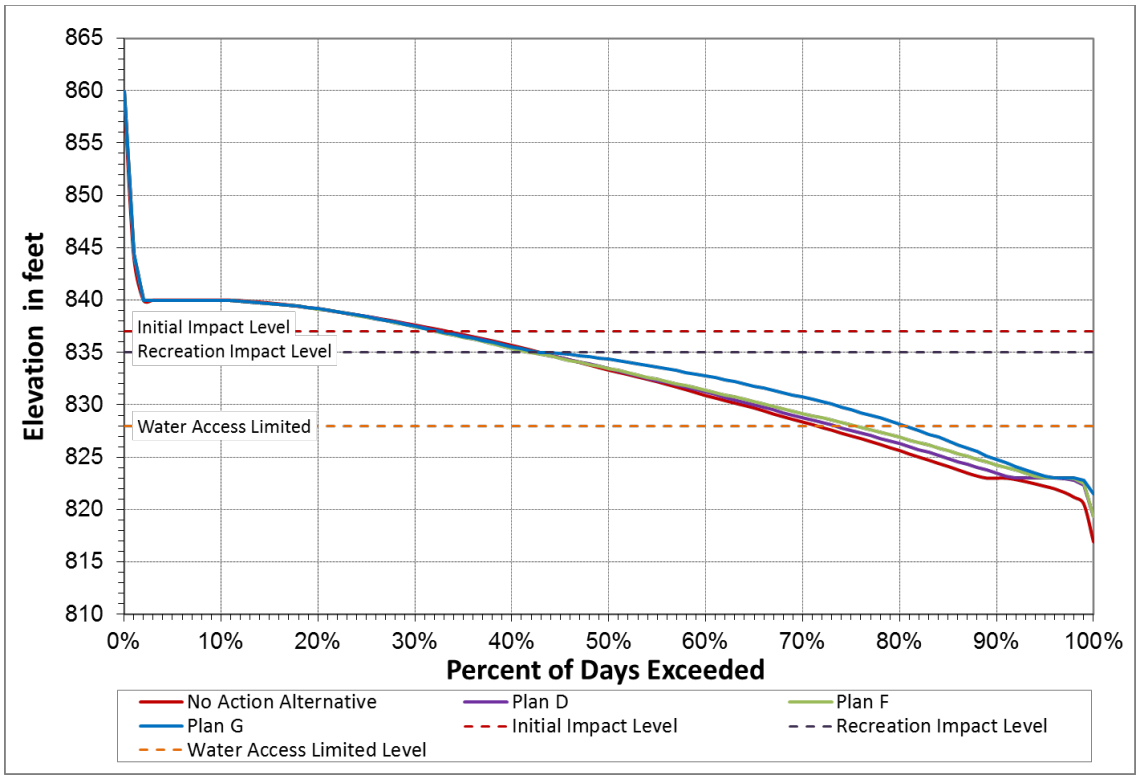


Figure 6.8-1. Allatoona Lake water surface frequency over the modeled period.

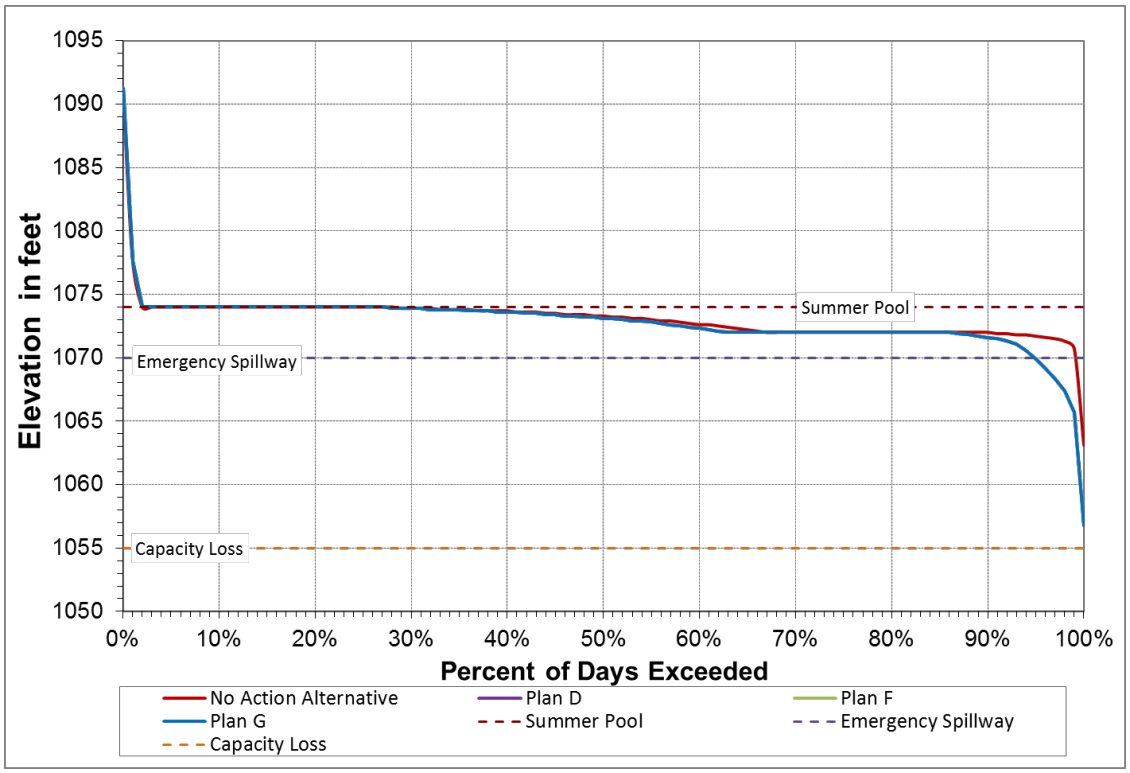


Figure 6.8-2. Carters Lake water surface frequency over the modeled period.

6.8.3 Alternative Plan F

As described in Section 6.8.2, under Plan F, it is unlikely that the percentage of sites (53 percent of the sites known and unknown) undergoing erosion or deposition would be changed from the No Action Alternative. As previously described, measures would be pursued when a site is at risk for adverse impact.

6.8.4 Alternative Plan G (Proposed Action Alternative)

Similar to conditions described in Section 6.8.3, the Proposed Action Alternative would not be expected to change the occurrence of sites undergoing erosion or deposition from the No Action Alternative. Nearly 50 percent of the time water surface elevations are the same between each alternative. The Proposed Action Alternative would not be expected to change the total number of sites impacted in the ACT Basin.

6.9 Sensitivity Analysis

As a result of agency and public review of the draft EIS for the ACT WCM update process, as well as a USACE external peer review process by a panel of independent subject matter experts, USACE performed an analysis of the sensitivity of the Proposed Action Alternative (Plan G) to the following scenarios:

(1) Increased future water demands in the basin [hereafter referred to as **Plan G-DI (demand increase)** and discussed in Section 6.9.1];

(2) Reduced basin inflows to the ACT reservoirs that may potentially result from climate change impacts on precipitation and run-off in the region [hereafter referred to as **Plan G-FR (flow reduction)** and discussed in Section 6.9.2];

(3) Potential temperature increases that may occur associated with climate change [hereafter referred to as **Plan G-TI (temperature increase)** and discussed in Section 6.9.3].

For purposes of this comparison in the following paragraphs of this section, Plan G is based upon conditions described in Section 4.2.6 and 5.4. More details on the modeling of these scenarios are provided in the HEC-ResSim and HEC-5Q modeling reports (Appendix C and Appendix D, respectively). **The lake level and flow values for these scenarios, as plotted for specific reservoir projects and stream locations in the following sections, may frequently be the same or nearly the same. In those cases, the last scenario plotted (per the legend) will appear on the figure. In such cases, the text accompanying the figure will describe the results for any scenario that is not visible on the figure.**

Table 6.9-1 presents a summary of expected incremental effects associated with the three scenarios described above. The paragraphs that follow in this section describe the potential effects for each scenario and for each resource area in the table in more detail based upon the HEC-ResSim and HEC-5Q model outputs, as well as other pertinent information.

Table 6.9-1.
Proposed Action Alternative (Plan G) – expected incremental effects with future water demand increase (DI), reduced basin inflow (FR), and air temperature increase (TI)

Resource Area	Incremental environmental effects		
	Proposed Action Alternative (PAA) with future water demand increase (Plan G-DI)	PAA with reduced basin inflows (climate change) (Plan G-FR)	PAA with air temperature increase (climate change) (Plan G-TI)
Water Quantity			
Flood Risk Management	None	None	None
Lake Levels/Storage			
Carters Lake	Negligible	Minor adverse	None
Allatoona Lake	Negligible	Minor adverse	None
APC Lakes (Weiss Lake, H. Neely Henry, Logan Martin, Harris, Martin)	Negligible	Minor adverse	None
Alabama River Lakes ("Bob" Woodruff, "Bill" Dannelly, Claiborne)	Negligible	Negligible	None
Stream Flow			
Coosawattee River below Carters Reregulation Dam	Negligible	Minor adverse	None
Etowah River below Allatoona Dam	Negligible	Moderate adverse	None
Coosa River at Rome, GA	Negligible	Moderate adverse	None
Alabama River at Montgomery, AL	Negligible	Moderate adverse	None
Alabama River below Claiborne L&D	Negligible	Moderate adverse	None
Drought Management / Operations	Negligible	Moderate adverse	None
Navigation Flow Targets	Negligible	Moderate adverse	None
Water Withdrawals Intakes	None	None	None
Water Quality			
Temperature	Negligible	Minor adverse	Adverse
Dissolved oxygen	Negligible	Negligible	Adverse
Total phosphorous	Negligible	Minor adverse	Negligible
Total nitrogen	Negligible	Minor adverse	Negligible
Chlorophyll *a*	Negligible	Negligible	Negligible
Biological Resources			
Vegetation	None	None	Negligible
Wildlife resources	Negligible	Negligible	Negligible
Fish and aquatic resources	Negligible	Minor to moderate adverse or beneficial	Negligible
Protected species	None	Minor to moderate adverse or beneficial	Negligible
Socioeconomic Resources			
M&I water supply	None	None	None
Navigation	Negligible	Moderate adverse	None
Hydropower	Minor adverse	Moderate adverse	None
Agricultural water supply	None	None	None
Flood risk management	None	None	None
Recreation	Negligible	Moderate adverse	None
Property values and taxes	None	Negligible	None
Environmental justice	None	None	None
Protection of children	None	None	None
Other Resource Areas (soils/geology, land use, air quality, cultural resources, etc.)	None	None	None

6.9.1 Increased Future Water Demands (Plan G-DI)

Future water demands that were used for the sensitivity analysis were derived from a methodology used for the ACF-ACT Comprehensive Study during the 1990's. Subsequently, Section 134 of Public Law 110-161, "The Consolidated Appropriations Act, 2008," directed USACE to provide information regarding water use in the ACT and ACF basins, including "an estimated projection of total water usage in the respective basins over the next 25 years." In response, the USACE Mobile District developed a Section 134 report based on the PMCL methodology from the Comprehensive Study, updated population data, and updated water use data in the ACT Basin within the states of Georgia and Alabama to develop a 25-year estimate of water demands using 2006 as the baseline year (2006–2031). Note that this assessment is not based upon projected water demands from specific M&I water providers in the basin and does not sanction or concur with any specific increased withdrawals within the basin, including Allatoona and Carters lakes.

Water demand estimates for the year 2030 were used in the HEC-ResSim and HEC-5Q models for comparison to Plan G with 2006 water demands. Year 2006 demands were selected by USACE to represent current withdrawals because they reflect the year of highest net withdrawals from the ACT Basin and, to date, the year of greatest stress on the system from water withdrawals. More information on how current water withdrawals are defined for purposes of HEC-ResSim modeling of the ACT Basin is provided in Section 4.2.6. The future water demand methodology from the Comprehensive Study, along with efforts to update population and water use data necessary to produce the Section 134 report, are summarized in Section 2.6.1.1. Overall, the 2030 demand projections would represent about a 30 percent increase over 2006 water demand levels.

The sensitivity of the Proposed Action Alternative (Plan G) to increased future water demands (Plan G-DI) is summarized in this section of the EIS. **Figures presented in this section will present results of HEC-ResSim model runs for (1) the Proposed Action Alternative (Plan G), (2) Plan G-DI, and (3) Plan G-FR (representing a potential climate change scenario involving reduced basin inflows). Section 6.9.1 will focus on the sensitivity of Plan G to the Plan G-DI scenario. Discussion of the sensitivity of Plan G to the Plan G-FR scenario is found in Section 6.9.2. Section 6.9.3 discusses the sensitivity of Plan G to the Plan G-TI scenario.**

6.9.1.1 Water Quantity

Based upon results from the HEC-ResSim simulation described above, the following subsections summarize the potential effects that would be expected relative to water quantity considerations for the Proposed Action Alternative (Plan G) compared to Plan G-DI in the ACT Basin.

6.9.1.1.1 Flood Risk Management

Plan G-DI would not have an adverse impact on the flood risk management purpose and function for the pertinent ACT Basin projects compared to Plan G.

6.9.1.1.2 Lake Levels / Storage Conditions

An HEC-ResSim simulation was conducted for the Proposed Action Alternative (Plan G) and for Plan G-DI over the modeled period of record. The purpose of this modeling was to assess the degree of sensitivity of the proposed update of the ACT WCM (Plan G) to increased future water demands in the basin.

Figure 6.9-1 through Figure 6.9-8 present the median daily and 90 percent exceeded pool elevations over the modeled period of record or the Proposed Action Alternative (Plan G) and for Plan G-DI for the following reservoirs in the ACT Basin: Carters Lake; Allatoona Lake; Weiss Lake (APC); and Lake Martin (APC). The effects of increased future water demands in the ACT Basin on each of these reservoirs will be discussed in the following paragraphs. The figures also depict results for a second scenario – Plan G with an assumed 15 percent reduction in basin inflow (Plan G-FR). Background on this scenario and its comparison to Plan G are discussed in Section 6.9.2.1.2.

For Carters Lake, the effect of increased demand (Plan G-DI) in the ACT Basin on median daily pool elevations (Figure 6.9-1) and on pool elevations at the 90 percent exceeded level (Figure 6.9-2) would be negligible. Throughout the year, these daily values would be the same or slightly lower, and any differences would be so small as to be practically imperceptible from Plan G values on the figures. For Allatoona Lake, the effect of increased water demands on median daily pool elevations (Figure 6.9-3) and on pool elevations at the 90 percent exceeded level (Figure 6.9-4) would be minor. Median pool elevations for Plan G-DI during the months of December through August would be essentially the same as Plan G. A slight decrease in median pool elevations (in the general range of 0.1 ft) would be expected in the months of September through November. At the 90 percent exceedance level, pool elevations in all months with Plan G-DI would be the same or slightly lower than Plan G (differences would be less than 0.1 ft). Since reservoir storage is directly correlated to pool levels, conservation storage values in the pertinent ACT reservoirs would not be appreciably affected by increased future water demands.

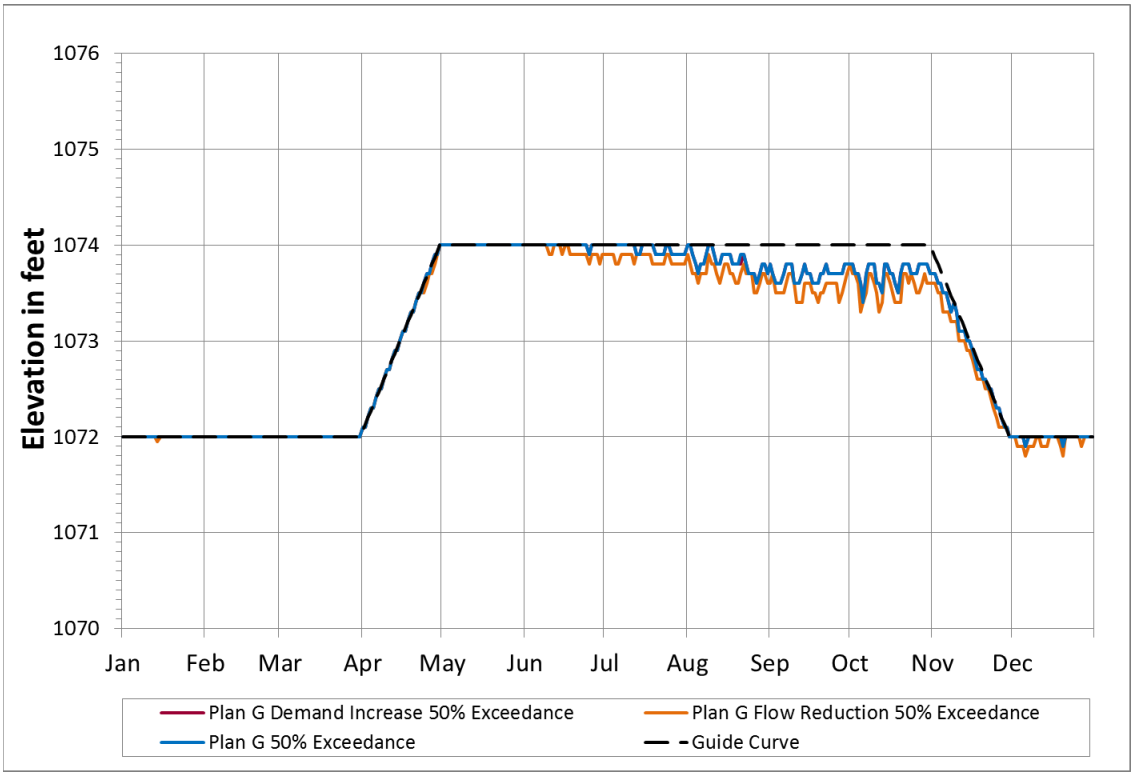


Figure 6.9-1. Carters Lake, median daily water surface elevation over the modeled period of record (1939–2011).

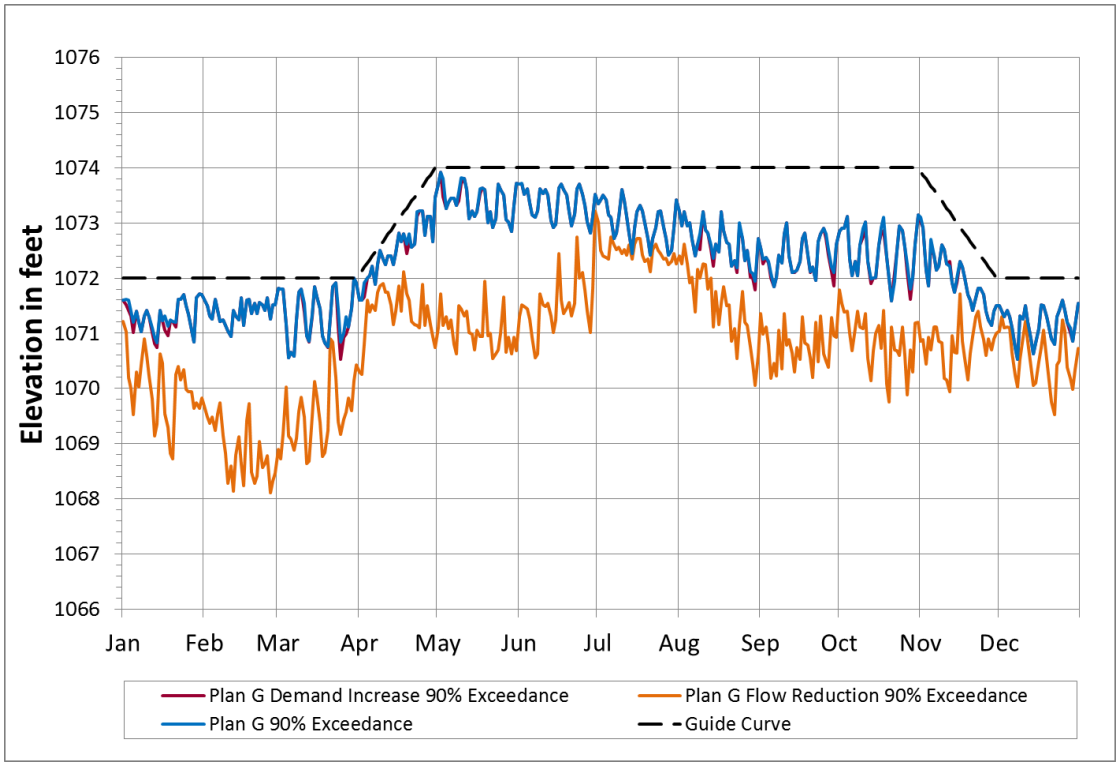


Figure 6.9-2. Carters Lake, daily water surface elevations that would be exceeded 90 percent of the time over modeled period of record (1939–2011).

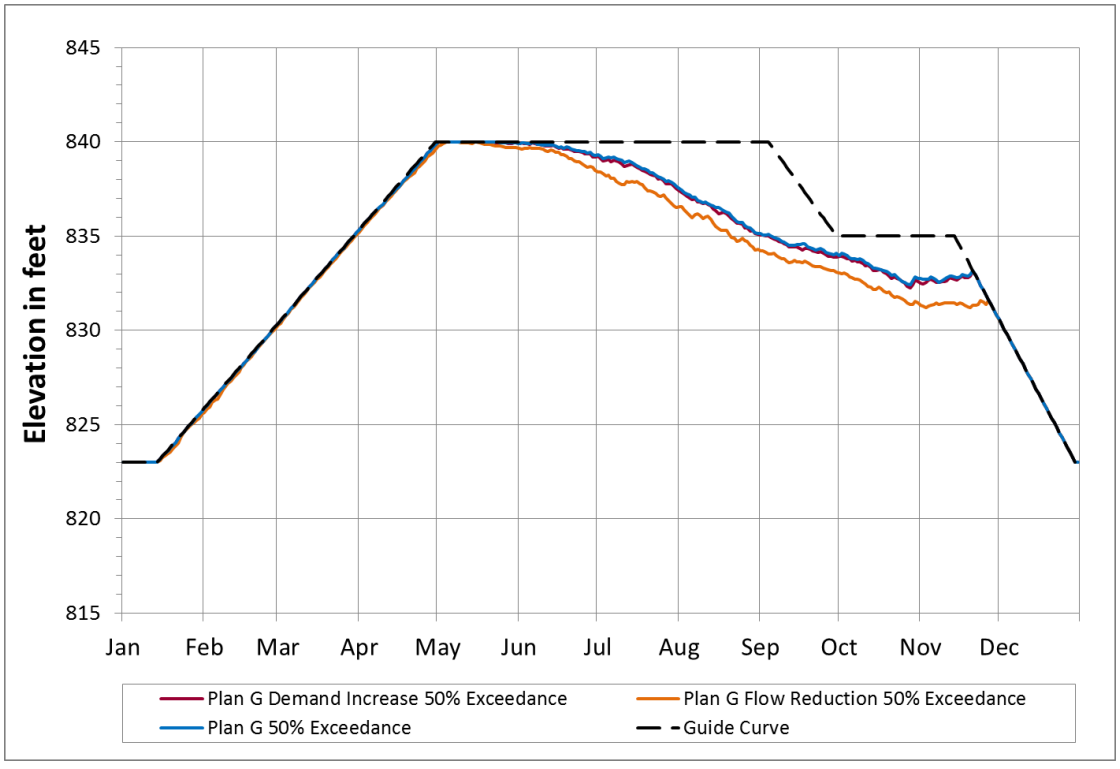


Figure 6.9-3. Allatoona Lake, median daily water surface elevation over the modeled period of record (1939–2011).

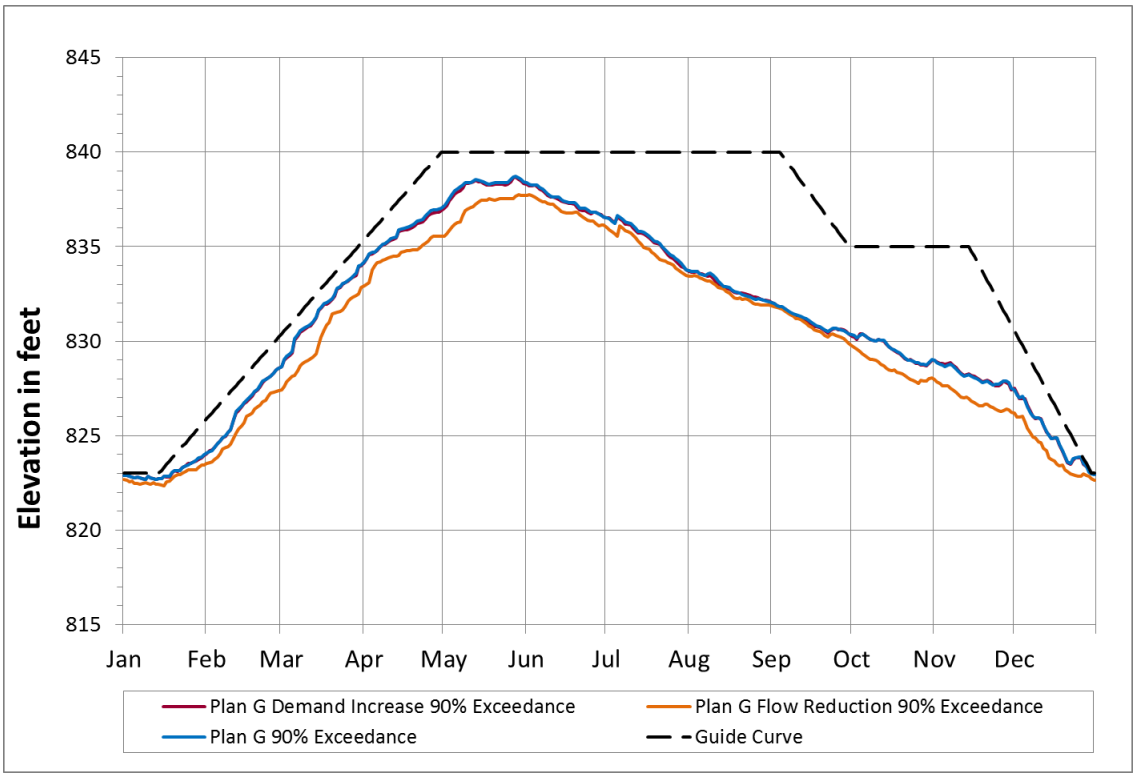


Figure 6.9-4. Allatoona Lake, daily water surface elevations that would be exceeded 90 percent of the time over modeled period of record (1939–2011).

Median daily and 90 percent exceeded pool elevations over the modeled period of record are presented for Weiss Lake and Lake Martin in Figure 6.9-5 through Figure 6.9-8 as examples of potential effects of Plan G-DI compared to Plan G. For Weiss Lake, the effect of increased demands in the basin on median daily pool elevations (Figure 6.9-5) and on pool elevations at the 90 percent exceeded level (Figure 6.9-6) would be negligible. Similar negligible effects at Lake Martin would be expected (see Figure 6.9-7 and Figure 6.9-8). At the 90 percent exceedance level, the differences at Lake Martin would be more pronounced during the months of September and October, but they would still equate to less the 0.1 ft. Plan G-DI would effectively match the results for Plan G.

Model results were reviewed for the other APC reservoirs directly affected by the ACT WCM update process: H. Neely Henry Lake, Logan Martin Lake, and R. L. Harris Lake. As with the other APC reservoirs, modeled lake level conditions for Plan G-DI would be essentially the same as Plan G. As modeled, these APC reservoirs would not be affected to a measurable extent by increased future water demands.

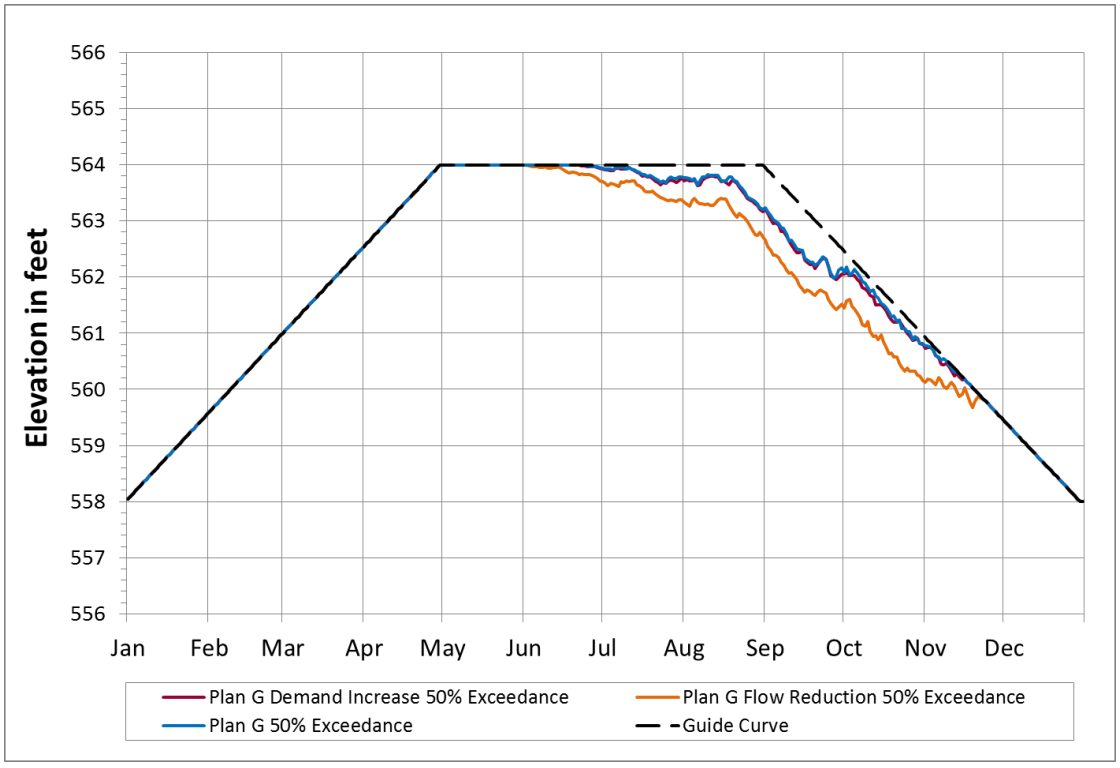


Figure 6.9-5. Weiss Lake, median daily water surface elevation over the modeled period of record (1939–2011).

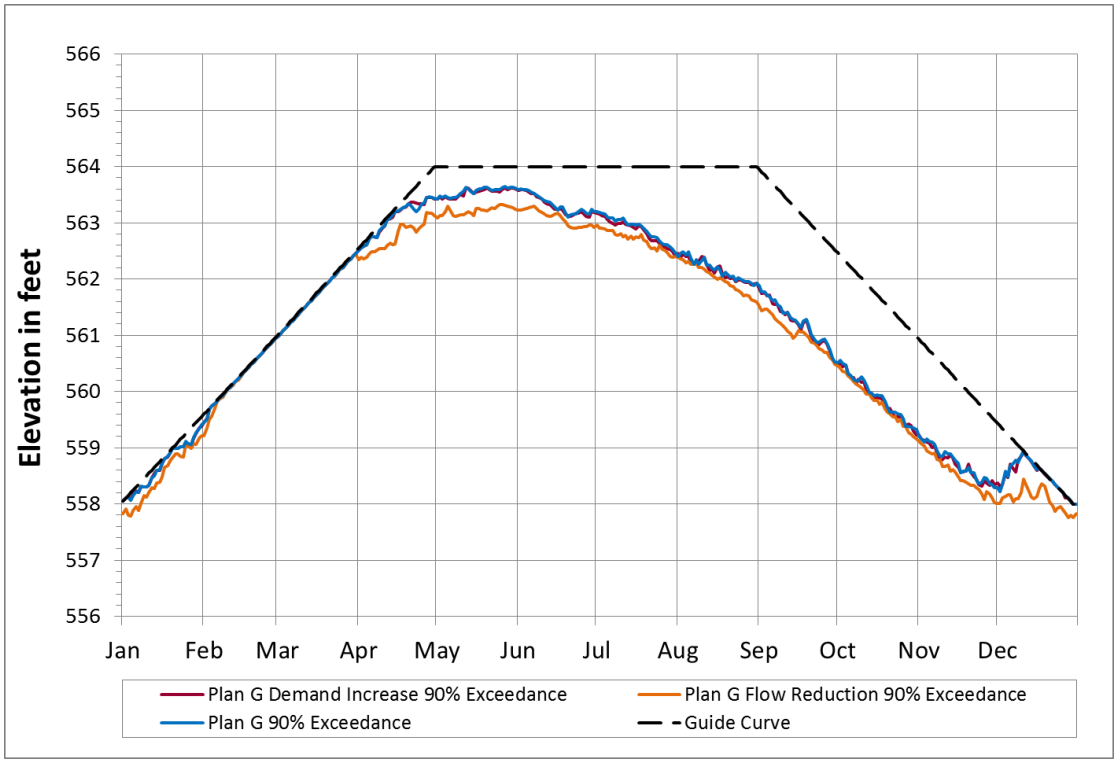


Figure 6.9-6. Weiss Lake (APC), daily water surface elevations that would be exceeded 90 percent of the time over modeled period of record (1939–2011).

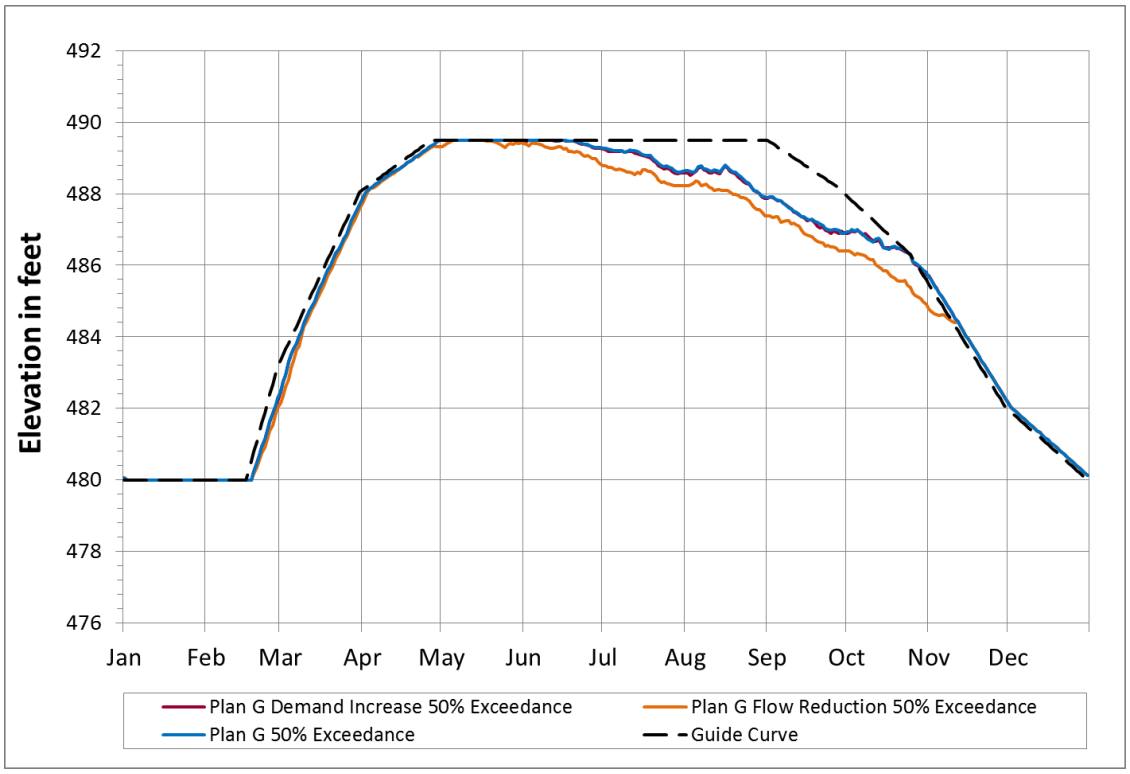


Figure 6.9-7. Lake Martin (APC), median daily water surface elevation over the modeled period of record (1939–2011).

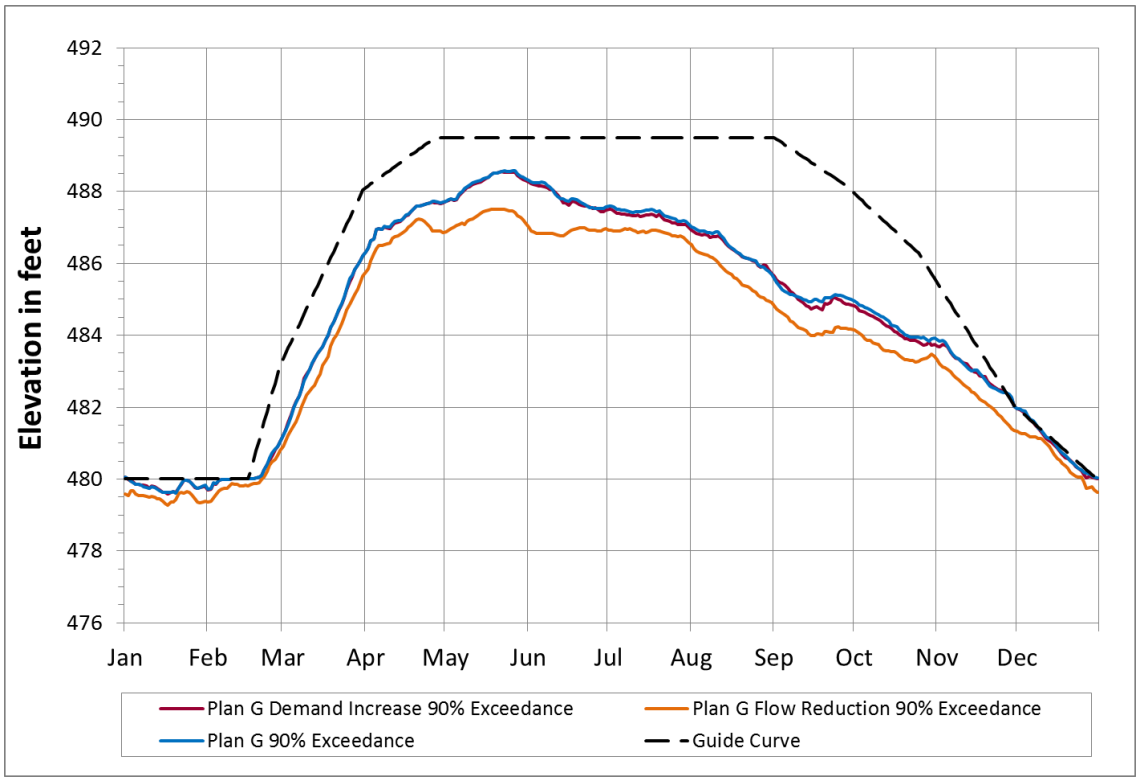


Figure 6.9-8. Lake Martin (APC), daily water surface elevations that would be exceeded 90 percent of the time over modeled period of record (1939–2011).

Table 6.9-2 summarizes the differences between pool elevations for Plan G and for Plan G-DI that would be expected to occur at the five affected APC reservoirs in the ACT Basin over the modeled period of record. The pool elevation differences are presented as measured at the 90th, 75th, 50th, 25th, and 10th percentile levels. For all the APC reservoirs depicted in the table, the biggest differences in pool elevations are observed at the 75th and 50th percentiles. Plan G-DI would result in slight decreases in lake levels, ranging from zero to about 0.05 ft at the various percentile levels compared to project operations under Plan G. Thus, the incremental effect of Plan G-DI on APC reservoir levels Plan G would likely be negligible.

Table 6.9-2.
Relative decreases in APC reservoir elevations likely to occur for Plan G-DI over the modeled period of record (1939–2011)

	Pool elevation differences compared to Plan G				
APC reservoir	90th percentile pool elevation	75th percentile pool elevation	50th percentile pool elevation	25th percentile pool elevation	10th percentile pool elevation
Weiss	0.00 ft	- 0.03 ft	- 0.01 ft	- 0.03 ft	- 0.03 ft
H.N. Henry	0.00 ft	0.00 ft	- 0.01 ft	0.00 ft	0.00 ft
Logan Martin	0.00 ft	- 0.02 ft	- 0.04 ft	- 0.02 ft	0.00 ft
R.L. Harris	- 0.01 ft	- 0.01 ft	- 0.03 ft	0.00 ft	- 0.01 ft
Martin	0.00 ft	- 0.03 ft	- 0.04 ft	- 0.01 ft	0.00 ft

Modeled pool levels for the three USACE Alabama River lakes ("Bob" Woodruff, "Bill" Dannelly, and Claiborne lakes) under Plan G would not be appreciably affected by Plan G-DI.

6.9.1.1.3 Stream Flow Conditions

This section compares stream flow conditions over the modeled period of record at several key points in the ACT Basin for the Proposed Action Alternative (Plan G) and Plan G-DI. The figures in this section also depict results for a second scenario – Plan G-FR (reduction in basin inflow). Background on this scenario and its comparison to Plan G are discussed in Section 6.9.2.1.3.

Coosawattee River downstream of Carters Reregulation Dam. Median daily stream flow conditions for Plan G and for Plan G-DI are presented in Figure 6.9-9. The plot indicates that Plan G-DI over the modeled period of record would result in negligible differences in flow conditions below the Carters Reregulation Dam when compared to Plan G. The modeled future water demand increase would not appreciably affect median daily flows below the Carters Reregulation Dam. Similar results were observed for flows at the 90 percent exceedance level, a level which is indicative of severe drought conditions in the basin.

For each month of the year over the modeled period of record, Table 6.9-3 indicates that Plan G-DI would not affect the extent to which the seasonal minimal flow targets below the Carters Reregulation Dam would be met compared to Plan G.

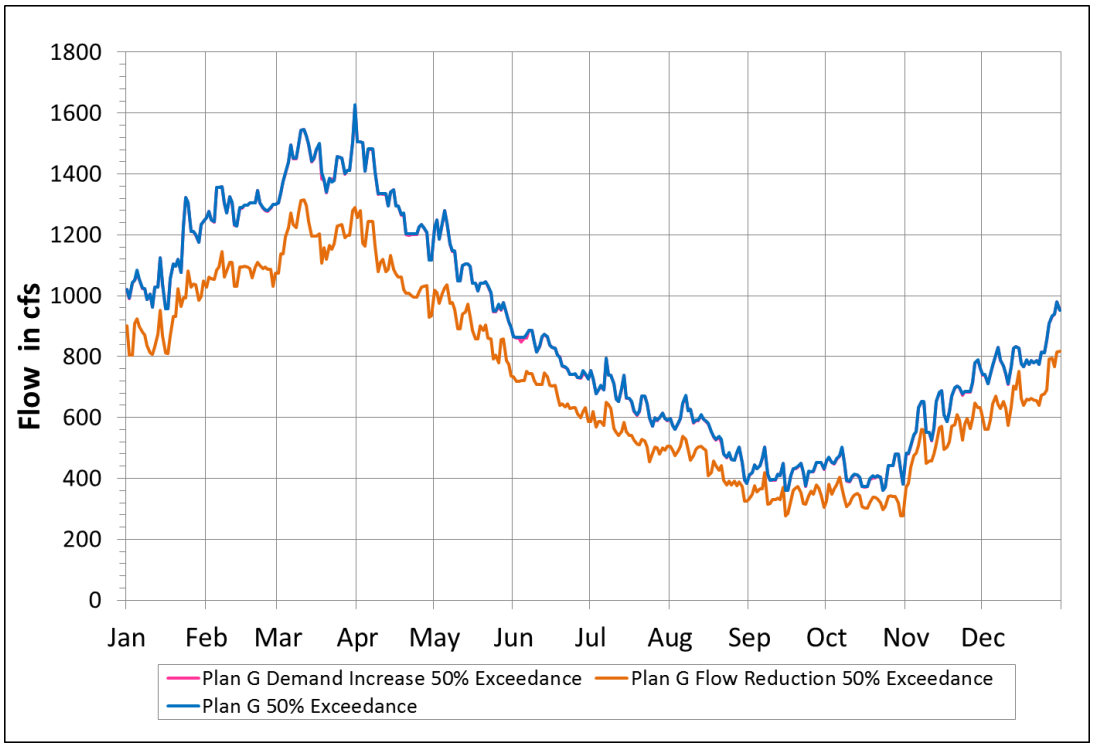


Figure 6.9-9. Coosawattee River downstream of Carters Reregulation Dam, median daily discharge (cfs) over the modeled period of record (1939–2011).

Table 6.9-3.
Coosawattee River downstream of Carters Reregulation Dam, seasonally variable minimum flow targets, percent of time targets would be met or exceeded

		Percent of time flow target would be equaled or exceeded		
Month	**Monthly minimum flow target (cfs)**	**Plan G**	**Plan G-DI**	**Plan G / G-DI Difference**
January	660	98%	98%	0%
February	790	98%	98%	0%
March	865	98%	98%	0%
April	770	97%	97%	0%
May	620	97%	97%	0%
June	475	94%	94%	0%
July	400	95%	95%	0%
August	325	95%	95%	0%
September	250	97%	97%	0%
October	275	98%	98%	0%
November	350	98%	98%	0%
December	465	98%	98%	0%

Etowah River downstream of Allatoona Dam. Flow conditions for Plan G and for Plan G-DI over the modeled period of record are presented in Figure 6.9-10 (median flows) and Figure 6.9-11 (90 percent exceeded flows). For median daily flows, Plan G-DI would indicate minor deviations in flows downstream of Allatoona Dam compared to Plan G. These deviations would likely involve minor short-term reductions in flow at various times during August through November compared to Plan G. At the 90 percent exceeded flow level, slightly reduced flows would be indicated at times during December and early January, but otherwise the differences would be negligible. The modeled future water demand increase for Plan G would not have an appreciable effect on flow conditions in the Etowah River below Allatoona Dam.

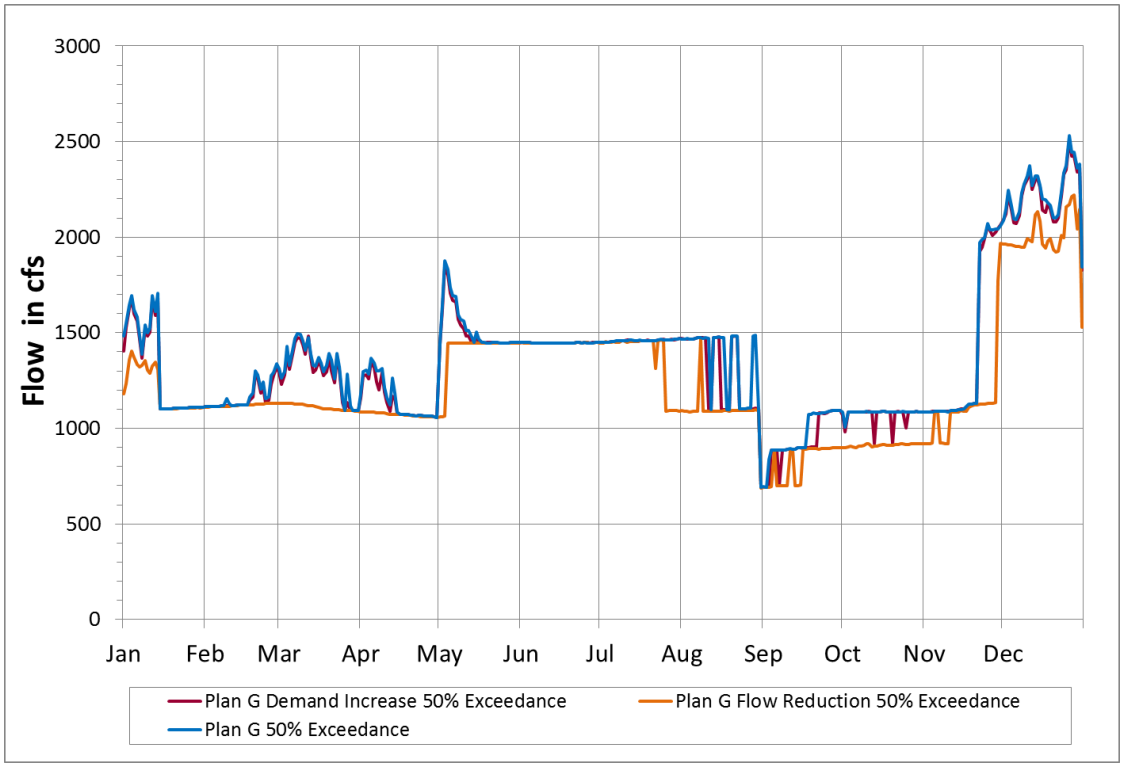


Figure 6.9-10. Etowah River downstream of Allatoona Dam, median daily discharge (cfs) over the modeled period of record (1939–2011).

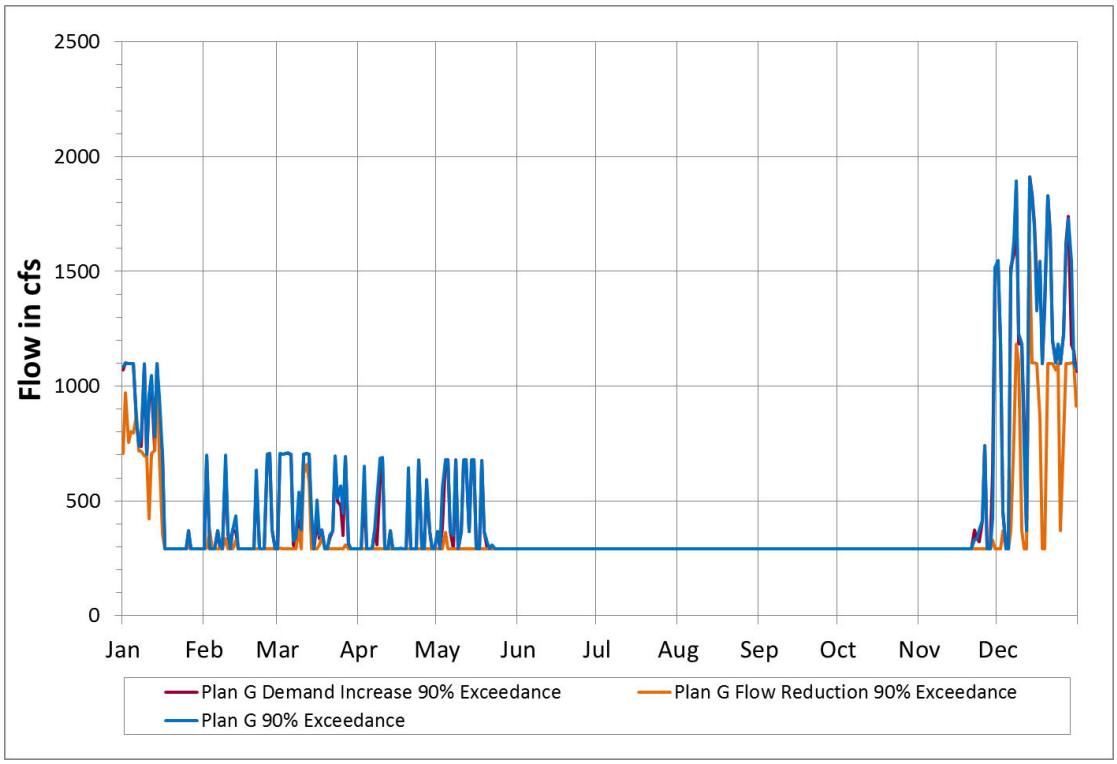


Figure 6.9-11. Etowah River downstream of Allatoona Dam, daily discharge (cfs) at the 90 percent exceedance level over the modeled period of record (1939–2011)

Coosa River at Rome, Georgia. Stream flow conditions for Plan G and for Plan G-DI over the modeled period of record are presented in Figure 6.9-12 (median daily flows) and Figure 6.9-13 (90 percent exceeded flows), the latter indicative of extreme drought conditions in the basin. Figure 6.9-12 indicates that Plan G-DI would generally result in slightly lower, but negligible, differences in median flow conditions in the Coosa River at Rome, Georgia when compared to Plan G. Flows at the 90 percent exceedance level would be slightly lower as a result of increased water demands, generally by less than 50 cfs. The modeled future water demand increase for the basin (Plan G-DI) would not have an appreciable effect on flow conditions in the Coosa River at Rome.

For each month of the year over the modeled period of record, Table 6.9-4 indicates that Plan G-DI would have a minor adverse effect on the extent to which the monthly 7Q10 flow values for the Coosa River at Rome, Georgia would be exceeded compared to Plan G. For eight months of the year, the percent of days that flows would exceed the monthly 7Q10 values would decline below Plan G by 0.5 percent or less due to future increased demands in the basin (Plan G-DI). For the months of August through November the declines would be slightly larger – ranging from 0.7 percent lower in October up to 1.2 percent lower in September. The monthly 7Q10 value at Rome is one of the key parameters in the ACT Basin for triggering drought operations that are part of the WCM update. Consequently, increased future water demands could have a slight impact on the frequency and duration of drought operations in the basin. These potential effects are discussed in Section 6.9.1.1.4.

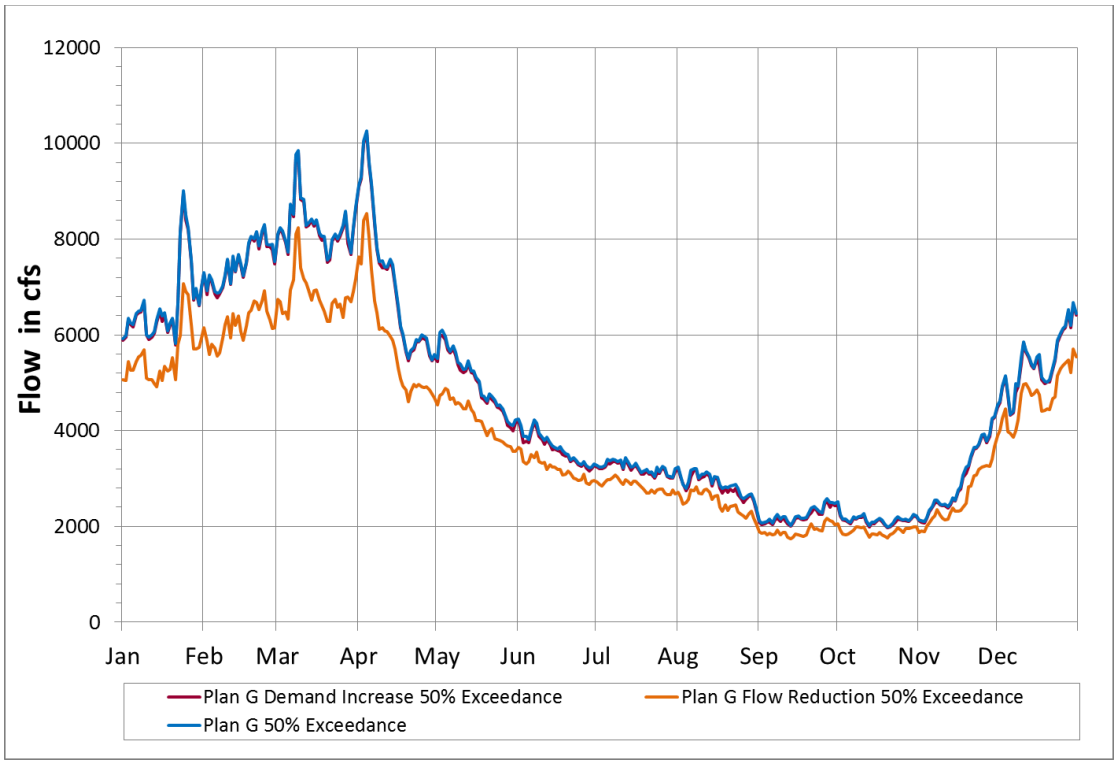


Figure 6.9-12. Coosa River at Rome (Georgia), median daily discharge (cfs) over the modeled period of record (1939–2011).

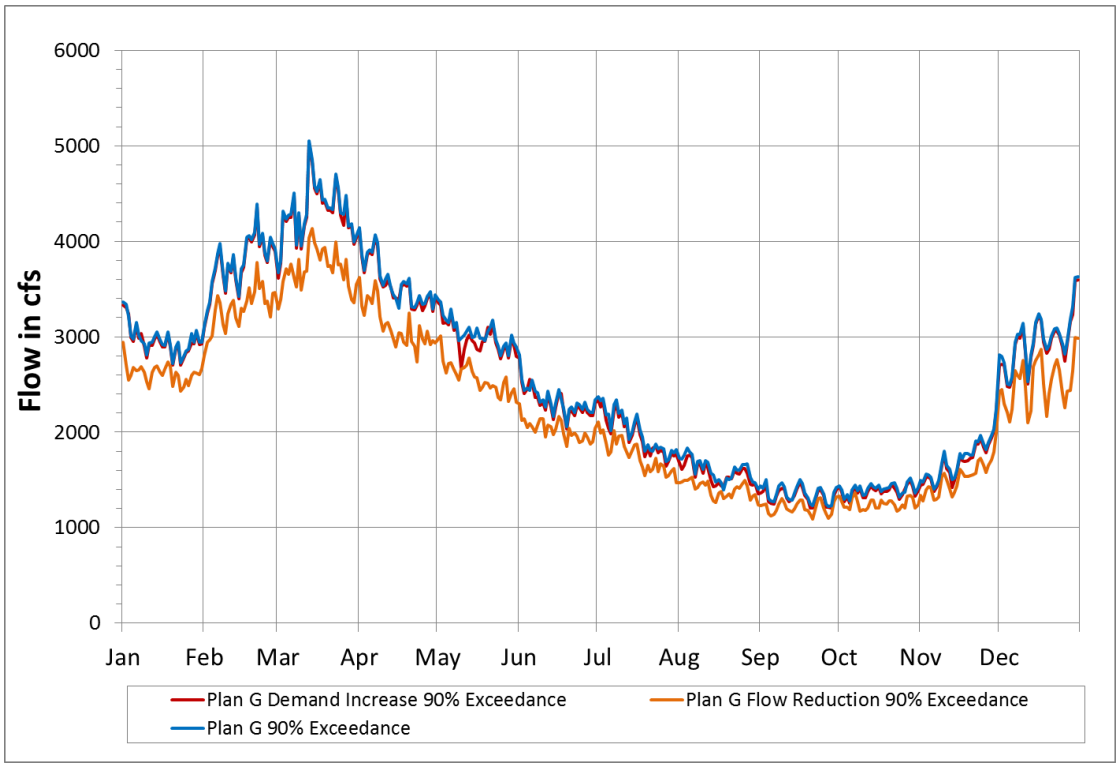


Figure 6.9-13. Coosa River at Rome (Georgia), daily discharge (cfs) at the 90 percent exceedance level over the modeled period of record (1939–2011).

Table 6.9-4.
Coosa River at Rome, Georgia—Percent of days (by month) over the modeled period of record (1939–2011) that flows would likely exceed 7Q10 value

		Percent of days flow would likely exceed 7Q10 values		
Month	7Q10 flow value (cfs)	Plan G	Plan G-DI	Plan G / G-DI Difference
January	2,544	94.1%	93.9%	-0.2%
February	2,982	94.6%	94.4%	-0.2%
March	3,258	97.0%	96.9%	-0.1%
April	2,911	94.5%	94.3%	-0.2%
May	2,497	93.4%	93.1%	-0.3%
June	2,153	91.9%	91.4%	-0.5%
July	1,693	93.8%	93.4%	-0.4%
August	1,601	89.1%	88.3%	-0.8%
September	1,406	87.4%	86.2%	-1.2%
October	1,325	92.6%	91.9%	-0.7%
November	1,608	91.4%	90.6%	-0.8%
December	2,043	97.4%	97.3%	-0.1%

Alabama River at Montgomery and at Claiborne Lock and Dam. Stream flow conditions in the Alabama River at Montgomery, Alabama for Plan G and for Plan G-DI over the modeled period of record are presented in Figure 6.9-14 (median daily flows) and Figure 6.9-15 (90 percent exceeded flows). Similarly, flow conditions in the Alabama River downstream of Claiborne Lock and Dam are presented in Figure 6.9-16 (median daily flows) and Figure 6.9-17 (90 percent exceeded flows). The effect of the Plan G-DI scenario on daily median flows in the Alabama River at both Montgomery (Figure 6.9-14) and Claiborne Lock and Dam (Figure 6.9-16) would be negligible compared to Plan G. At the 90 percent exceedance flow level, minor decreases at both locations (Figure 6.9-15 and Figure 6.9-17) can be noted at various times during the months of June through November, typically the drier portion of the year. The decreases in flow at these locations that would be attributable to increased future water demands would tend to be in the range of 50 cfs or less. Thus, the modeled future water demand increase for the basin (Plan G-DI) would not have an appreciable adverse effect on flow conditions in the Alabama River at either location.

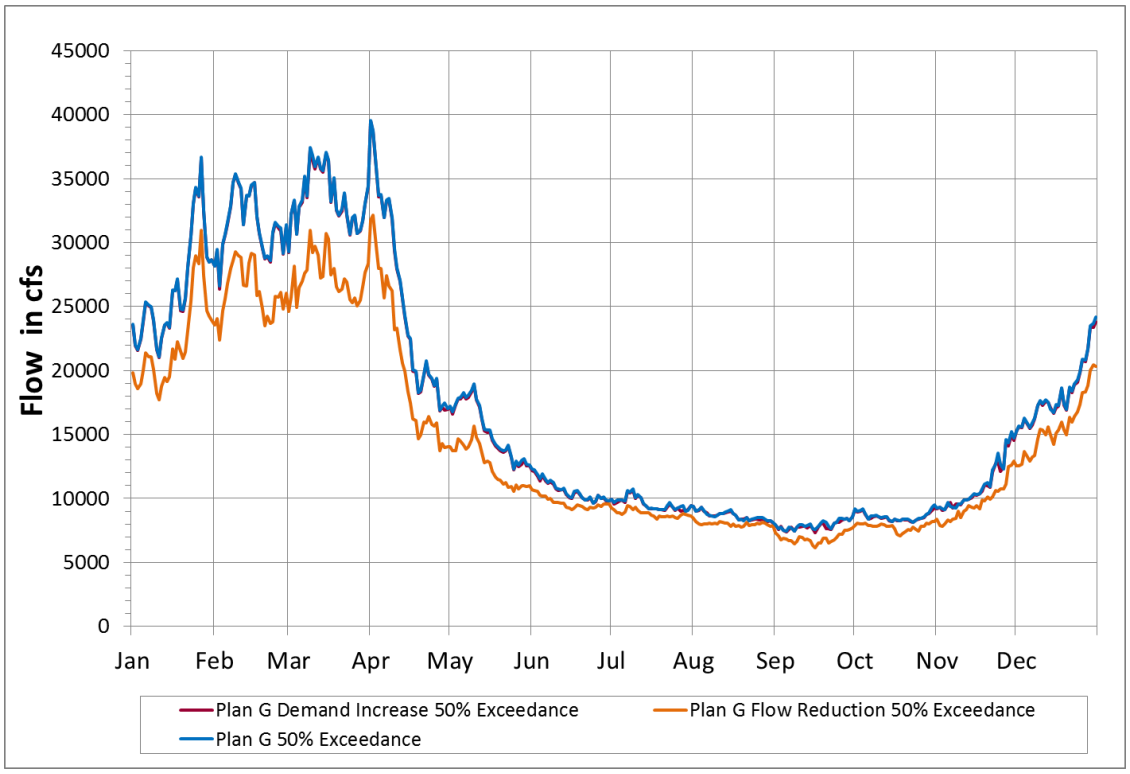


Figure 6.9-14. Alabama River at Montgomery, median daily discharge (cfs) over the modeled period of record (1939–2011).

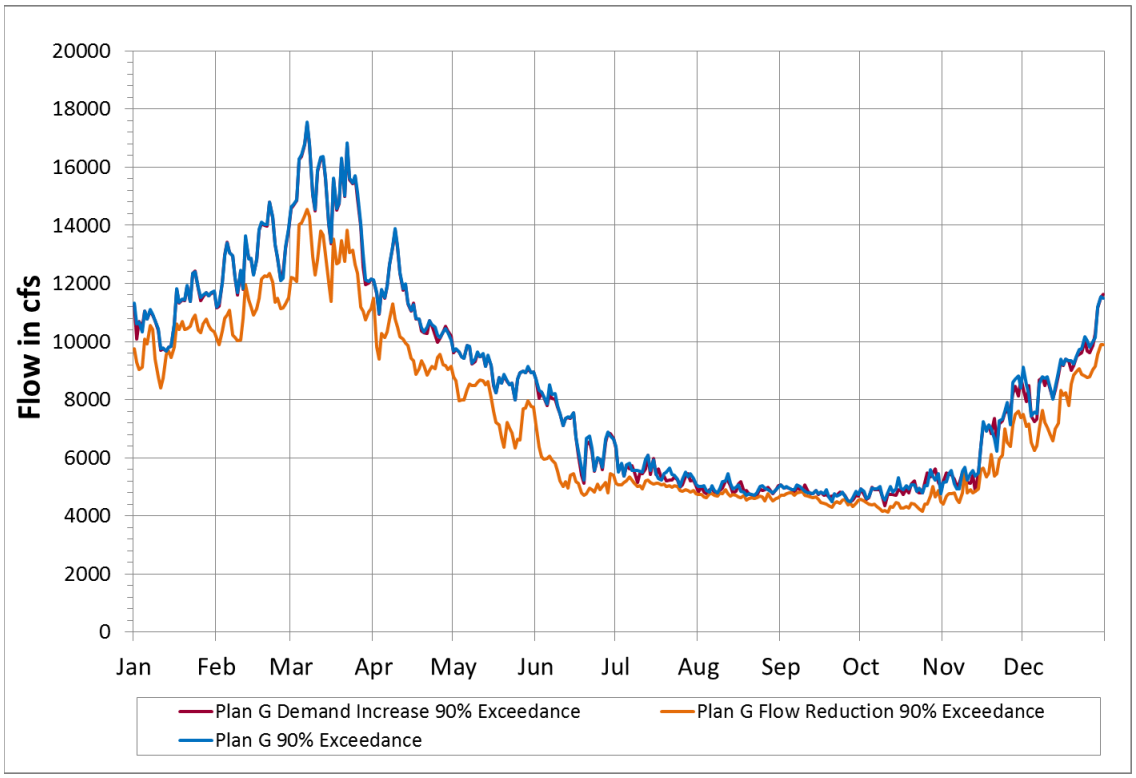


Figure 6.9-15. Alabama River at Montgomery, daily discharge (cfs) at the 90 percent exceedance level over the modeled period of record (1939–2011).

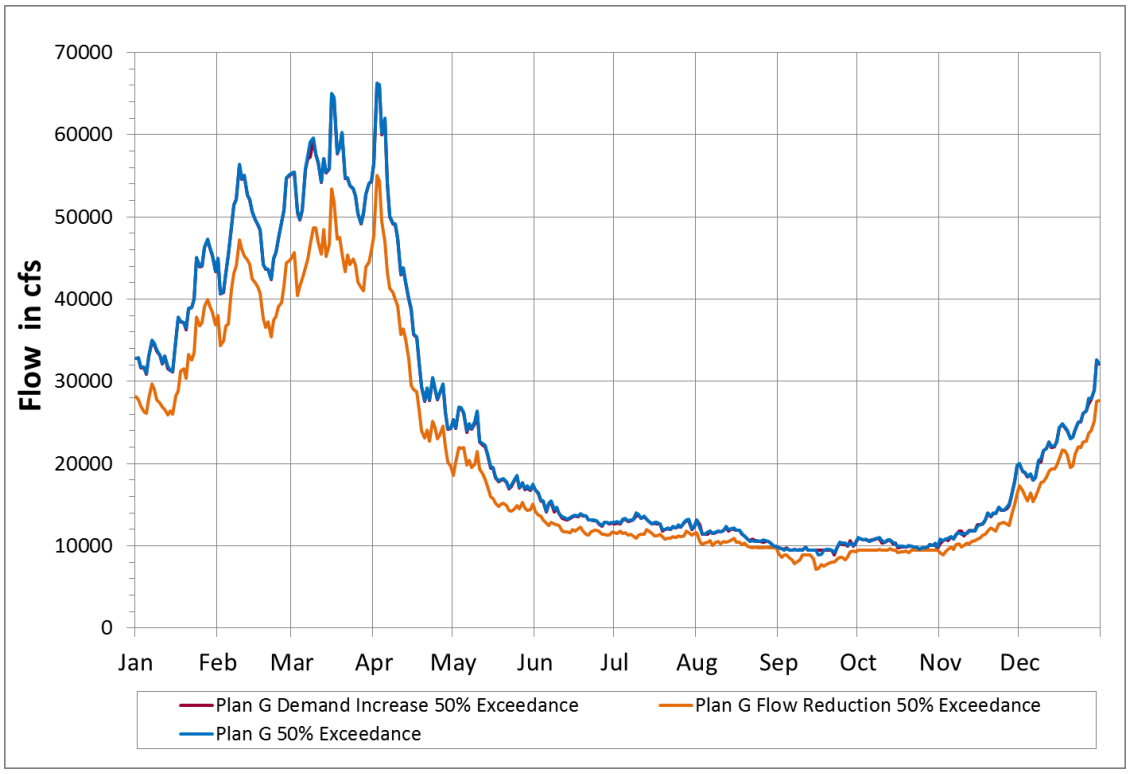


Figure 6.9-16. Claiborne Lock and Dam, daily discharge (cfs), median daily discharge (cfs) over the modeled period of record (1939–2011).

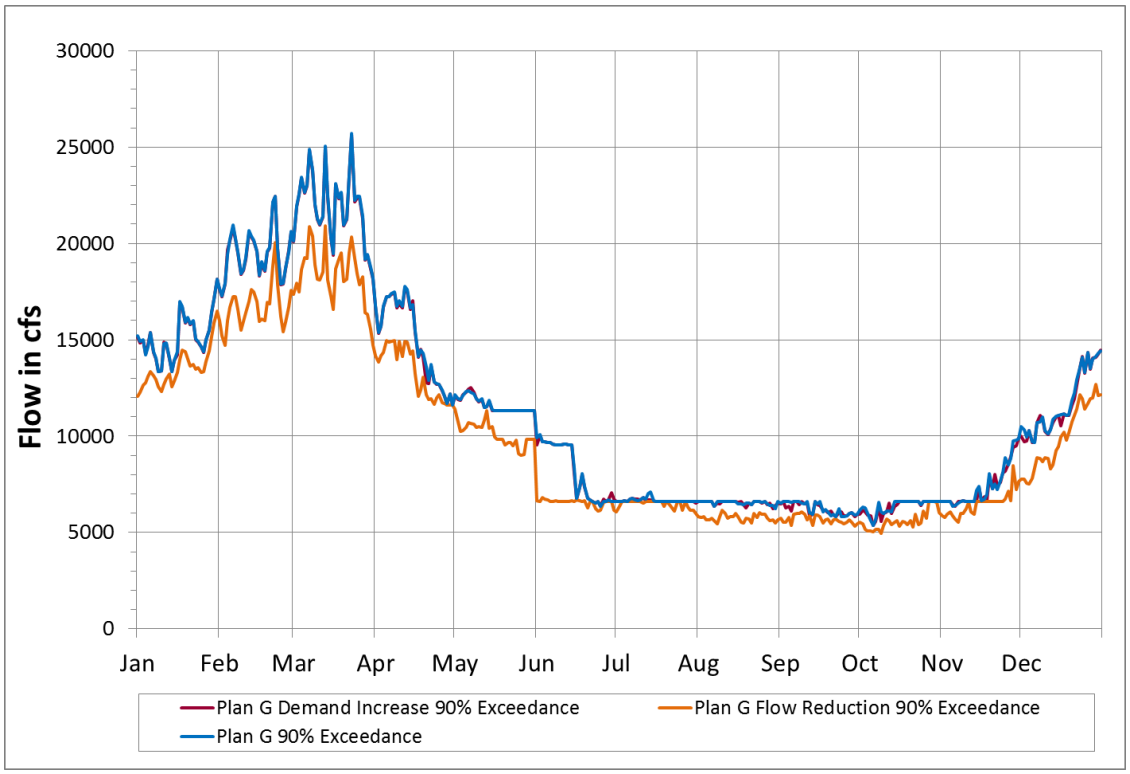


Figure 6.9-17. Claiborne Lock and Dam, daily discharge (cfs) at the 90 percent exceedance level over the modeled period of record (1939–2011).

In summary, Table 6.9-5 presents differences in flow values (expressed in percent change) to compare flow conditions under Plan G to Plan G-DI at five locations in the ACT Basin. For each of the five locations, the differences were calculated at five different percentile levels covering the range from high to low flow occurrences (90^{th}, 75^{th}, 50^{th}, 25^{th}, and 10^{th} percentiles). As the table indicates, the overall effects of increased water demands on flow conditions in the ACT Basin (Plan G-DI) would be expected to be minor. The largest change attributable to increased water demand would be a 3.5 percent decrease in the median flow value immediately downstream of Allatoona Dam and decreases in the 10^{th} percentile flow values (representing extremely dry conditions in the basin) at Rome, Montgomery, and Claiborne Lock and Dam in the range of 1.7 to 2.1 percent. All other values in the table indicate negligible changes.

Table 6.9-5.
Percent change in flow values between Plan G and Plan G-DI over modeled period of record (1939–2011)

	Percent change in flow value compared to Plan G				
Location	90^{th} percentile flow value	75^{th} percentile flow value	50^{th} percentile flow value	25^{th} percentile flow value	10^{th} percentile flow value
Coosawattee River below Carters Reregulation Dam	-0.1%	-0.1%	-0.2%	-0.4%	-0.2%
Etowah River below Allatoona Dam	-0.2%	0.0%	-3.5%	-1.9%	0.0%
Coosa River at Rome, Georgia	-0.3%	-0.7%	-1.1%	-1.6%	-1.7%
Alabama River at Montgomery, Alabama	-0.1%	-0.3%	-0.8%	-0.5%	-1.8%
Alabama River below Claiborne Lock and Dam	-0.1%	-0.3%	-0.6%	-0.2%	-2.1%

Overall, the Proposed Action Alternative (Plan G) would have a relatively low degree of sensitivity to increased future water demands in the basin based on the future water demand projections used in this analysis (Plan G-DI).

6.9.1.1.4 Drought Management / Operations

Over the modeled period of record, Plan G-DI would not appreciably change the number of instances for which various levels of drought operations would be triggered compared the Plan G. Table 6.9-6 provides a more detailed comparison of model results for Plan G and Plan G-DI. Initiation of drought operations (particularly Level 1) could be encountered more than once in any year. Levels 2 and 3 would likely be encountered much less frequently. The number of times that a particular drought level is triggered does not indicate how long that duration might be. Based upon the manner in which the drought level is checked and updated, the minimum duration for a drought level designation would be 14 days. For any occurrence, the drought level duration could extend from 14 days to several weeks or months as long as the conditions that triggered drought operations in the ACT system would persist.

Table 6.9-6.
Number of times drought operations would be triggered for Plan G and Plan G-DI over the modeled period of record (1939–2011)

	Plan G	Plan G-DI
Drought Level 1	122	118
Drought Level 2	30	29
Drought Level 3	5	5

Table 6.9-7 summarizes the percent of time over the modeled period of record that operations would be considered *normal* versus various levels of drought operation. *Normal operations* in this context would include any period when drought operations have not been triggered. Plan G-DI would result in a slight decrease in the percent of time the ACT system would be in normal operations (by one percent) and a corresponding increase in the percent of time in drought operations. Most of the increased percent of time in drought operations would occur at Drought Level 1, involving the least stringent drought operations measures. The number of instances over the modeled period of record when Drought Level 1 operations would be triggered is slightly higher for Plan G (122) compared to the Plan G-DI scenario (118) (per Table 6.9-6). The table shows similar results for Drought Level 2. However, as shown in Table 6.9-7, there would be a slight increase in the percent of time that Plan G-DI would be in Drought Level 1 operations compared to Plan G (13.1 percent versus 12.3 percent). These results indicate that drought operations may be triggered slightly more often under Plan G but the individual occurrences may tend to be of longer duration with Plan G-DI. For example, during a given year, drought operations may be triggered two separate times under Plan G, each of relatively short duration, whereas in the same year, drought operations may be triggered under Plan G-DI only once with an extended duration.

Table 6.9-7.
Percent of time that ACT system would operate in normal and drought mode for Plan G and Plan G-DI over modeled period of record (1939–2011)

	Plan G	Plan G-DI
Normal	83.1%	82.1%
Drought Level 1	12.3%	13.1%
Drought Level 2	3.3%	3.3%
Drought Level 3	1.3%	1.5%

According to Table 6.9-8, under both Plan G and Plan G-DI, the state line flow would be the drought trigger most often reached to activate drought operations, followed by the basin inflow trigger. The composite conservation storage trigger for APC projects would rarely be reached, only under the most extreme drought conditions. For Plan G-DI, the percent of time that each of the drought triggers would be met would slightly increase compared to Plan G.

Table 6.9-8.
Percent of time drought operations activated and specific drought triggers met for Plan G and Plan G-DI over modeled period of record (1939–2011)

	Plan G	Plan G-DI
Drought Operations Activated	16.9%	17.9%
Basin Inflow Trigger Met	9.3%	9.9%
State Line Flow Trigger Met	11.6%	12.1%
Composite Conservation Storage Trigger Met	1.5%	1.7%

6.9.1.1.5 Navigation Flow Targets

Compared to Plan G, the increased water demands scenario (Plan G-DI) would have a negligible effect on the ability to meet navigation flow targets below Claiborne Lock and Dam for either a 9-ft or 7.5-ft navigation channel depth. Figure 6.9-18 and Figure 6.9-19 present a summary of the percent of time (by month) over the modeled period of record that required navigation flows for a 9-ft and 7.5-ft deep channel, respectively, would be met or exceeded for Plan G and for Plan G-DI. For both channel depths, increased future water demands in the ACT basin (Plan G-DI) would be expected to have a negligible overall effect on meeting the prescribed navigation flow targets. For the months of December through June, the percent of time that target flows would be equaled or exceeded would be about the same for Plan G and Plan G-DI. Percentages for Plan G-DI would decline slightly (in the range of zero to two percent) during the months of July through November.

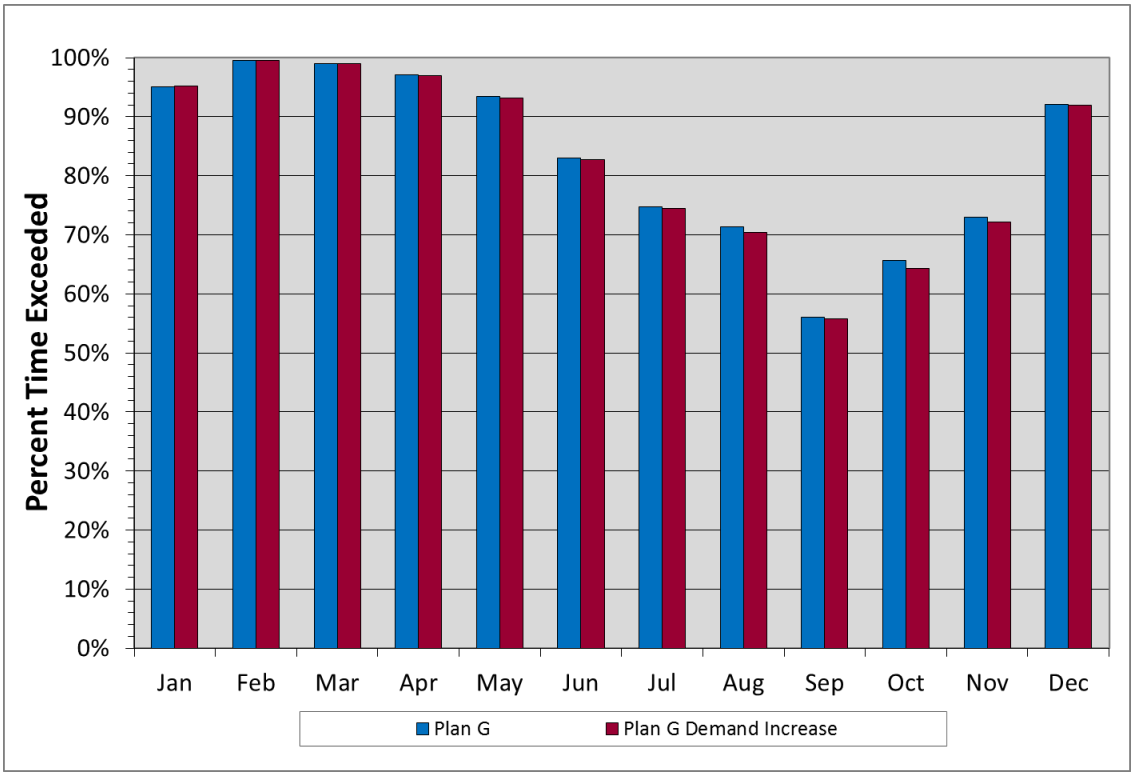


Figure 6.9-18. Alabama River, percent of time (by month) that flow downstream of Claiborne Lock and Dam would be sufficient to support 9-ft channel during modeled period of record (1939–2011).

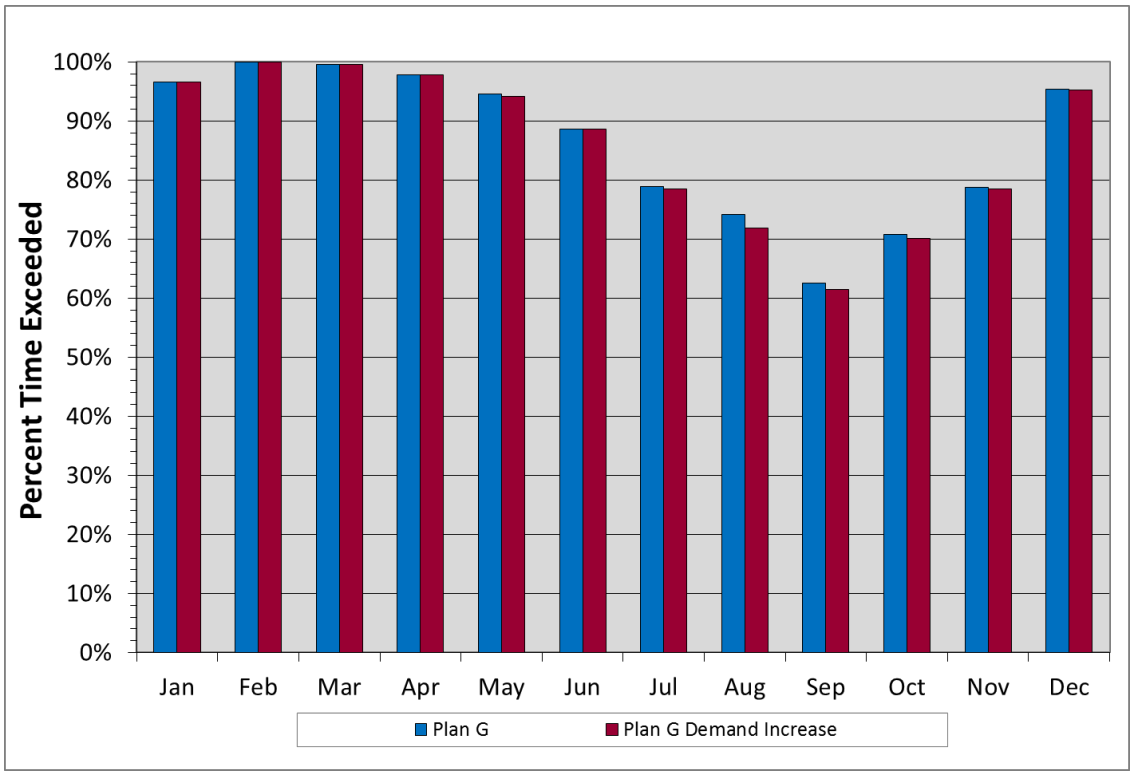


Figure 6.9-19. Alabama River, percent of time (by month) that flow downstream of Claiborne Lock and Dam would be sufficient to support 7.5-ft channel during modeled period of record (1939–2011).

6.9.1.1.6 Water Withdrawals

Plan G-DI would not place water intakes in the ACT Basin at any increased risk of encountering insufficient flows or reservoir levels compared to Plan G.

6.9.1.2 Water Quality

The HEC-5Q model was used to evaluate the sensitivity of the Proposed Action Alternative (Plan G) on future water demands and climate change effects on water quality. Flow outputs by reach from the HEC-ResSim sensitivity analysis were input to the HEC-5Q model. The two scenarios included (1) increased future water demands (Plan G-DI) and (2) reduced basin inflows as a potential result of climate change.

The sections that follow detail the results of modeling comparing the Plan G-DI scenario to Plan G. The HEC-5Q results presented in this section are for the modeled period (2001–2008), which also represented the most recent point and nonpoint contributions. Loads from both point and nonpoint sources were not varied in modeling scenarios. Instead, the results presented illustrate how water quality is affected by changing hydrologic conditions and water management activities in the ACT Basin under the Plan G-DI scenario when compared with Plan G.

The modeled period includes wet, dry, and normal flow conditions, which allows a display of the water quality response to varying hydrologic conditions. Wet years are defined by the wettest 25th percentile rainfall and dry years are defined by the driest 25th percentile rainfall. Normal years are represented by median rainfall. The wet, dry, and normal years presented are 2003, 2007, and 2002, respectively. Those

years were selected to represent the range of hydrologic conditions that can occur, understanding that conditions can vary greatly over the entire basin.

The sections to follow present the change (or *delta*) in various modeled parameters between the Plan G and Plan G-DI. The longitudinal occurrence profiles by RM illustrate how water quality varies along the reach, and how water quality might be affected by dams, other structures, or discharges from point and nonpoint sources. Presenting data in such a way illustrates the amount of time a concentration is higher or lower than a given value. In those plots, the 5th, 50th (or median), and 95th percent occurrences are illustrated. Those percentiles illustrate the range of concentrations that would be likely to occur. These results are based on modeled output. The figures are not meant to present statistical ranges. These profiles illustrate the percentage of time a concentration of pollutant occurs as a *Percent Occurrence* at stations in mainstem sections of the ACT Basin.

6.9.1.2.1 Water Temperature

The projected changes between Plan G and Plan G-DI are negligible for much of the system (Figure 6.9-20). These results indicate that the slight reduction in basin flows has little effect on water temperature in the ACT Basin. The greatest variation between Plan G and Plan G-DI occurs during the 2002 representative normal-year growing season where median modeled deviations in water temperature would be expected to change by 1.0°F (0. 5°C) in the Tallapoosa River. During the 2007 representative dry-year, small fluctuations where also modeled in the Tallapoosa River but the change in water temperature is negligible. Some small variation is also seen on the Coosa River downstream of Weiss Lake in dry years but annual median changes in a representative dry year were less than 0.5°F (0. 25°C).

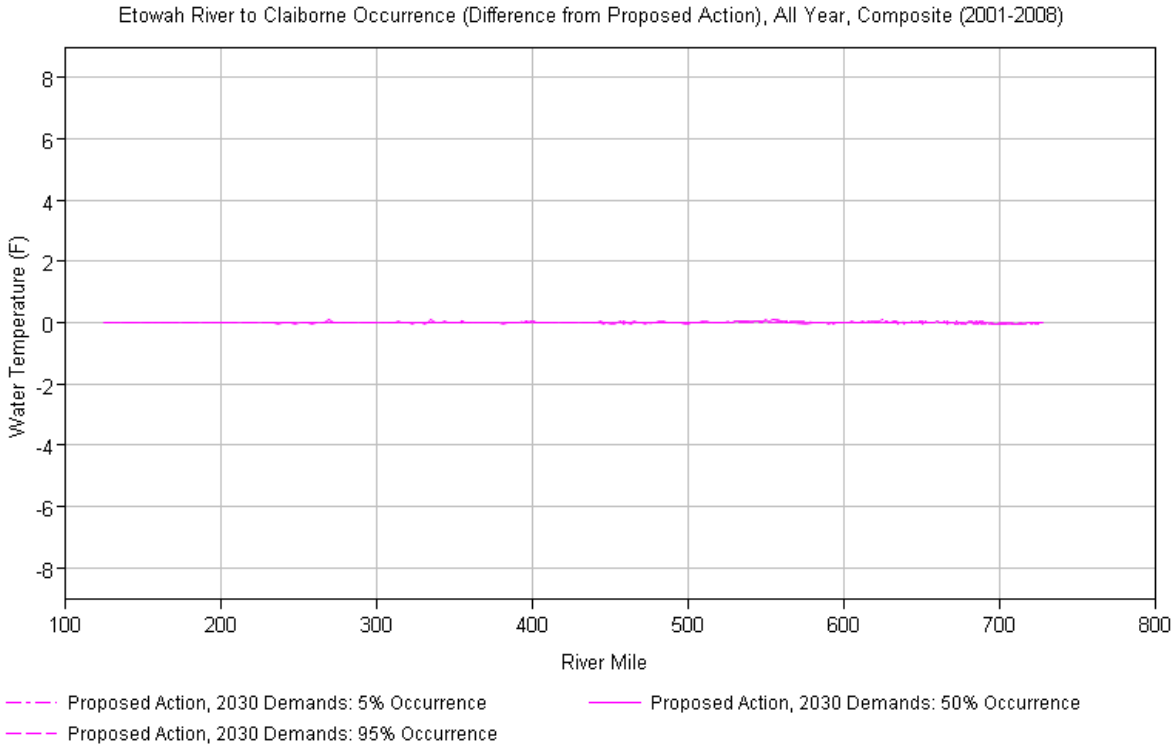


Figure 6.9-20. Etowah River to Claiborne Lock and Dam water temperature delta longitudinal profile for the modeled period (2001–2008).

6.9.1.2.2 Dissolved Oxygen

There was a noticeable but negligible difference in DO concentrations between Plan G and Plan G-DI (Figure 6.9-21). Responses in DO appeared to be inversely proportional to the responses in temperature throughout the ACT Basin. This change is expected due to the relationship between DO and temperature. As water temperature increases, the maximum solubility of oxygen in water decreases, resulting in lower DO concentrations. The greatest fluctuations in DO occur during the critical period of 2007 along the Coosa River downstream of Weiss Lake (Figure 6.9-22) and in normal-weather years in Allatoona Lake (Figure 6.9-23).

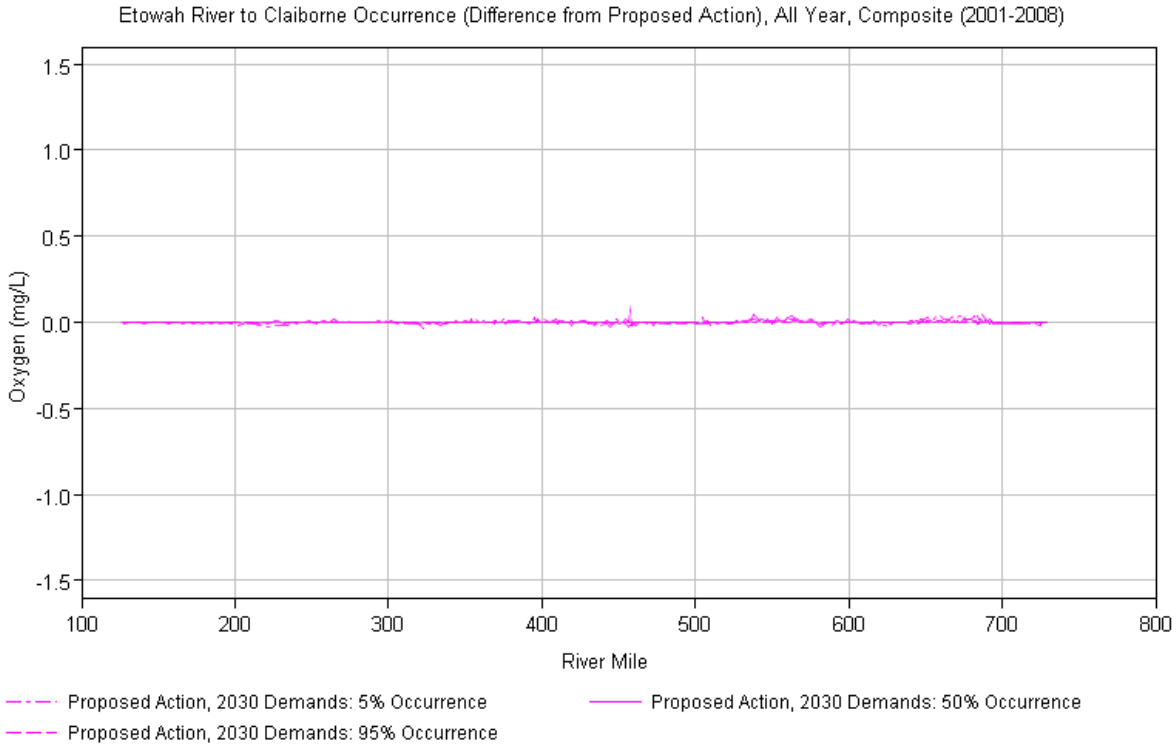


Figure 6.9-21. Etowah River to Claiborne Lock and Dam annual oxygen delta longitudinal profile for the modeled period (2001–2008).

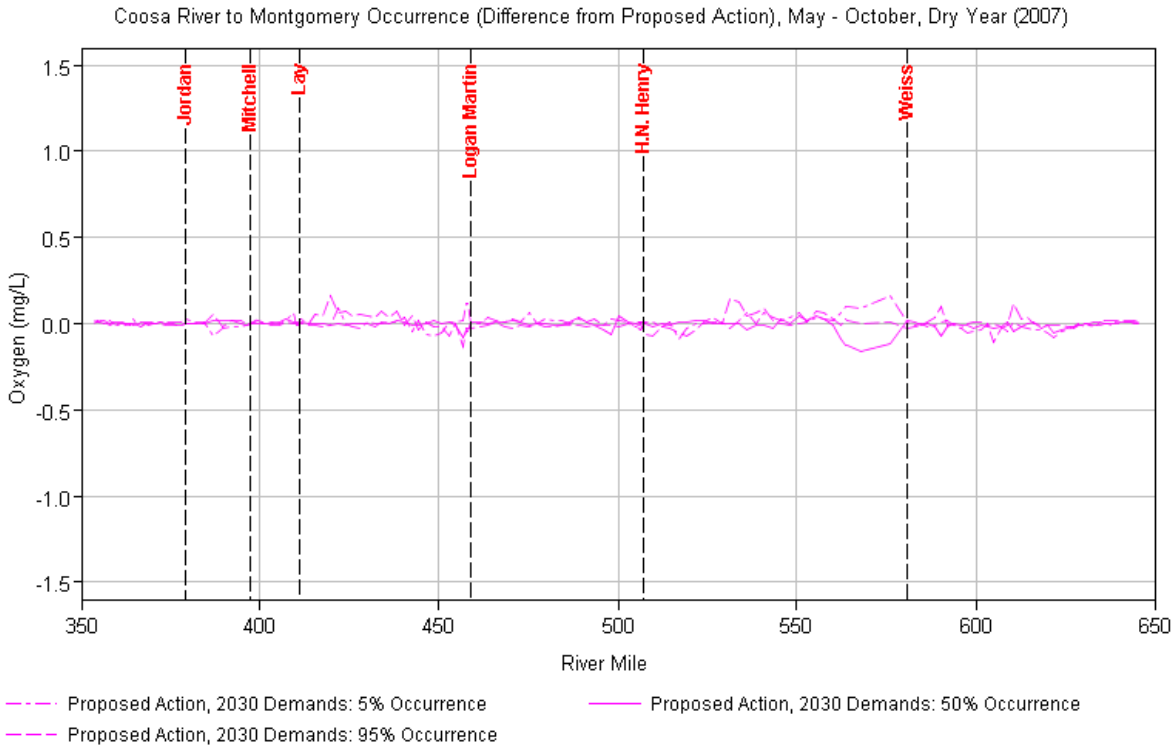


Figure 6.9-22. Coosa River oxygen delta longitudinal profile for the modeled period in a representative dry year from May through October (2007).

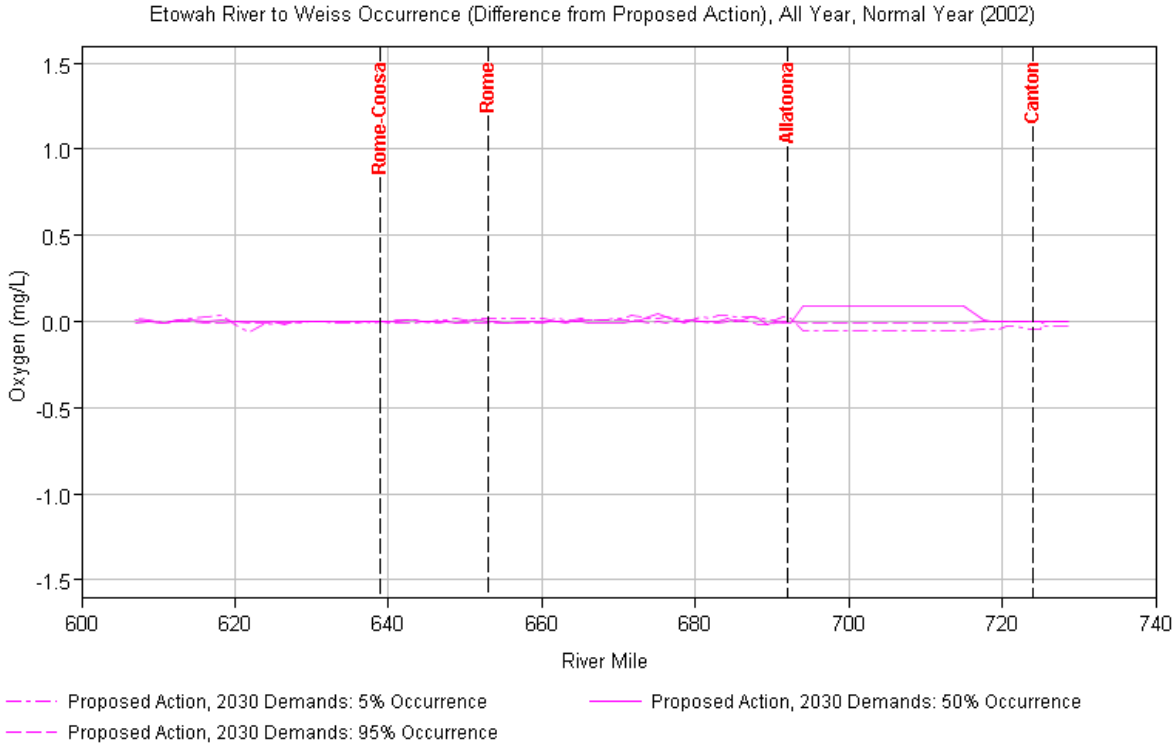


Figure 6.9-23. Etowah River annual oxygen delta longitudinal profile for the modeled period in a representative normal year (2002).

Changing the timing and quantity of flow can influence the system's ability to assimilate oxygen-demanding pollutants (like total phosphorus, nitrogen, and chlorophyll *a*). The result of these changes in the system illustrate negligible fluctuations in DO and BOD (Figure 6.9-24). These negligible differences indicate that the increased demand did not appear to inhibit the system's ability to assimilate oxygen-demanding pollutants.

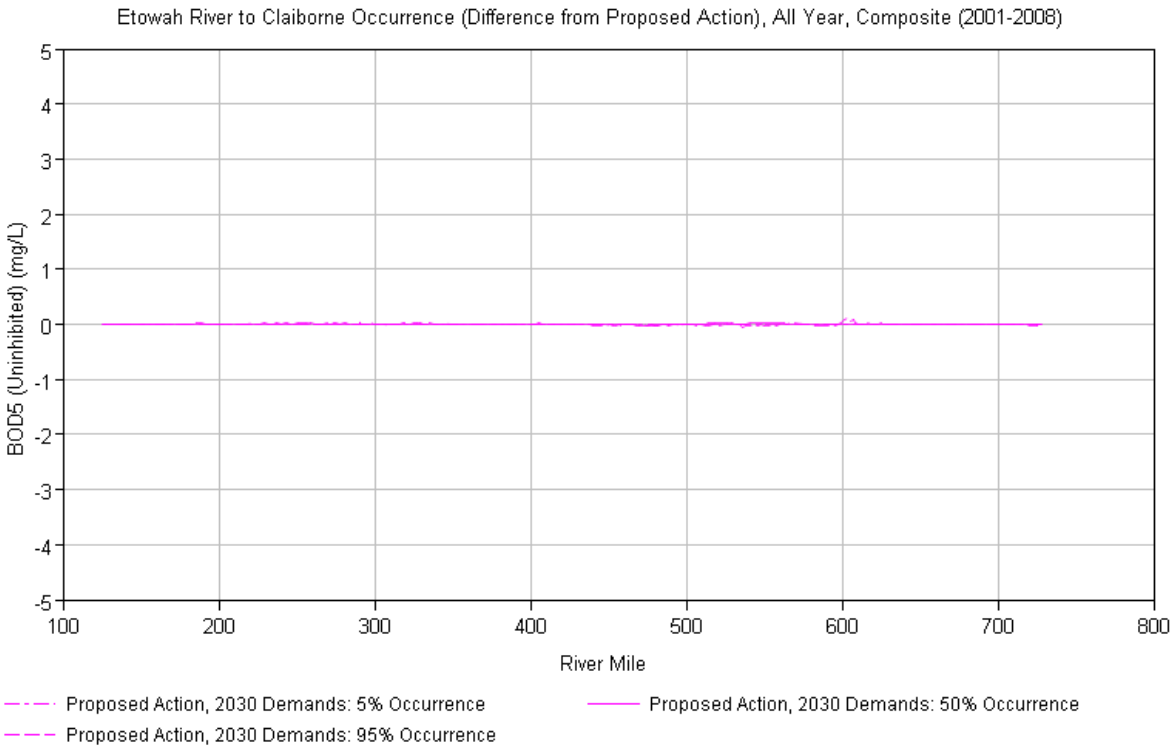


Figure 6.9-24. Etowah River to Claiborne Lock and Dam annual biochemical oxygen demand delta longitudinal profile for the modeled period (2001–2008).

6.9.1.2.3 Total Phosphorus

The expected flow changes between Plan G and Plan G-DI would have a negligible impact in much of the ACT Basin on total phosphorus concentrations. Throughout the ACT Basin, the differences in median concentrations is near zero, as shown in the Etowah River, Coosa River, and Alabama River (Figure 6.9-25). The greatest influence on total phosphorus concentrations occurs when the Oostanaula River enters the Coosawattee River in a dry-weather year (Figure 6.9-26). These differences have little influence on phosphorus further downstream (Figure 6.9-27).

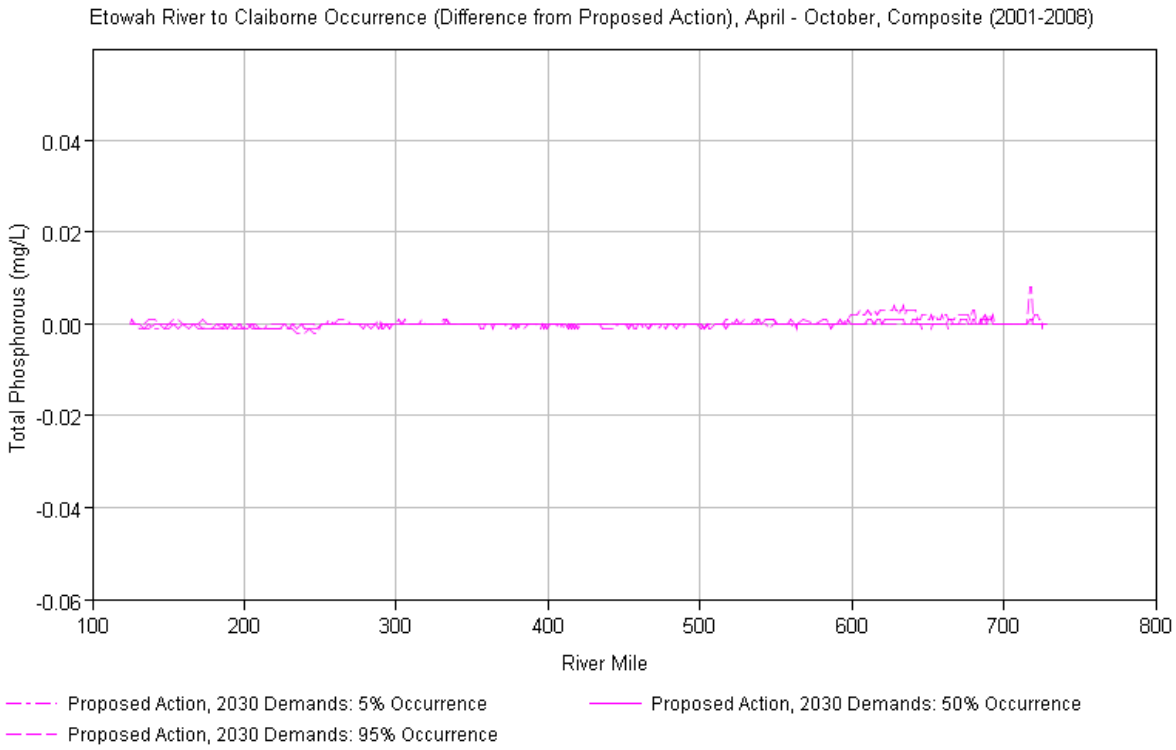


Figure 6.9-25. Etowah River to Claiborne Lock and Dam total phosphorus delta longitudinal profile the modeled period from April through October (2001-2008).

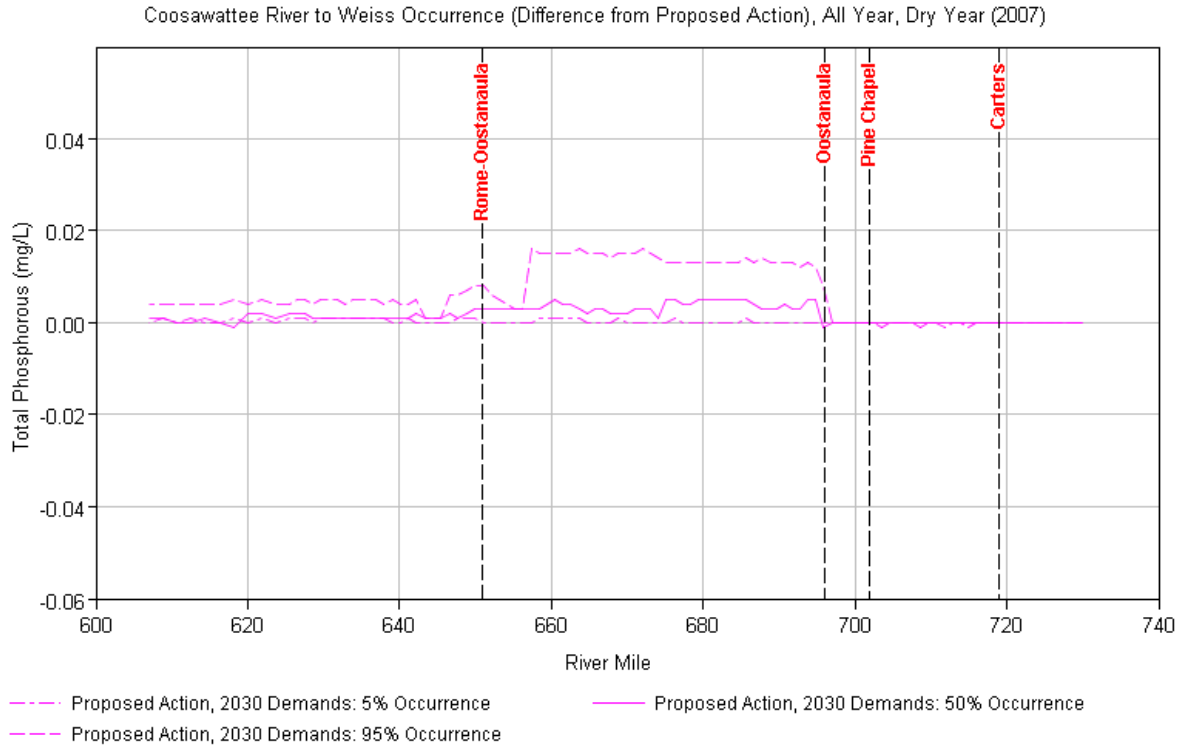


Figure 6.9-26. Coosawattee River annual total phosphorus delta longitudinal profile for a representative dry-weather year (2007).

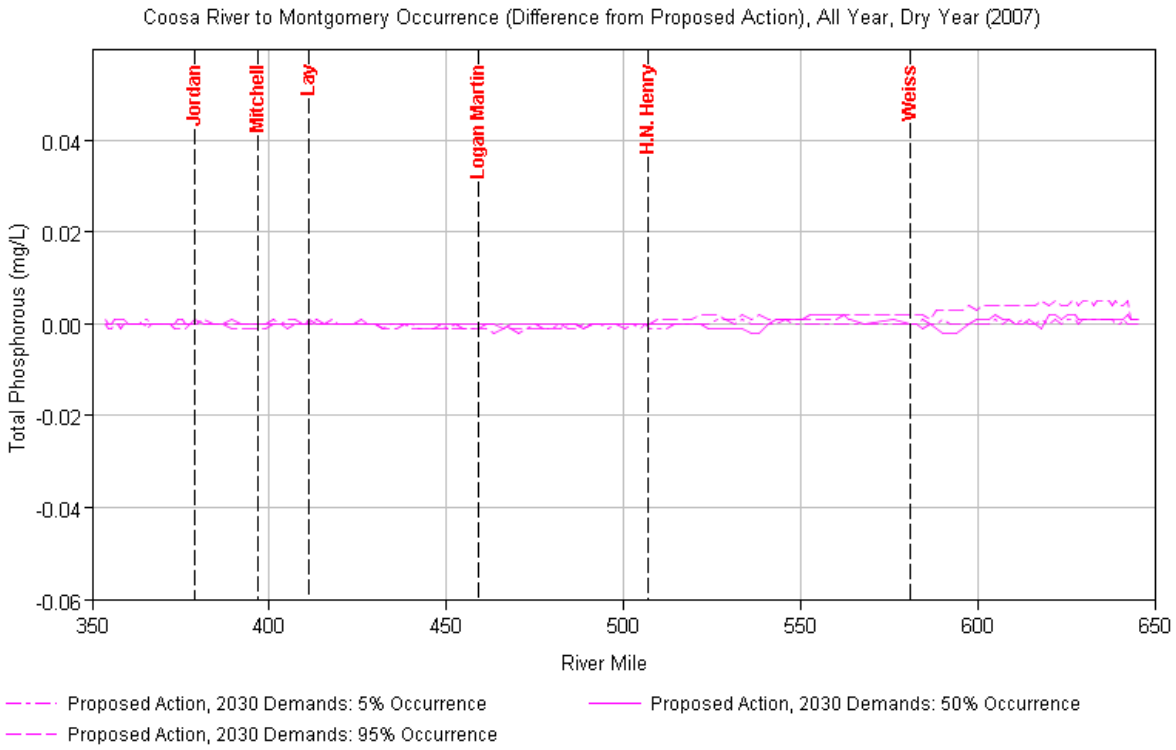


Figure 6.9-27. Coosa River annual total phosphorus delta longitudinal profile for a representative dry-weather year (2007).

6.9.1.2.4 Total Nitrogen

Similar to total phosphorus, the expected flow changes between Plan G and Plan G-DI would have a negligible impact in much of the ACT Basin on total nitrogen concentrations. Throughout the ACT Basin during the modeled period the differences in median concentrations are near 0.0 mg/L, as shown in the Etowah River, Coosa River, and Alabama River (Figure 6.9-28). The greatest influence on total nitrogen concentrations occurs when the Oostanaula River enters the Coosawattee River in a dry-weather year (Figure 6.9-29). These differences have little influence on nitrogen further downstream (Figure 6.9-28).

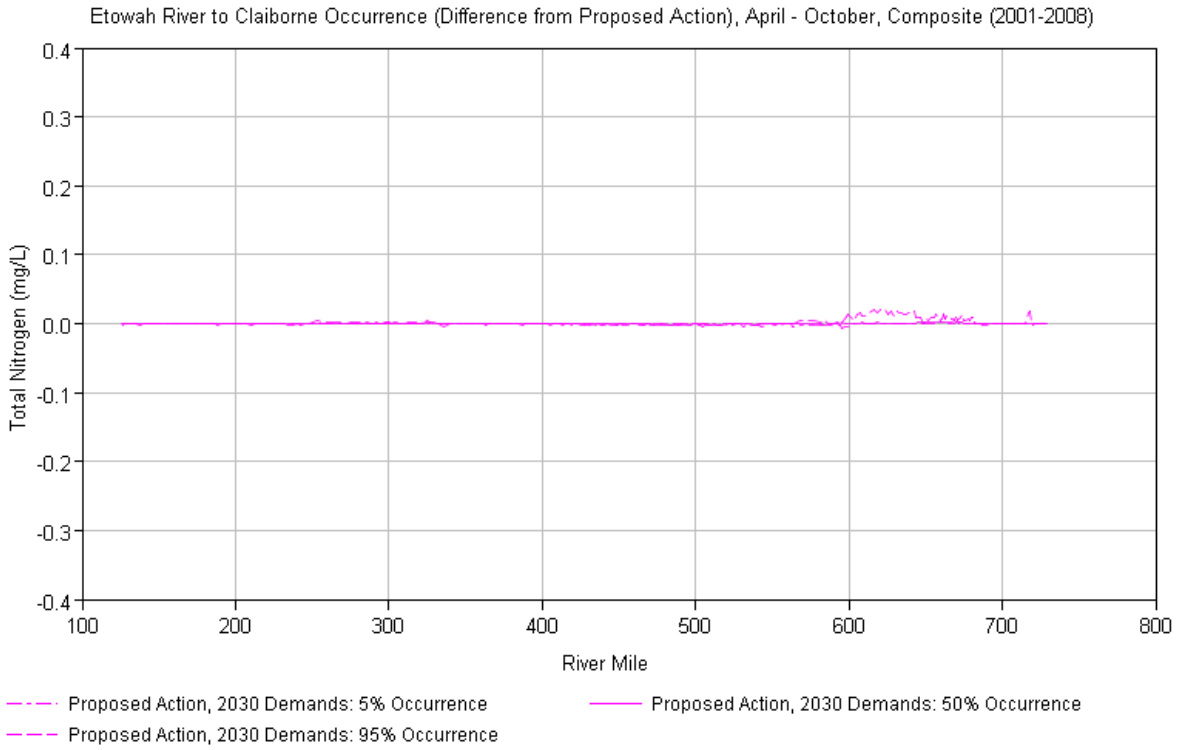


Figure 6.9-28. Etowah River to Claiborne Lock and Dam total nitrogen delta longitudinal profile the modeled period from April through October (2001-2008).

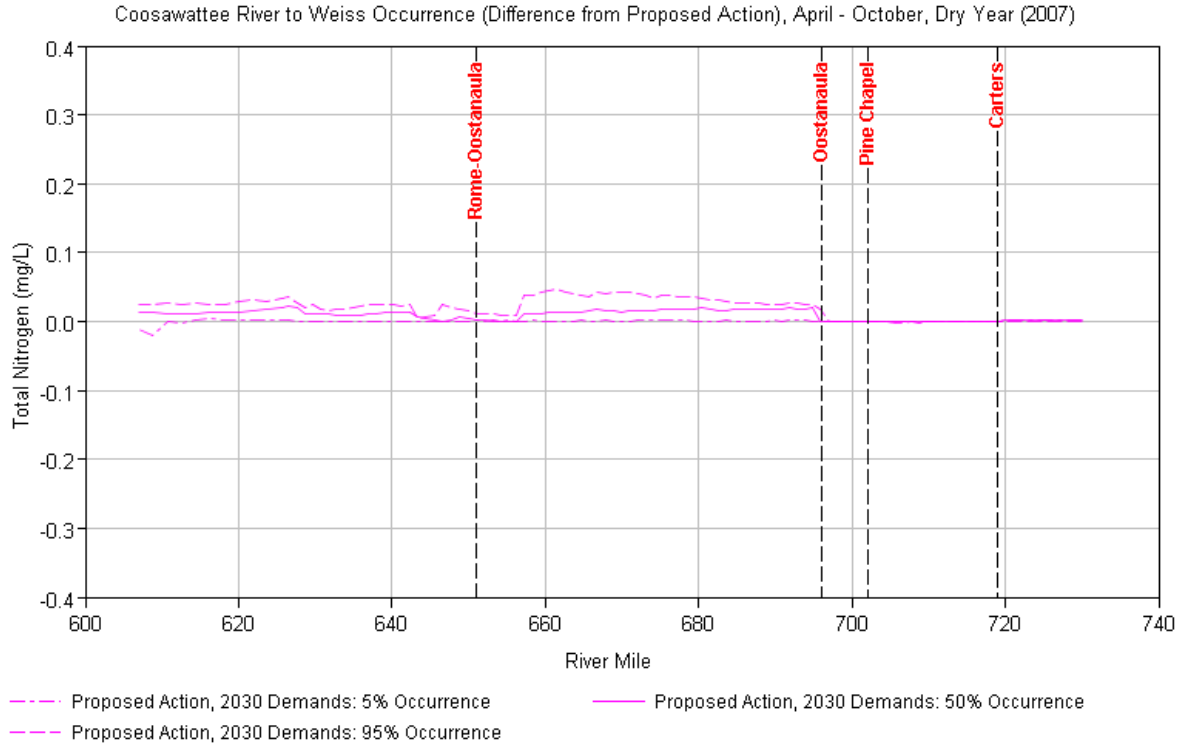


Figure 6.9-29. Coosawattee River total nitrogen delta longitudinal profile for a representative dry-weather year from April through October (2007).

6.9.1.2.5 Chlorophyll *a*

Little change in chlorophyll *a* would be expected in the ACT Basin over a period of various flow conditions during the growing season. Growth in chlorophyll *a* typically varies by near 0 µg/L from Plan G-DI over Plan G. Even under dry-weather conditions chlorophyll *a* varies by less than 1 µg/L in the growing season as illustrated in Figure 6.9-30.

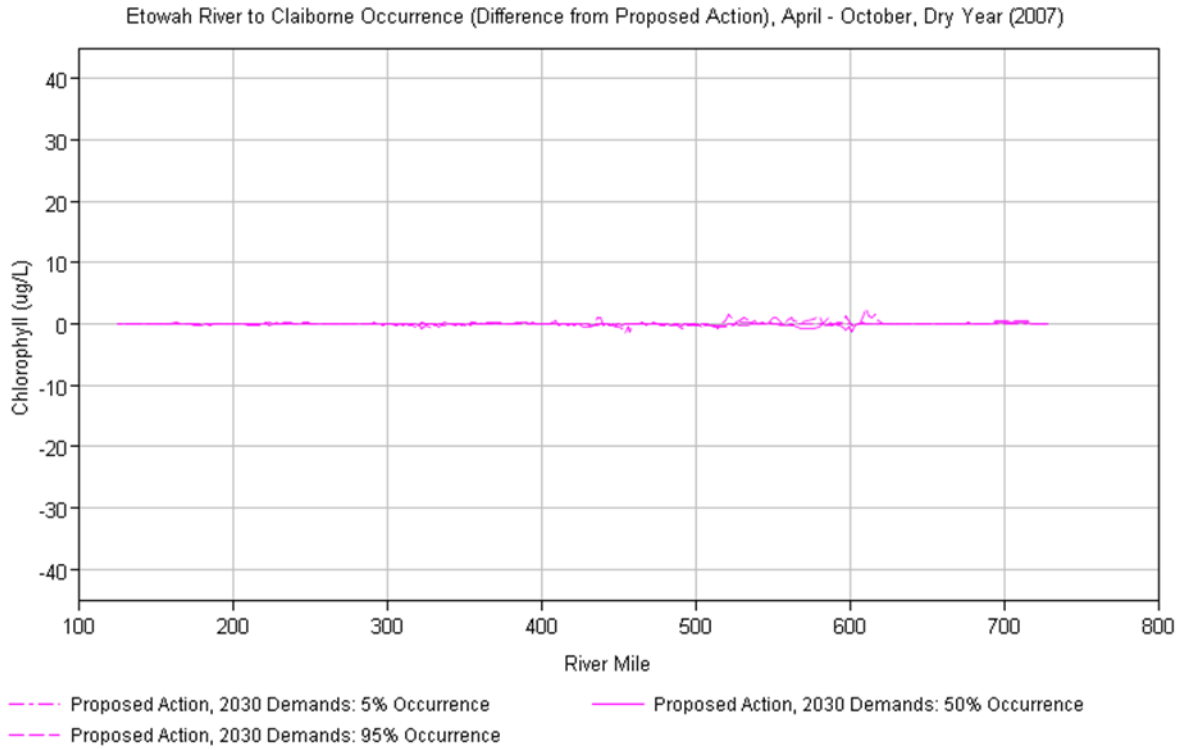


Figure 6.9-30. Etowah River to Claiborne Lock and Dam chlorophyll delta longitudinal profile for a representative dry-weather year from April through October (2007).

6.9.1.3 Biological Resources

6.9.1.3.1 Vegetation

It was determined in Section 6.5.1 that, for the Proposed Action Alternative (Plan G), no effects on the vegetative resources would be expected for any of the river systems. The high degree of water regulation in the ACT Basin prevents extreme flooding, and generally restricts water to the main channel, keeping it out of the historic floodplain downstream of the major dams. Plan G produces a minor effect on river dynamics, but not enough to affect vegetation. Plan G-DI would result in only minor changes in lake levels and flows, and would also not be expected to affect vegetation.

6.9.1.3.2 Wildlife

The effects of implementing Plan G on wildlife resources were determined to be negligible (Section 6.5.2). Because flows and lake levels would be minimally affected by Plan G throughout the ACT Basin, the primary mechanism by which wildlife resources could be affected by implementing Plan G would be through an effect on water quality. Overall changes in water quality in the ACT rivers under Plan G

include slight differences in temperature and DO from the No Action Alternative, but would be expected to have little effect on wildlife resources, as explained in Section 6.5.2. Plan G-DI would have negligible effect on lake levels compared to Plan G. Increased water demand would have a noticeable but negligible effect on DO concentrations, and cause some changes in temperature as detailed in Section 6.9.1.2.1. Such changes in water quality would not be expected to affect upland wildlife in the ACT Basin.

6.9.1.3.3 Fish and Aquatic Resources

The rivers in the ACT Basin are expected to have no or minimal adverse effects due to changes in flow and water quality conditions under Plan G, as detailed in section 6.5.3.1. As Table 6.9-4 indicates, the potential overall effects of increased water demands on flow conditions in the ACT Basin would be expected to be minor. The largest change attributable to increased water demand would be a 3.9 percent decrease in the median flow value immediately downstream of Allatoona Dam and decreases in the 10th percentile flow values (representing extremely dry conditions in the basin) at Rome, Montgomery, and Claiborne Lock and Dam in the range of two to three percent. All other values indicate changes ranging from minor to negligible.

Water temperature changes are seen in some of the rivers, as detailed in section 6.9.1.2.1. In general, water temperatures are slightly higher than Plan G. Elevated water temperatures result in lower dissolved oxygen concentrations, which could adversely affect fish if DO levels decrease too much. Slight changes in water temperature would not be expected to affect fish and other aquatic resources, either directly or indirectly through associated slight decreases in DO that could occur. Throughout the ACT Basin, dissolved oxygen decreased between Plan G and Plan G-DI, often by less than 0.1 mg/L, during the May through October critical periods.

6.9.1.3.4 Protected Species

It was noted in section 6.5.4.1 that little information is known about the relationship between flow regime characteristics and the life histories of protected species occurring in the basin. Minor alterations to flow regimes may provide a slight benefit to some species, while simultaneously providing less optimal conditions for other species. Increased future water demands in the ACT Basin added to Plan G would generally result in slightly lower, but negligible, differences in median flow conditions in all of the rivers in the ACT Basin.

Water quality is likely a limiting factor for several of the protected species in the ACT Basin. Protected fish and mussels are likely to be more sensitive to water quality impairments and extreme conditions than more common, tolerant species. Dissolved oxygen decreased between Plan G and Plan G-DI, often by less than 0.1 mg/L, during the May through October critical periods. The mainstems throughout the ACT Basin had responses similar to each other for the normal-, wet-, and dry-weather representative years. For the 2002 and 2003 modeled years, the representative normal- and wet-weather years respectively, ACT Basin response was similar to that of the entire modeling period wherein DO decreased by approximately 0.1 mg/L. In the representative dry year, median DO temperature also decreased by approximately 0.1 mg/L. However, DO concentration in the upper 95th percentile occurrence decreased by as much as 0.5 mg/L throughout the ACT Basin. Because this decrease in temperature occurs in the highest DO concentrations, it is not expected to have a negative impact on critical species within the ACT Basin. Other water quality parameters analyzed in the sensitivity analysis, including total phosphorus, total nitrogen, and chlorophyll *a* show negligible effects due to increased water demand. Increased water demand would not change the determination that the proposed action may affect but is not likely to adversely affect listed species.

6.9.1.4 Socioeconomic Resources

This section addresses the effects on socioeconomic resources that would likely be associated with the Proposed Action Alternative (Plan G) as compared to Plan G-DI. The assessment of effects herein will generally be qualitative in nature, supported by model outputs from HEC-ResSim and HEC 5-Q as they may relate to effects on various socioeconomic resources.

6.9.1.4.1 M&I Water Supply

Plan G-DI would be expected to provide essentially the same pool levels as Plan G. For Carters Lake, both Plan G and Plan G-DI would provide essentially the same median lake levels conditions. Plan G-DI would be expected to have no incremental effect on the M&I water supply availability in Allatoona Lake or Carters Lake compared to Plan G. The amount of storage made available by USACE in its reservoirs for water supply is unchanged under Plan D-GI, and Plan D-GI assumes that water supply users would make full use of that storage to satisfy anticipated water supply needs. As discussed in Appendix C, the available storage under existing water supply agreements at USACE reservoirs may not be sufficient under all conditions to accommodate the current (2006) level of water supply withdrawals, or the increased demand projected for purposes of the sensitivity analysis, from those reservoirs. Plan G-DI assumes that withdrawals from USACE reservoirs would be limited to the amount available in water supply storage under existing agreements, as measured by the storage accounting methodology that the USACE currently employs at those reservoirs.

6.9.1.4.2 Navigation

Over the modeled period of record, Plan G-DI would likely produce essentially the same results with respect to navigation channel availability as Plan G (see Figure 6.9-18 and Figure 6.9-19).

6.9.1.4.3 Hydropower

This section presents a comparison of the effects on hydropower benefits associated with the Proposed Action Alternative (Plan G) to the Plan G-DI scenario. The methodology for the hydropower analysis summarized in Section 6.6.3 and the detailed HAC analysis of hydropower benefits is included in Appendix E of this EIS. This section summarizes additional analysis to assess the sensitivity of the hydropower benefits of the Plan G to a scenario with increased future water demands (Plan G-DI). Based upon the modeled period of record, the difference in average annual energy generated for Plan G compared to Plan G-DI was determined to be negligible.

Table 6.9-9 illustrates each plant's average annual energy benefits for Plan G and Plan G-DI. The table also includes estimated pumping costs for the Carters Lake facility. Plan G-DI would require approximately 94 MWh less energy for pumping than Plan G at an estimated value of $0.03 per kilowatt hour (KWh), which represents an annualized value calculated using the historical cost received from SEPA. Annual pumping costs for both Plan G and Plan G-DI would be about $18.8 million. In general, the majority of the plants would show no noteworthy differences between Plan G and Plan G-DI. Plan G-DI would likely result in a 0.38 percent reduction in total system energy benefits, or $843,000, compared to Plan G.

The total system difference between Plan G and the Plan G-DI is the gain or loss in dependable capacity caused by changes in system water control operations. Those results are shown in Table 6.9-10. Plan G-DI would be expected to have a slightly smaller system-dependable capacity (by two MW) than Plan G, resulting in a likely reduction in system capacity benefits of about $197,000 compared to Plan G.

Table 6.9-9.
Individual plant and total system energy benefits

Plant	Proposed Action Alternative (Plan G)	Plan G-DI
Allatoona Lake	$5,062,000	$5,001,000
Weiss Lake	$8,669,000	$8,620,000
H. Neely Henry Lake	$8,543,000	$8,494,000
Logan Martin Lake	$17,785,000	$17,710,000
Lay Lake	$26,886,000	$26,769,000
Mitchell Lake	$22,875,000	$22,786,000
Jordan Dam and Lake	$11,534,000	$11,523,000
Bouldin Dam	$34,782,000	$34,613,000
R.L. Harris Lake	$8,443,000	$8,428,000
Lake Martin	$17,817,000	$17,766,000
Yates Lake	$6,704,000	$6,689,000
Thurlow Lake	$11,487,000	$11,461,000
Robert F. Henry Lock and Dam and R.E. “Bob” Woodruff Lake	$13,235,000	$13,198,000
Millers Ferry Lock and Dam and William “Bill” Dannelly Lake	$15,251,000	$15,208,000
Carters Lake	$31,785,000	$31,781,000
Carters Pumping cost	($18,810,000)	($18,840,000)
Total	$222,048,000	$221,205,000

NOTE: Values shown in parentheses are negative values

Table 6.9-10.
Plant and system-dependable capacity calculations

Project	Proposed Action Alternative (MW)	Plan G-DI (MW)
Allatoona Lake	76.51	76.26
Carters Lake	576.79	576.78
Weiss Lake	73.07	72.91
H. Neely Henry Lake	57.08	56.99
Logan Martin Lake	127.05	126.72
Lay Lake	158.87	158.55
Mitchell Lake	160.20	159.82
Jordan Dam and Lake	107.22	107.16
Bouldin Dam	210.38	209.52
R.L. Harris Lake	126.26	126.23
Lake Martin	178.12	178.59
Yates Lake	44.39	44.46
Thurlow Lake	76.55	76.66
Robert F. Henry Lock and Dam and R.E. “Bob” Woodruff Lake	76.96	76.89
Millers Ferry Lock and Dam and William “Bill” Dannelly Lake	88.07	88.00
Total	2137.53	2135.53

Plan G-DI would be expected to produce $1,040,000 less in total hydropower benefits than Plan G. The reduction would be comprised of $843,000 in energy benefits and $197,000 in capacity benefits Compared to the ACT total system hydropower benefits, this overall difference would be minimal, in the general range of 0.25 percent. The effects of Plan G-DI on ACT hydropower benefits would likely be negligible.

6.9.1.4.4 Agricultural Water Supply

As indicated in Section 6.6.4, the Proposed Action Alternative (Plan G) would have overall negligible effects on the availability of agricultural water supply. Plan G with increased future M&I water demands (Plan G-DI) would have no incremental adverse impact on agricultural water supply availability.

6.9.1.4.5 Flood Risk Management

One of the screening criteria for the ACT WCM update was that water management measures (or alternatives) should maintain at least the current level of flood risk management. As indicated in Sections 6.1.1.1 and 6.6.5, the Proposed Action Alternative (Plan G) would not have an adverse effect on flood risk management operations or capabilities in the ACT Basin. Likewise, Plan G-DI would have a negligible incremental effect on flood risk management capabilities in the basin.

6.9.1.4.6 Recreation

Carters Lake. Specific pool elevations at Carters Lake at which defined impacts to recreation resources and activities would occur are described in Sections 2.1.1.2.1.4 and 6.6.6.2.2.2. Table 6.9-11 shows the number of days for the period of record (73 years) at Carters Lake that pool levels would likely fall within each recreation impact range for Plan G and for Plan G-DI. The model outputs indicate that Plan G-DI would likely result in a negligible increase in the number of days within the Initial Impact range and Recreation Impact range compared to Plan G. Neither scenario would reach the Water Access Limited range.

Table 6.9-11.
Carters Lake – no. of days and percent of time over period of record that lake levels fall within recreation impact ranges for Plan G and Plan G-DI

	Plan G (no. of days)	% of time pool level falls within range	Plan G-DI (no. of days)	% of time pool level falls within range
Initial Impact range (1068–1060 ft)	668	2.5%	669	2.5%
Recreation Impact range (1060–1055 ft)	64	0.2%	69	0.3%
Water Access Limited range (< 1055 ft)	0	0.0%	0	0.0%

Allatoona Lake. Specific pool elevations at Allatoona Lake at which defined impacts to recreation resources and activities would occur are described in Sections 2.1.1.2.1.4 and 6.6.6.2.2.1. Table 6.9-12 shows the number of days for the period of record (73 years) at Allatoona Lake that pool levels would likely fall within each recreation impact range for Plan G and Plan G-DI. The model outputs indicate that Plan G-DI would likely result in negligible differences in the number of days and percent of time within the Initial Impact, Recreation Impact, and Water Access Limited impact ranges compared to Plan G.

Table 6.9-12.
Allatoona Lake – no. of days and percent of time over period of record that lake levels fall within recreation impact ranges for Plan G and Plan G-DI

	Plan G (no. of days)	% of time pool level falls within range	Plan G-DI (no. of days)	% of time pool level falls within range
Initial Impact range (837 ft–835 ft)	2701	10.1%	2726	10.2%
Recreation Impact range (835 ft–828 ft)	10,046	37.7%	10,139	38.0%
Water Access Limited range (< 828 ft)	5225	19.6%	5245	19.7%

Alabama River lakes ("Bob" Woodruff, "Bill" Dannelly, and Claiborne lakes). The Alabama River lakes are formed by the three USACE lock and dam projects in the southern portion of the ACT Basin. These projects have minimal pool fluctuations as they are essentially run-of-river projects. Median pool elevations throughout the year are 125 ft for Woodruff Lake, 80.4 ft for Dannelly Lake, and 36 ft for Claiborne Lake. As discussed in Section 6.6.6.4, Plan G would have no effects on recreation resources and activities on these lakes. Lake conditions for Plan G-DI would be essentially the same as for Plan G (see Section 6.9.1.1.2). Therefore, no incremental effects on recreation resources or activities would be expected on the Alabama River lakes with Plan G-DI.

6.9.1.4.7 Property Values and Taxes

As indicated in Section 6.6.7, the Proposed Action Alternative (Plan G) would have overall negligible effects on lake levels compared to the No Action Alternative under normal conditions and would generally provide for improved lake levels under extreme drought conditions. Therefore, these alternatives would be expected to have a neutral to minor positive impact with respect to property values and tax revenues in the immediate vicinity of the reservoirs. Plan G-DI would be expected to have negligible incremental effects on lake level conditions in affected USACE and APC reservoirs and on property values and tax revenues.

6.9.1.4.8 Environmental Justice and Protection of Children

As described in Section 6.6.8, the Proposed Action Alternative (Plan G) would not be expected to have adverse effects on minority and low-income populations. In some cases where Plan G may help improve lakes level conditions during extreme droughts compared to current operations, minor beneficial effects for minority and low-income users may occur through improved shoreline access during those occurrences. Plan G-DI would be expected to have a negligible incremental effect on minority and low-income populations in the basin.

As described in Section 6.6.9, Plan G would not impose increased environmental health and safety risks on children per E.O. 13045. Plan G-DI would have no incremental adverse effects with respect to the environmental health and safety of children.

6.9.1.5 Other Resource Areas

Compared to Plan G, Plan G-DI would not likely result in appreciable increased effects on other natural and human resource considerations, including soils and geology, climate conditions, land use, aesthetics, air quality, transportation and traffic, and cultural resources.

6.9.2 Reduced Basin Inflows Scenario (Plan G-FR) (Climate Change)

To assess the sensitivity of the Proposed Action Alternative (Plan G) to potential effects of reduced precipitation and or/altered precipitation patterns in the southeast region in the future associated with climate change, USACE conducted an HEC-ResSim model simulation over the 73-year period of record assuming a 15 percent reduction in basin inflow (Plan G-FR). These results are summarized in Section 6.9.2.1 below. Additionally, a model simulation was performed with HEC-5Q (assuming reduced basin inflow) for Plan G and Plan G-FR in order to assess the sensitivity of Plan G to the potential effects of reduced basin inflows with respect to water quality considerations in the ACT Basin. The reduced basin inflow assumptions are generally comparable to the expected change in available precipitation in the region before 2050 (as discussed in Section 6.3 and presented in Figure 6.3-1), and are conservative when compared to the average expected decrease of 8.7 percent for individual counties in the ACT Basin. This section addresses the effects associated with the Plan G-FR scenario on key resource considerations as compared to the expected effects of Plan G.

6.9.2.1 Water Quantity

Based upon results from the HEC-ResSim model simulation described above, the following subsections summarize the potential effects that would be expected relative to water quantity considerations for the Proposed Action Alternative (Plan G) as compared to Plan G-FR.

6.9.2.1.1 Flood Risk Management

The Proposed Action Alternative (Plan G) and Plan G-FR would not have an adverse impact on the flood risk management purpose and function for the pertinent ACT Basin projects.

6.9.2.1.2 Lake Levels / Storage Conditions

HEC-ResSim model simulations over the modeled period of record for the Proposed Action Alternative (Plan G) and for Plan G-FR indicate that reduced inflows would measurably affect reservoir levels, and consequently storage conditions in ACT basin reservoirs. This section addresses the degree to which lake levels would likely be affected under the Plan G-FR scenario.

Carters Lake. Figure 6.9-1 and Figure 6.9-2 present the median daily and 90 percent exceeded pool elevations, respectively, for the Proposed Action Alternative (Plan G) and Plan G-FR at Carters Lake over the modeled period of record. For median pool levels, The Plan G-FR scenario would be expected to produce pool elevations slightly lower (ranging from zero up to about 0.3 ft) than Plan G for the months of June through December. Plan G-FR would have a negligible effect on median pool levels from the months of January through May. At the 90 percent exceedance level, indicative of drought conditions, lake levels would likely be lower, fluctuating throughout all months in the range from about 0.5 ft to 3.5 ft below those expected under Plan G. These differences with the Plan G-FR scenario would be expected to have a relatively minor overall effect on Carters Lake levels.

Allatoona Lake. Figure 6.9-3 and Figure 6.9-4 present the median daily and 90 percent exceeded pool elevations, respectively, for the Proposed Action Alternative (Plan G) and for Plan G-FR over the modeled period of record for Allatoona Lake. For median pool levels, Plan G-FR would be expected to provide pool elevations the same as for Plan G from December through most of June. Median elevations from July through November would likely be slightly lower (ranging from about one to two ft lower) than Plan G. At the 90 percent exceedance level, indicative of drought conditions, lake levels would likely be lower throughout the year, typically ranging from about 0.5 ft to 1.5 ft below those expected for Plan G.

Differences produced under the Plan G-FR scenario would be expected to have a relatively minor incremental effect on Allatoona Lake levels compared to Plan G.

Weiss Lake (APC). Figure 6.9-5 and Figure 6.9-6 present the median daily and 90 percent exceeded pool elevations, respectively, for the Proposed Action Alternative (Plan G) and for Plan G-FR for Weiss Lake over the modeled period of record. For median pool levels, the Plan G-FR scenario would be expected to produce pool elevations the same as for Plan G from December through most of June. Median elevations from July through November would likely be slightly lower (ranging from about 0.2 ft to 0.6 ft lower) than Plan G. At the 90 percent exceedance level, indicative of drought conditions, lake levels would likely be slightly lower throughout the year, typically ranging from about 0.1 ft to 0.6 ft below those expected under Plan G. Differences produced under the Plan G-FR scenario would be expected to have a relatively minor overall effect on Weiss Lake levels compared to Plan G.

Lake Martin (APC). Figure 6.9-7 and Figure 6.9-8 present the median daily and 90 percent exceeded pool elevations, respectively, for the Proposed Action Alternative (Plan G) and for Plan G-FR for Lake Martin over the modeled period of record. Lake Martin elevations under the Plan G-FR scenario follow a similar pattern throughout the year to those observed at Weiss Lake, except that the elevation differences would be expected to be slightly larger at Lake Martin, up to about one foot lower at the median level and up to about 1.3 ft lower at the 90 percent exceedance level. Differences produced under the Plan G-FR scenario would be expected to have a minor overall adverse effect on Lake Martin levels.

Other Affected APC Reservoirs. Modeling for Plan G and for Plan G-FR over the 73-year period of record indicate that the following potential effects associated with reduced basin inflows on the other affected APC storage reservoirs in the ACT Basin:

- Pool elevations for H. Neely Henry Lake would likely be minimally affected by the Plan G-FR scenario. Incremental differences resulting from reduced basin inflow on H. Neely Henry Lake over the modeled period of record would be negligible.
- Pool elevations for Logan Martin Lake would be affected by the Plan G-FR scenario in a manner similar to the effects on Lake Martin, with respect to both the extent of the effects and when they would be expected to occur.
- Pool elevations for R.L. Harris Lake would be affected by the Plan G-FR scenario in a manner similar to the effects on Lake Martin, with respect to both the extent of the effects and when they would be expected to occur.

Table 6.9-13 summarizes the differences between pool elevations for Plan G and for Plan G-FR at the five affected APC reservoirs in the ACT Basin that would be expected to occur for all days over the 73-year modeled period of record. The differences are presented as measured at the 90^{th}, 75^{th}, 50^{th}, 25^{th}, and 10^{th} percentile levels. For all the APC reservoirs depicted in the table, the biggest differences in pool elevations are observed at the 75^{th} and 50^{th} percentiles. The incremental differences in lake levels for Plan G-FR compared to Plan G at the five percentile levels range from zero up to about 0.5 ft. Overall, the effect on the APC reservoirs potentially caused by G-FR would be a minor adverse effect.

Table 6.9-13.
Relative decreases in APC reservoir elevations likely to occur for Plan G-FR compared to Plan G over the modeled period of record (1939–2011)

	Pool elevation differences compared to Plan G				
APC reservoir	90th percentile pool elevation	75th percentile pool elevation	50th percentile pool elevation	25th percentile pool elevation	10th percentile pool elevation
Weiss	0.00 ft	- 0.24 ft	- 0.22 ft	- 0.19 ft	- 0.13 ft
H.N. Henry	0.00 ft	- 0.13 ft	- 0.11 ft	0.00 ft	- 0.21 ft
Logan Martin	0.00 ft	- 0.47 ft	- 0.46 ft	- 0.09 ft	0.00 ft
R.L. Harris	- 0.24 ft	- 0.17 ft	- 0.41 ft	0.00 ft	- 0.14 ft
Martin	- 0.01 ft	- 0.35 ft	- 0.50 ft	- 0.32 ft	0.00 ft

USACE Alabama River lakes ("Bob" Woodruff, "Bill" Dannelly, and Claiborne lakes). These projects function practically as run-of-river reservoirs which maintain relatively stable pool levels at all times, primarily in support of the navigation project purpose. Modeled pool levels for the three USACE Alabama River lakes under Plan G would not be appreciably affected under the reduced basin inflow scenario (Plan G-FR).

6.9.2.1.3 Stream Flow Conditions

This section compares stream flow conditions for the Proposed Action Alternative (Plan G) and Plan G-FR at key locations in the ACT Basin.

Coosawattee River downstream of Carters Reregulation Dam. Figure 6.9-9 presents median daily flows over the modeled period of record downstream of Carters Reregulation Dam for Plan G and Plan G-FR. Median flows for Plan G-FR would generally tend to range between about 10 and 30 percent lower than those for Plan G.

Model outputs at the 90 percent exceedance level, representative of severe drought conditions, indicate that flow conditions would likely be the same for Plan G and for the Plan G-FR scenario. Modeled flows at this level would essentially match the monthly minimum flow targets established under Plan G.

For each month of the year over the modeled period of record, Table 6.9-14 indicates that Plan G-FR would have a minor adverse effect on the extent to which the seasonal minimal flow targets below the Carters Reregulation Dam would be met compared to Plan G. The reduction in the percent of time that the seasonal minimum flow target would be met would typically be about one to two percent in any given month (the month of March would be four percent). Plan G-FR would still be expected to meet the prescribed seasonal minimum flows below the Carters Reregulation Dam a much higher percentage of the time than the No Action Alternative would likely attain (see Table 6.1-1). Incrementally, the Plan G-FR scenario would have a moderate adverse effect on Coosawattee River flows compared to Plan G.

Table 6.9-14.
Coosawattee River downstream of Carters Reregulation Dam, seasonally variable minimum flow targets, percent of time targets would be met or exceeded

Month	Monthly minimum flow target (cfs)	Percent of time flow target would be equaled or exceeded		
		Plan G	Plan G-FR	Plan G / G-FR Difference
January	660	98%	97%	-1%
February	790	98%	96%	-2%
March	865	98%	94%	-4%
April	770	97%	95%	-2%
May	620	97%	95%	-2%
June	475	94%	93%	-1%
July	400	95%	94%	-1%
August	325	95%	94%	-1%
September	250	97%	96%	-1%
October	275	98%	96%	-2%
November	350	98%	96%	-2%
December	465	98%	96%	-2%

Etowah River downstream of Allatoona Dam. Figure 6.9-10 and Figure 6.9-11 present median daily and 90 percent exceedance flows, respectively, over the modeled period of record downstream of Allatoona Dam for Plan G and for Plan G-FR. Plan G-FR would result in lower median daily flows than Plan G from August through mid-January (by about 200 to 400 cfs) and from mid-February through mid-April (by up to about 400 cfs). At the 90 percent exceedance level, Plan G-FR would generally be at the modeled minimum flow (290 cfs) from mid-January through November. Flows for Plan G would likely be higher only in December through mid-January and about 400 cfs higher during much of the time from February through mid-May compared to Plan G-FR. Incrementally, Plan G-FR would likely have an overall minor adverse effect in comparison to Plan G.

Coosa River at Rome, Georgia. Figure 6.9-12 and Figure 6.9-13 present median daily and 90 percent exceedance flows, respectively, in the Coosa River at Rome, Georgia for Plan G and Plan G-FR. Median daily flows for Plan G-FR from the month of December through May over the modeled period of record (generally the wetter portion of the year) would likely range from about 14 to 18 percent lower than Plan G. During the period that is generally dryer (June through November), median daily flows would tend to be about eight to 14 percent lower than Plan G. Median daily flows for Plan G-FR during September and October would range as low as 1,800 to 2,000 cfs.

At the 90 percent exceedance level, Plan G-FR would produce stream flows at Rome, Georgia that would likely have a similar pattern and percent decline as median daily flows compared to Plan G. During the months of September and October, 90 percent exceedance flows would range as low as 1,200 to 1,300 cfs for the Plan G-FR scenario.

For each month of the year over the modeled period of record, Table 6.9-15 indicates that Plan G-FR would reduce the percent of time that monthly 7Q10 values would be exceeded for the Coosa River at Rome, Georgia compared to Plan G. Overall, these declines in "percent of time exceeded" (by month) for Plan G-FR, as compared to Plan G, would range from about three to nine percent. The most notable declines would be expected to occur in the drier months (August through November) and would likely be in the range of seven to nine percent. In the other months, the declines would be in the three to four percent range. A potential reduction in basin inflows of this magnitude under the Plan G-FR scenario

would be expected to have adverse implications for meeting monthly 7Q10 values in the Coosa River at Rome, which is the location for one of the triggers in Plan G for initiating drought operations in the ACT Basin (GA/AL state line flow). The potential implications for Plan G-FR on ACT drought operations are discussed further in Section 6.9.2.1.4.

Table 6.9-15.
Coosa River at Rome, Georgia—Percent of days (by month) over the modeled period of record (1939–2011) that flows would likely exceed 7Q10 value

		Percent of days flow would likely exceed 7Q10 values		
Month	7Q10 flow value (cfs)	Plan G	Plan G-FR	Plan G / G-FR Difference
January	2,544	94.1%	90.6%	-3.5%
February	2,982	94.6%	91.7%	-2.9%
March	3,258	97.0%	93.9%	-3.1%
April	2,911	94.5%	91.2%	-3.3%
May	2,497	93.4%	89.7%	-3.7%
June	2,153	91.9%	86.6%	-5.3%
July	1,693	93.8%	90.1%	-3.7%
August	1,601	89.1%	82.1%	-7.0%
September	1,406	87.4%	78.5%	-8.9%
October	1,325	92.6%	85.7%	-6.9%
November	1,608	91.4%	84.0%	-7.4%
December	2,043	97.4%	94.9%	-2.6%

Alabama River at Montgomery, Alabama. Figure 6.9-14 and Figure 6.9-15 present median daily and 90 percent exceedance flows, respectively, in the Alabama River at Montgomery for Plan G and Plan G-FR. Median daily flows for Plan G-FR from the month of December through May over the modeled period of record (generally the wetter portion of the year) would likely range from about 11 to 16 percent lower than Plan G. During the period that is generally dryer (June through November), median daily flows would tend to be about eight to 12 percent lower than Plan G. Median daily flows for Plan G-FR during September and October would range as low as 6,500 to 8,500 cfs.

At the 90 percent exceedance level, Plan G-FR would produce stream flows at Montgomery, Alabama that would likely have a similar pattern and percent decline as median flows compared to Plan G. During the months of September and October, 90 percent exceedance flows would range as low as 4,000 to 5,000 cfs for Plan G-FR.

The JBT minimum flow target (4,640 cfs) in the Alabama River near Montgomery would likely be met about 97 percent of the days over the period of record for Plan G and about 95 percent for Plan G-FR.

Alabama River downstream of Claiborne Lock and Dam. Figure 6.9-16 and Figure 6.9-17 present median daily and 90 percent exceedance flows, respectively, downstream of Claiborne Lock and Dam for Plan G and Plan G-FR. Relative to Plan G as proposed, Plan G-FR would likely result in median flows that are reduced during the typically wetter months of December through May in the range of 15 to 25 percent. Flow reductions during June through November would likely be in the range of six to ten percent. At the 90 percent exceedance level, similar reductions would likely be observed during December through May. From June through November, flows for Plan G would likely be below the minimum flow target of 6,600 cfs most of the time.

In summary, Table 6.9-16 presents differences in flow values (expressed in percent change) to compare flow conditions under Plan G to Plan G-FR at five locations in the ACT Basin. For each of the five locations, the differences were calculated at five different percentile levels covering the range from high to low flow occurrences (90^{th}, 75^{th}, 50^{th}, 25^{th}, and 10^{th} percentiles). Other than the Etowah River immediately below Allatoona Dam, the percent change in flow ranges from about a 10 to 21 percent reduction as a result of the Plan G-FR scenario. Downstream of Allatoona Dam, the extent of the decrease in flow for Plan G-FR compared to Plan G at the 10^{th} percentile level is limited by the minimum flow requirement. With a couple of minor exceptions at locations immediately downstream of dams, the larger differences most likely would occur at the 90^{th} and 75^{th} percentile levels (i.e., under higher flow conditions).

Plan G would have a relatively high degree of sensitivity to a potential climate change scenario involving a reduction in basin inflows as reflected in Plan G-FR.

Table 6.9-16.
Percent change in flow values between Plan G and Plan G-FR over the period of record (1939–2011)

	Percent change in flow value compared to Plan G				
Location	90^{th} percentile flow value	75^{th} percentile flow value	50^{th} percentile flow value	25^{th} percentile flow value	10^{th} percentile flow value
Coosawattee River below Carters Reregulation Dam	-17.3%	-16.4%	-11.5%	-12.2%	-19.1%
Etowah River below Allatoona Dam	-18.8%	-14.3%	-11.5%	-20.8%	-2.6%
Coosa River at Rome, Georgia	-19.4%	-17.2%	-13.7%	-13.7%	-13.4%
Alabama River at Montgomery, Alabama	-18.3%	-17.1%	-15.7%	-10.1%	-13.9%
Alabama River below Claiborne Lock and Dam	-15.4%	-16.3%	-15.7%	-11.4%	-11.7%

6.9.2.1.4 Drought Management / Operations

As indicated by Table 6.9-17, Plan G-FR would result in a substantial increase in the number of occurrences in which drought operations would likely be triggered (at all three levels) compared to Plan G. Drought Level 1 occurrences would increase by 29 percent, Level 2 by 67 percent, and Level 3 by 60 percent. Over the modeled period of record, initiation of drought operations would likely by triggered much more frequently under this scenario. However, as described in Section 6.9.1.1.4, the number of occurrences does not address the length or overall percent of time that drought operations would be active in the ACT Basin.

Table 6.9-17.
Number of times drought operations would be triggered for Plan G and Plan G-FR over the modeled period of record (1939–2011)

	Plan G	Plan G-FR
Drought Level 1	122	158
Drought Level 2	30	50
Drought Level 3	5	8

Table 6.9-18 summarizes the percent of time over the modeled period of record that operations would be considered *normal* versus various levels of drought operation. Plan G-FR would dramatically increase the percent of time in drought operations (at all three levels of severity) compared to Plan G. Under Plan G-FR, the percent of time in *normal operations* over the 73-year modeled period of record would decrease by about 10 percent. The percent of time in the established levels of drought operations would likely increase as follows: Drought Level 1–45 percent; Drought Level 2–70 percent; and Drought Level 3–31 percent. The increased percent of time in drought operations over the 73-year modeled period of record would equate to about six additional years that drought operations would be in effect under the Plan G-FR scenario compared to Plan G.

Table 6.9-18.
Percent of time that ACT system would operate in normal and drought mode for Plan G and Plan G-FR over the modeled period of record (1939–2011)

	Plan G	Plan G-FR
Normal	83.1%	74.9%
Drought Level 1	12.3%	17.8%
Drought Level 2	3.3%	5.6%
Drought Level 3	1.3%	1.7%

According to Table 6.9-19, the drought operations trigger most affected by Plan G-FR compared to Plan G would be the state line flow trigger, followed by the basin inflow trigger, and the composite conservation storage trigger. The percent of time that each of the established drought operations triggers would be in effect would substantially increase under the Plan G-FR scenario compared to Plan G.

Table 6.9-19.
Percent of time drought operations activated and specific drought triggers met for Plan G and Plan G-FR over the modeled period of record (1939–2011)

	Plan G	Plan G-FR
Drought Operations Activated	16.9%	25.1%
Basin Inflow Trigger Met	9.3%	13.2%
State Line Flow Trigger Met	11.6%	17.8%
Composite Conservation Storage Trigger Met	1.5%	2.4%

6.9.2.1.5 Navigation Flow Targets

Compared to the Proposed Action Alternative (Plan G), Plan G-FR as a potential future condition would likely reduce the percent of time during the year that navigation flow targets below Claiborne Lock and Dam would be met for either a 9-ft or 7.5-ft navigation channel depth. This scenario would be expected to reduce the overall availability of navigable depths throughout the year, but the extent of the reduction would vary by month. Figure 6.9-31 and Figure 6.9-32 present a summary of the percent of time (by month) over the modeled period of record during which the required navigation flows for a 9-ft and 7.5-ft deep channel, respectively, would be met or exceeded for Plan G and for Plan G-FR. For both the 9-ft and 7.5-ft channel depths, the Plan G-FR scenario would have a relatively minor effect on the percent of time that navigation flow targets would be met for the months of December through April (from one to six percent lower than Plan G). For the months of May through November, the reductions in the percent of time that sufficient navigation flows would be available would generally be larger (ranging from five to about 14 percent lower than Plan G).

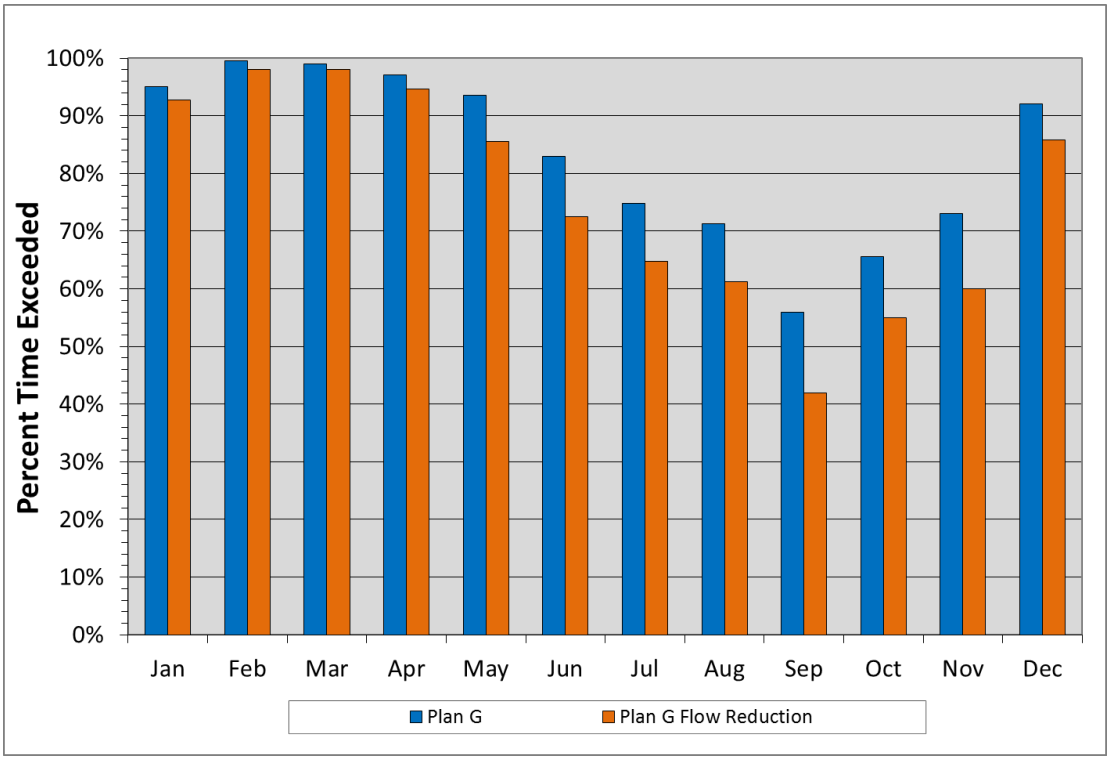


Figure 6.9-31. Alabama River, percent of time (by month) that flow downstream of Claiborne Lock and Dam would be sufficient to support 9-ft channel during modeled period of record (1939–2011).

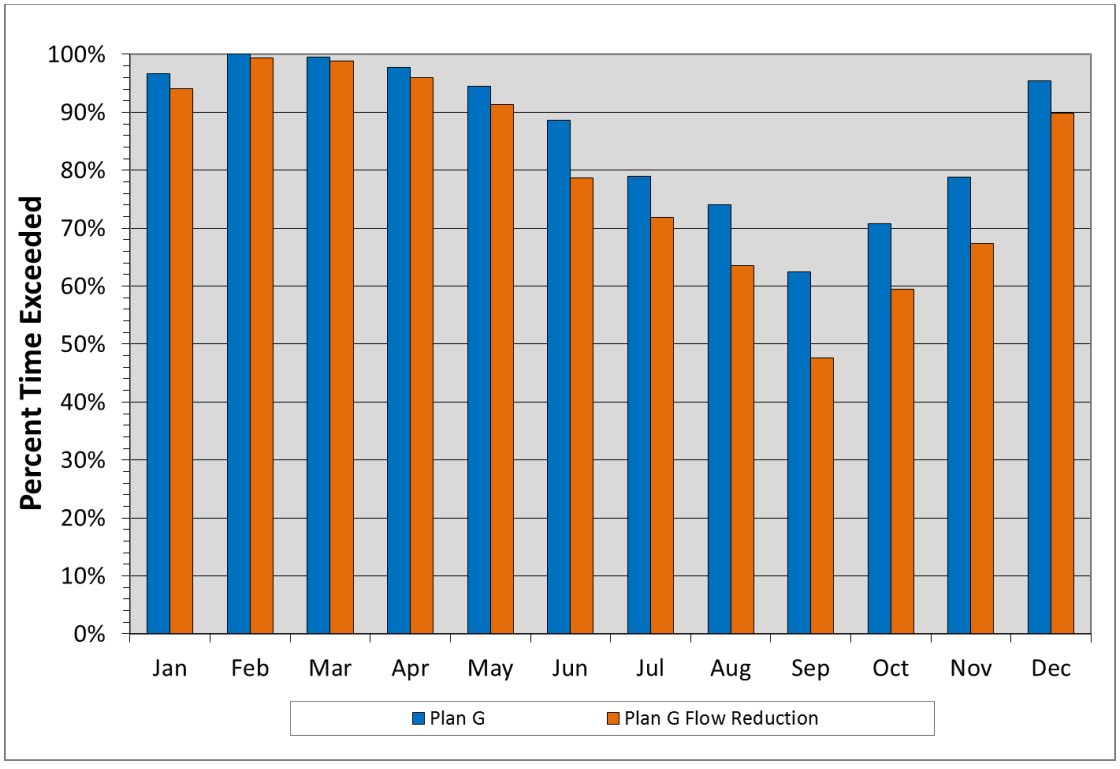


Figure 6.9-32. Alabama River, percent of time (by month) that flow downstream of Claiborne Lock and Dam would be sufficient to support 7.5-ft channel during modeled period of record (1939–2011).

Plan G-FR as a potential climate change scenario would represent an appreciable impact with respect to navigation flow targets particularly during the months of June through November. However, even under this scenario, flows below Claiborne Lock and Dam would likely be sufficient to support navigable depths (at either the 9-ft or 7.5-ft level) at least 70 percent of the time during seven months of the year. Only in the month of September would sufficient navigation flows be available less than 50 percent of the time.

6.9.2.1.6 Water Withdrawals

Plan G-FR would not be expected to place water intakes in the ACT Basin at an increased risk of encountering insufficient flows or reservoir levels compared to Plan G.

6.9.2.2 Water Quality

The HEC-5Q model was used to evaluate Plan G-FR associated with a potential reduction in precipitation from climate change. The sections that follow detail the results of modeling comparing the 15 percent flow reduction scenario to Plan G results. Similar to the Plan G-DI sensitivity analysis scenario, the HEC-5Q results presented in this section are for the modeled period (2001–2008), which also represented the most recent point and nonpoint contributions. The modeled period includes wet, dry, and normal flow conditions, which allows a display of the water quality response to varying hydrologic conditions.

The sections to follow present the change (or *delta*) in various modeled parameters between the Plan G and Plan G-FR. The longitudinal occurrence profiles by RM illustrate how water quality varies along the reach, and how water quality might be affected by dams, other structures, or discharges from point and nonpoint sources. The 5th, 50th (or median), and 95th percent occurrences are illustrated. Those percentiles illustrate the range of concentrations that would be likely to occur and are based on modeled output. The figures are not meant to present statistical ranges. These profiles illustrate the percentage of time a concentration of pollutant occurs as a *Percent Occurrence* at stations in mainstem sections of the ACT Basin.

6.9.2.2.1 Water Temperature

The projected changes between Plan G and the Plan G-FR scenario are minor; there was no overall trend in water temperature changes throughout the ACT Basin. Median changes in temperature were less than 0.5°F (0.3°C) in most reaches of the ACT Basin over a range of flow conditions (Figure 6.9-33 and Figure 6.9-34). The largest negative deviations from the Plan G results typically occurred immediately downstream or upstream of lakes, such as a reduction in temperature downstream of Allatoona Lake and Carters Lake. In these locations dam operations can influence water temperature results. Water temperatures typically increased on reach sections without impoundments, such as the Coosa River downstream of Rome.

Deviation from Plan G simulated temperatures was greatest in representative dry-weather year. Changes in temperature were still minor, and less than 0.5°F (0.3°C) in all reaches of the ACT Basin except the Tallapoosa River, as shown in the Etowah River downstream to the Claiborne Lock and Dam (Figure 6.9-35). In the Tallapoosa the 95th percentile occurrence temperatures increased by over 2°F (1.2°C) downstream of the reservoir operations beginning at Lake Martin (Figure 6.9-36).

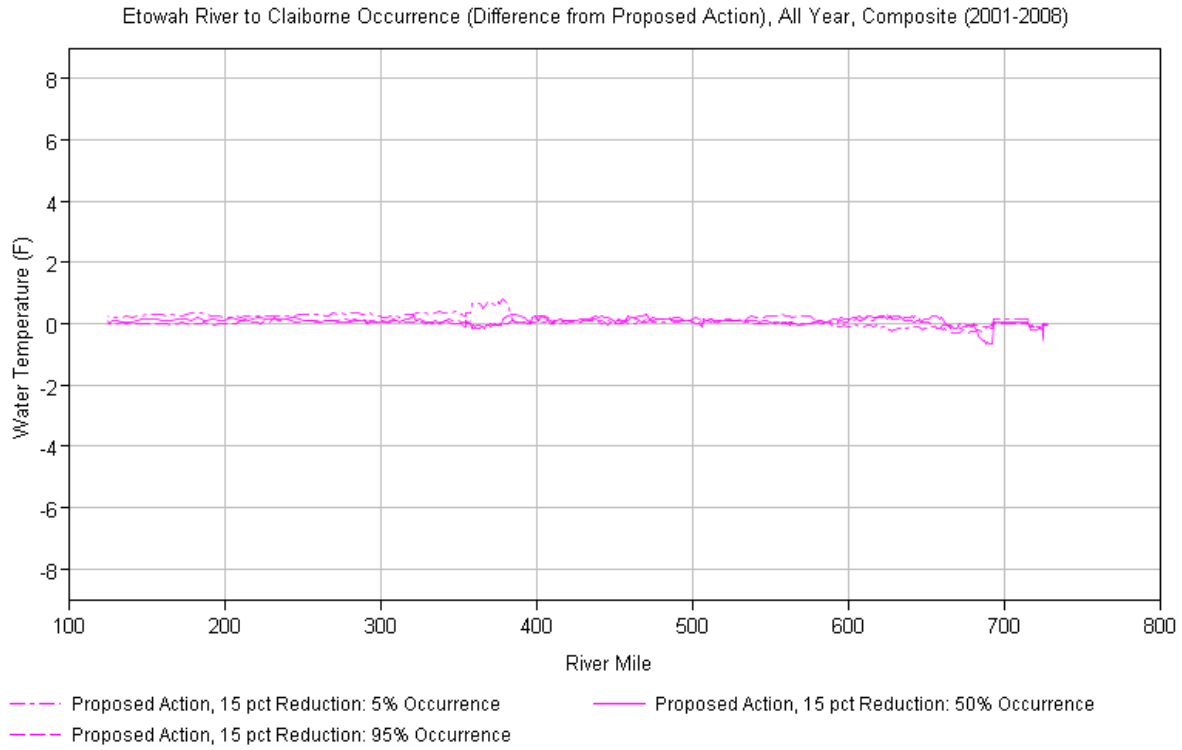


Figure 6.9-33. Etowah River to Claiborne Lock and Dam water temperature delta longitudinal profile for the modeled period (2001–2008).

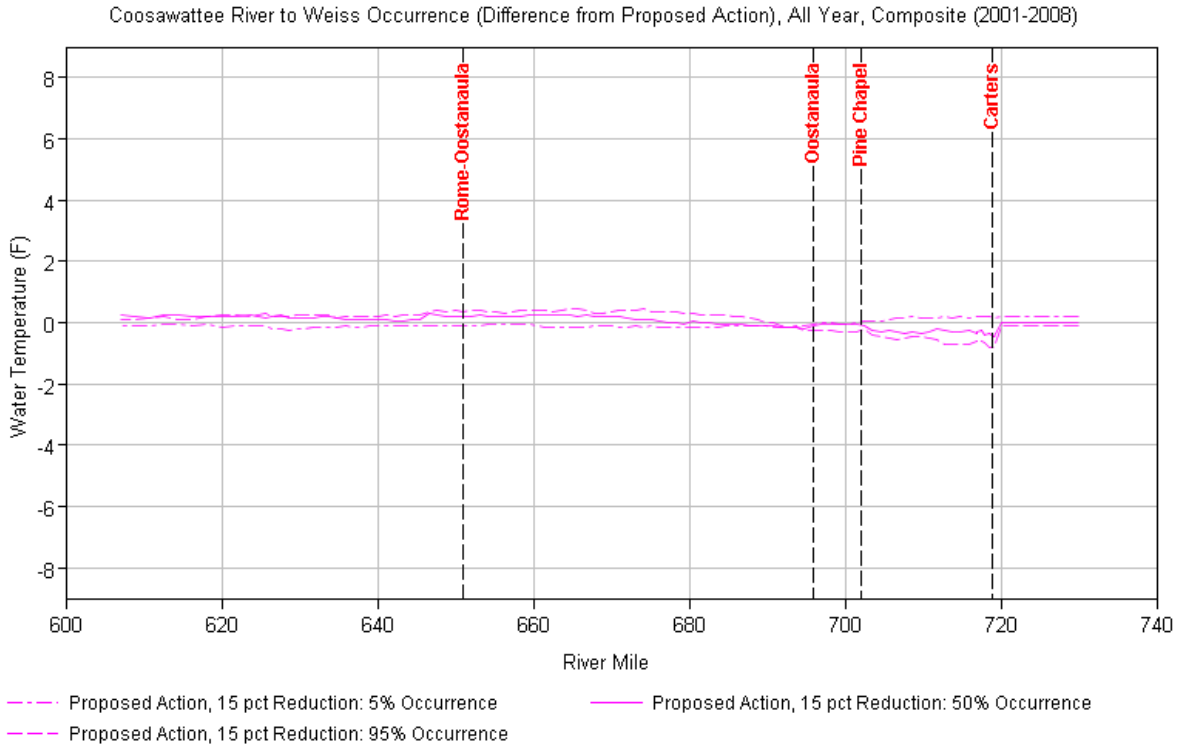


Figure 6.9-34. Coosawattee River water temperature delta longitudinal profile for the modeled period (2001–2008).

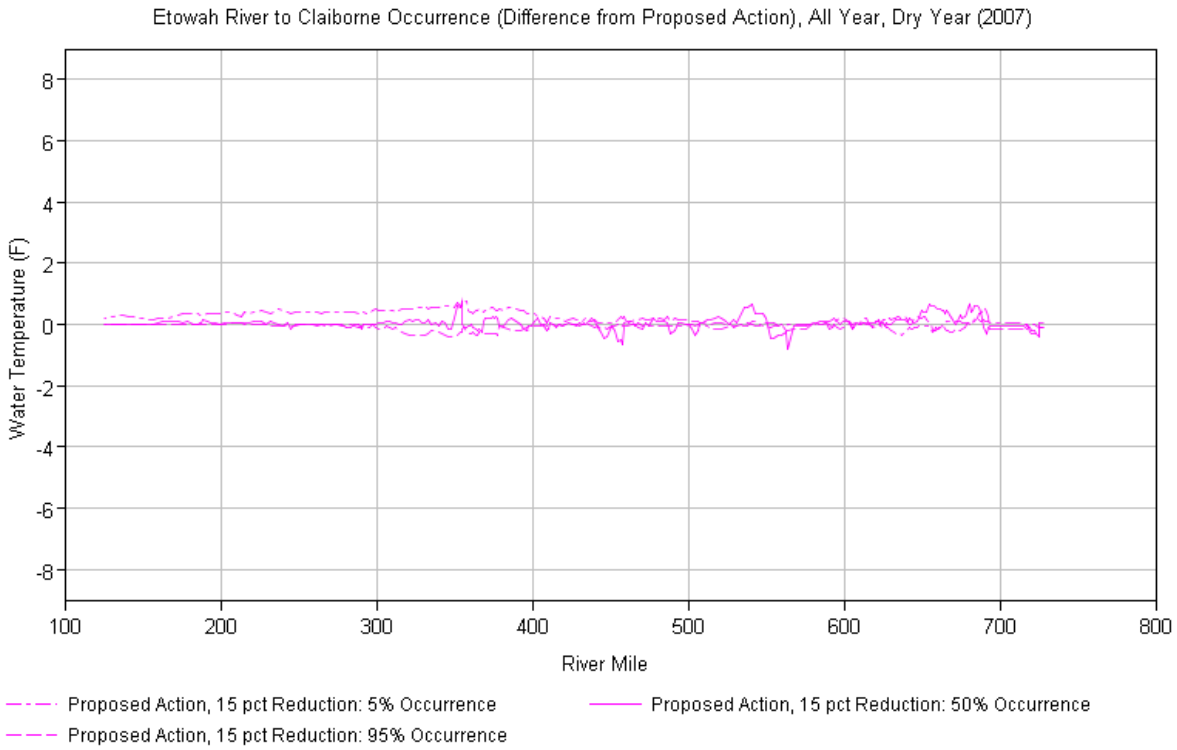


Figure 6.9-35. Etowah River to Claiborne Lock and Dam water temperature delta longitudinal profile for a representative dry year (2007).

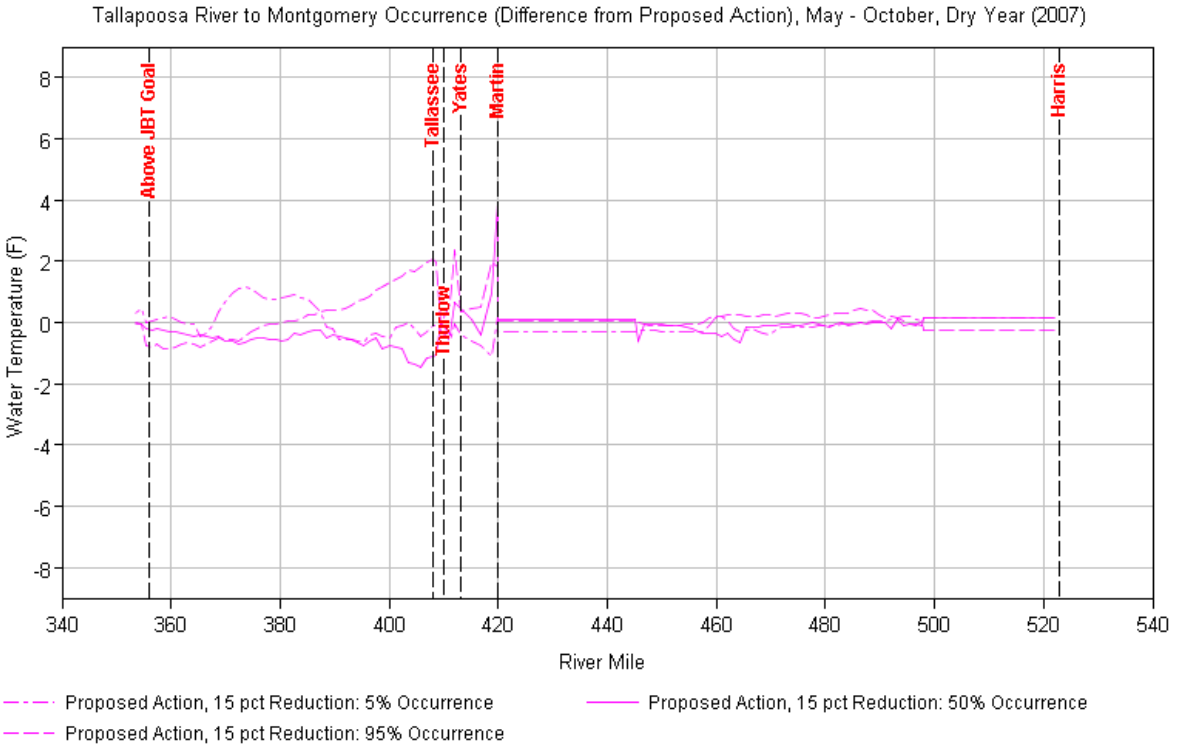


Figure 6.9-36. Tallapoosa River water temperature delta longitudinal profile for a representative dry year from May through October (2007).

6.9.2.2.2 Dissolved Oxygen

There was a noticeable difference in DO concentrations between Plan G and the Plan G-FR scenario over a range of flow conditions (Figure 6.9-37). Changes in DO were similar during the dry-weather year (Figure 6.9-38). Responses in DO appeared to be inversely proportional to the responses in temperature throughout the ACT Basin. This change is expected due to the relationship between DO and temperature. As water temperature increases, the maximum solubility of oxygen in water decreases, resulting in lower DO concentrations. This relationship is most apparent at Allatoona Lake. Dissolved oxygen concentrations increased immediately downstream of Allatoona Lake in the same location where median temperature decreased. In a wet-weather year, water temperatures in the lake increased and DO decreased (Figure 6.9-39 and Figure 6.9-40).

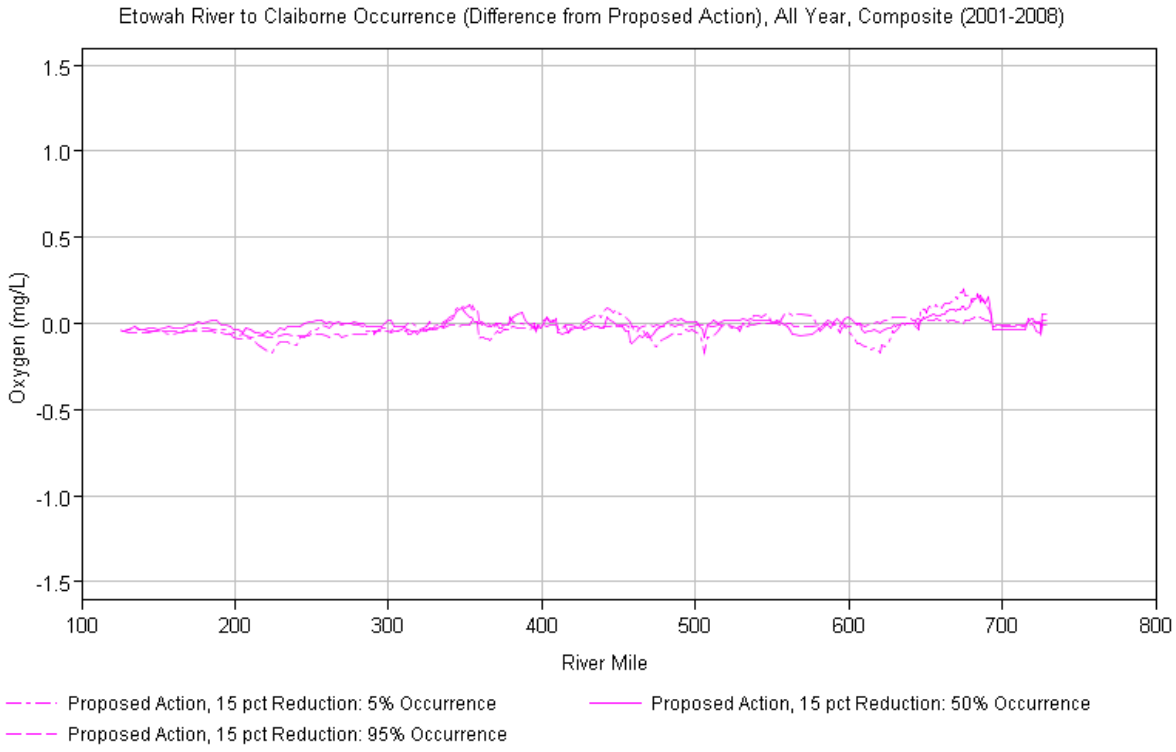


Figure 6.9-37. Etowah River to Claiborne Lock and Dam oxygen delta longitudinal profile for the modeled period (2001–2008).

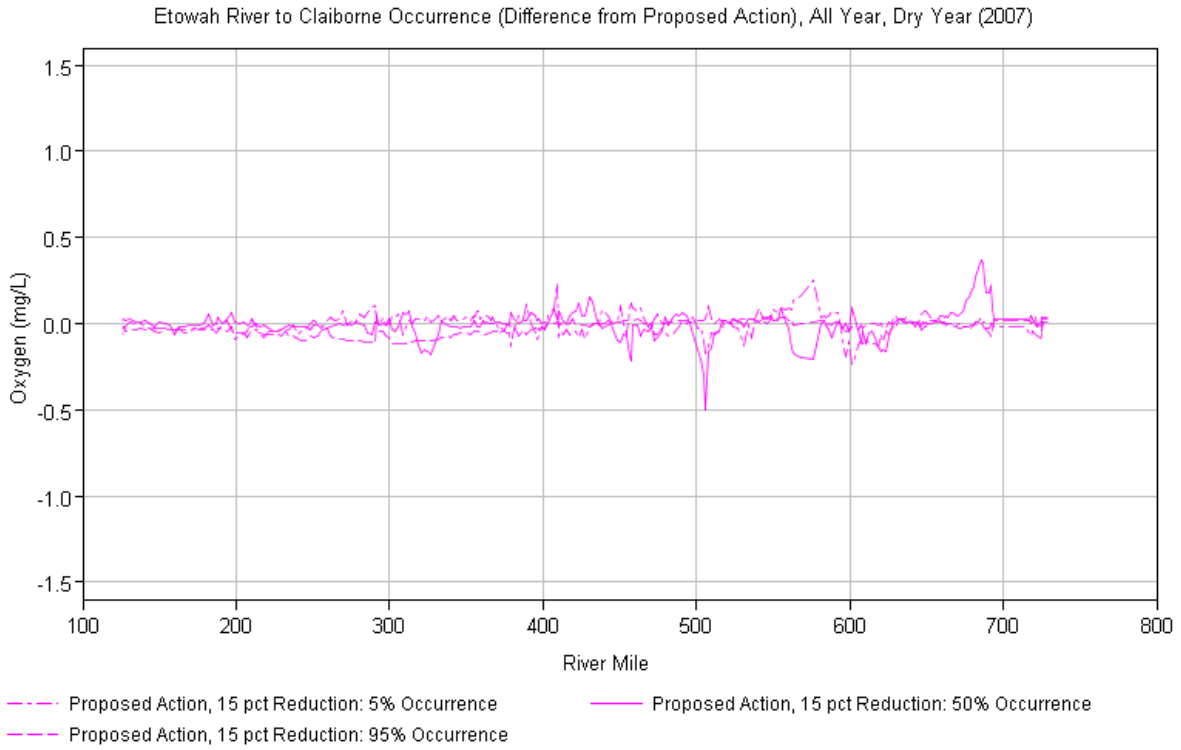


Figure 6.9-38. Etowah River to Claiborne Lock and Dam oxygen delta longitudinal profile for a representative dry year (2007).

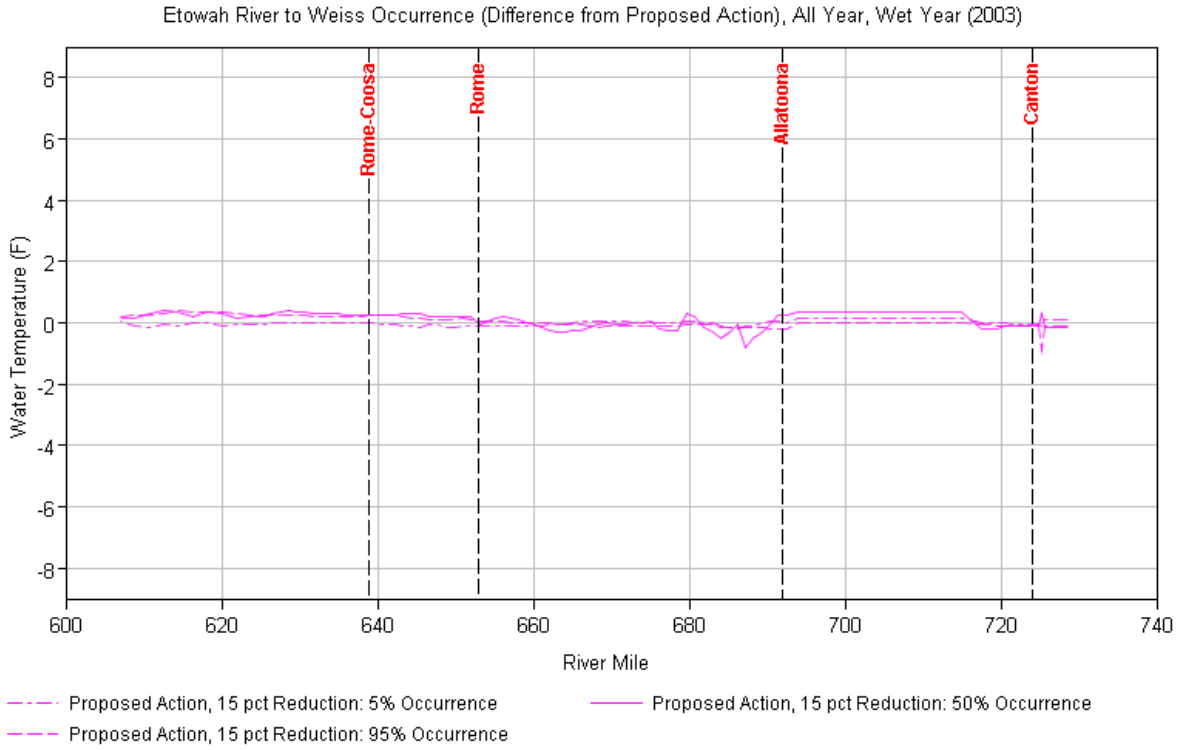


Figure 6.9-39. Etowah River water temperature delta longitudinal profile for a representative wet year (2003).

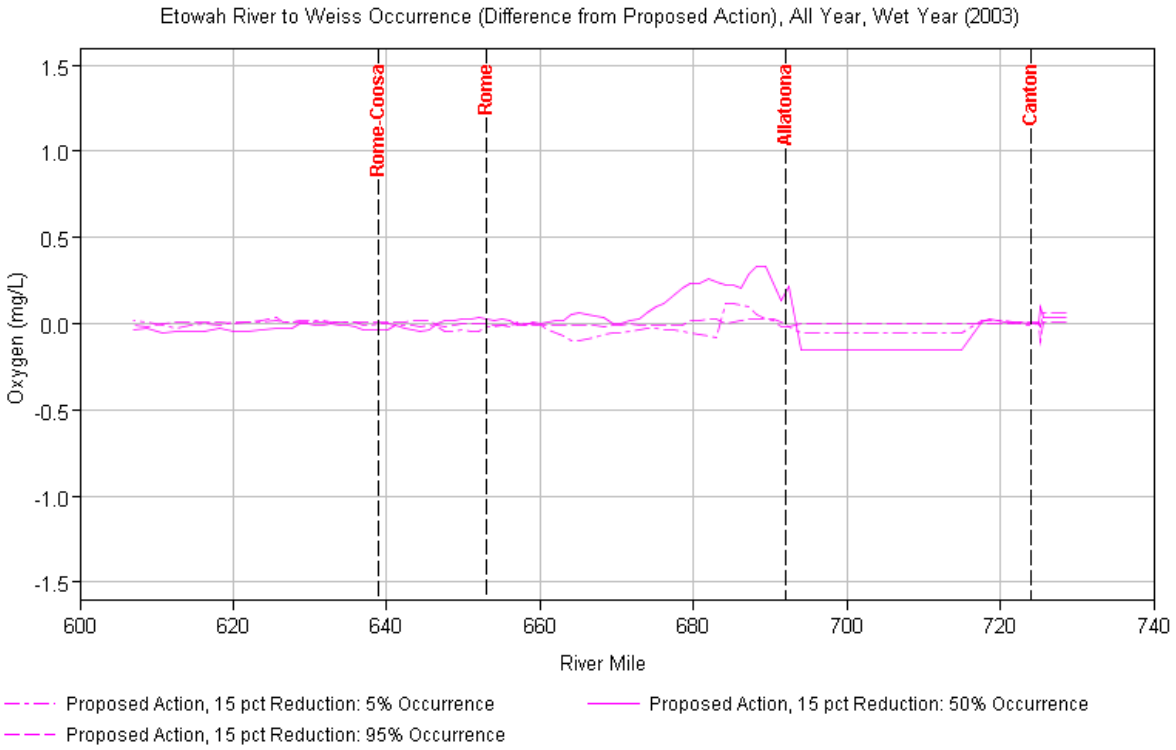


Figure 6.9-40. Etowah River oxygen delta longitudinal profile for a representative wet year (2003).

6.9.2.2.3 Total Phosphorus

The flow changes between Plan G and the Plan G-FR scenario are expected to cause a slight increase in total phosphorus concentrations in much of the ACT Basin. The increases occur throughout the modeled period, but are most pronounced in the representative dry-weather year (Figure 6.9-41). Median concentrations rarely increase by more than 0.01 mg/L, although median concentrations increase by nearly 0.02 mg/L during the growing season in Weiss Lake.

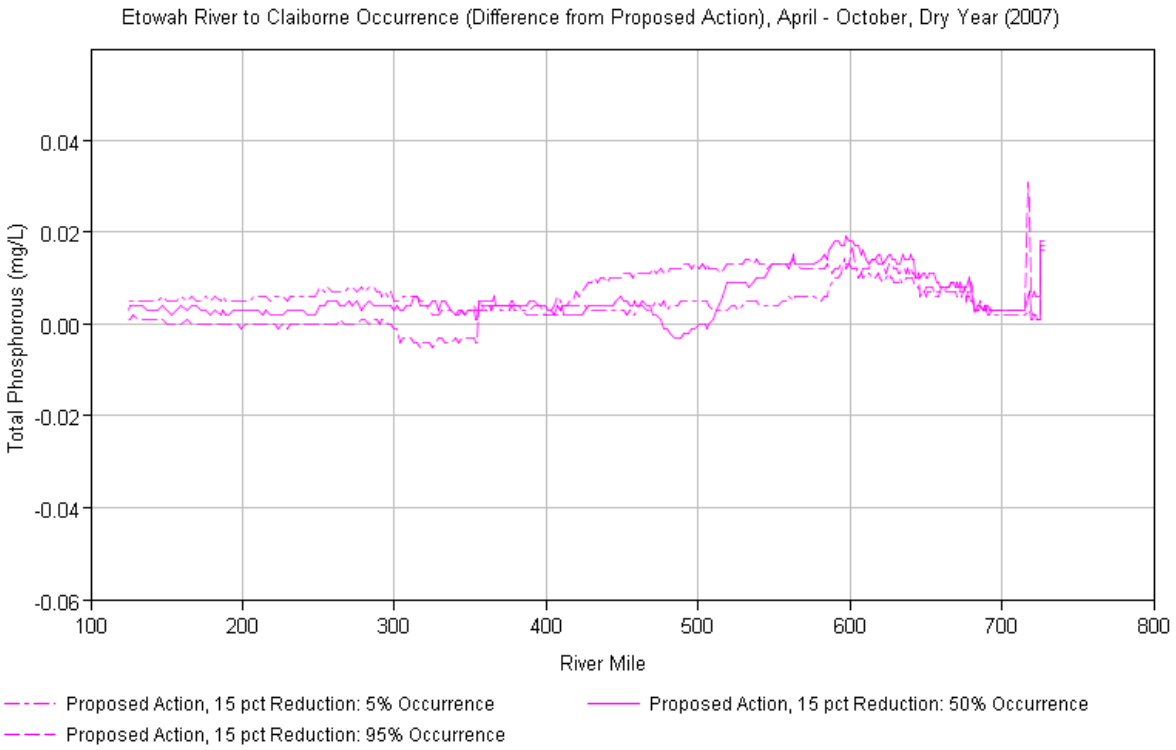


Figure 6.9-41. Etowah River to Claiborne Lock and Dam total phosphorus delta longitudinal profile for a representative dry year from April through October (2007).

There are numerous wastewater dischargers in the ACT Basin. The reduction in flow in the ACT Basin by 15 percent would likely increase the percentage of point source loads in the ACT Basin, thereby increasing the contributing load of nutrients to the basin. The increase in the wastewater loads directly correlates to the increase in total phosphorus concentrations in ACT Basin. For example, in the Coosa River at Weiss Lake, the median of point source loads increase by nearly one percent where median total phosphorus concentrations are highest (Figure 6.9-42). This correlates with an increase of total phosphorus concentrations by 0.02 mg/L in the same location.

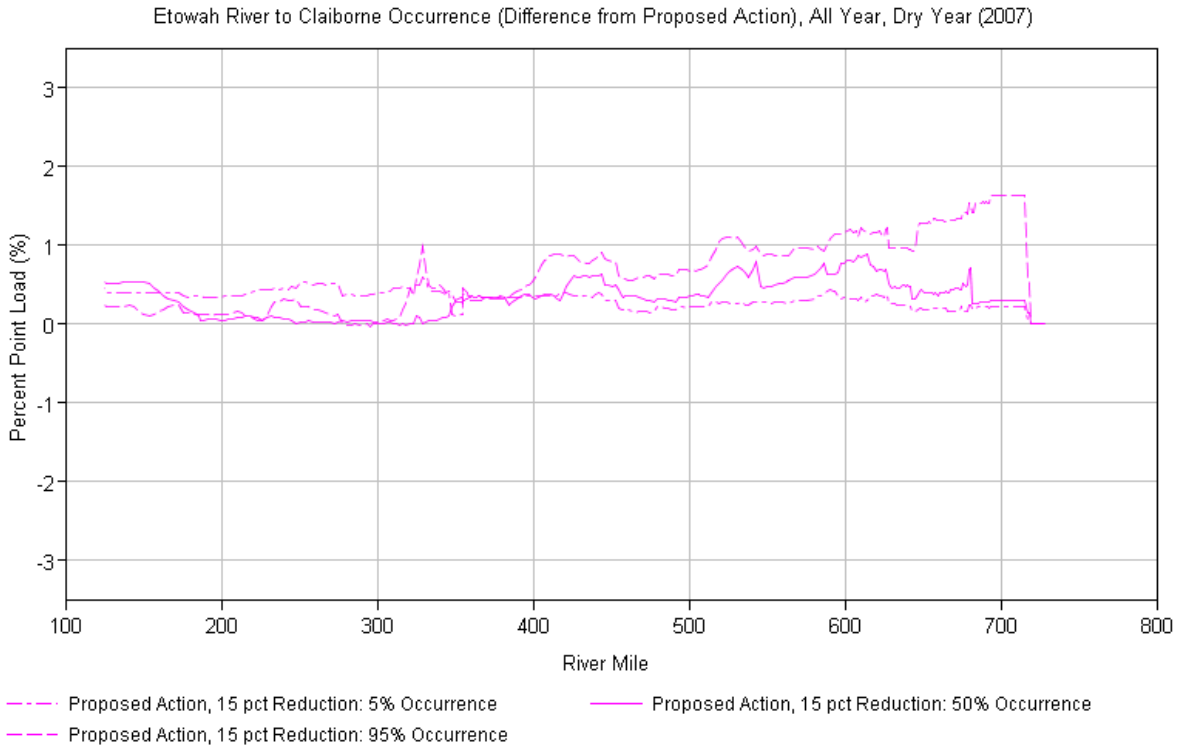


Figure 6.9-42. Etowah River to Claiborne Lock and Dam wastewater loading delta longitudinal profile for a representative dry year (2007).

There are no point source dischargers in the headwaters of the Etowah River and Coosawattee River. In these locations, such as upstream of Carters Lake, there was no measurable change in total phosphorus between Plan G and Plan G-FR. This indicates that much of the system is not sensitive to the reduced flow, outside of the effects of increases in wastewater loading. The response to increased wastewater loading is most pronounced in the Coosa River at Weiss Lake (Figure 6.9-42). As additional inflows enter the Coosa River, the total phosphorus concentrations are diluted and decrease. In the Alabama River, changes in median total phosphorus concentrations increase are less than 0.01 mg/L.

Decreased median total phosphorus in the Tallapoosa River by about 0.01 mg/L illustrates the influence of reduced basin inflows however (Figure 6.9-43). Along this reach, changes in wastewater loading are nearly zero (Figure 6.9-44).

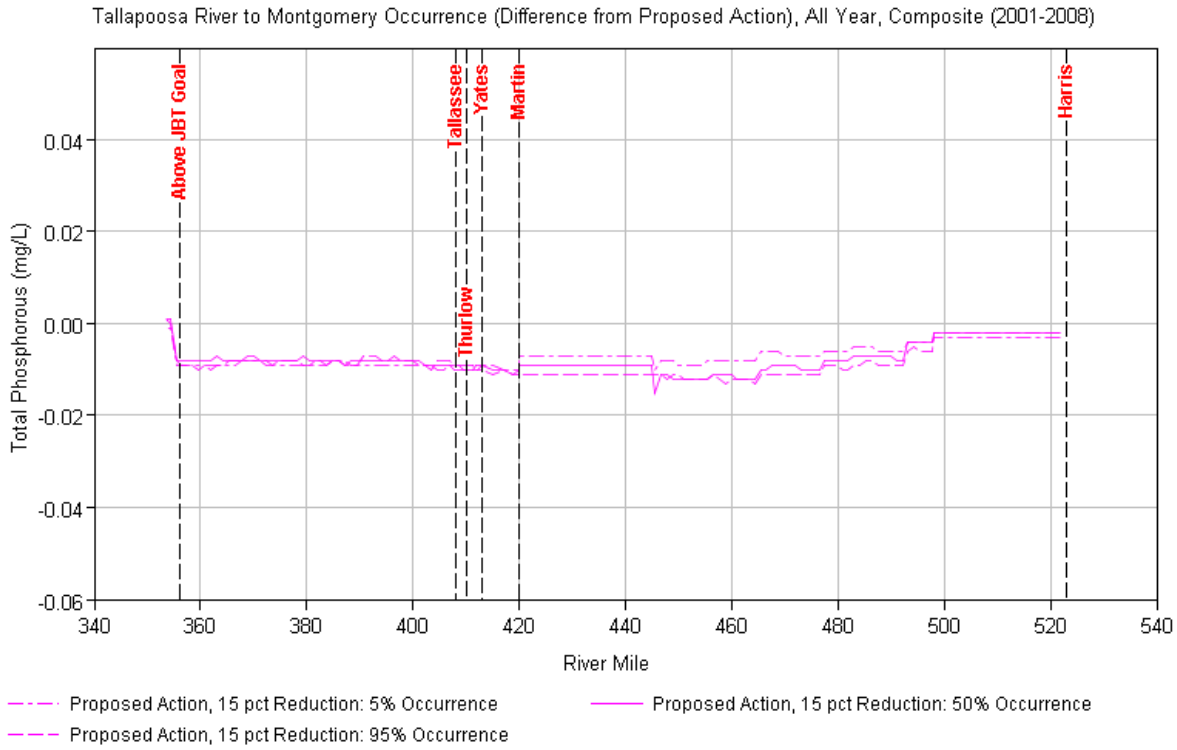


Figure 6.9-43. Tallapoosa River annual total phosphorus delta longitudinal profile for the modeled period (2001–2008).

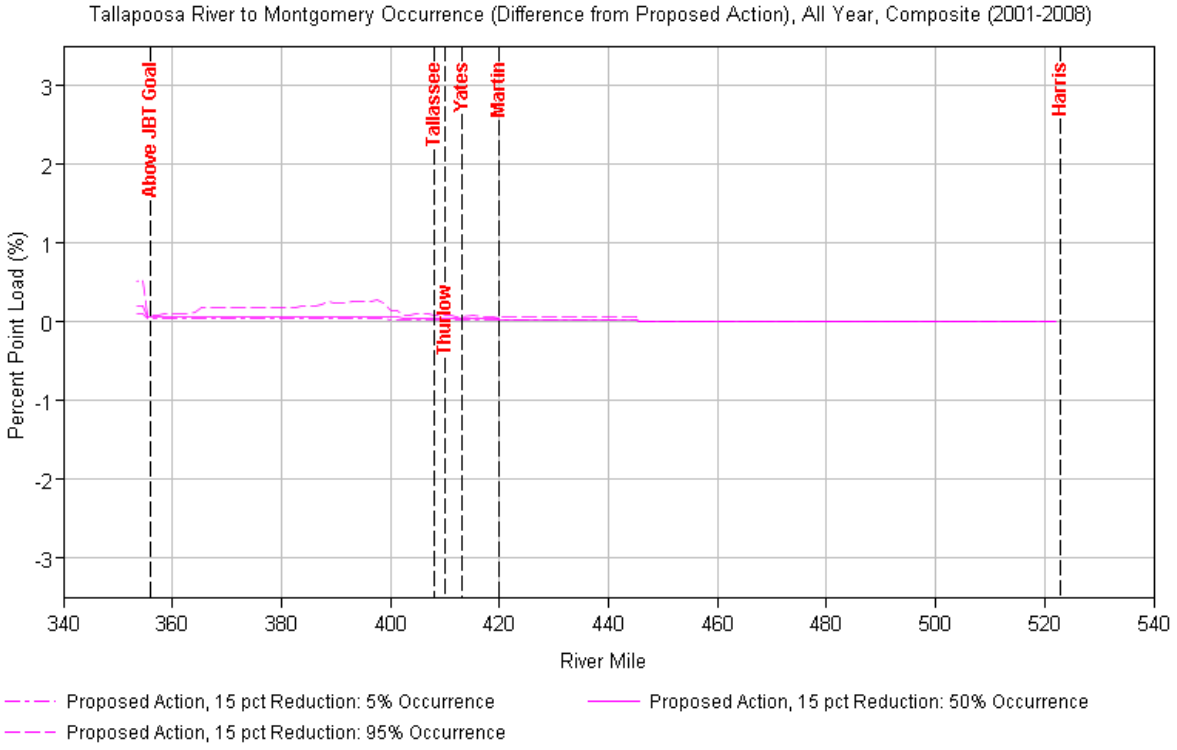


Figure 6.9-44. Tallapoosa River wastewater loading delta longitudinal profile for the modeled period (2001–2008).

6.9.2.2.4 Total Nitrogen

The expected flow changes between Plan G and 15 percent reduced inflow scenario is expected to cause a slight increase in median total nitrogen concentrations upstream of Weiss Lake in the ACT Basin (Figure 6.9-45) and no change to decreased median concentrations downstream of Weiss Lake and in the Tallapoosa River (Figure 6.9-46). The increases occur throughout the modeled period, but are most pronounced in the representative dry-weather year. Median total nitrogen increases ranged between 0.0 mg/L and 0.1 mg/L during the growing season of the dry-weather period (Figure 6.9-47 through Figure 6.9-49).

As stated previously, loads from both point and nonpoint sources were not varied in modeling scenarios, and were held constant in all years. The reduction in flow in the ACT Basin by 15 percent would likely increase the percentage of point source loads in the ACT Basin, thereby increasing the contributing load of nutrients to Weiss Lake (Figure 6.9-42).

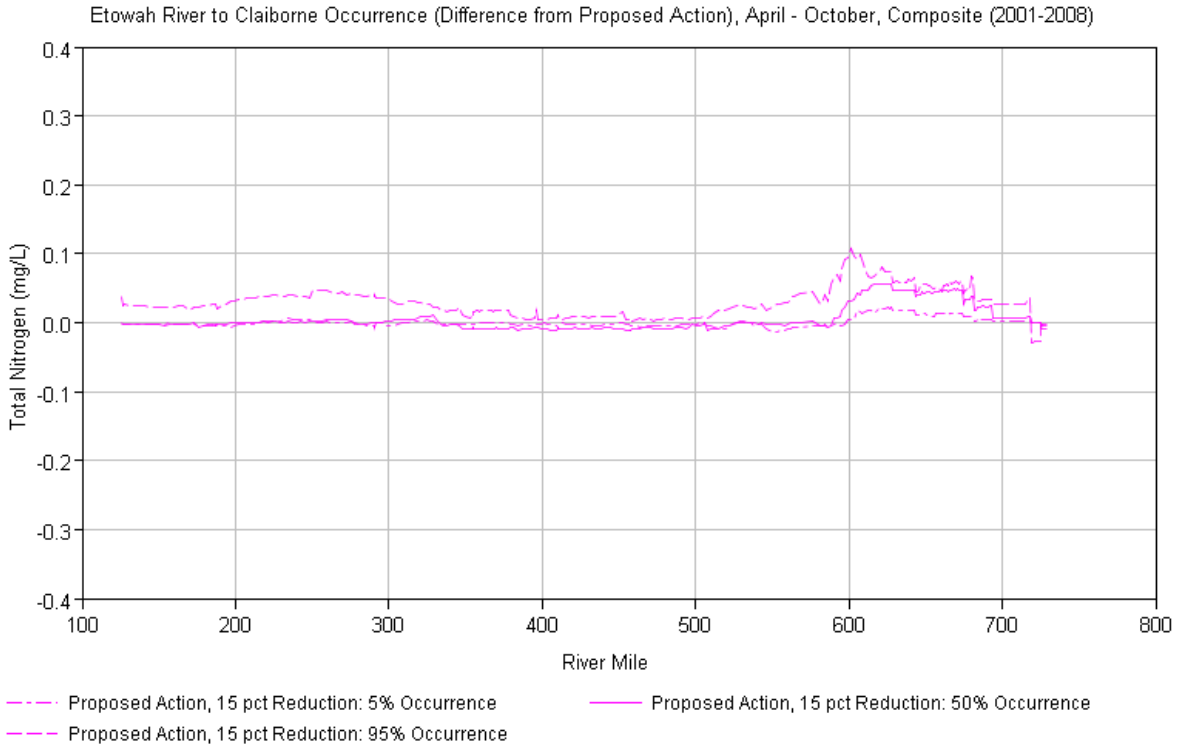


Figure 6.9-45. Etowah River to Claiborne Lock and Dam total nitrogen delta longitudinal profile for the modeled period from April through October (2001–2008).

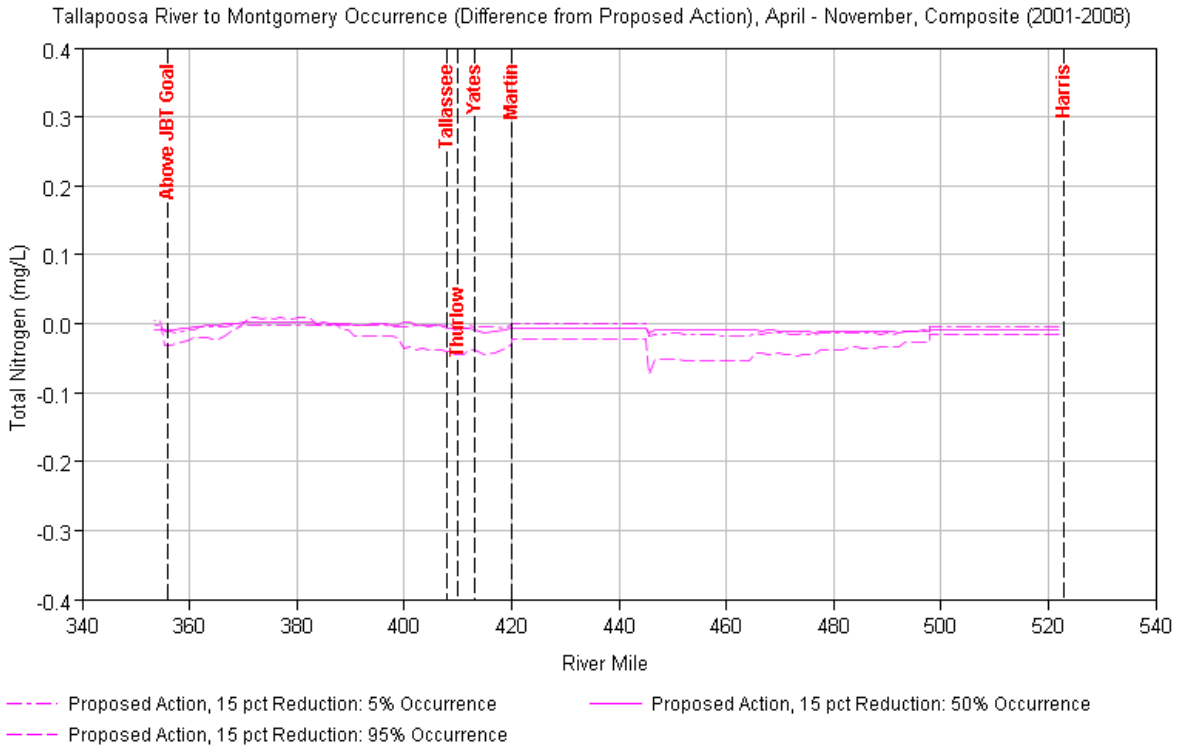


Figure 6.9-46. Tallapoosa River total nitrogen delta longitudinal profile for the modeled period from April through November (2001–2008).

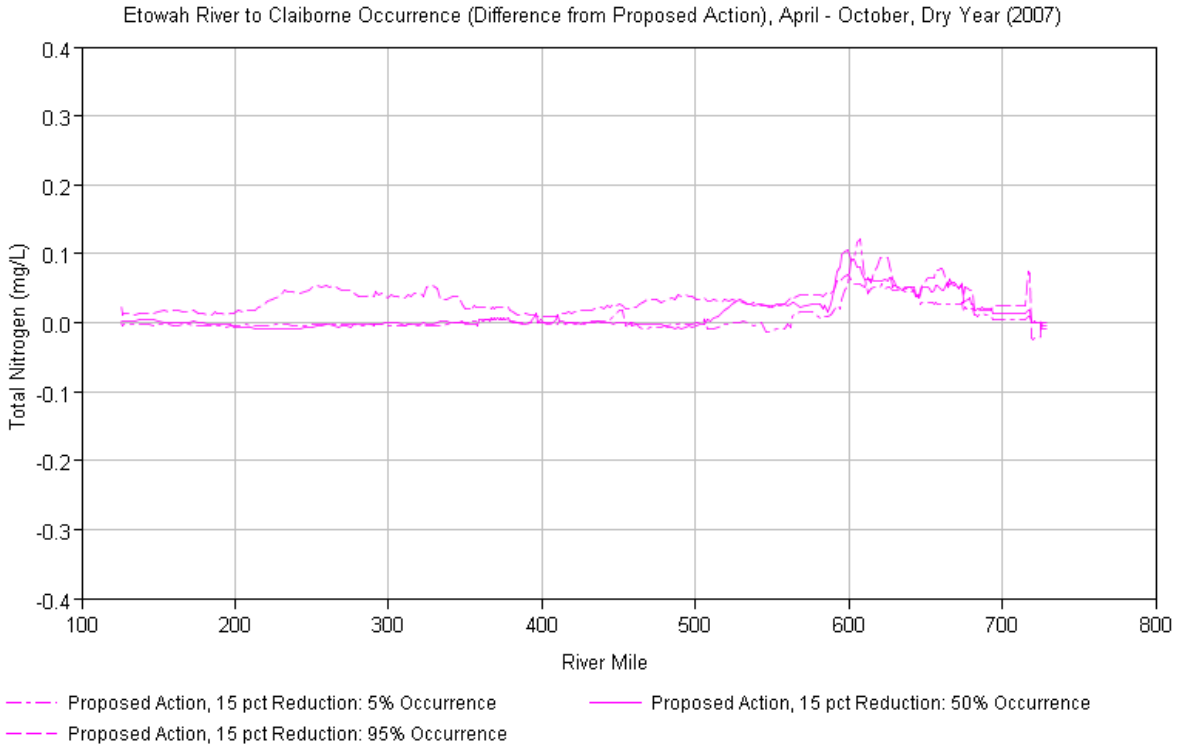


Figure 6.9-47. Etowah River to Claiborne Lock and Dam total nitrogen delta longitudinal profile for a representative dry year from April through October (2007).

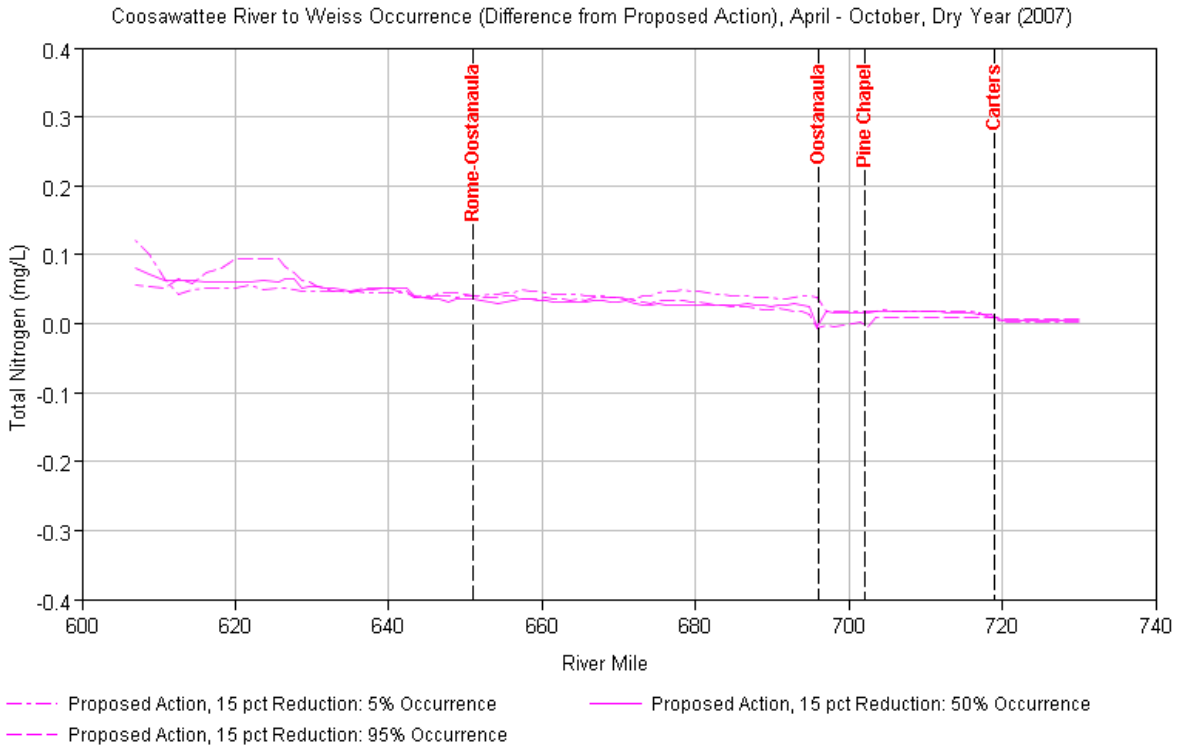


Figure 6.9-48. Coosawattee River total nitrogen delta longitudinal profile for a representative dry year from April through October (2007).

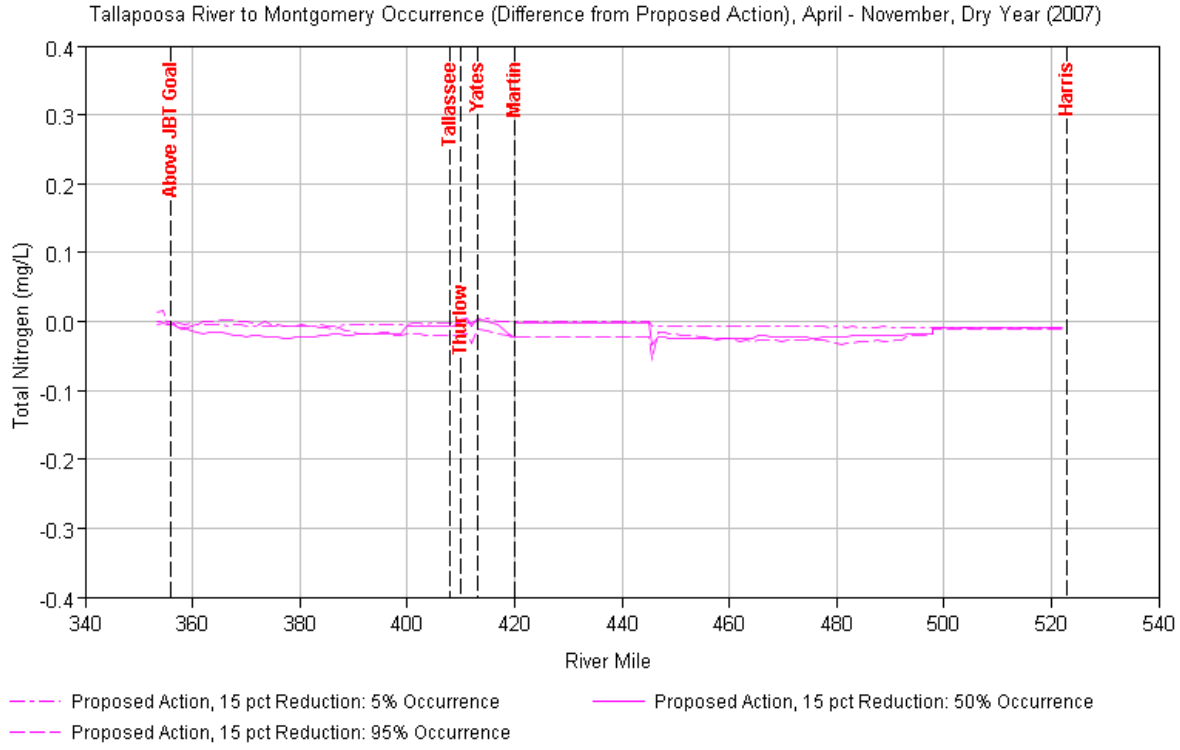


Figure 6.9-49. Tallapoosa River total nitrogen delta longitudinal profile for a representative dry year from April through November (2007).

6.9.2.2.5 Chlorophyll *a*

Little change in chlorophyll *a* would be expected in the ACT Basin over a period of various flow conditions during the growing season as illustrated in Figure 6.9-50. Growth in chlorophyll *a* typically varies by less than 1 µg/L from the 15 percent reduced inflow over Plan G. In dry-weather conditions, changes in temperature and flow would be expected to affect the system's ability to assimilate nutrient loads causing algal growth. During the representative dry year, the change in median chlorophyll *a* concentrations was less than 1 µg/L, although there was some variation in the extreme upper and lower percentiles (Figure 6.9-51 through Figure 6.9-53). This indicates that the ACT Basin is able to assimilate the increased nutrient loads without effecting algal growth.

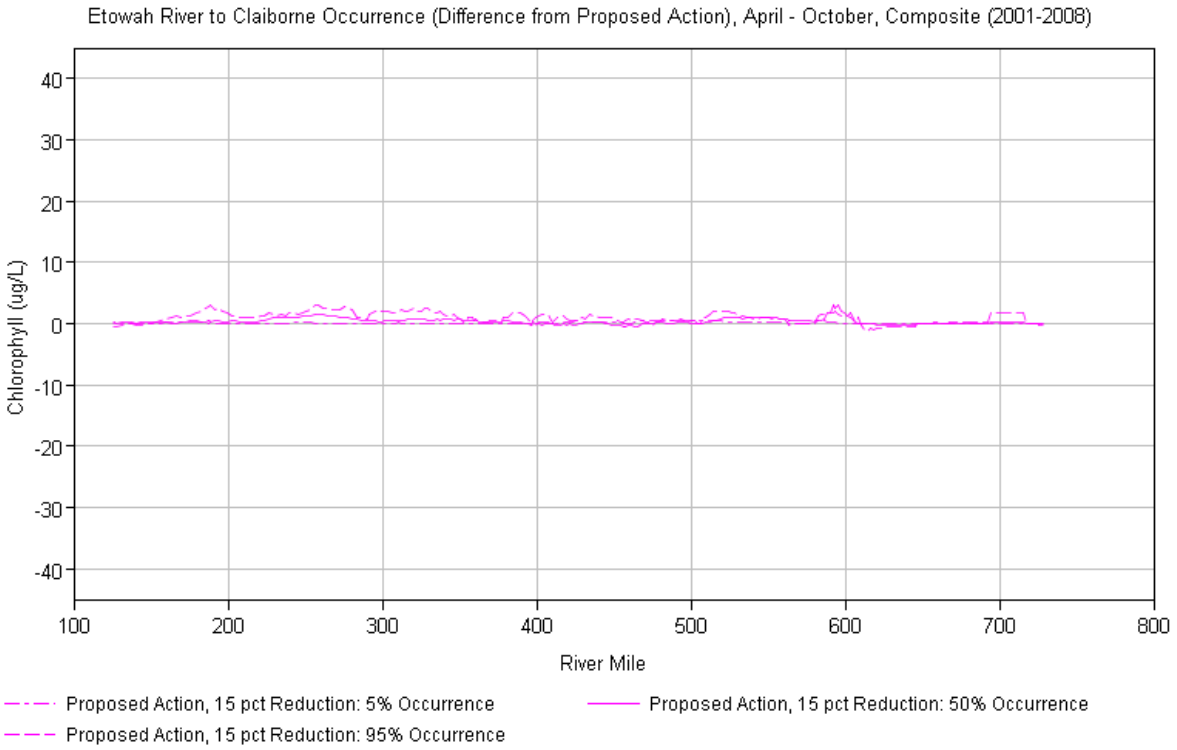


Figure 6.9-50. Etowah River to Claiborne Lock and Dam chlorophyll delta longitudinal profile for the modeled period from April through October (2001–2008).

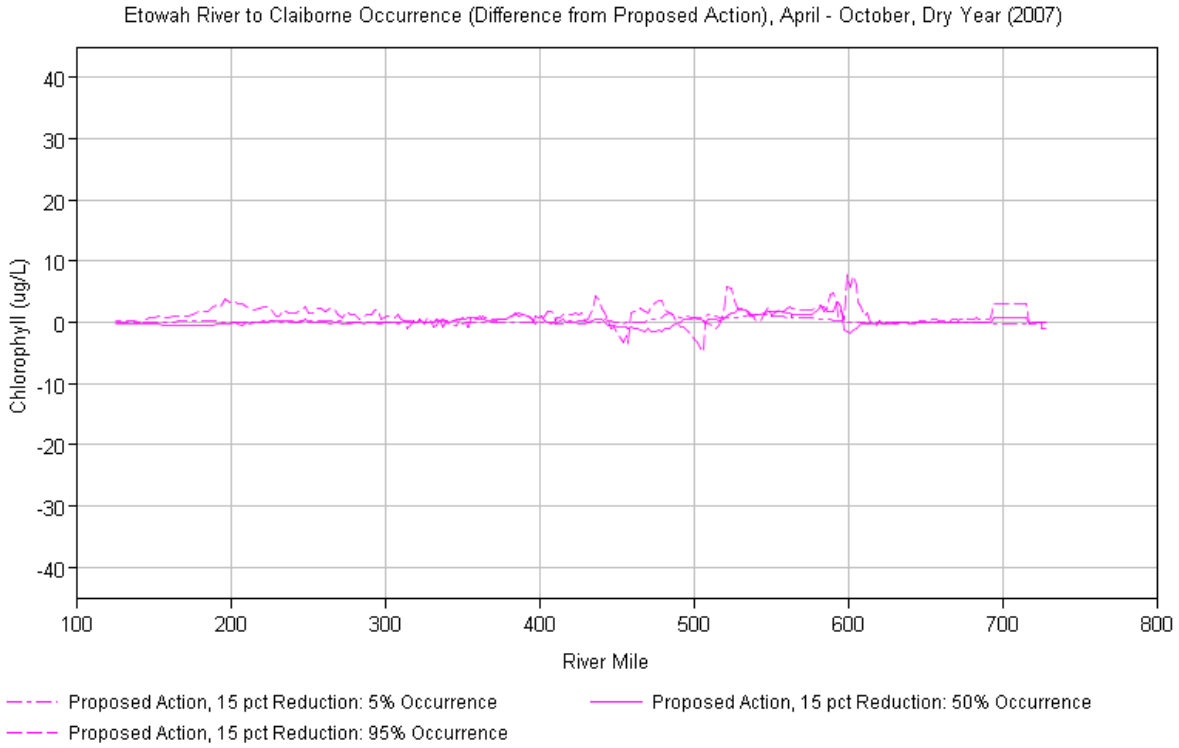


Figure 6.9-51. Etowah River to Claiborne Lock and Dam growing season chlorophyll delta longitudinal profile for a representative dry year from April through October (2007).

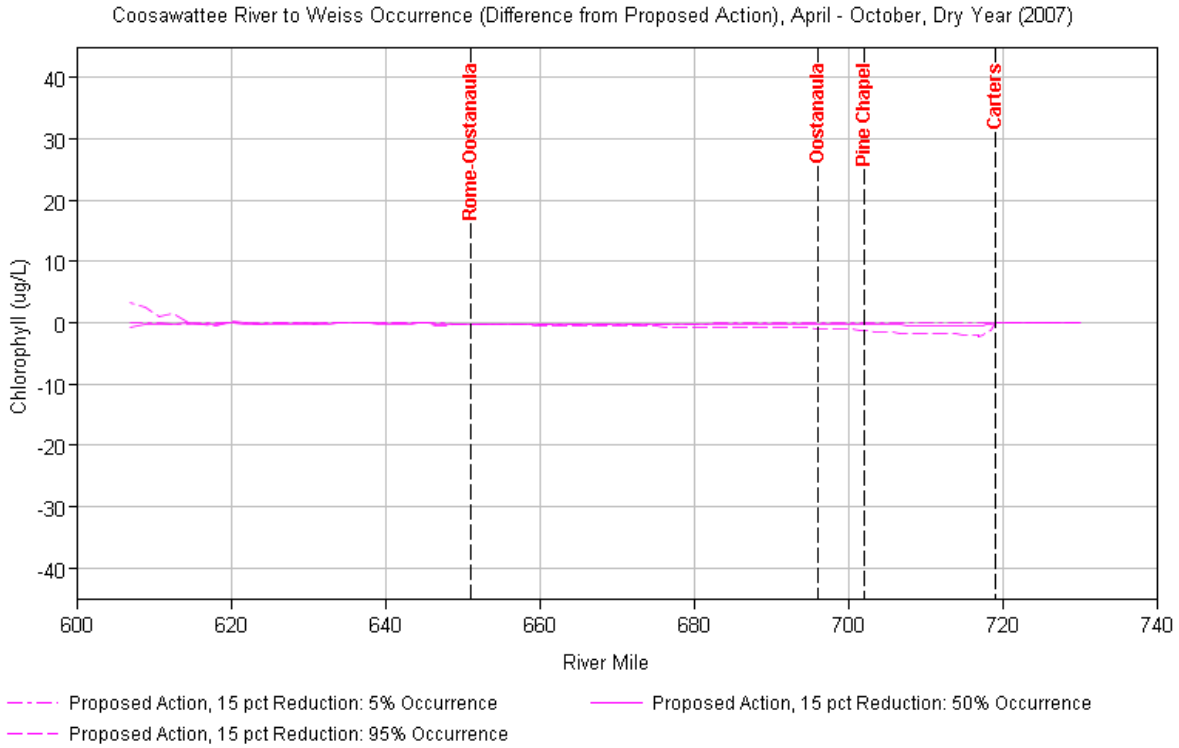


Figure 6.9-52. Coosawattee River chlorophyll delta longitudinal profile for a representative dry year from April through October (2007).

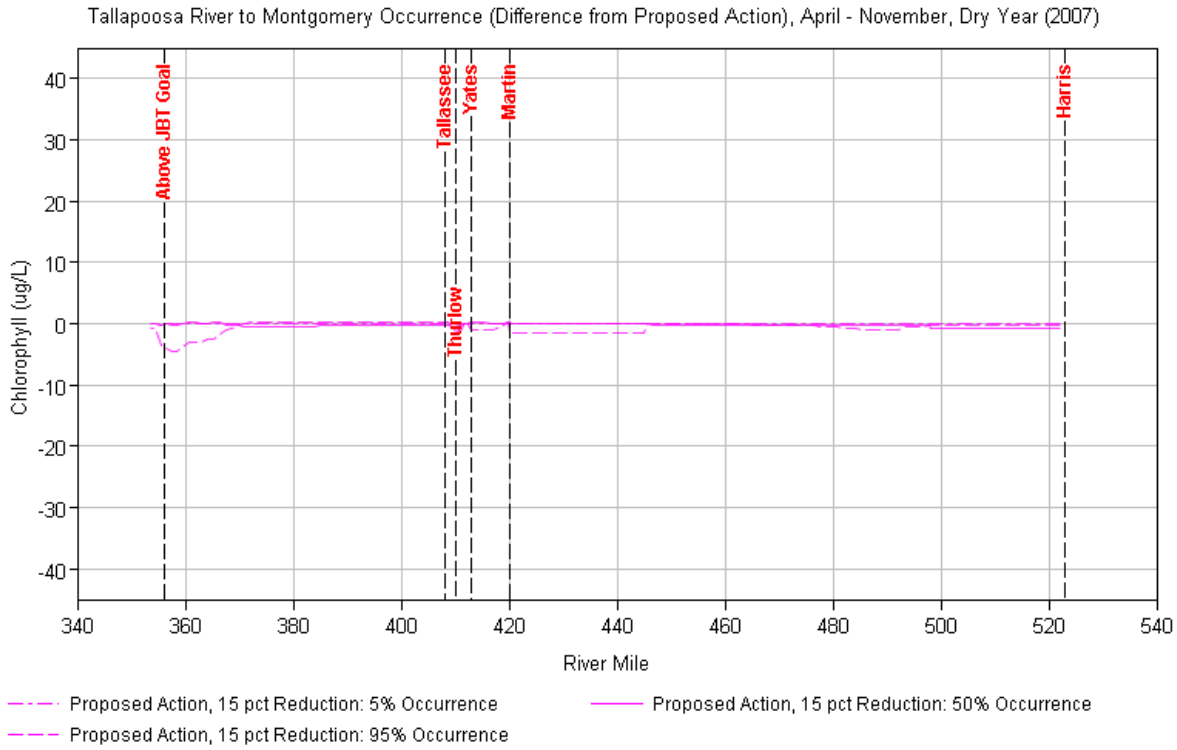


Figure 6.9-53. Tallapoosa River chlorophyll delta longitudinal profile for a representative dry year from April through November (2007).

6.9.2.3 Biological Resources

6.9.2.3.1 Vegetation

Plan G-FR would result in slightly lower water levels in the reservoirs than Plan G, but these negligible decreases in water levels would not affect vegetation. Reduced flows in the basin would also not be expected to affect vegetation because of the highly controlled nature of the rivers and lack of connection to the floodplain.

6.9.2.3.2 Wildlife

The effects of implementing the alternative plans on wildlife resources were determined to be negligible for all plans, including Plan G (Section 6.5.2). Similarly to the Plan G-DI scenario, slight changes in flow and water quality that would be expected due to Plan G-FR would not have an adverse impact on upland wildlife compared to Plan G.

6.9.2.3.3 Fish and Aquatic Resources

The minor decreases in water levels in the reservoirs that would be expected under Plan G-FR would not affect fish and aquatic resources. Reduced flows under this scenario are the greater concern. Table 6.9-17 presents differences in flow values (expressed in percent change) to compare flow conditions under Plan G to Plan G-FR at five locations in the ACT Basin. For each of the five locations, the differences were calculated at five different percentile levels covering the range from high to low flow occurrences (90^{th}, 75^{th}, 50^{th}, 25^{th}, and 10^{th}). Other than the Etowah River immediately below Allatoona Dam, where the

10th percentile flow value equals the required minimum flow for either condition, the percent change in flow ranges from about a 10 to 21 percent reduction as a result of the Plan G-FR scenario associated with climate change. With a couple of minor exceptions at locations immediately downstream of dams, the larger differences most likely would occur at the 90th and 75th percentile levels (i.e., under higher flow conditions). Plan G would have a relatively high degree of sensitivity to a potential climate change scenario involving reduced basin inflows (Plan G-FR). Decreases in flow that would be expected in this scenario could potentially result in minor impacts to fish and aquatic resources.

Reduction in flow can also affect other habitat variables such as dissolved oxygen, flow velocity, sedimentation, and channel bed characteristics. Habitat suitability indices for fish often have suitability index graphs for average velocity during critical periods or in particular habitats such as pools or riffles, because optimal velocities vary by species. Flow reduction in a river could potentially change the fish assemblage in the stream as some species are negatively impacted by the change and other species benefit.

Plan G-FR would likely result in only minor changes in water temperature and noticeable but negligible difference in DO concentrations. Median changes in temperature were less than 0.5°F (0.3°C) in most reaches of the ACT Basin over a range of flow conditions. The largest negative deviations from the Plan G results typically occurred immediately downstream or upstream of lakes, such as a reduction in temperature downstream of Allatoona Lake and Carters Lake. As water temperature increases, the maximum solubility of oxygen in water decreases, resulting in lower DO concentrations. This relationship is most apparent at Allatoona Lake. Dissolved oxygen concentrations increased immediately downstream of Allatoona Lake, in the same location where median temperature decreased. In a wet-weather year, water temperatures in the lake increased and DO decreased. The expected flow changes between Plan G and the Plan G-FR scenario is expected to cause a slight increase in total phosphorus concentrations in much of the ACT Basin. The increases occur throughout the modeled period, but are most pronounced in the representative dry-weather year. The same flow changes are expected to cause a slight increase in median total nitrogen concentrations upstream of Weiss Lake in the ACT Basin and no change to decreased median concentrations downstream of Weiss Lake and in the Tallapoosa River. The increases occur throughout the modeled period, but are most pronounced in the representative dry-weather year. Reducing flow in the ACT Basin by 15 percent increases the percentage of point source loads in-stream in the ACT Basin, thereby increasing the contributing load of nutrients to Weiss Lake. Little change in chlorophyll *a* is expected in the ACT Basin over a period of various flow conditions during the growing season. Growth in chlorophyll a typically varies by less than 1 µg/L from the 15 percent reduced inflow over Plan G. This indicates that the ACT Basin is ably to assimilate the increased nutrient loads without effecting algal growth. Water quality changes in the ACT Basin that would be expected as a result of the reduced inflow would have negligible effects on fish and aquatic life.

6.9.2.3.4 Protected Species

This sensitivity analysis does not evaluate the potential impacts to individual species. However, as noted in Section 6.9.2.3.4, reductions in flow could benefit some species and negatively impact others. Although the flow reductions do not result in large changes in temperature or dissolved oxygen in rivers in the ACT Basin, reduced flows may potentially change the fish assemblage in the stream as some species are negatively impacted by the change and other species benefit. Reduced inflows would result in a determination that Plan G-FR may adversely affect listed species.

6.9.2.4 Socioeconomic Resources

This section addresses the effects that would likely be associated with the Proposed Action Alternative (Plan G) as compared to Plan G-FR to represent potential future conditions with climate change. The

following assessment of potential effects will generally be qualitative in nature, supported by model outputs from HEC-ResSim as they may relate to effects on various socioeconomic resources.

6.9.2.4.1 M&I Water Supply

Plan G-FR (representing potential climate change effects) would be expected to provide slightly lower pool levels (monthly median levels ranging from zero to one ft lower) than Plan G. For Carters Lake, Plan G-FR would provide slightly lower monthly median pool levels than Plan G (in the range of 0.1 ft lower). These changes would be relatively minor with respect to M&I water supply availability. Plan G-FR would be expected to have no incremental effect on the M&I water supply availability in Allatoona Lake or Carters Lake compared to Plan G.

6.9.2.4.2 Navigation

Over the modeled period of record, Plan G-FR would be expected to reduce the overall availability of sufficient navigation flows to support both 9-ft and 7.5-ft channel depths compared to Plan G (see Figure 6.9-31 and Figure 6.9-32), For the months of January through April, the Plan G-FR scenario would be expected to provide a similar level of navigation flow target availability compared to Plan G. However, for the months of May through December, Plan G-FR would result in a decline in the percent of time that the established navigation flow targets would be equaled or exceeded. The declines in monthly values would range from two to 13 percentage points compared to Plan G.

Plan G-FR would have an adverse effect on the ability to meet navigation channel flow targets compared Plan G. Future reduced basin inflows representing a potential climate change scenario would be expected to have adverse implications for navigation in the ACT Basin.

6.9.2.4.3 Hydropower

This section presents a comparison of the effects on hydropower benefits associated with the Proposed Action Alternative (Plan G) to the Plan G-FR scenario, representing a potential future climate change scenario for the ACT Basin. The methodology for the hydropower analysis summarized in Section 6.6.3 and the detailed HAC analysis of hydropower benefits is included in Appendix E of this EIS. This section summarizes additional analysis to assess the sensitivity of the hydropower benefits for Plan G compared to a scenario with reduced basin inflows (Plan G-FR). Based upon the modeled period of record, the difference in average annual energy generated for Plan G compared to Plan G-FR would likely be substantial.

Table 6.9-20 illustrates each plant's average annual energy benefits for Plan G and Plan G-FR. The table also includes estimated pumping costs for the Carters Lake facility. Plan G-FR would require approximately 13,504 MWh more energy for pumping than Plan G at an estimated value of $0.03 per kilowatt hour (KWh), which represents an annualized value calculated using the historical cost received from SEPA. Annual pumping costs at the Carters project would be about $18.8 million for Plan G and about $19.6 million for Plan G-FR. In general, all of the plants would likely experience noteworthy differences between Plan G and Plan G-FR. Plan G-FR would likely result in about a ten percent reduction in total system energy benefits (average annual) compared to Plan G (approximately $23,135,000).

Table 6.9-20.
Individual plant and total system energy benefits

Plant	Proposed Action Alternative (Plan G)	Plan G-FR
Allatoona Lake	$5,062,000	$4,187,000
Weiss Lake	$8,669,000	$7,780,000
H. Neely Henry Lake	$8,543,000	$7,606,000
Logan Martin Lake	$17,785,000	$15,564,000
Lay Lake	$26,886,000	$24,221,000
Mitchell Lake	$22,875,000	$20,344,000
Jordan Dam and Lake	$11,534,000	$10,449,000
Bouldin Dam	$34,782,000	$30,512,000
R.L. Harris Lake	$8,443,000	$7,248,000
Lake Martin	$17,817,000	$15,410,000
Yates Lake	$6,704,000	$5,926,000
Thurlow Lake	$11,487,000	$10,155,000
Robert F. Henry Lock and Dam and R.E. “Bob” Woodruff Lake	$13,235,000	$12,664,000
Millers Ferry Lock and Dam and William “Bill” Dannelly Lake	$15,251,000	$14,790,000
Carters Lake	$31,785,000	$31,315,000
Carters Pumping cost	($18,810,000)	($19,590,000)
Total	$222,048,000	$198,579,000

NOTE: Values shown in parentheses are negative values

The total system difference between Plan G-FR and the Plan G is the gain or loss in dependable capacity caused by changes in system water control operations. Those results are shown in Table 6.9-21. Plan G-FR would be expected to have a smaller system-dependable capacity (40.32 MW or 1.9 percent smaller) than Plan G. This change would translate to a likely reduction in system capacity benefits for Plan G-FR of about $3,964,000 compared to Plan G.

Plan G-FR would be expected to produce about $27,433,000 less in total hydropower benefits than Plan G. The reduction would be comprised of about $23,469,000 in energy benefits and about $3,964,000 in capacity benefits. Compared to the ACT total system hydropower benefits for Plan G, the overall differences for Plan G-FR would be substantial. The effects of Plan G-FR, representing a potential climate change scenario, would be a substantial decline in ACT total hydropower benefits (approximately seven percent) compared to Plan G.

Table 6.9-21.
Plant and system-dependable capacity calculations

Project	Proposed Action Alternative (Plan G) (MW)	Plan G-FR (MW)
Allatoona Lake	76.51	73.15
Carters Lake	576.79	575.91
Weiss Lake	73.07	71.36
H. Neely Henry Lake	57.08	56.21
Logan Martin Lake	127.05	122.12
Lay Lake	158.87	155.57
Mitchell Lake	160.20	156.48
Jordan Dam and Lake	107.22	104.69
Bouldin Dam	210.38	201.67
R.L. Harris Lake	126.26	120.05
Lake Martin	178.12	176.99
Yates Lake	44.39	43.98
Thurlow Lake	76.55	75.98
Robert F. Henry Lock and Dam and R.E. “Bob” Woodruff Lake	76.96	75.94
Millers Ferry Lock and Dam and William “Bill” Dannelly Lake	88.07	87.10
Total	2137.53	2097.21

6.9.2.4.4 Agricultural Water Supply

As indicated in Section 6.6.4, the Proposed Action Alternative (Plan G) would have overall negligible effects on the availability of agricultural water supply. Plan G-FR (representing a potential climate change scenario) would likely result in slightly to moderately reduced stream flow conditions in the rivers of the ACT Basin as discussed in Section 6.9.2.1.3. Reduced stream flow during certain period could potential result in some adverse effects on surface water availability for agricultural water supply. Groundwater withdrawals for agricultural water supply would likely not be appreciably affected by the Plan G-FR scenario.

6.9.2.4.5 Flood Risk Management

As indicated in Sections 6.1.1.1 and 6.6.5, the Proposed Action Alternative (Plan G) would not have an adverse effect on flood risk management operations or capabilities in the ACT Basin. Plan G-FR (representing potential future climate change effects), would have a negligible incremental effect on flood risk management capabilities in the basin.

6.9.2.4.6 Recreation

Carters Lake. Specific pool elevations at Carters Lake at which defined impacts to recreation resources and activities would occur are described in Sections 2.1.1.2.1.4 and 6.6.6.2.2.2. Table 6.9-22 shows the number of days for the period of record (73 years) at Carters Lake that pool levels would likely fall within each recreation impact range for Plan G and for Plan G-FR. The model outputs indicate that Plan G-FR

would likely result in a negligible increase in the number of days within the Initial Impact range and Recreation Impact range compared to Plan G. Neither scenario would reach the Water Access Limited range.

Table 6.9-22.
Carters Lake – no. of days and percent of time over period of record that lake levels fall within recreation impact ranges for Plan G and Plan G-FR

	Plan G (no. of days)	% of time pool level falls within range	Plan G-FR (no. of days)	% of time pool level falls within range
Initial Impact range (1068–1060 ft)	668	2.5%	1,323	5.0%
Recreation Impact range (1060–1055 ft)	64	0.2%	107	0.4%
Water Access Limited range (< 1055 ft)	0	0.0%	40	0.2%

Allatoona Lake. Specific pool elevations at Allatoona Lake at which defined impacts to recreation resources and activities would occur are described in Sections 2.1.1.2.1.4 and 6.6.6.2.2.1. Table 6.9-23 shows the number of days for the period of record (73 years) at Allatoona Lake that pool levels would likely fall within each recreation impact range for Plan G and for Plan G-FR. The model outputs indicate that Plan G-FR would likely result in negligible differences in the number of days and percent of time within the Initial Impact range. However, there would likely be moderate increases in the number of days that lake levels would be in the Recreation Impact and Water Access Limited impact ranges compared to Plan G. For Plan G-FR, pool levels would likely be in the Recreation Impact range for an additional 542 days over the period of record, or the equivalent of 1.48 years. Pool levels would likely be in the Water Access Limited range for an additional 665 days over the period of record, or the equivalent of 1.82 years. The Plan G-FR scenario would likely have an adverse effect on recreational use of the lake.

Table 6.9-23.
Allatoona Lake – no. of days and percent of time over period of record that lake levels fall within recreation impact ranges for Plan G and Plan G-FR

	Plan G (no. of days)	% of time pool level falls within range	Plan G-FR (no. of days)	% of time pool level falls within range
Initial Impact range (837–835 ft)	2,701	10.1%	2,692	10.1%
Recreation Impact range (835–828 ft)	10,046	37.7%	10,588	39.7%
Water Access Limited range (< 828 ft)	5,225	19.6%	5,890	22.1%

Alabama River Lakes ("Bob" Woodruff, "Bill" Dannelly, and Claiborne lakes). The Alabama River lakes are formed by the three USACE lock and dam projects in the southern portion of the ACT Basin. These projects have minimal pool fluctuations as they are essentially run-of-river projects. Median pool elevations throughout the year are 125 ft for Woodruff Lake, 80.4 ft for Dannelly Lake, and 36 ft for Claiborne Lake. As discussed in Section 6.6.6.4, Plan G would have no effects on recreation resources and activities on these lakes. Lake conditions under Plan G-FR would be essentially the same as for Plan G (see Section 6.9.2.1.2). Therefore, no incremental effects on recreation resources or activities would be expected on the Alabama River lakes from Plan G-FR.

6.9.2.4.7 Property Values and Taxes

The Proposed Action Alternative (Plan G), as described in Section 6.6.7, would have overall negligible effects on lake levels compared to the No Action Alternative under normal conditions and would generally provide for improved lake levels under extreme drought conditions. Therefore, these alternatives would be expected to have a neutral to minor positive impact with respect to property values and tax revenues in the immediate vicinity of the reservoirs. Plan G-FR (representing potential future climate change effects), would be expected to have minor adverse incremental effects on lake level conditions in affected USACE and APC reservoirs compared to Plan G. This effect could, in turn, potentially have some minor adverse implications for the value of property around the lakes over time and the associated tax revenues.

6.9.2.4.8 Environmental Justice and Protection of Children

As described in Section 6.6.8, the Proposed Action Alternative (Plan G) would not be expected to have adverse effects on minority and low-income populations. In some cases where Plan G may help improve lakes level conditions during extreme droughts compared to current operations, minor beneficial effects for minority and low-income users may occur through improved shoreline access during those occurrences. Plan G-FR (representing potential future climate change effects), likewise would not be expected to have adverse incremental effects on these populations. Some of the lake level benefits for improved shoreline access during extreme droughts associated with Plan G could potentially be diminished by the incremental effects of the Plan G-FR scenario.

As described in Section 6.6.9, Plan G would not impose increased environmental health and safety risks on children per E.O. 13045. Plan G-FR (representing potential future climate change effects on hydrology), would have no incremental adverse effects with respect to the environmental health and safety of children.

6.9.2.5 Other Resource Areas

Compared to Plan G, reservoir management activities in the ACT Basin with a potential climate change scenario involving a future reduction in basin inflows (Plan G-FR) would not be expected to have appreciable increased effects on other natural and human resource considerations, including: soils and geology, land use, aesthetics, air quality, transportation and traffic, and cultural resources.

Clearly, the overall reduction in precipitation associated with this scenario, as well as any changes in the timing and distribution of that precipitation, would likely have significant implications across the ACT Basin and greater southeast U.S. region regardless of the specific set of reservoir management activities implemented at the ACT Basin projects (ranging from No Action to Plan G). Plan G inherently includes management measures that tend to trigger more conservative project operations with the onset of drier conditions in the basin, thus providing more flexibility to respond to extreme and extended periods of drought when they occur. These measures would tend to minimize adverse effects on other related resources in the basin.

6.9.3 Air Temperature Increase Scenario (Plan G-TI) (Climate Change)

HEC-5Q model runs were conducted with the historic basin inflows and a projected temperature increase associated with climate change (Plan G-TI) to independently assess the potential effects on water quality conditions and other resource considerations compared to Plan G. The HEC-5Q model for Plan G-TI increased the air temperature basin wide by 1.8 °F (1 °C). Various climate studies for the southeastern U.S. indicate that an increase of one degree Celsius would be expected in the next 100-years. Increased

air temperatures also affect other meteorological parameters used in the model (wind speed, cloud cover, and dew point temperature).

The daily maximum and minimum air temperatures were increased by 1.8 °F (1 °C) for the modeled period. The new maximum and minimum air temperatures were then matched with other meteorological parameters. The most extensive set of observed values for wind speed, cloud cover, air temperature, and dew point temperature was collected from 1984 through 1988. These parameters for the 1984 through 1988 period were matched with the new maximum and minimum air temperatures for modeling. More detail on the development of the weather data used in this scenario can be found in Appendix D.

Increasing air temperature would be expected to affect water quality and the biological resources that depend on water quality in the basin. No incremental effects would be expected to other resource areas.

6.9.3.1 Water Quantity

There would not be any incremental effects on water quantity considerations associated with the Plan G-TI scenario in comparison to Plan G.

6.9.3.2 Water Quality

The process used to generate weather conditions for this modeled scenario results in a meteorological record represented by incremental temperature variability. Therefore, some unexpected variability was simulated in the water quality model. The sections to follow describe changes in water quality that would be expected from Plan G by increased air temperatures (Plan G-TI).

6.9.3.2.1 Water Temperature

Increased air temperature would be expected to increase water temperatures by about 1.0 °F (0.5 °C) throughout the ACT Basin (Figure 6.9-54 through Figure 6.9-56). Increased water temperatures would be expected to have a negative effect on aquatic species. A discussion of the effects of Plan G-TI on biological resources is presented in Section 6.9.3.3.

The modeled results also indicate periods when water temperatures may decrease (Figure 6.9-57 and Figure 6.9-58). Unexpected decreased water temperature from Plan G to Plan G-TI is the result of variability in the meteorological record. Increased maximum and minimum air temperatures were matched with measured cloud cover and wind speeds. Varying these parameters influences the modeled heat budget resulting in decreased water temperatures in some occurrences.

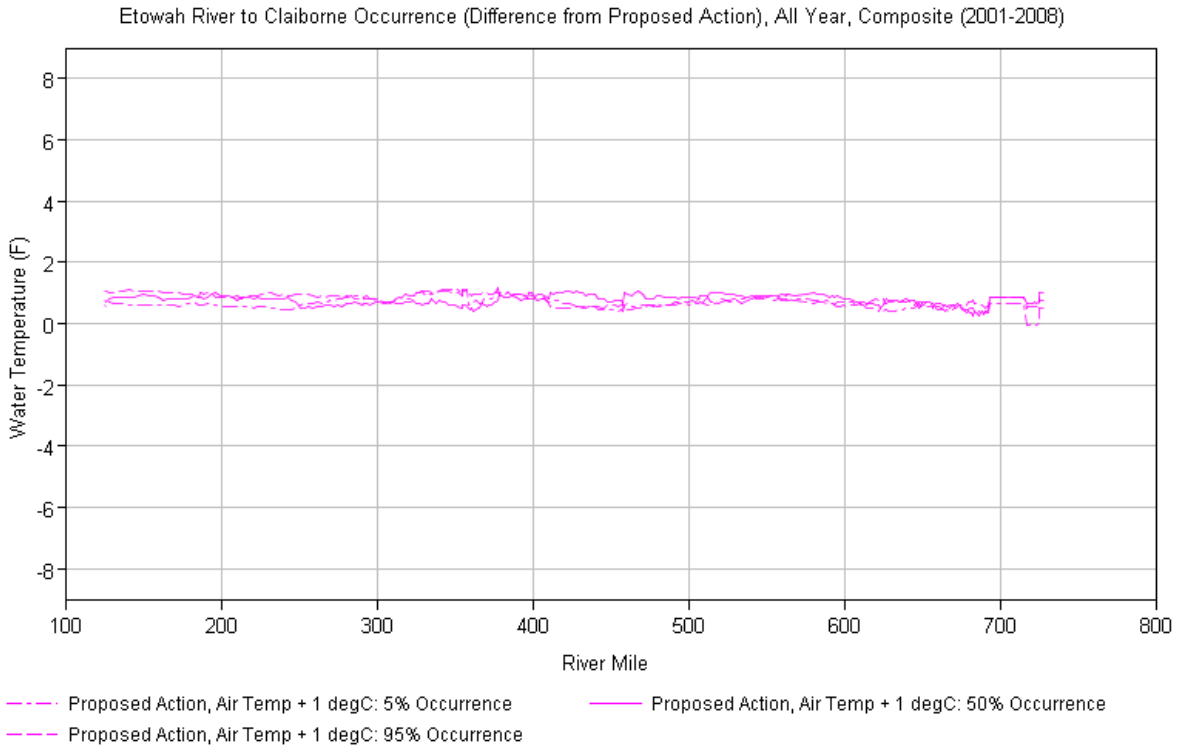


Figure 6.9-54. Etowah River to Claiborne Lock and Dam water temperature delta longitudinal profile for the modeled period (2001–2008).

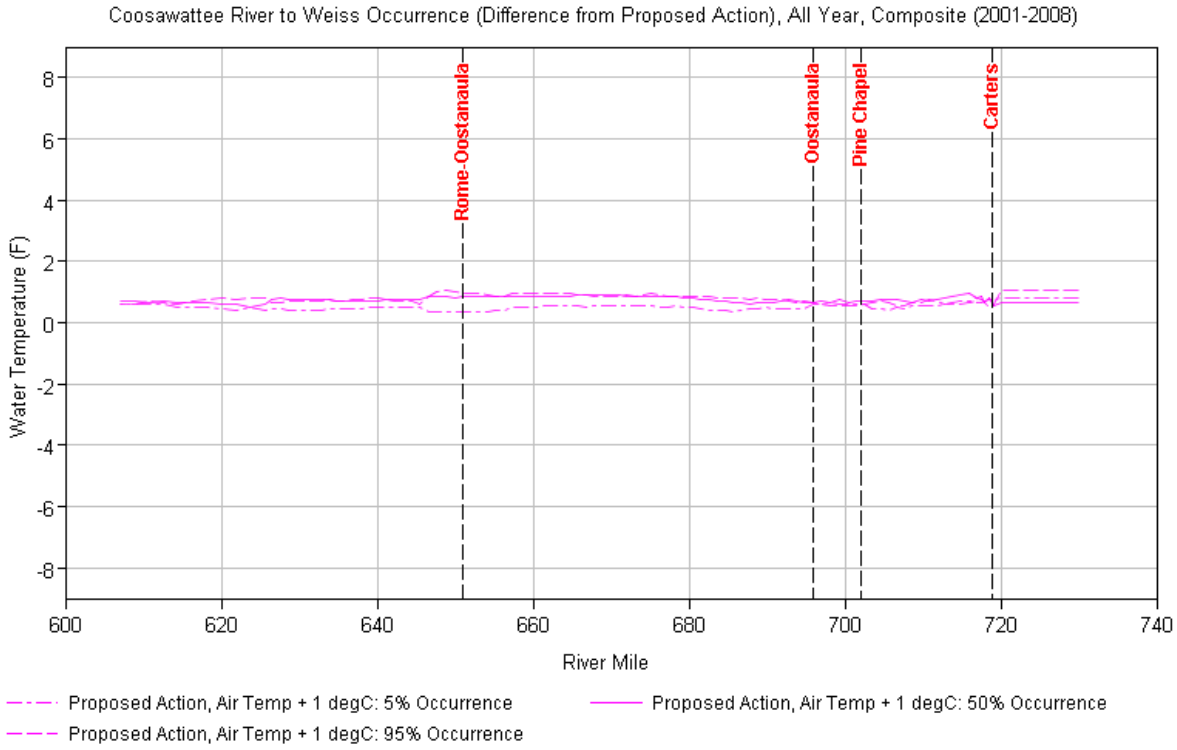


Figure 6.9-55. Coosawattee River water temperature delta longitudinal profile for the modeled period (2001–2008).

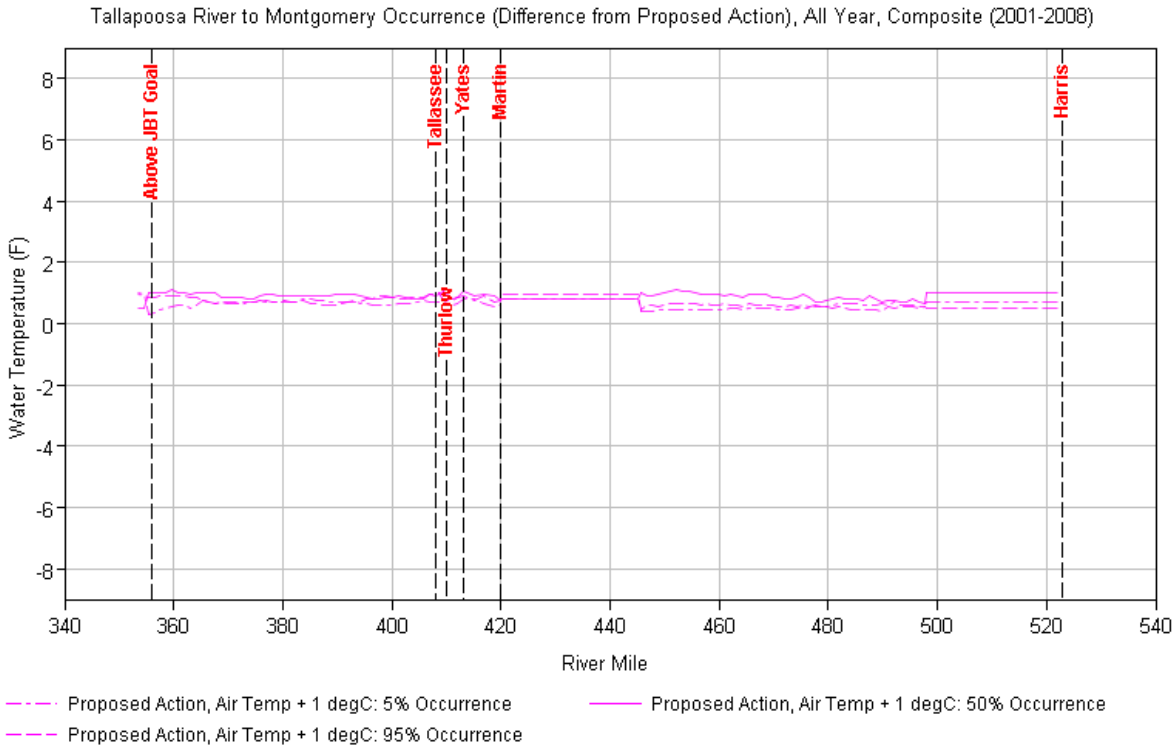


Figure 6.9-56. Tallapoosa River water temperature delta longitudinal profile for the modeled period (2001–2008).

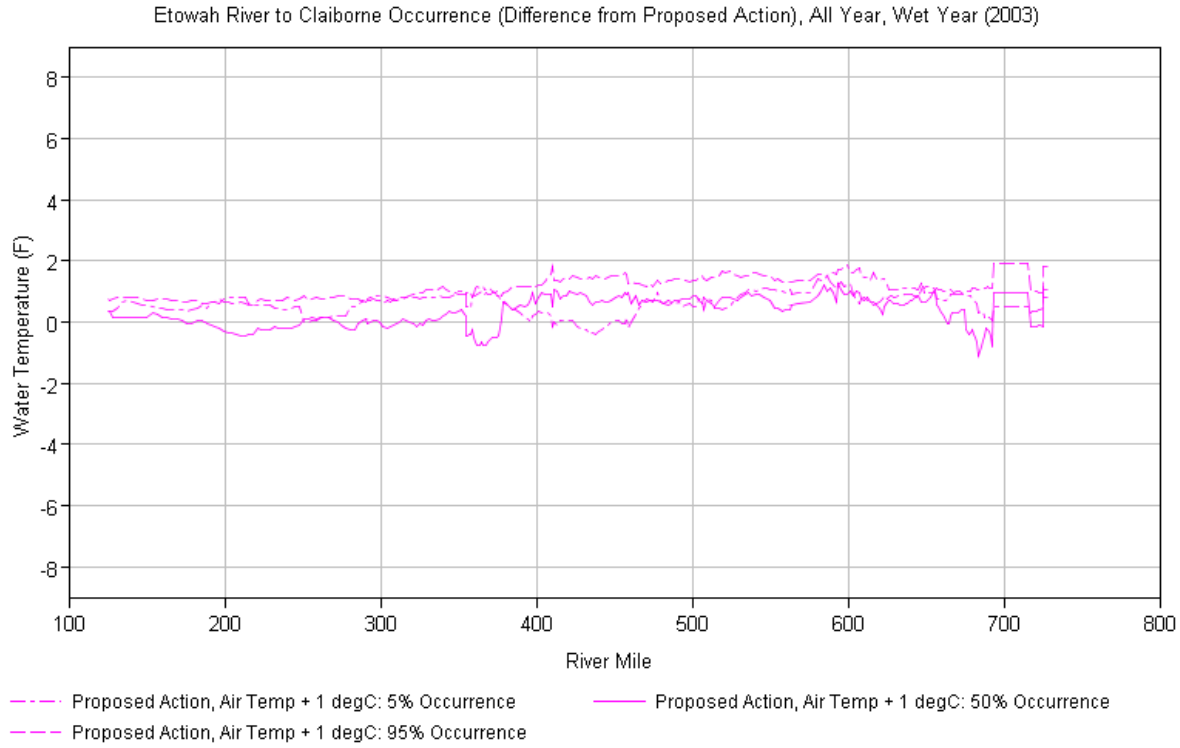


Figure 6.9-57. Etowah River annual water temperature delta longitudinal profile for a representative wet-weather year (2003).

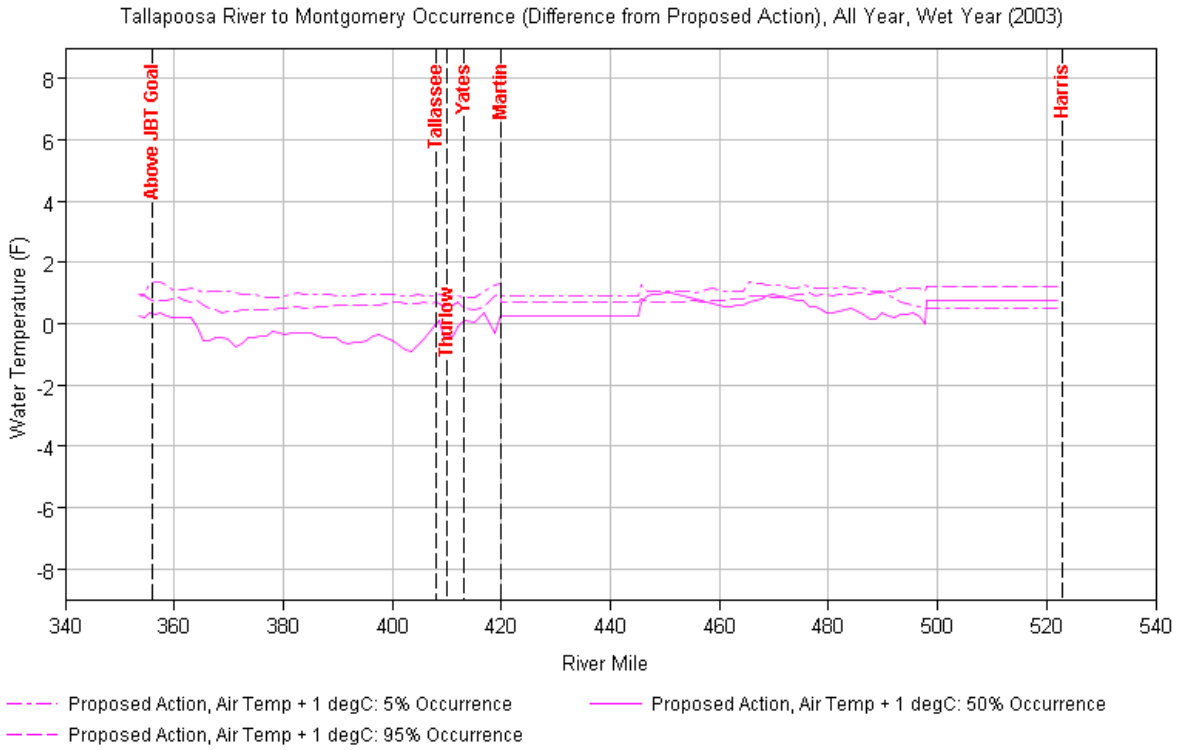


Figure 6.9-58. Tallapoosa River annual water temperature delta longitudinal profile for a representative wet-weather year (2003).

6.9.3.2.2 Dissolved Oxygen

Similar to Plan G-DI and Plan G-FR, comparisons of DO for Plan G-TI are generally inversely proportional to water temperature (Figure 6.9-59 through Figure 6.9-61). Increased air temperature would be expected to decrease DO concentrations throughout the ACT Basin. As water temperature increases, the maximum solubility of oxygen in water decreases, resulting in lower DO concentrations. Decreased DO would be expected to affect aquatic species. A discussion of the effects of Plan G-TI on biological resources is presented in Section 6.9.3.3.

The greatest variability in DO would be expected to occur in dry-weather conditions when air temperature increased. Median DO in the basin would be expected to fluctuate but would generally decrease (Figure 6.9-62). In rare occurrences, DO may be expected to increase.

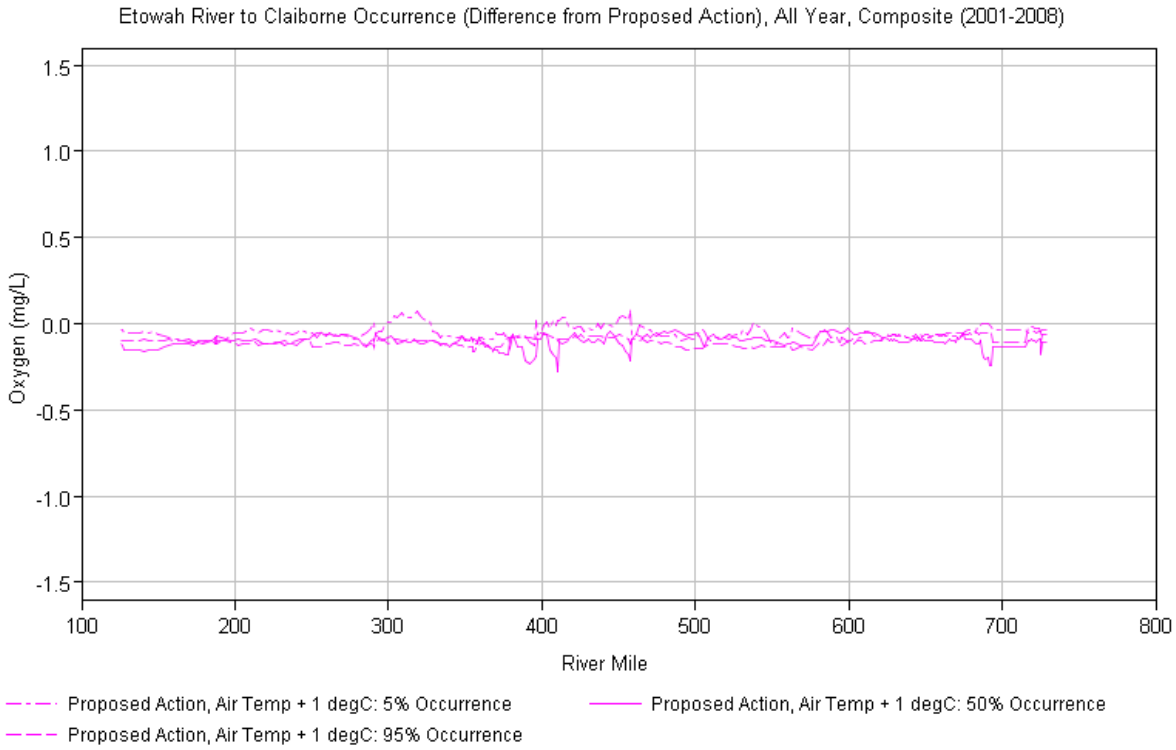


Figure 6.9-59. Etowah River oxygen delta longitudinal profile for the modeled period (2001–2008).

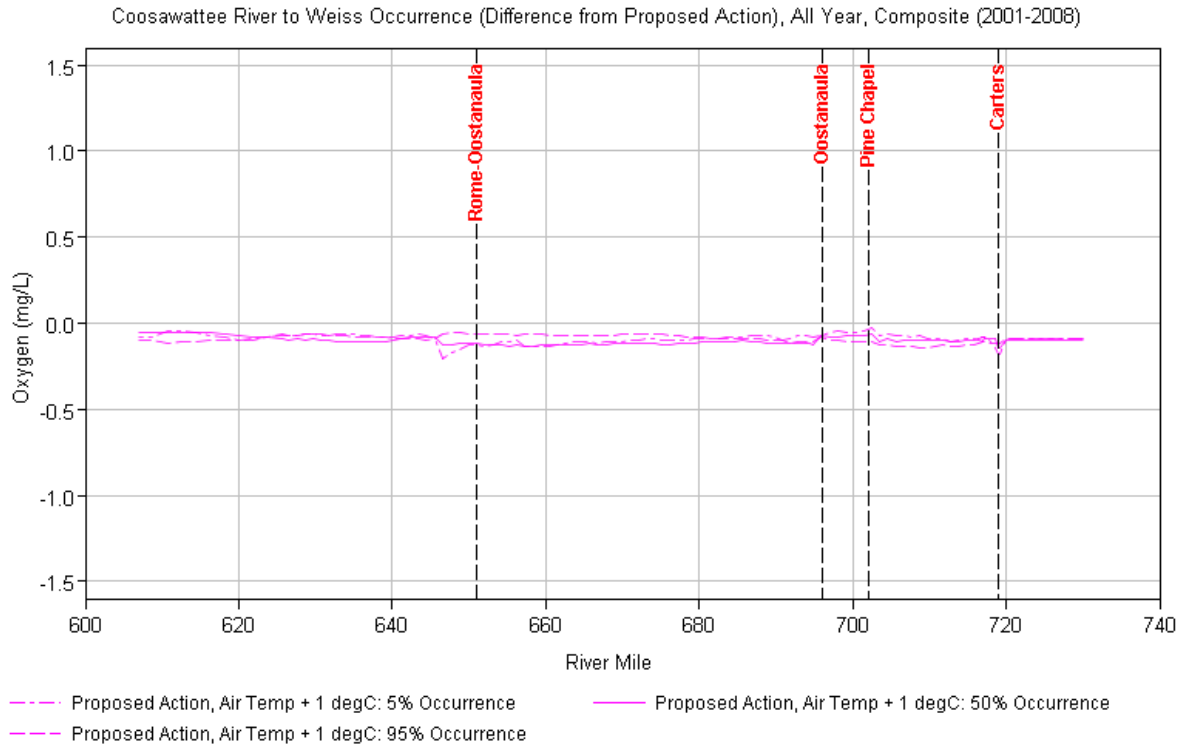


Figure 6.9-60. Coosawattee River oxygen delta longitudinal profile for the modeled period (2001–2008).

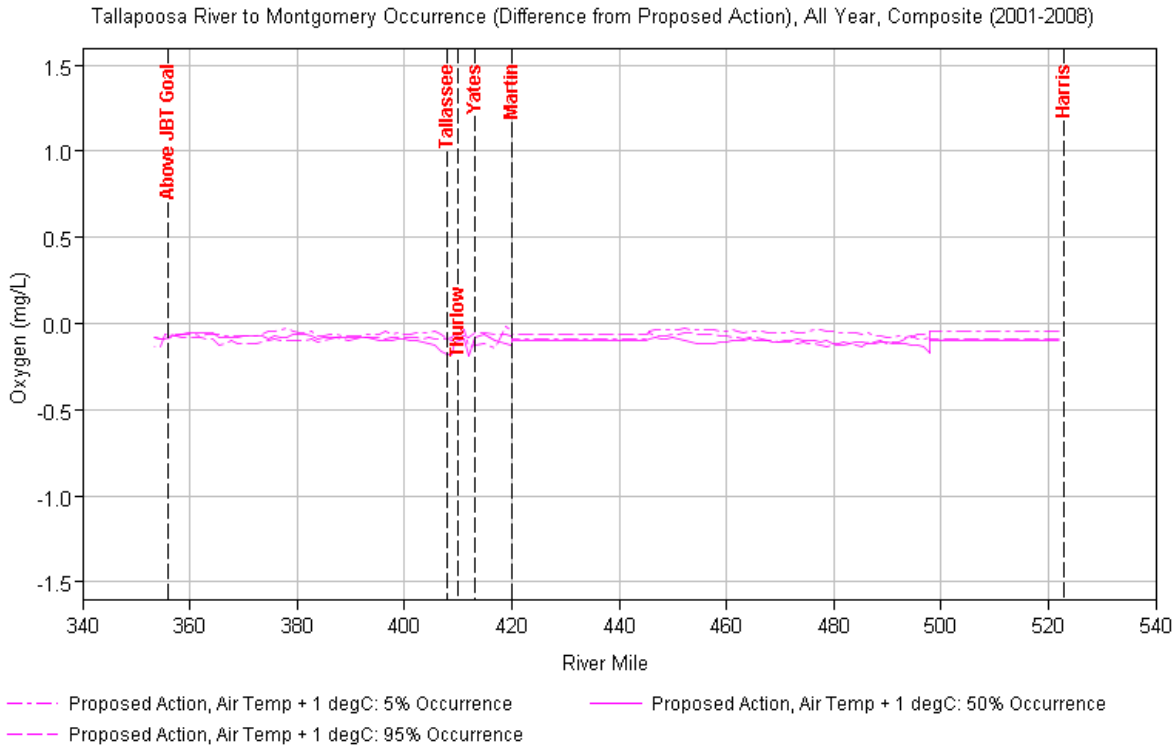


Figure 6.9-61. Tallapoosa River oxygen delta longitudinal profile for the modeled period (2001–2008).

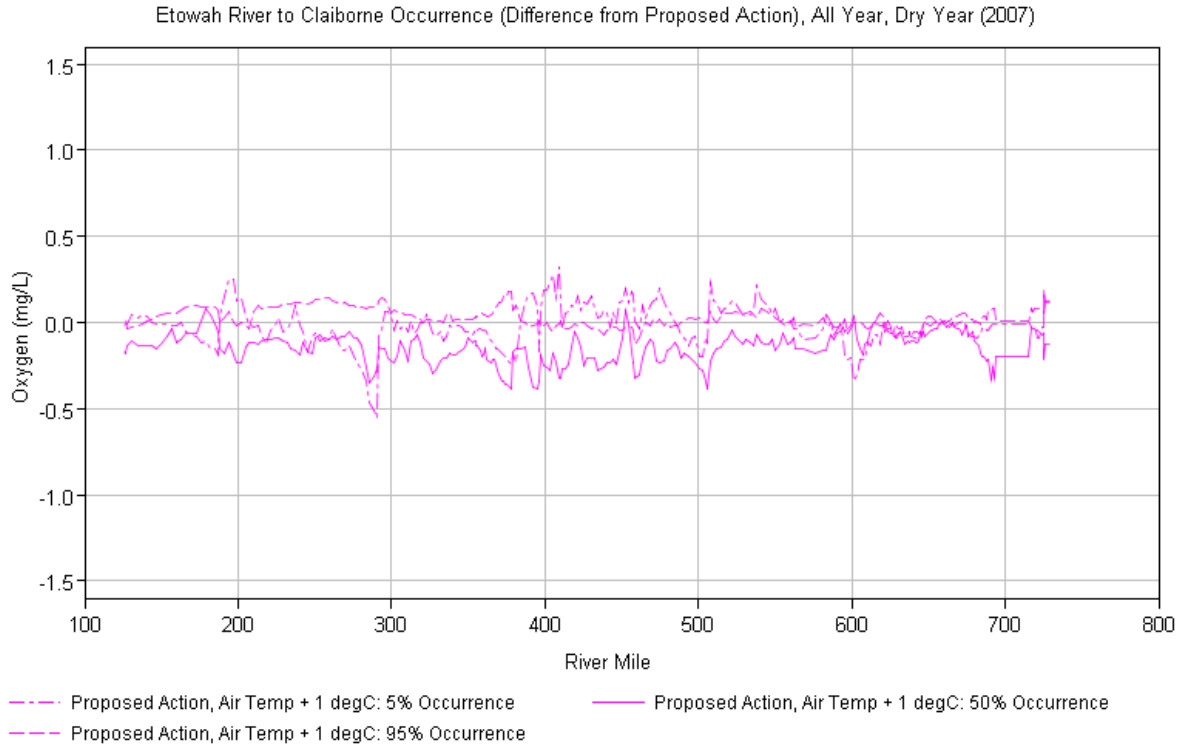


Figure 6.9-62. Etowah River annual oxygen delta longitudinal profile for a representative dry-weather year (2007).

6.9.3.2.3 Total Phosphorus

Increased air temperature has little effect on total phosphorus in the ACT Basin (Figure 6.9-63 and Figure 6.9-64). Differences occur most often in rare occurrences, 5th and 95th percentiles. The variability between Plan G-TI and Plan G in total phosphorus is similar for the entire modeled period and during dry-weather conditions both annually and seasonally (Figure 6.9-63, Figure 6.9-65, and Figure 6.9-66). This is expected since the nutrient load would not be affected by changing air temperature. The changes in total phosphorus would be expected to have negligible effect on water quality. The ability of the system to meet current standards and its effect on other resources would be expected to be unchanged from Plan G.

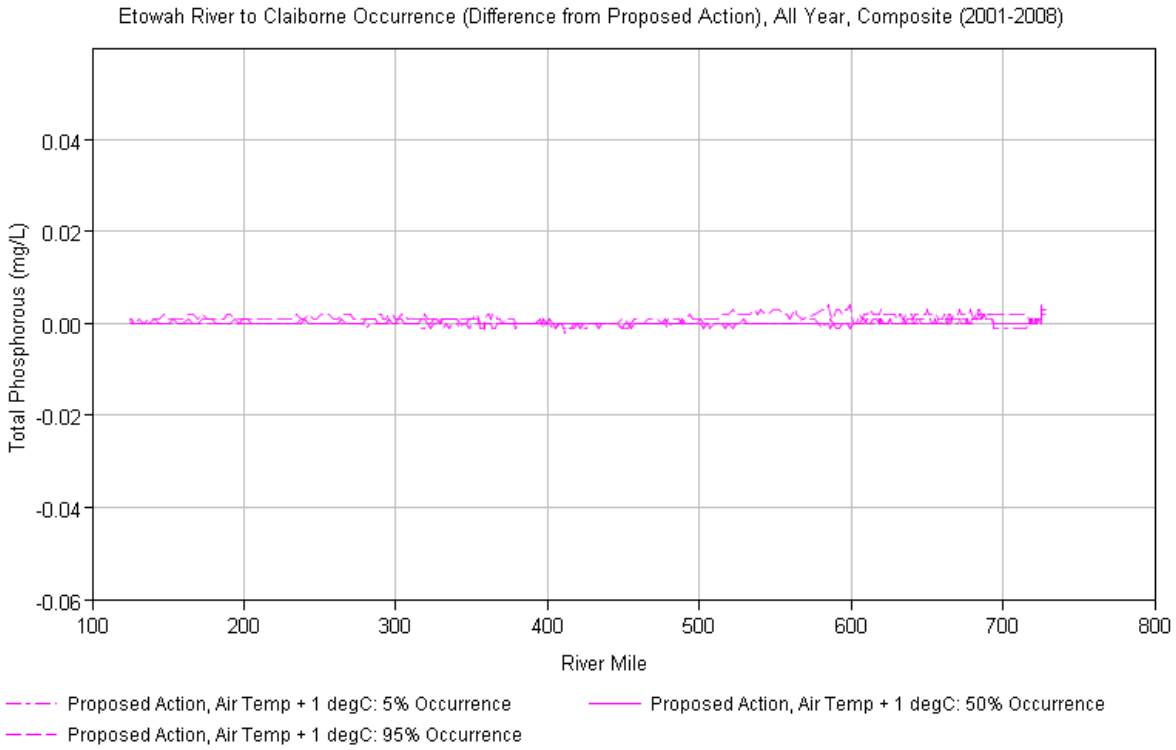


Figure 6.9-63. Etowah River total phosphorus delta longitudinal profile for the modeled period (2001–2008).

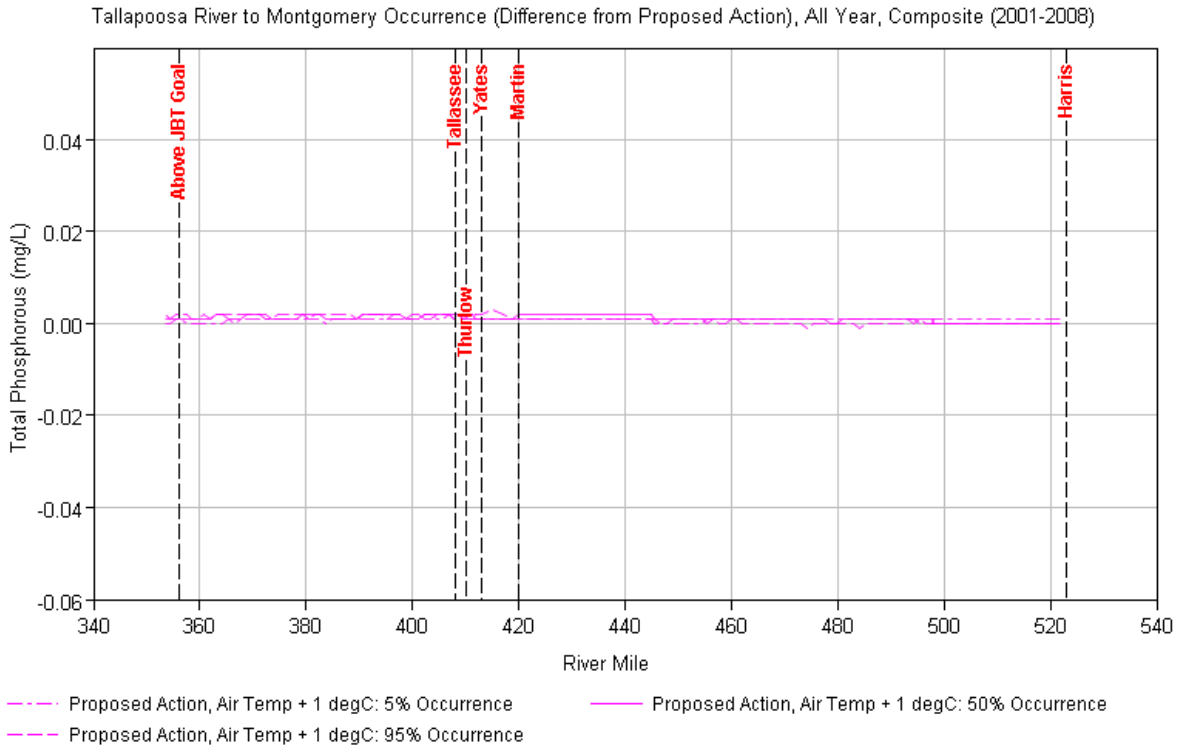


Figure 6.9-64. Tallapoosa River total phosphorus delta longitudinal profile for the modeled period (2001–2008).

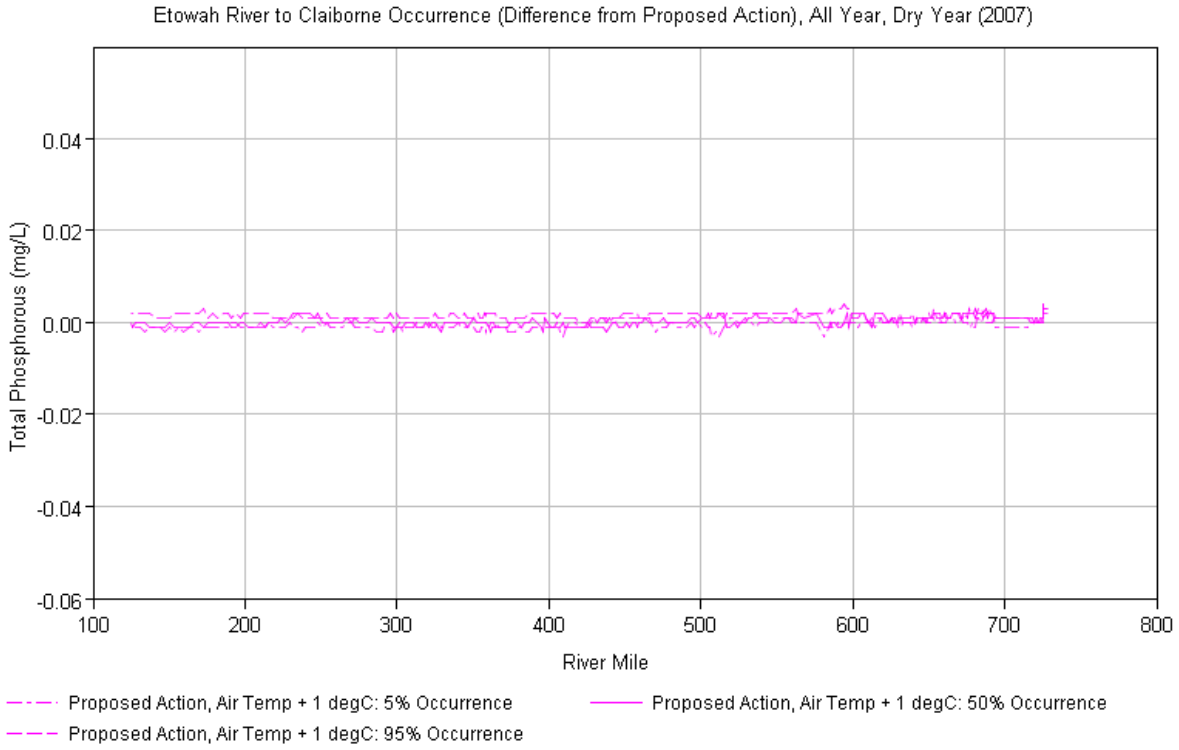


Figure 6.9-65. Etowah River annual total phosphorus delta longitudinal profile for a representative dry-weather year (2007).

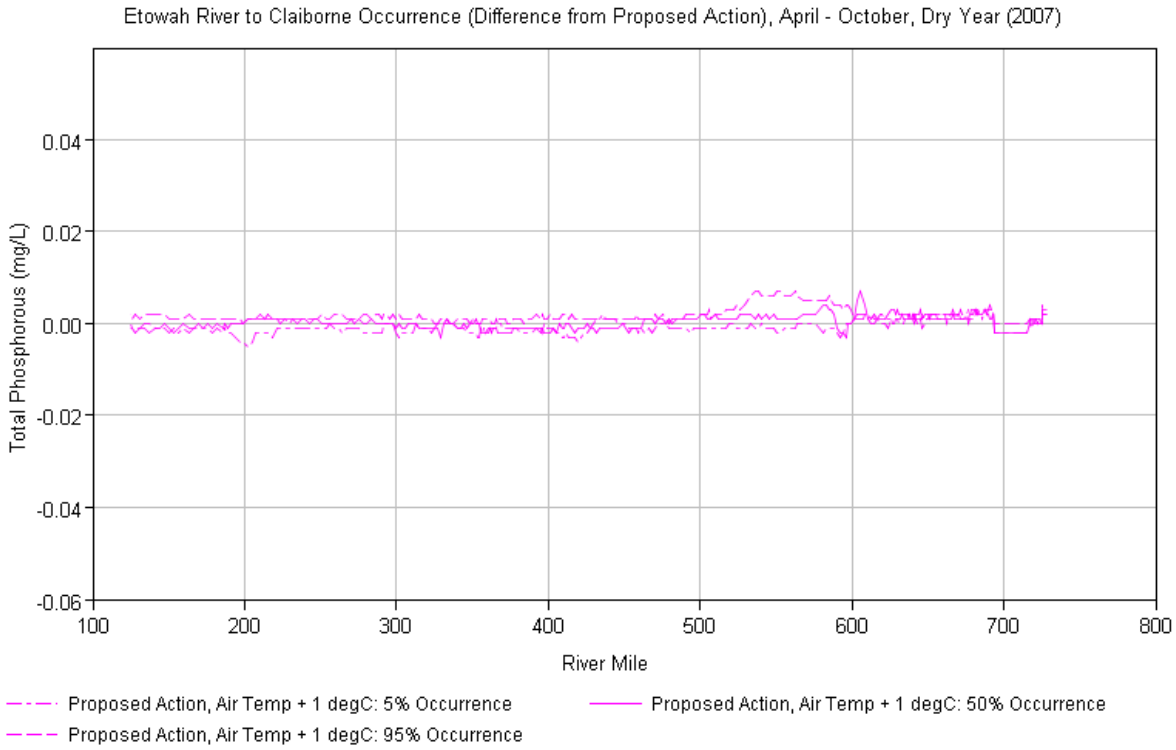


Figure 6.9-66. Etowah River total phosphorus delta longitudinal profile for a representative dry-weather year from April through October (2001–2008).

6.9.3.2.4 Total Nitrogen

The response in total nitrogen is similar to total phosphorus, with the exception of dry-weather conditions during the growing season. Generally, increased air temperature has little effect on total nitrogen in the ACT Basin (Figure 6.9-67 and Figure 6.9-68). The greatest variability in total nitrogen is seen in rare occurrences during the growing season (Figure 6.9-69). The modeled results indicate that 95th percentile occurrences of total nitrogen from May through October may increase in the Weiss Lake forebay and decreases downstream. Overall, the changes in total nitrogen would be expected to have negligible effect on water quality. The ability of the system to meet current standards and its effect on other resources would be expected to be unchanged from Plan G.

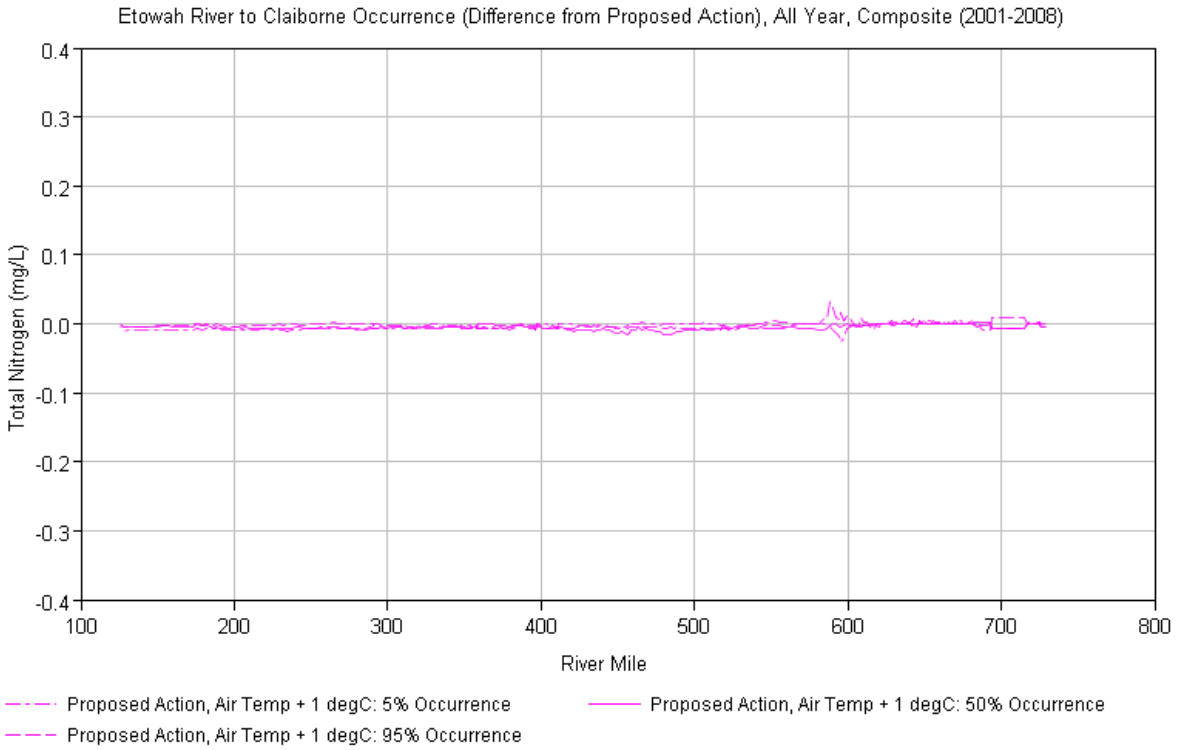


Figure 6.9-67. Etowah River total nitrogen delta longitudinal profile for the modeled period (2001–2008).

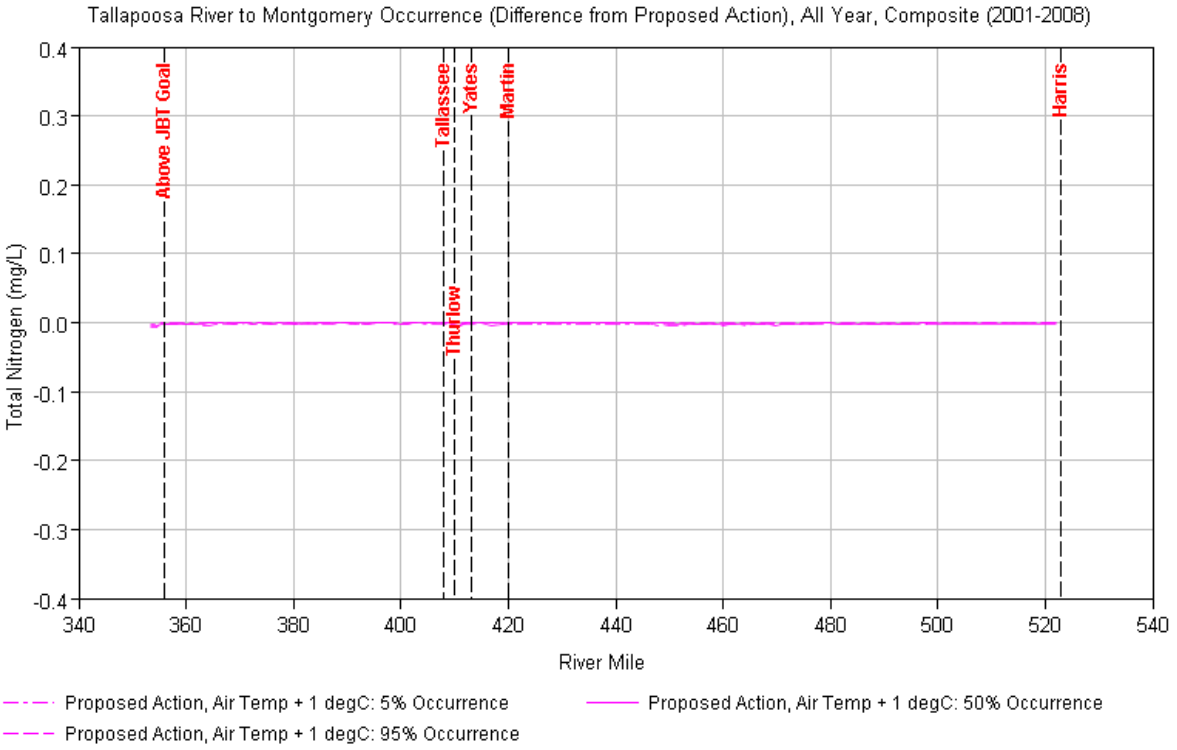


Figure 6.9-68. Tallapoosa River total nitrogen delta longitudinal profile for the modeled period (2001–2008).

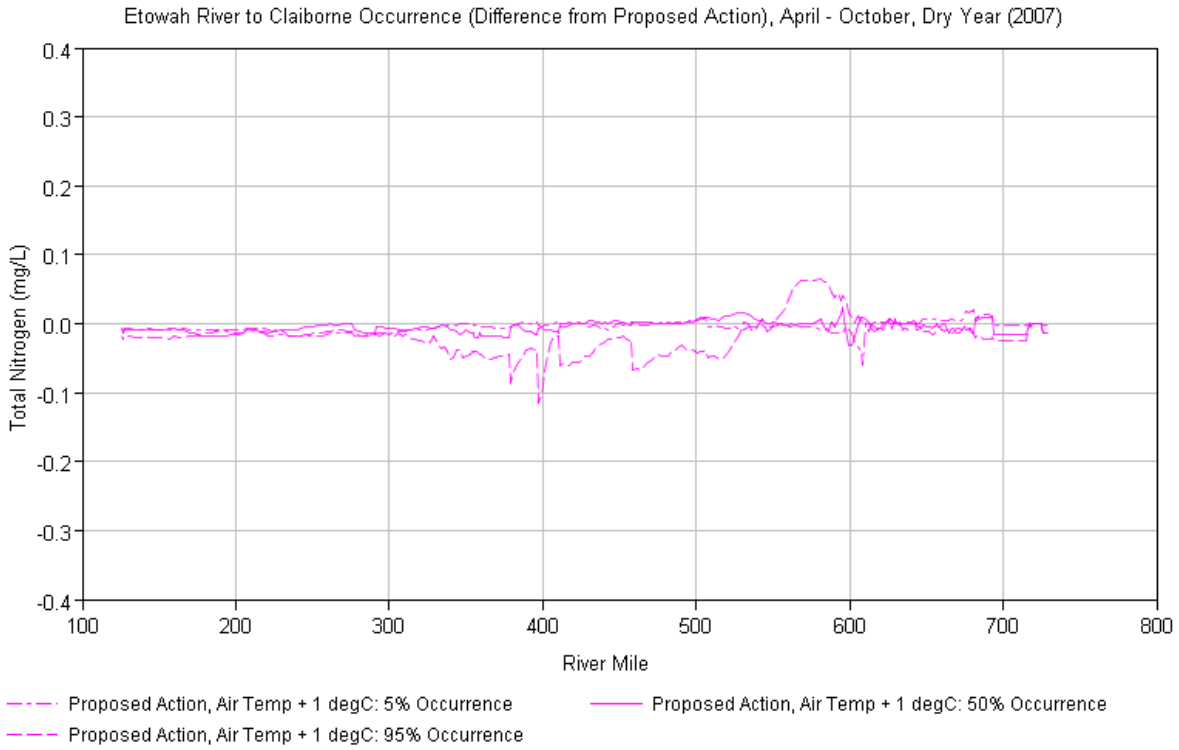


Figure 6.9-69. Etowah River total nitrogen delta longitudinal profile for a representative dry-weather year from April through October (2007).

6.9.3.2.5 Chlorophyll *a*

The greatest variability in water quality was simulated in the lowest concentrations of chlorophyll *a*. Generally increased air temperatures would not affect median concentrations of chlorophyll *a* and would decrease the highest concentrations, 95th percentile occurrences (Figure 6.9-70 through Figure 6.9-72). Given that median concentrations are relatively unchanged, Plan G-TI would be expected to have negligible effect on water quality. The ability of the system to meet current standards and its effect on other resources would be expected to be unchanged from Plan G.

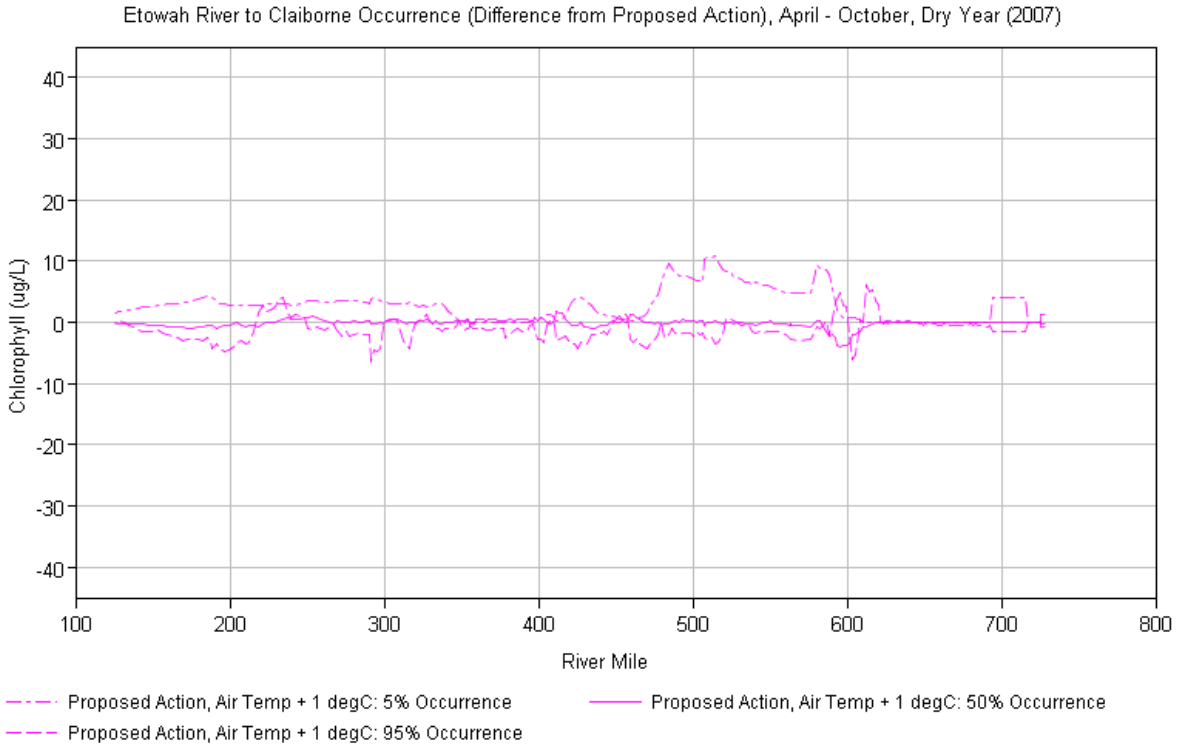


Figure 6.9-70. Etowah River chlorophyll delta longitudinal profile for a representative dry-weather year from April through October (2001–2008).

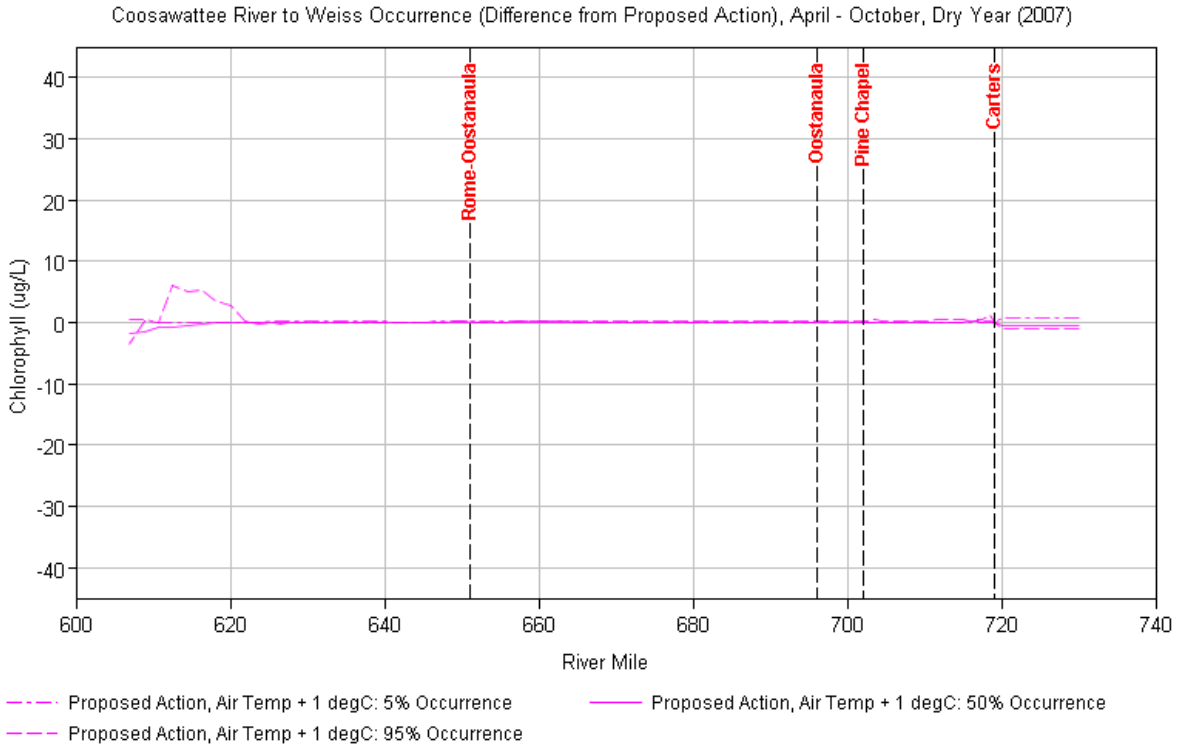


Figure 6.9-71. Coosawattee River chlorophyll delta longitudinal profile for a representative dry-weather year from April through October (2007).

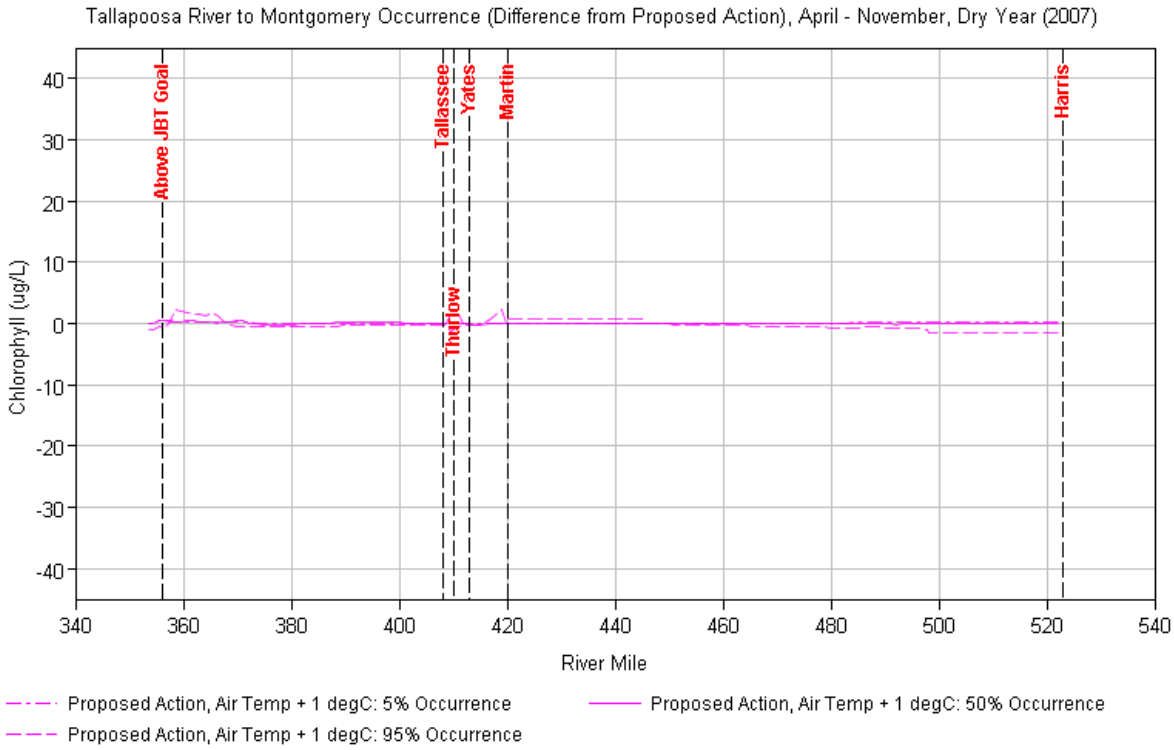


Figure 6.9-72. Tallapoosa River chlorophyll delta longitudinal profile for a representative dry-weather year from April through November (2007).

6.9.3.3 Biological Resources

The Plan G-TI scenario would not affect vegetation of upland wildlife.

Increased air temperature would affect water quality, and could therefore potentially affect fish and aquatic species. Overall, the changes in total phosphorous, total nitrogen, and chlorophyll *a* would be expected to have negligible effect on water quality. Slight decreases in dissolved oxygen throughout the ACT Basin would be expected as a result of temperature increases. Effects are greatest in dry weather years, when average DO concentrations may be reduced by up to 0.4 mg//L during certain times of the year. This reduction in DO concentrations could put stress on fish and aquatic life considering that DO concentration would already be low during dry weather years. This additional decrease in DO could negatively affect aquatic life, including threatened and endangered species. The more sensitive fish species would be the most affected by low DO concentrations.

6.9.3.4 Socioeconomic Resources

There would not be any expected incremental effects on socioeconomic resources associated with the Plan G-TI scenario in comparison to Plan G.

6.9.3.5 Other Resource Areas

Compared to Plan G, reservoir management activities in the ACT Basin with a potential climate change scenario based on an increase in ambient air temperature over time (Plan G-TI) would not be expected to

affect other natural and human resource considerations, including: soils and geology, land use, aesthetics, air quality, transportation and traffic, and cultural resources.

6.9.4 Conclusions

Compared to the Proposed Action Alternative (Plan G), an increased water demands scenario (Plan G-DI) would likely have a minor overall incremental impact on water quantity, water quality, biological resources, socioeconomic resources, or other resource areas of interest. Project operations in the ACT Basin under the Proposed Action Alternative (Plan G) would not be highly sensitive to increased future water demands in the basin. Detailed basin-wide and site-specific analyses may be appropriate and necessary in the future to more accurately assess impacts and adapt project WCMs as future conditions in the basin may dictate.

Plan G would be highly sensitive to a 15 percent reduction in basin inflow (Plan G-FR), which is considered to be a reasonable representation of the hydrologic effects associated with a potential climate change scenario in the region. The estimate of climate change effects is highly uncertain and could potentially be more or less pronounced than the assumptions upon which this sensitivity analysis is based. Among the natural resource considerations most sensitive to a future decline in basin inflows would be flow conditions downstream of reservoirs or at other key points in the system that may be important for one or more reasons, (e.g., navigation flow targets, ecological function, water quality, etc.).

Like Plan G-FR, changes of 1.8 °F (1 °C) in air temperature assumed in Plan G-TI are considered reasonable for the region, yet are highly uncertain and could potentially be more or less pronounced. Water temperature and dissolved oxygen in water bodies, and the biological resources that depend on water quality in the basin, would be expected to experience negative effects due to changing air temperature. No incremental effects would be expected to other water quality parameters or resource areas. However, overall increased water temperatures and decreased dissolved oxygen would be expected to shift species habitat areas in the basin.

As natural and human-induced conditions unfold in the future that may affect project operations in the ACT Basin, USACE personnel will monitor and review changing conditions and evaluate whether future updates to the ACT WCM are needed to adapt project operations to pertinent changing conditions.

6.10 Cumulative Effects

Cumulative effects in ecosystems are defined as, “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions” (40 CFR Parts 1500–1508). Constructing dams in riverine ecosystems abruptly, severely, and permanently alters many important physical and biological processes involving the movement of water, energy, sediments, nutrients, and biota. Seventeen major dams impound mainstem channels of the ACT Basin (Table 2.1-4), eliminating, fragmenting, and dramatically altering riverine habitat.

As described in Section 2.1.1.1.4.17, USACE conducted a preliminary survey in 2002 of existing reservoirs in the ACT Basin in Alabama and Georgia that are not on the mainstem rivers of the ACT Basin (Alabama, Coosa, Tallapoosa, Etowah, Oostanaula, Coosawattee, and Cahaba). The survey identified 280 reservoirs in the ACT Basin (Alabama and Georgia) that are 20 ac or larger (USACE, Mobile District 2002). The total surface area of the reservoirs is about 17,220 ac, an average reservoir size of about 62 ac. Those existing impoundments serve a variety of purposes, including water supply for livestock and irrigation; fish and wildlife conservation; recreation; M&I water supply; and other localized uses. Hundreds of other smaller ponds and impoundments are scattered across the ACT Basin. While the preliminary survey might not have identified and included every impoundment in the basin, it was

detailed enough to provide a reasonably complete summary of the more noteworthy surface water impoundments in the ACT Basin. Those other reservoirs in the ACT Basin represent a total surface area in the range of about 10 percent of the total surface area of the 17 primary mainstem impoundments in the ACT Basin addressed in this EIS.

Table 2.1-6 summarizes non-federal reservoir projects in the ACT Basin for which USACE has issued a section 404 permit since 1990 (a total of five) or for which a USACE permit is pending (three). Those reservoirs generally represent local water supply projects for public supply needs in the upper portion of the ACT Basin in Georgia. All those projects, completed and pending, represent a total surface area of about 2,300 ac and a yield of about 125 mgd. Current surface water withdrawals for water supply associated with the reservoirs that have been completed since 1990 and are in-service have been considered in the analysis for the WCM updates.

To meet projected future demands for public water supply, Georgia, MNGWPD, and the affected counties have undertaken a number of actions. Those efforts, which include both instituting aggressive conservation measures and developing new sources of water, are described in detail in Section 2.1.1.2.5. A 2008 study by the GEFA, summarized in Section 2.1.1.2.5.1.6, identifies ongoing and potential future investments in new reservoirs to address water supply needs in Georgia (GEFA 2008). The 2008 study revealed that one existing local reservoir project (Sharpe Creek Reservoir in Carroll County, Georgia) has the potential to expand storage volume about 2.5 times above the current level of about 3,400 ac-ft. At the time of the 2008 study, one proposed new reservoir (Richland Creek in Paulding County, Georgia) was in the permitting process (still underway). Dawson County Water Supply Reservoir (Russell Creek, Dawson County, Georgia) and Indian Creek Reservoir (Indian Creek, Carroll County, Georgia) are now also in the permitting process.

The three new reservoirs and the reservoir with expansion potential described above are planned as alternate or back-up sources for existing demand or are expected to address localized increases in water demand within the western and northwestern portions of the metro Atlanta area. The reservoir projects would represent a marginal overall increase in water use for public supply. Other than the additional loss and fragmentation of stream habitat as discussed below, the local water supply reservoir projects are likely to have an inconsequential overall effect on water quantity aspects of the ACT Basin. This conclusion is generally supported by the sensitivity analysis for increased future water demands as described in the Section 6.9. Section 404 permits for the three new reservoirs described above remain pending. Their overall effects are still being evaluated and final decisions have not been made. The three proposed projects are geographically dispersed within the ACT Basin, one each in the watersheds of the Tallapoosa River, the upper Etowah River, and the lower Etowah River. The potential effects of these proposed reservoirs on WCM update alternatives D, F, and G are expected to be minor.

Table 2.1-20 identifies 56 other locations in the upper ACT Basin in Georgia that have been determined generally suitable by the state of Georgia from an engineering and site development standpoint for future water supply reservoir development, compiled from a variety of different studies and reports. Future development at any of those locations would be highly speculative (not reasonably foreseeable for purposes of this cumulative effects analysis). Similar regional or statewide studies have not been completed in Alabama; however, there are no known plans for water supply reservoir development in the Alabama portion of the ACT Basin.

As discussed in Sections 2.1.1.1.4.1 and 2.1.1.1.4.16, various private sector power interests have pursued steps to acquire a license from FERC for non-federal hydroelectric power development at the Carters Reregulation Dam and at Claiborne Lock and Dam, beginning in the early 1980's at both projects. It is reasonable to expect that cost-effective projects to retrofit the Carters Reregulation Dam and Claiborne Lock and Dam to produce non-federal hydropower under FERC licenses are likely to occur in the future for a variety of reasons, including: greater emphasis on developing clean energy sources; continued rising

of fossil fuel costs, and less challenging environmental requirements associated with retrofitting an existing structure versus developing a new power generation source.

There are no active FERC preliminary permits or license application activities underway for non-federal hydropower development at the Carters Reregulation Dam since Northbrook Carters Lake, LLC surrendered their preliminary permit in March 2011. It is likely that other permit applications will be forthcoming in the future. If so, the proposed hydropower development at the reregulation dam could potentially impact the seasonal minimum flow regime that is a component of the Proposed Action Alternative (Plan G) as well as Plans D and F. This and other pertinent issues would be addressed though the FERC non-federal hydropower licensing process.

Since 1999, efforts by several private sector entities to study the feasibility of developing non-federal hydropower facilities at Claiborne Lock and Dam under FERC preliminary permits have been nearly continuous. The most recent FERC applicant, Lock+ Hydro Friends Fund XIX, LLC (a subsidiary of Hydro Green Energy, LLC) has pursued feasibility studies under a preliminary permit from FERC since April 2010 (a successive preliminary permit was issued in December 2013) and is in the process of developing license application for a specific project proposal to be filed with FERC by December 2015. The proposed hydropower project would operate as a modified run-of-river project since Claiborne Lake does not have conservation storage. Water released from Millers Ferry Lock and Dam, plus any intervening basin inflows to Claiborne Lake, would pass through a new hydropower generation facility up to its discharge capacity in lieu of flowing over the spillway. Flows in excess of plant capacity would be passed over the spillway. Flow and water quality conditions downstream of the dam would not be expected to be markedly different than they are now. Ongoing efforts by USACE to use the lock to pass migrating fish upstream could potentially be disrupted by the non-federal hydropower operations. This issue, and other pertinent considerations, would be further addressed in conjunction with USACE and USFWS during the FERC license process.

As outlined in Section 2.1.1.2.3, demands for public water supply and agricultural water supply in the ACT Basin have steadily increased since 1950 and are expected to continue to increase in the future. Agricultural water supply represents less than 5 percent of surface water withdrawals in the ACT Basin. As water efficiency and conservation measures associated with public water supply (particularly in those portions of the ACT Basin in the metro Atlanta area) become more institutionalized through education, incentives, and enforceable laws/regulations, the rate of increase in water demand is likely to appreciably decline. This trend is supported by data in Section 2.1.1.2.5.1.7. Industrial water use in the ACT Basin has declined dramatically in the past 40 years with the decline of the manufacturing sector. Overall, the declines, which are expected to continue in the future, tend to offset increased demands for public water supply and agricultural water supply. Water requirements for thermoelectric power production in the Georgia portion of the ACT Basin has declined as more efficient methods for cooling water have been employed. Water withdrawals for thermoelectric power production in Alabama increased dramatically between 1970 and 2000, thereafter remaining fairly constant. Cooling water withdrawals associated with thermoelectric power generation is essentially a non-consumptive use.

For purposes of this cumulative effects analysis, it is not appropriate to speculate on what specific actions Alabama, Georgia, the MNGWPD, or local water providers might elect to pursue in the future in response to water resource related litigation or water allocations formulas derived by the states. In general terms, more aggressive conservation measures could be likely to reduce or curtail the growth of current water demands, as would the implementation of any feasible water reuse projects. In the portion of the ACT Basin within the metro Atlanta area, interbasin transfers are likely to continue for the foreseeable future, reflecting a minor net loss of water from the Coosa River Basin to the Chattahoochee River Basin. Existing laws and regulatory mechanisms limiting interbasin transfers in Georgia would likely have to be modified to enable this option to be implemented on a larger scale. More specific recommendations for addressing any future shortfalls in water supply will likely be incorporated into the regional water plans

developed by the regional water councils established under the ongoing Georgia SWP process. No water supply reservoir projects are anticipated in the Alabama portion of the ACT Basin for the foreseeable future.

One effect of the conversion of flowing water habitat to still water by construction of dams along the mainstem rivers of the ACT Basin and tributaries has been the decline or loss of river-dependent species of freshwater fishes, mussels, and snails. The habitat fragmentation effects of dams in the ACT Basin have resulted in declines in habitat for anadromous fishes. USACE, APC, and other reservoirs in the ACT Basin have changed the frequency of floodplain inundation in some areas and altered the ecology of the river. New dams in the ACT Basin would replicate many of those impacts elsewhere in the tributary streams and add to the cumulative alteration of natural flow regimes and habitat fragmentation. Depending on location, size, operating modes, amid other factors, new dams to meet water supply demands could adversely affect, and possibly extirpate, some protected aquatic species.

Human-induced inputs of various stressors into aquatic and terrestrial ecosystems can further compromise the ability of an ecological system to support a healthy biota. As growth (that is, increased density of human habitation) continues, the impacts on terrestrial ecosystems and wetlands adjacent to waterbodies in the basin are expected to become more degraded in spite of various levels of regulation or conservation efforts (e.g., stream buffers and wetland mitigation requirements). If, however, additional attention is given to protecting the integrity of floodplains and restrictions are placed on land cover conversions from residential/suburban/urban development, those areas could retain their function in fluvial processes. Those factors are expected to have some influence on conditions in tributaries, but they are expected to have little, if any, effect on the inundation of floodplains and wetlands in the Alabama, Coosa, and Tallapoosa River corridors. Those systems are largely driven by reservoir operations.

For the WCM update process, the ROI for land use is the reservoir project land and the adjacent shoreline. The Proposed Action Alternative to manage project pool levels and flow requirements would have minor effects on lake elevation levels (principally at Allatoona Lake and Carters Lake), in turn would affect the project shoreline; therefore, the focus of the land use analysis is on the project land over which USACE has proprietary or managerial jurisdiction, and the immediately adjacent land. The Proposed Action Alternative to prepare an updated Master Manual for the ACT Basin would not change these land use allocations or zoning. The Proposed Action Alternative would not change established land uses, disrupt or divide established land use configurations, represent a substantial change in existing land uses, or be inconsistent with adopted land use plans. Therefore, no cumulative effects would be expected.

USACE typically considers requests for a variety of real estate easements/leases at its projects. Two such actions currently pending are a proposed marina expansion and a proposed electrical transmission line crossing at Carters Lake. Such actions are not expected to have impacts on water management decisions or project purposes nor would they be impacted by the proposed action.

Mobile Bay estuary faces a variety of anthropogenic pressures, including coastal urban development and associated pollution, upland urban development and associated pollution, fishery pressures, sea level rise, dredging, and coastal erosion and wetland destruction. Flow manipulation undoubtedly adds to the cumulative effect of existing anthropogenic stressors. Amid that pressure, even with variable system conditions, the Mobile Bay estuary has remained a productive estuarine ecosystem.

Appreciable flow alteration (in terms of quantity, quality, timing, and distribution) would be likely to have potential effects on the Mobile-Tensaw Delta and Mobile Bay estuary, including commercial fisheries. The proposed updates to the ACT Master Manual would be expected to have negligible effects on the aquatic resources and ecological function of the Mobile Bay estuary. As indicated in Section 2 of the EIS, the ACT Basin contributes roughly 50 percent of the total flow in the Mobile River below the juncture of the Alabama and Tombigbee rivers. USACE projects in the Black Warrior-Tombigbee River

basin operate as run-of-river projects with no conservation storage and little capacity to appreciably modify the flow regime. Modeling of the ACT Basin for the No Action Alternative and the Proposed Action Alternative indicate that differences in the flow regime at the most downstream points in the basin (e.g., Claiborne Lock and Dam) are generally negligible. For these reasons, the Mobile-Tensaw Delta and the Mobile Bay are not likely to be affected any differently by the Proposed Action Alternative than current water management operations in the ACT Basin.

As human population density in the coastal area continues to rise, along with associated habitat and water quality impacts, estuarine conditions can be expected to respond negatively, even with associated regulatory or conservation measures. However, if additional attention is given to protecting the integrity of the estuary, restrictions are placed on land cover conversions to residential/suburban/urban development, and attention is paid to aggressive restoration and protection of habitat and water quality, the estuary could continue to function with minimal adverse impact.

Water quality is influenced by a number of factors, including pollutant loads and in-stream flows (water quantity). Pollutant loads include both point and nonpoint sources of pollution. Point sources of pollution are regulated by USEPA through the NPDES under the Water Pollution Act of 1972 as amended. Nonpoint sources of pollution are also targeted to reduce pollutant loads under the Water Pollution Act of 1972 as amended through TMDLs. Enforcement of reductions is varied because of limited resources. As activities in the ACT Basin change from forested to urban land cover, especially in the headwaters areas of the Etowah River Basin, peak flows in the system are likely to increase and base flows in the system are likely to decrease. Urban land cover generally decreases interception of rainfall and infiltration, increasing stormwater runoff. That would be expected to result in less assimilative capacity during periods of low flow because base flow decreases.

Implementing Plan D, Plan F, or the Proposed Action Alternative would result in cumulative effects in the ACT Basin with respect to water quality. The combination of a change to the flow regime and continued discharges during low-flow conditions by some entities holding NPDES permits would affect water temperature, nitrogen, phosphorus, and chlorophyll *a*. For the most part, those effects would be uneven throughout the course of the affected project area and would be expected to occur only during low-flow periods.

A waterbody's ability to assimilate pollutants is dependent on the amount of water in-stream, especially during low-flow periods. That is why the HEC models have been developed to ascertain the relationship between quantity and quality in the ACT Basin. Agencies regulating water quality in rivers and reservoirs will continue to monitor for impairment and improvement and enforce reductions until standards are met. That balance of what is allowable and what is discharged is an ongoing cycle of monitoring, assessment, and implementation. It is assumed that over time violations of the water quality standard will decrease because of reductions achieved through the Water Pollution Act of 1972 as amended.

Regardless of changes in reservoir operation, populations in the ACT Basin are expected to increase in the future, thus bringing more people into potential contact with known significant archaeological sites along the lakeshores and waterways. Increased human interaction is likely to increase the impact of access due to vandalism or artifact collection.

6.11 Mitigation Considerations

Mitigation includes measures to avoid, reduce, minimize, or compensate for adverse impacts that could result from a selected course of action, in this case, the update of the Master Manual for the ACT Basin. As potential water management measures were identified and alternative plans were developed and analyzed for beneficial and adverse effects to be addressed in the EIS, potential mitigative actions were identified and considered in the planning process.

The iterative process employed by USACE for formulation and evaluation of water management alternatives, coupled with substantial coordination with the USFWS, APC, and others, provided a strong framework for considering the incremental effects of the various components of the alternative plans and for adjusting proposed operations to minimize adverse effects on the natural environment, as well as social, cultural, and economic impacts.

Implementing Plan D, Plan F, or the Proposed Action Alternative (Plan G) may result in adverse effects on water quality at various locations in the ACT Basin during drought operations. Affected water quality parameters include water temperature and nutrients (nitrogen, phosphorus, and chlorophyll *a*). As in past years of drought, working closely with APC, states, and affected stakeholders releases were made to assist with public health and safety throughout the basin. USACE also supported an APC request to reduce the 4,640 cfs flow target by 20 percent to 3,700 cfs. As in past years of low-flow conditions, water users can coordinate directly with USACE to notify USACE of their needs. USACE will periodically notify users when releases are made during these low-flow conditions.

On the basis of the analysis of the Proposed Action Alternative and other alternatives, specific compensatory mitigation measures would not be required. No specific mitigation commitments are included in the Proposed Action Alternative and Plans D and F, but all those plans incorporate specific measures to improve conditions for fish and wildlife, such as promoting fish spawning through reservoir operations practices and facilitating fish passage by way of specific lock operations protocols.

Water management inherently involves adapting to unforeseen conditions. The development of water control criteria for the management of water resource systems is conducted throughout all phases of a water control project. The water control criteria are based on sound engineering practices using the latest approved models and techniques for all reasonably foreseeable conditions. There could be further refinements or enhancements of the water control procedures to account for changed conditions resulting from unforeseen conditions, new requirements, additional data, or changed social or economic goals. However, it is necessary to define the water control plan in precise terms at a particular time to ensure implementation of the intended functional commitments in accordance with the authorizing documents (EM 1110-2-3600 Management of Water Control Systems). Because adverse impacts of the water control plan might occur due to unforeseen conditions, actions will be taken within applicable authority and policies, and in coordination with other interests, to address such conditions when they occur through the implementation of temporary deviations to the water control plan, such as interim operation plans.

Such temporary deviations from the approved water control plan might have impacts that go beyond the scope of the current evaluation. Because it is not possible to predict the entire range of possible water management responses to extraordinary circumstances, an evaluation of each potential action would be made at the time of its consideration. If it is determined that the action had not been previously considered by the NEPA evaluation, a supplemental EIS or an EA would be required.

6.12 Other NEPA Considerations

6.12.1 Irreversible or Irretrievable Commitments of Resources

Irreversible or irretrievable resource commitments are related to the use of nonrenewable resources and the effects that use of those resources will have on future generations. Irreversible effects primarily result from use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the use or loss in value of an affected resource that cannot be restored as a result of the action (e.g., extinction of a threatened or endangered species).

The Proposed Action Alternative and the other WCM update action alternatives are not consumptive in nature. Maintaining peak hydropower production as an objective in the development of WCM update alternatives promotes continued use of renewable resources (water) to meet peak power demands in lieu of fossil fuels. The updated WCMs for the ACT Basin would be expected to have generally positive effects on resources (e.g., potential reduction of damages from flooding). The Proposed Action Alternative would not result in irreversible or irretrievable commitments of resources.

6.12.2 Short-Term Uses of the Human Environment and Maintenance and Enhancement of Long-Term Productivity

The construction of the large dams in the ACT Basin altered the environment in various ways. For instance, the creation of reservoirs replaced free-flowing rivers and streams and adjacent flood plains, significantly altering the habitat and the composition of aquatic species that favor living in high-velocity water or slow-moving, wide rivers versus those that thrive in a series of large impoundments. Dams with large storage have the effect of reducing the occurrence and magnitude of peak flows; those periods are typically used as opportunities to refill reservoirs and reduce downstream flooding. These projects provide substantial opportunities for economic growth and development and an improved quality of life in the southeast region of the U.S. through improved flood risk management, increased hydropower production, new recreational opportunities, dependable navigation channels, more stable sources of water supply, and other benefits to the public. Operations to reduce flood risk have decreased the occurrence and severity of damaging floods but have also changed the character of floodplain vegetation and available habitats. Construction of dams has also allowed maintenance of minimum flows downstream of the dams during critically dry periods. Before dam construction and reservoir creation, water levels would have likely decreased well below acceptable levels for aquatic species and water withdrawal intakes. The proposed update of the WCMs for the ACT Basin would not be expected to alter substantially the present relationship between short-term uses of man's environment and maintenance and enhancement of long-term productivity. The proposed WCM update includes operational adjustment that best balance the multiple purposes of the USACE projects in the ACT Basin, including those that would sustain and improve environmental conditions in the basin.

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10 Distribution List

The EIS was distributed as hard copy by the U.S. Postal Service and electronically through the project website. Notification of availability was distributed through the *Federal Register* and by an email sent to those on the project mailing list. Hard copies were also made available at libraries throughout the ACT Basin and sent to stakeholders who had requested hard copies. The project mailing list includes federal, state, and local agencies, Native American tribes, elected officials, other organizations, and individuals.

10.1 Federal Agencies

Federal Commissioner, ACT and ACF River Basin Compact
FEMA (Federal Emergency Management Agency)
FHA (Federal Highway Administration)
FERC (Federal Energy Regulatory Commission)
National Marine Fisheries Service
National Oceanic and Atmospheric Administration, National Ocean Service
National Oceanic and Atmospheric Administration, Office of Oceanic and Atmospheric Research
Office of Federal Commissioners
U.S. Army Corps of Engineers
U.S. Army Corps of Engineers, Economic and Social Analysis Branch
U.S. Army Corps of Engineers, Mobile District
U.S. Army Environmental Policy Institute
U.S. Army Infantry Center
U.S. Army Infantry School
U.S. Army Signal Center and School
U.S. Coast Guard Group
U.S. Coast Guard, Auxiliary
U.S. Consolidated Farm Service Agency
U.S. Department of Agriculture
U.S. Department of Agriculture, Natural Resources Conservation Service
U.S. Department of Agriculture, Natural Resources Conservation Service, Alabama State Conservation Engineer
U.S. Department of Agriculture, Natural Resources Conservation Service, Office of the Chief
U.S. Department of Agriculture, Natural Resources Conservation Service, Water Resources
U.S. Department of Agriculture, Rural Economic and Community Development
U.S. Department of Commerce
U.S. Department of Energy
U.S. Department of Health and Human Services
U.S. Department of Housing and Urban Development, Region IV
U.S. Department of Justice
U.S. Department of the Interior
U.S. Department of Transportation Maritime Administration, Central Region, Regional Director
U.S. Environmental Protection Agency, NEPA Compliance
U.S. Environmental Protection Agency
U.S. Environmental Protection Agency, Library
U.S. Environmental Protection Agency, Region 4
U.S. Environmental Protection Agency, Water Management Division
U.S. Fish and Wildlife Service
U.S. Fish and Wildlife Service, Ecological Services
U.S. Fish and Wildlife Service, Georgia
U.S. Fish and Wildlife Service, Region 4, Regional Director
U.S. Forest Service
U.S. Forest Service, Southern Region, Biological Physical Resources Unit, Georgia Director
U.S. Forest Service, Southern Region, Regional Hydrologist
U.S. Geological Survey, Alabama Water Science Center Office
U.S. Geological Survey, Georgia District
U.S. National Park Service
U.S. National Park Service, Horseshoe Bend National Military Park
U.S. National Park Service, Kennesaw Mountain National Battlefield Park
U.S. National Park Service, Southeast Support Office
U.S. Naval Air Station
U.S. Public Health Service
Weeks Bay National Reserve

10.2 State Agencies

Alabama Army National Guard
Alabama Assistant Attorney General
Alabama Association of Conservation Districts
Alabama Attorney General's Office
Alabama Bureau of Environmental and Health Services
Alabama Bureau of Tourism and Travel
Alabama Department of Environmental Management
Alabama Department of Agriculture and Industry
Alabama Department of Conservation and National Resources
Alabama Department of Conservation and Natural Resources, Game and Fish Division
Alabama Department of Conservation and Natural Resources, State Fish Hatchery
Alabama Department of Economic and Community Affairs
Alabama Department of Environmental Management
Alabama Department of Environmental Management, Water Division
Alabama Department of Industrial Relations
Alabama Department of Public Health
Alabama Department of Urban Planning
Alabama Development Office
Alabama Emergency Management Agency
Alabama Forestry Commission
Alabama Game and Fish Office
Alabama Geological Survey
Alabama Historic Commission
Alabama Municipal Electric Authority
Alabama Office of Water Resources
Alabama Oil and Gas Board
Alabama Public Service Commission
Alabama Rural Electric Association
Alabama Soil and Water Conservation District
Alabama State Docks
Alabama State Highway Department
Alabama State Parks
Georgia Bureau of Pollution Control
Georgia Department of Industry, Trade and Tourism
Georgia Department of Agriculture
Georgia Department of Community Affairs
Georgia Department of Environmental Protection
Georgia Department of Health and Human Services
Georgia Department of Human Resources
Georgia Department of Natural Resources
Georgia Department of Water and Pollution Control
Georgia Economic Development Administration
Georgia Environmental Protection Division
Georgia Farm Bureau Federation
Georgia Geologic Survey
Georgia Natural Resources Conservation Service
Georgia State Clearinghouse
Georgia State Dock
Georgia Wildlife Resource Division
Georgia Wildlife Resources Division of Fisheries
Tennessee River Water Authority

10.3 Local Agencies

Abbeville Chamber of Commerce
Acworth, Georgia – City Manager
Alabama Gulf Coast Area Chamber of Commerce
Albany, Georgia – City Engineer
Albertville Chamber of Commerce
Alexander City Chamber of Commerce
Alexander City Water Department
Aliceville Area Chamber Commerce
Alpharetta Environmental Service
Andalusia Area Chamber of Commerce
Anniston Chamber of Commerce
Anniston Water and FPA
Arab Chamber of Commerce
Athens-Limestone County Chamber of Commerce
Atlanta Chamber of Commerce
Atmore Area Chamber of Commerce
Attalla Chamber of Commerce
Auburn Chamber of Commerce
Autauga County Commission
Baldwin County Commission
Baldwin County Solid Waste
Barbour County Alabama Farmers Federation
Barbour County Commission
Bartow County Water Department

Bay Minette Area Chamber Commerce
Bayou La Batre Chamber of Commerce
Bessemer Area Chamber of Commerce
Bibb County Chamber of Commerce
Bibb County Commission
Birmingham Water Works and Sewer Board
Blount County–Oneonta Chamber of Commerce
Board of Commissioners, Americus, Georgia
Board of Commissioners, Barnesville, Georgia
Board of Commissioners, Butler, Georgia
Board of Commissioners, Byromville, Georgia
Board of Commissioners, Camilla, Georgia
Board of Commissioners, Carrollton, Georgia
Board of Commissioners, Cedartown, Georgia
Board of Commissioners, Chatsworth, Georgia
Board of Commissioners, Cleveland, Georgia
Board of Commissioners, Cornelia, Georgia
Board of Commissioners, Cusseta, Georgia
Board of Commissioners, Damascus, Georgia
Board of Commissioners, Dawson, Georgia
Board of Commissioners, Edison, Georgia
Board of Commissioners, Forsyth, Georgia
Board of Commissioners, Fort Gaines, Georgia
Board of Commissioners, Franklin, Georgia
Board of Commissioners, Gainesville, Georgia
Board of Commissioners, Georgetown, Georgia
Board of Commissioners, Hamilton, Georgia
Board of Commissioners, LaFayette, Georgia
Board of Commissioners, LaGrange, Georgia
Board of Commissioners, Leesburg, Georgia
Board of Commissioners, Lovejoy, Georgia
Board of Commissioners, Lumpkin, Georgia
Board of Commissioners, Montezuma, Georgia
Board of Commissioners, Norman Park, Georgia
Board of Commissioners, Preston, Georgia
Board of Commissioners, RockeyFace, Georgia
Board of Commissioners, Rome, Georgia
Board of Commissioners, Sumner, Georgia
Board of Commissioners, Talbotton, Georgia
Board of Commissioners, Thomaston, Georgia
Board of Commissioners, Whigham, Georgia
Boaz Chamber of Commerce
Bullock County Chamber of Commerce
Bullock County Commission
Butler County Commission
Calera Chamber of Commerce
Calhoun County Chamber of Commerce
Calhoun County Commission
Calhoun Utilities
Cartersville Housing Authority
Cartersville Water Department
Cartersville-Bartow County Chamber of Commerce
Central Alabama Regional Planning and Development Commission
Central Baldwin Chamber of Commerce
Centre Water and Sewer Board
Chamber of Commerce of Russellville-Franklin County
Chamber of Commerce of Walker County
Chamber of Commerce of West Alabama
Chamber of Commerce, Alexander City, Alabama
Chamber of Commerce, Athens, Alabama
Chamber of Commerce, Calhoun, Georgia
Chamber of Commerce, Centre, Alabama
Chamber of Commerce, Fayette, Alabama
Chamber of Commerce, Fort Payne, Alabama
Chamber of Commerce, Gadsden, Alabama
Chamber of Commerce, Jasper, Alabama
Chamber of Commerce, Opelika, Alabama
Chamber of Commerce, Ozark, Alabama
Chamber of Commerce, Rome, Georgia
Chamber of Commerce, Russellville, Alabama
Chamber of Commerce, Sumiton, Alabama
Chambers County Commission
Chatsworth Water Works Commission
Chattahoochee County Commission
Cherokee County Chamber of Commerce
Cherokee County Commission
Cherokee County Water and Sewer Authority
Cherokee County, AP Probate Judge
Chickasaw Chamber of Commerce
Childersburg Chamber of Commerce
Childersburg Water Sewer and Gas Board
Chilton County Chamber of Commerce
Chilton County Commission
Choctaw County Chamber of Commerce
Citronelle Area Chamber of Commerce
City of Acworth, Georgia
City of Atlanta, Georgia
City of Auburn, Alabama
City of Bainbridge, Georgia
City of Calhoun, Georgia
City of Calhoun, Water Plant, Georgia
City of Camilla, Georgia
City of Cartersville, Georgia
City of Cartersville-LAPA, Georgia
City of Columbus, Georgia
City of Cordele, Georgia
City of Cumming, Georgia
City of Dallas, Georgia

City of Eufaula, Alabama
City of Gainesville, Georgia
City of Gulf Shores, Alabama
City of Hiram, Georgia
City of Jacksonville, Alabama
City of Kennesaw, Georgia
City of LaGrange, Georgia
City of Lanett, Alabama
City of Montgomery, Alabama
City of Opelika, Alabama
City of Orange Beach, Alabama
City of Orange Beach Planning Department, Alabama
City of Oxford, Alabama
City of Pell City, Alabama
City of Phenix City, Alabama
City of Rome, Georgia
City of Rome Water and Sewer, Georgia
City of Tallapoosa, Georgia
City of Villa Rica, Georgia
City of West Point, Georgia
City of Wetumpka, Alabama
Clarke County Commission
Clay County Board of Commissioners
Clay County Chamber of Commerce
Clayton County Chamber of Commerce
Cleburne County Chamber of Commerce
Cleburne County Commission
Cob Marietta Water Authority
Cobb Chamber of Commerce
Cobb County Chamber of Commerce
Cobb County Commission
Cobb County Tag Office
Cobb County Water System
Cobb County-Marietta Water Authority
College Park, Georgia – City Engineer
Columbus Chamber of Commerce
Columbus Consolidated Government
Columbus Travel Bureau
Columbus Water Works
Conecuh County Commission
Coosa County Commission
Coosa River SWCD (Soil and Water Conservation District)
Coosa Valley APDC (Area Planning and Development Commission)
Coosa Valley Regional Development Center
Cordele City Commission
County Supervisor, McDonough, Georgia
Covington County Commission
Coweta County Water and Sewer Department
Crenshaw County Commission
Crisp County
Cullman County Chamber of Commerce
Dadeville Area Chamber of Commerce
Dadeville Water/Gas Board
Daleville Chamber of Commerce
Dallas County Commission
Dauphin Island Chamber Of Commerce
Dauphin Island Sea Lab
Davco Development Company
Decatur Chamber of Commerce
Dekalb Chamber of Commerce
Dekalb County
Dekalb Public Works
Dekalb School System
Demopolis Area Chamber of Commerce
Donalsonville Chamber of Commerce
Dothan Area Chamber of Commerce
Dothan Utilities
Dothan-Houston County Chamber of Commerce
Douglas County Commission
Douglasville-Douglas County Authority
Early County Board of Commissioners
Early County Commission
East Alabama Regional Planning and Development Commission
Eastern Shore Chamber of Commerce
Eataw Area Chamber of Commerce
Elba Chamber of Commerce
Ellijay City Hall
Elmore County Commission
Enterprise Chamber of Commerce
Escambia County Commission
Etowah County Commission
Etowah Water Authority
Eufaula Water and Sewer Department
Euraula, Alabama – Parks and Recreation
Evergreen/Conecuh County Area Chamber of Commerce
Fayette Area Chamber of Commerce
Fayette County Commission
Fayette County Water System
Flomaton Chamber of Commerce
Florence, Alabama – Parks and Recreation Department
Floyd County Commission
Floyd County Commissioners' Office
Floyd County Planning
Forsyth County
Forsyth County Board of Commissioners
Fort Deposit Chamber of Commerce

Fort Payne/DeKalb County Chamber of Commerce
Franklin Water Works
Frisco City Chamber of Commerce
Fulton County Office of Environmental Affairs
Fulton County Public Works Department
Gadsden Water Works and Sewer Board
Gadsden-Etowah Chamber of Commerce
Gainesville Water Department
Gardendale Chamber of Commerce
Geneva County Commission
Georgia Center for Law in the Public Interest
Georgia Chamber of Commerce
Georgia County Commissioners Association
Georgia Municipal Association
Gilmer County Commissioner
Gordon County Commissioners Office
Greater Hall Chamber of Commerce
Greater Leeds Area Chamber of Commerce
Greater Talladega Area Chamber of Commerce
Greater Valley Area Chamber of Commerce
Greenville Area Chamber of Commerce
Guntersville, Alabama – Parks and Recreation Department
Gwinnett County
Gwinnett County Planning and Development
Gwinnett County Water System
Haleyville Area Chamber of Commerce
Hall County
Hall County Commission
Hamilton Area Chamber of Commerce
Haralson County
Haralson County Water
Hartselle Chamber of Commerce
Haralson County Water
Headland Chamber of Commerce
Henry County Water and Sewage Authority
Homewood Chamber of Commerce
Hoover Chamber of Commerce
Houston County Commission
Houston County Port Authority
Hueytown Area Chamber of Commerce
Huguley Water System
Jackson Chamber of Commerce
Lake Guntersville Chamber of Commerce
Lawrence County Chamber of Commerce
Lee County Commission
Lowndes County Commission
Lumpkin County
Luverne/Crenshaw Chamber of Commerce
Macon County Commission
Macon County Water/FPA
Marengo County Commission
Marietta Water Authority
McDonough, Georgia – County Supervisor
MEAG Power (Municipal Electric Authority of Georgia)
Millport Area Chamber of Commerce
Mitchell County Commission
Mobile Area Chamber of Commerce
Mobile Area Water and Sewer System
Mobile City Planning Commission
Mobile County Commission
Mobile County Engineering Department
Mobile County Health Department
Mobile County Wildlife and Conservation Association
Mobile, Alabama – Inspection Services Department
Monroe County Commission
Monroe County, Probate Judge
Monroeville Area Chamber of Commerce
Montevalla Chamber of Commerce
Montgomery Area Chamber of Commerce
Montgomery County Commission
Montgomery Water Works and Sewer Board
Montgomery, Alabama – Parks and Recreation Department
Morrow, Georgia – Public Works Director
Municipal Electric Authority, Montgomery, Alabama
Murray County Commissioners Office
Oakdale Community
Oglethorpe Power Company
Opelika Chamber of Commerce
Opelika Water Works Board
Opp and Covington County Area Chamber of Commerce
Orange Beach Water System
Ozark Area Chamber of Commerce
Paulding County Commission
Pea River Electric Cooperative
Perry County Commission
Phenix City Chamber of Commerce
Phenix City, Alabama – City Engineer
Pike County Chamber of Commerce
Pike County Commission
Pine Hill Water System
Public Works, City of Powder Springs, Georgia
Randolph County Chamber of Commerce
Randolph County Commission
Reform Area Chamber of Commerce

Rome Chamber of Commerce
Rome, Georgia, City Commission
Rome/Floyd Parks and Recreation Department
Russell County Commission, Phenix City, Alabama
Scottsboro-Jackson County Chamber of Commerce
Selma Waterworks and Sewer Board
Shelby County Commission
Shoals Chamber of Commerce
South Baldwin Chamber of Commerce
South Shelby Chamber of Commerce
South Tallapoosa Water Authority
Southeast Power Resources Committee, Inc.
Southeastern Power Administration (SEPA)
Stewart County Commission
Sylacauga Chamber of Commerce
Talladega Water and Sewer
Tallapoosa County Board of Registrars
Tallapoosa County Commission
Thomasville Chamber of Commerce
Thompson Power System
Tillman's Corner Chamber of Commerce
Town of Dauphin Island
Tri Rivers
Trussville Area Chamber of Commerce
Tuscaloosa Park and Recreation Authority
Tuscaloosa, Alabama – Legal Department
Tuskegee Utilities Board
Vernon Chamber of Commerce
Villa Rica, Georgia – City Manager
Walnut Grove Water System
Walton County Board of Commissioners
Walton County Water and Sewerage Authority
Wetumpka Area Chamber of Commerce
Wilcox County Commission

10.4 Native American Tribes

Absentee-Shawnee Tribe of Oklahoma
Alabama-Coushatta Tribe of Texas
Alabama-Quassarte Tribal Town of the Creek Nation
Catawba Tribe of South Carolina
Cherokee Nation
Choctaw Nation of Oklahoma
Coushatta Tribe of Louisiana
Eastern Band of the Cherokee Nation
Eastern Shawnee Tribe of Oklahoma
Jena Band of Choctaw Indians
Kialegee Tribal Town of the Creek Nation of Oklahoma
Muscogee (Creek) Nation
Oneida Nation
Poarch Band of Creek Indians
Shawnee Tribe
The Chickasaw Nation
Thlopthlocco Tribal Town
United Keetoowah Band of Cherokee Indians in Oklahoma
United Southern and Eastern Tribes

10.5 State and Local Elected Officials

Alabama House of Representatives
Alabama Senate
Alabama State Governor
Alabama State House District 8
Alabama State House District 9
Alabama State House District 11
Alabama State House District 13
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Georgia House District 163
Georgia House District 164
Georgia House District 179
Georgia House of Representatives
Georgia Senate
Georgia State Governor
Mayor and Council, Chatsworth, Georgia
Mayor of Smyrna, Georgia
Mayor, Acworth, Georgia
Mayor, Alabaster, Alabama
Mayor, Albany, Georgia
Mayor, Alexander City, Alabama
Mayor, Alpharetta, Georgia
Mayor, Alto, Georgia
Mayor, Arabi, Georgia
Mayor, Arlington, Georgia
Mayor, Ashford, Alabama
Mayor, Ashland, Alabama
Mayor, Atlanta, Georgia
Mayor, Attalla, Alabama
Mayor, Attapulgus, Georgia
Mayor, Auburn, Georgia
Mayor, Austell, Georgia
Mayor, Avondale Estates, Georgia
Mayor, Baconton, Georgia
Mayor, Bainbridge, Georgia
Mayor, Baldwin, Georgia
Mayor, Barnesville, Georgia
Mayor, Berkeley Lake, Georgia
Mayor, Blakely, Georgia
Mayor, Bluffton, Georgia
Mayor, Boaz, Alabama
Mayor, Bowdon, Georgia
Mayor, Braselton, Georgia
Mayor, Bremen, Georgia
Mayor, Brent, Alabama
Mayor, Brinson, Georgia
Mayor, Bronwood, Georgia
Mayor, Brooks, Georgia
Mayor, Buena Vista, Georgia
Mayor, Butler, Georgia
Mayor, Byromville, Georgia
Mayor, Byron, Georgia
Mayor, Cairo, Georgia
Mayor, Calhoun, Georgia
Mayor, Camden, Alabama
Mayor, Centre, Alabama
Mayor, Centreville, Alabama
Mayor, Chamblee, Georgia
Mayor, Chatsworth, Georgia
Mayor, Childersburg, Alabama
Mayor, Clanton, Alabama
Mayor, Clarkesville, Georgia
Mayor, Clarkston, Georgia
Mayor, Climax, Georgia
Mayor, College Park, Georgia
Mayor, Columbus, Georgia
Mayor, Concord, Georgia
Mayor, Cornelia, Georgia
Mayor, Cowarts, Alabama
Mayor, Cuthbert, Georgia
Mayor, Dacula, Georgia
Mayor, Dadeville, Alabama
Mayor, Dallas, Georgia
Mayor, Damascus, Georgia
Mayor, Decatur, Georgia
Mayor, Demopolis, Alabama
Mayor, Demorest, Georgia
Mayor, Donalsonville, Georgia
Mayor, Doraville, Georgia
Mayor, East Ellijay, Georgia
Mayor, East Point, Georgia
Mayor, Edison, Georgia
Mayor, Ellaville, Georgia
Mayor, Eufaula, Alabama
Mayor, Fairburn, Georgia
Mayor, Fayetteville, Georgia
Mayor, Forest Park, Georgia
Mayor, Fort Deposit, Alabama
Mayor, Fort Gaines, Georgia
Mayor, Fort Payne, Alabama
Mayor, Fort Valley, Georgia
Mayor, Franklin, Georgia
Mayor, Gainesville, Georgia
Mayor, Gay, Georgia
Mayor, Georgetown, Georgia
Mayor, Georgiana, Alabama
Mayor, Glencoe, Alabama
Mayor, Goodwater, Alabama
Mayor, Grantville, Georgia
Mayor, Greenville, Alabama
Mayor, Greenville, Georgia
Mayor, Griffin, Georgia
Mayor, Hamilton, Georgia
Mayor, Hapeville, Georgia
Mayor, Headland, Alabama
Mayor, Heflin, Alabama
Mayor, Helena, Alabama
Mayor, Hiram, Georgia

Mayor, Hogansville, Georgia
Mayor, Hokes Bluff, Alabama
Mayor, Hurtsboro, Alabama
Mayor, Ideal, Georgia
Mayor, Iron City, Georgia
Mayor, Jackson, Alabama
Mayor, Jacksonville, Alabama
Mayor, Junction City, Georgia
Mayor, Lafayette, Alabama
Mayor, Lake City, Georgia
Mayor, Lanett, Alabama
Mayor, Leesburg, Georgia
Mayor, Lincoln, Alabama
Mayor, Linden, Alabama
Mayor, Lineville, Alabama
Mayor, Lithonia, Georgia
Mayor, Loganville, Georgia
Mayor, Lula, Georgia
Mayor, Lumpkin, Georgia
Mayor, Luthersville, Georgia
Mayor, Manchester, Georgia
Mayor, Marietta, Georgia
Mayor, Marion, Alabama
Mayor, Marshallville, Georgia
Mayor, Meansville, Georgia
Mayor, Milner, Georgia
Mayor, Monroeville, Alabama
Mayor, Montevallo, Alabama
Mayor, Montezuma, Georgia
Mayor, Moreland, Georgia
Mayor, Morgan, Georgia
Mayor, Morrow, Georgia
Mayor, Mount Airy, Georgia
Mayor, Newnan, Georgia
Mayor, Newton, Georgia
Mayor, Norcross, Georgia
Mayor, Notasulga, Alabama
Mayor, Oakwood, Georgia
Mayor, Oglethorpe, Georgia
Mayor, Ohatchee Alabama
Mayor, Opelika, Alabama
Mayor, Orange Beach, Alabama
Mayor, Orchard Hill, Georgia
Mayor, Oxford, Alabama
Mayor, Palmetto, Georgia
Mayor, Parrott, Georgia
Mayor, Peachtree City, Georgia
Mayor, Pelham, Alabama
Mayor, Pell City, Alabama
Mayor, Perry, Georgia
Mayor, Phenix City, Alabama
Mayor, Piedmont, Alabama
Mayor, Pine Mountain, Georgia
Mayor, Pinehurst, Georgia
Mayor, Plains, Georgia
Mayor, Poulan, Georgia
Mayor, Powder Springs, Georgia
Mayor, Prattville, Alabama
Mayor, Preston, Georgia
Mayor, Rainbow City, Alabama
Mayor, Rainsville, Alabama
Mayor, Reynolds, Georgia
Mayor, Richland, Georgia
Mayor, Riverdale, Georgia
Mayor, Roberta, Georgia
Mayor, Roopville, Georgia
Mayor, Sale City, Georgia
Mayor, Selma, Alabama
Mayor, Shellman, Georgia
Mayor, Shiloh, Georgia
Mayor, Smyrna, Georgia
Mayor, Southside, Alabama
Mayor, Spanish Fort, Alabama
Mayor, Stone Mountain, Georgia
Mayor, Sugar Hill, Georgia
Mayor, Suwanee, Georgia
Mayor, Sylacauga, Alabama
Mayor, Sylvester, Georgia
Mayor, Talbotton, Georgia
Mayor, Talladega, Alabama
Mayor, Tallassee, Alabama
Mayor, Temple, Georgia
Mayor, Thomaston, Georgia
Mayor, Thomasville, Alabama
Mayor, Town of Argo, Alabama
Mayor, Town of Ashville, Alabama
Mayor, Town of Autaugaville, Alabama
Mayor, Town of Avon, Alabama
Mayor, Town of Billingsley, Alabama
Mayor, Town of Blue Springs, Alabama
Mayor, Town of Butler, Alabama
Mayor, Town of Calera, Alabama
Mayor, Town of Camp Hill, Alabama
Mayor, Town of Clayton, Alabama
Mayor, Town of Clio, Alabama
Mayor, Town of Coffeeville, Alabama
Mayor, Town of Collinsville, Alabama
Mayor, Town of Columbiana, Alabama
Mayor, Town of Coosada, Alabama
Mayor, Town of Cottonwood, Alabama
Mayor, Town of County Line, Alabama
Mayor, Town of Cowarts, Alabama

Mayor, Town of Crossville, Alabama
Mayor, Town of Eclectic, Alabama
Mayor, Town of Edwardsville, Alabama
Mayor, Town of Excel, Alabama
Mayor, Town of Faunsdale, Alabama
Mayor, Town of Five Points, Alabama
Mayor, Town of Franklin, Alabama
Mayor, Town of Fulton, Alabama
Mayor, Town of Fyffe, Alabama
Mayor, Town of Gaylesville, Alabama
Mayor, Town of Geraldine, Alabama
Mayor, Town of Goldville, Alabama
Mayor, Town of Gordon, Alabama
Mayor, Town of Grove Hill, Alabama
Mayor, Town of Harpersville, Alabama
Mayor, Town of Hayneville, Alabama
Mayor, Town of Henagar, Alabama
Mayor, Town of Hobson City, Alabama
Mayor, Town of Ider, Alabama
Mayor, Town of Indian Springs, Alabama
Mayor, Town of Jackson's Gap, Alabama
Mayor, Town of Jemison, Alabama
Mayor, Town of Leesburg, Alabama
Mayor, Town of Loachapoka, Alabama
Mayor, Town of Louisville, Alabama
Mayor, Town of Madrid, Alabama
Mayor, Town of Maplesville, Alabama
Mayor, Town of Maplesville, Georgia
Mayor, Town of Margaret, Alabama
Mayor, Town of Mckenzie, Alabama
Mayor, Town of Mentone, Alabama
Mayor, Town of Midway, Alabama
Mayor, Town of Millbrook, Alabama
Mayor, Town of Millport, Alabama
Mayor, Town of Mosses, Alabama
Mayor, Town of Myrtlewood, Alabama
Mayor, Town of Newville, Alabama
Mayor, Town of Notasulga, Alabama
Mayor, Town of Oak Hill, Alabama
Mayor, Town of Odenville, Alabama
Mayor, Town of Ohatchee, Alabama
Mayor, Town of Orrville, Alabama
Mayor, Town of Pine Apple, Alabama
Mayor, Town of Pine Hill, Alabama
Mayor, Town of Pine Ridge, Alabama
Mayor, Town of Powell, Alabama
Mayor, Town of Providence, Alabama
Mayor, Town of Ragland, Alabama
Mayor, Town of Ranburne, Alabama
Mayor, Town of Reece City, Alabama
Mayor, Town of Riverside, Alabama
Mayor, Town of Rockford, Alabama
Mayor, Town of Sand Rock, Alabama
Mayor, Town of Sardis City, Alabama
Mayor, Shellville, Georgia
Mayor, Town of Shiloh, Alabama
Mayor, Town of Shorter, Alabama
Mayor, Town of South Vinemont, Alabama
Mayor, Town of Springville, Alabama
Mayor, Town of Steele, Alabama
Mayor, Town of Sumiton, Alabama
Mayor, Town of Sweet Water, Alabama
Mayor, Town of Talladega Springs, Alabama
Mayor, Town of Taylor, Alabama
Mayor, Town of Thomaston, Alabama
Mayor, Town of Thorsby, Alabama
Mayor, Town of Valley Head, Alabama
Mayor, Town of Vincent, Alabama
Mayor, Town of Vredenburgh, Alabama
Mayor, Town of Wadley, Alabama
Mayor, Town of Waldo, Alabama
Mayor, Town of Walnut Grove, Alabama
Mayor, Town of Weaver, Alabama
Mayor, Town of Webb, Alabama
Mayor, Town of Wedowee, Alabama
Mayor, Town of West Blocton, Alabama
Mayor, Town of White Hall, Alabama
Mayor, Town of Wilsonville, Alabama
Mayor, Town of Wilton, Alabama
Mayor, Town of Woodland, Alabama
Mayor, Town of Yellow Bluff, Alabama
Mayor, Tuskegee, Alabama
Mayor, Tyrone, Georgia
Mayor, Unadilla, Georgia
Mayor, Union City, Georgia
Mayor, Union Springs, Alabama
Mayor, Valley Head, Alabama
Mayor, Valley, Alabama
Mayor, Vienna, Georgia
Mayor, Villa Rica, Georgia
Mayor, Waverly Hall, Georgia
Mayor, Waverly, Alabama
Mayor, West Point, Georgia
Mayor, Wetumpka, Alabama
Mayor, Whigham, Georgia
Mayor, Williamson, Georgia
Mayor, Woodbury, Georgia
Mayor, Woodland, Georgia
Mayor, Woodstock, Georgia
Rockdale County Commissioner, Georgia
U.S. Congressman John Lewis, 5th District, Georgia

U.S. Congressman Robert Woodall, 7th District, Georgia
U.S. Congressman Robert Aderholt, 4th District, Alabama
U.S. Senator Jeff Sessions, Alabama
U.S. Senator Richard Shelby, Alabama
U.S. Senator Johnny Isakson, Georgia
U.S. Senator Saxby Chambliss, Georgia

10.6 Academic Institutions

Alabama Cooperative Extension Service
Alabama Southern Community College
Alabama State University
Andrew College
Athens State College
Auburn University
Auburn University Environmental Institution
Auburn University Field Office
Auburn University Marine Extension and Research Center
Ayers State Technical College
Bessemer State Technical College
Bevill State Community College
Bishop State Community College
Burriss Institute, Kennesaw State College
Calhoun Community College
Central Alabama Community College
Chattahoochee Valley Community College
Columbus College
Columbus State University
Drake State Technical College
Duran Junior High School
Emory University
Emory University – School of Law
Enterprise-Ozark Community College
Environmental Policy and Information Center
Faulkner State Junior College
Gadsden State Community College
Gainesville Junior College
Georgia Institute of Technology
Georgia Southwestern State University
Georgia State University
Gordon College
H. Councill Trenholm State Technical College
Huntingdon College
Jefferson County Schools
Jefferson Davis Community College
Jefferson State Community College
Lawson State Community College
Lurleen B. Wallace Junior College
Macarthur State Technical College
Miles College
Northeast Alabama Community College
Northwest-Shoals Community College
Oak Hill Community College
Patterson State Technical College
Reid State Technical College
Shelton State Community College
Shorter College
Snead State Community College
Southern College of Technology
Southern Polytechnic State University
Southern Union State Community College
Sparks State Technical College
Spellman College
Stillman College
Talladega College
Troy State University
Tuskegee University
University of Alabama
University of Georgia
University of Montevallo
University of South Alabama
University of West Alabama
Valdosta State University
Wallace State Community College
Wallace State Community College, Selma

10.7 Other Organizations

ABC 33/40 (Birmingham, AL News, Weather, Sports)
Acworth Lake Authority
Adams and Reese
Addsco Industries
Adopt-A-Stream
AESO Systems, Inc.
Agricultural Services of Alabama, Inc.
Alabama Baptist
Alabama Messenger
Alabama Paisano
Alabama Rivers Alliance
Alabama Association of Conservation Districts
Alabama Association of Water Conservation Districts
Alabama Bass Federation

Alabama Cattlemen's Association
Alabama Chemical Association
Alabama Coastal Foundation
Alabama Council of Farmers Co-ops
Alabama Crop Improvement Association, Inc.
Alabama Electric Cooperative, Inc.
Alabama Environmental Council
Alabama Farmers and Rural Appraiser
Alabama Farmers Cooperative, Inc.
Alabama Farmers Federation
Alabama Forest Resources Center
Alabama Forestry Association
Alabama Industrial Development Training
Alabama Journal
Alabama Kraft Company
Alabama League of Municipalities
Alabama Nurserymen's Association
Alabama Peanut Producers Association
Alabama Pork Producers Association
Alabama Poultry and Egg Association
Alabama Power Company
Alabama Power Foundation
Alabama Pulp and Paper Council
Alabama River Newsprint Company
Alabama River Pulp
Alabama Rivers Alliance
Alabama Sierra Club
Alabama State Rivers Alliance
Alabama Surface Mining Commission
Alabama Textile Manufacturers Association
Alabama Water and Sewer Institute, Inc.
Alabama Water Resources Commission
Alabama Water Watch
Alabama-Tombigbee Regional Commission
All South Machine and Supply Company, Inc.
Allatoona Bay S/O
Allatoona Bay Subdivision
Allatoona Boat and Ski Club
Allatoona Canoe and Sailing Club
Allatoona Community Association, Inc.
Allatoona Lake Association
Allatoona Youth Club
Alpha Phi Alpha
American Consulting Engineers
American Rivers
American Water Works Association
AmeriDream Realty
Amsouth Bank
Amsouth Bank of Dothan
Anniston Star
Arcadis-US
Around Town Acworth
ASCS
Ash Realty
Association of County Commissions
Atlanta Boat Club
Atlanta Business Chronicle
Atlanta Chinese News
Atlanta Daily News
Atlanta Daily World
Atlanta Intown
Atlanta Jewish Times
Atlanta Journal-Constitution
Atlanta Latino
Atlanta Marine Trade Association
Atlanta Metro Observer
Atlanta Regional Commission
Atlanta University Center Digest
Atlanta Voice
Atlanta Water Ski Club
Atmore News
AUC Digest
Audubon Society of Atlanta, Georgia
Audubon Society of Birmingham, Alabama
Audubon Society of Mobile Bay, Alabama
AYC
BASS, Inc.
Balch and Bingham
Baldwin County Now
Barry A. Vittor and Associates
Bassmaster Magazine
Bay Marine
Beat10 Action Group
Bender Shipbuilding and Repair
Betbeze Realty Company, Inc.
Better Backers, Inc.
Bill Harbert International Construction Inc.
Binswanger Southern
Birmingham News
Birmingham Weekly
Birmingham Audubon Society
Birmingham Business Journal
Birmingham Free Press
Birmingham Post Herald
Birmingham Regional Planning Commission
Birmingham Times
Birmingham World Newspaper
Black and White
Blount Countian
Boise Cascade Corporation
Bounds Family Branch YMCA
Bowden Oil Company

Boy Scouts of America, Rome, GA
Bradley Arant Boult Cummings LLP
BRATS (Baldwin Area Transportation System), Baldwin County, Alabama
Brown and Caldwell
Buford Trout Hatchery
Business Council of Alabama
Butler Street YMCA
C&H Enterprises
C. H. Guernsey and Company
C.C. Brown Family Center
Cahaba River Publishing, Inc.
Cahaba River Society
Cahaba River Steering Committee
Cal/Southern
Calhoun Times
Camp Dresser and McKee, Inc.
Campus Digest Tuskegee University
Car Paints, Inc.
CARIA (Coosa-Alabama River Improvement Association, Inc.)
Carters Project
Carver Hills Neighborhood Association, Inc.
Cashing Park
Catfish Producers of Alabama
Catholic Week
Cattlemen's Association, Alabama
Cattlewomen's Association, Alabama
CCRG
CDM
CELLO FOAM
Central Atlanta Progress, Inc.
CFROC
CH Guernsey
CH2M HILL
Charles Hulsey Consulting, Inc.
Chatom Community Center – Washington County, Alabama
Chattahoochee Chapter – Trout Unlimited
Chattahoochee Riverkeeper, Inc.
Chattahoochee-Flint RDC (Regional Development Center)
Chattanooga Courier Newspaper
Cherokee Tribune
Cherokee Coalition for Responsible Growth
Cherokee Ledger News
Childress Company, Inc.
Childress Towing
Chilton County News
Choctawhatchee-Pea-Yellow Rivers
Civil Engineering Consultants, Inc.
Clarke County Democrat
Clarke County Extension Office
Clay News
Cleveland Daily Banner
Cobb County Community Development
Contract Administration
Coosa Basin Water Group
Coosa River Basin Initiative
Coosa Valley Regional Development Center
Coosa-Alabama River Improvement Association
Courtney and Morris Appraisals
Creative Loafing
Crimson White
Crowe Shorter Associates, Inc.
CTSI Corporation
Cummings and White-Spunner, Inc.
Cushing Park
Dade County Sentinel
Dahlonega Nugget
Daily Home
Daily Report
Dallas County Extension Office
Dangler Real Estate Service
Dawson Community News
Dawson News and Advertiser
DDA
Dellinger Management Co., Inc.
Demopolis Times
Dempsey, Carson and Steed, P.C.
Denman's Cove Subdivision
Dixie Sailing Club
Dobbs Realty
Dollar Farm Products
Dothan Bassmasters
Dothan Eagle
Dowling Environmental Services
Dravo Basic Material Company, Inc.
Dravo Natural Resources
Drummond Coal Company
Drummond Coal Sales
Drummond Company, Inc.
DTA
Duffey Communications
Dunbarton Corporation
Dunywoody Crier
Dynamac Corporation
East Alabama Fish Farmers Association
East Alabama Regional Planning and Development Commission
East Alabama Water and Sewer and Fire Protection District

Eastern Shore Courier
Eastern Technologies, Inc.
Eclectic Observer
Elberta Lillian Ledger
Electric Systems Operations
Electrical Cost Cutters, Inc.
Emerald Property Owners Association
Emond and Vines Attorneys at Law
Emory Wheel
Englehard Corporation
Enquirer
Enterprise Marine Services, Inc.
Enterprise Water Works
ENTRIX
Environmental Coalition of Concerned Citizens
Environmental Licensing Engineers
Environmental Reporting
Ernest Construction Company
Espisopal Lodge
Etowah Yacht Club
Ezra Cunningham
F. W. Dodge Company
F&W Construction Company
Fairhope Courier
Farley Nuclear Plant
Farm Managers and Rural Appraisers
Farmers Fertilizer Company
Fidelity National Bank
First Alabama Bank
First National Banking Company
First United Methodist Church
Fisheries Information Management Systems
Flint River Mills, Inc.
Forsyth County News
Fort Payne Times-Journal
Fox WFXL-TV
Friends of Dauphin Island Audubon
Friends of Locust Fork
Futren Corporation
G.E. Sprenger and Associates, Inc.
Gadsden Time
Gallet and Associates, Inc.
Galts Cottage Subdivision
Galts Ferry Marina
Gemini Interests, Inc.
General Electric
General Electric Plastics
Georgia Adopt-A-Stream
Georgia Bulletin
Georgia Canoeing Association
Georgia Conservancy
Georgia for Children
Georgia Mountains Regional Development Center
Georgia Peanut Commission
Georgia Poultry Federation
Georgia Power Company
Georgians for Clean Water, Inc.
Georgia-Pacific
Geotechnical Eng-Test, Inc.
Girl Scouts of America, Atlanta, Georgia
Golden Stevedoring Company
Golder Associates, Inc.
Goodyear Tire and Rubber Company
Gordon County Sportsmen
GRACC
Great Southern Paper
Gulf Oil Company, US
Gulf Shores Islander
Gulf States Paper Corporation
Gulf States Steel
Gwinnett Homeowners Alliance
H & W Contracting
H. H. Jordan Construction Company
Hammermill Papers Group
Hand, Arendall, Bedsole, Greaves, Johnston
Hankneyville Water/FPA
Harding Lawson Association
Harrison Bros Dry Dock and Repair Yard
Henry County Alabama Farmers Federation
Heritage Riversway Commission
Hillhouse Lodge
Hillside Area Community Center
Hiwassee Land Company
Hofer Construction
Holland Diving Service
Hollinger's Island Community Association
Homeowners (PROWL)
Hughes Missile Electronics, Inc.
Ideal Basic Industries
Indian Village Subdivision
Inner City News
Institute of Community and Area Development
International Brotherhood of Electrical Workers
International Longshoreman's Association
International Paper Company
IUOE Local 653
J.B. Donaghey, Inc.
Jackson Burgin, Inc.
Jackson Sawmill Company
James River Corporation
John Hunsinger and Company

John Smith
Johns Creek Herald
Jordan Industries, Inc.
K Club
Kaleidoscope
Kimberly-Clarke Corporation
King and Spalding
Kingswood Shores
Kinpak, Inc.
Kleinschmidt Association
KPS Group
La Voz de Dalton
LAA
LaGrange Daily News
LAI Engineering
Lake Allatoona
Lake Allatoona Association
Lake Breeze Realty
Lake Lanier Advisory Council
Lake Lanier Association, Inc.
Lake Lanier Corporation, Inc.
Lake Lanier Homeowners Association
Lake Lanier Islands Authority
Lake Lanier Property Owners Association
Lake Lanier Regional Watershed Commission
Lake Martin
Lake Martin Area Association of Realtors
Lake Martin Dock Company
Lake Martin Home Owners and Boat Owners Association, Inc.
Lake Martin Realty
Lake Martin Resource Association
Lake Mitchell Home Owners and Boat Owners Association
Lake Point Marina
Lake Watch
Lake Watch of Lake Martin
Lakefront Property
Lakeland North Florida Chapter
Lakewood Heights Subdivision
Land and Water Magazine
Lanier Canoe and Kayak Club
Lanier Environmental Consultants
Lanier Property Owners' Association
Lan-Mar Marina, Inc.
LAPA (Lake Allatoona Preservation Authority)
Latino News
Law Environmental
Lazy Days Dry Storage – Buford
League of Women Voters
Leeds News
Lever Brothers Company
Lewis-Smith Corporation
Lightfoot, Franklin and White
Little River Grill
LMCPA
LMPA
Lockheed Aircraft Corporation
Logan Martin Lake
Logan Martin Lake Protection Association
Lowe Engineers
Lower Chattahoochee RDC
Lowndes County Extension Office
LPOA
M & N of Alabama
MacMillian Blodel, Inc.
Malcolm Pirnie, Inc.
Mannis Bait Company
Marietta Board of Lights and Water
Marine Environmental Sciences Consortium
Marine Manufacturers
Marine Trade Association
Marine Trade Association of Atlanta
Maritime Administration
Mcconnell Marine Service, Inc.
McGarity's
McIntosh Community Center
McKenna Longz Aldridge
Mcleod Real Estate
Mead Coated Board, Inc.
MeadWestvaco
Mechanical Enterprises
Metro Bank
Metro Business Forum
Meyer Real Estate
Middle Flint Regional Development Center
Middle Georgia Regional Development Commission
Middle Georgia Water Systems, Inc.
Midland Automotive Products
Miller Brewing Company
Miller Diver, Inc.
Minority Heath Professional Foundation
Minutemen Recreation Association
Mobile Register
Mobile Bay Business Journal
Mobile Bay Audubon Society
Mobile Bay National Estuary Program
Mobile Beacon
Mobile Land Development Corporation
Mobile Press Register
Mobile Regional Senior Community Center

Mobile-Chickasaw Port Facility
Monroe County Extension Office USDA Service Center
Monroe County YMCA
Monsanto Chemical Corporation
Montgomery Clean City Commission
Montgomery Marina, Inc.
Montgomery-Tuskegee Times
Montgomery Clean City Commission
Morgan Dredging and Piledriving, Inc
Morris Tractor Co.
Mullet Wrapper
Mundo Hispanico
Myra Smith Real Estate, Inc.
NPS CHAT
NAACP
NAACP Atlanta Chapter
NAACP Bibb County Chapter
NAACP Carroll County Chapter
NAACP Clarke County Chapter
NAACP Cobb County Chapter
NAACP Conecuh County Chapter
NAACP Dothan Wiregrass Chapter
NAACP Elmore County Chapter
NAACP Escambia County Chapter
NAACP Etowah County Chapter
NAACP Lee County Chapter
NAACP Marengo County Chapter
NAACP Metro County Chapter
NAACP Mobile County Chapter
NAACP Montgomery County Chapter
NAACP NW Jefferson County Chapter
NAACP Phoenix City Russell County Chapter
NAACP Rome Chapter
NAACP Selma/Dallas County Chapter
NAACP Talladega County Chapter
NAACP Tallapoosa County Chapter
NAACP Tuscaloosa County Chapter
NAACP Tuskegee-Macon County Chapter
NAACP West Metro Chapter
National Association of Retired Federal Employees
National Biological Survey
National Marine, Inc.
National Toxics Campaign
Natural Heritage Institute
NBC WXIA-TV 11Alive
Neely Henry Lake Association
Nevins and Associates, Inc.
New Mac, Inc.
Norfolk Southern Corporation
North American Water Mgt. Institute, Inc.
North Georgia News
North Georgia RDC (Regional Development Center)
Northport Gazette
Northside Neighbor
Northside Realty
Northwest Alabama C.L.G.
Northwest Georgia and Lookout Valley Baptist Associations
Northwest Georgia Bass Club
Norton Agency
Nuckolls Construction Co.
OBV, Inc.
Oanow
Offshore Construction Inc
Ogden Environmental
Oil Recovery Co., Inc., of Alabama
Oneill and Company
Over the Mountain Journal
Page and Jones, Inc.
Parker Towing Company
Parsons Engineering Science
Paulding County Sentinel
Paulding Neighbor
Peavy Farm Services
Pelican
Pell City Rotary Club
PH&J Architects
Pickens County Progress
Pickens Today
Pine Apple Community Center
Piney Woods
Pinson News
Planet Weekly
Polk County News
Porter, White and Company
Post
Prattville Progress
Precision Planning, Inc.
Prescott Bait Farm
President Fort Morgan
Protect Allatoona, LLC
Protect Cobb
Pumpkin Kollow Corporation
R. Nuckolls Construction Company
R. C. Fuller Engineers
Radcliff Marine Services, Inc.
Ramada Hotels Corporation
Ranger Directional, Inc.
Ray Comm W and FPA

Real Island Marina
Regional Development Center
Regions Bank
Rheem Manufacturing Company
Rigsby Investment Company
Riverkeeper
Robertsdale Independent
Robinson Iron-Chairman
Rochester and Associates, Inc.
Rock-Tenn
Rome News
Rome News Tribune
Rowe Realty Company, Inc.
Russell Corporation
Russell County Alabama Farmers Federation
Russell Lands, Inc.
Ryan-Walsh
Sain Associates
Sasser Safton PC
SAVE
Save the Lake Association
Save Weiss Lake
School Board
Scott Paper Company
Scroggins Farms
SE Federal Power Customers
Sea Grant Advisory Services
Seaman Timber Company
SEARP&DC
SEASC
Seminole Sportsman's Lodge and Marina
Serving Alabama Future Environment
Shaw Industries, Inc.
Sierra Club
Sierra Club Southeast Office
Sierra Club-Greater Gwinnett Group
Sirote and Permutt
Small Business
Soil and Water Conservation Committee
SONOPCO Project
SOS West Mobile Bay
South Alabamian
South Alabama Ducks Unlimited
South Alabama Regional Planning Commission
South Central Alabama Development Commission
Southeast Alabama Regional Planning and Development Commission
Southeast Farm Press
Southeast River Forecast Center
Southeastern Natural Resources
Southern Voice
Southern Company
Southern Company Services
Southern Environmental Law Center
Southern Natural Gas Company
Southern Nuclear Company
Southern Organizing committee for Economic and Social Justice
SREP (Southern Rainbow Education Project)
Southwest Georgia Regional Development Commission
Spanish Fort Sun
Spectrum Maritime, Inc.
St. Clair News Aegis
St. Clair Times
St. Luke's Episcopal Church
Star Fish and Oysters Company
Starboard Marina
State Farm Insurance
Stein Steel and Supply Co.
Steiner Shipyard
Stevedoring Services of America
Stewards of Family Farm
Stormy Petrel
Stovall Marine
Stratus Petroleum Corporation
Subdivision Lutherwood
Summerdale Community Center – Baldwin County
Sunday Paper
Suzuki Manufacturing of America
Sweet Valley/Cobb Town EJ Task Force
Swift Denim
Tai Environmental Sciences
Tallacoosa Highland Lakes
Taylor Corporation
TDP7L
TDPYC
TE Construction
Technical Marine Services
Tenn-Tom Towing
The Lagniappe
The Messenger
The Rockmart Journal
The Sentinel
The Anniston Star
The Atlanta Constitution
The Atlanta Inquirer
The Atlanta Tribune
The Atlanta Voice
The Atmore Advance

The Auburn Plainsman
The Auburn Villager
The AUC Digest
The Brewton Standard
The Bulletin
The Bulletin Board
The Call News
The Campus Digest
The Cedartown Standard
The Centreville Press
The Chanticleer
The Chattanooga Courier
The Chattanooga Minority Business Alliance
The Cherokee Herald
The Clanton Advertiser
The Clay-Times Journal
The Cleburne News
The Coalition for Environmental Consciousness
The Coosa River Basin Initiative
The Corner
The Country Store
The Daily Citizen
The Daily Tribune
The Daphne Bulletin
The Deep South Jewish Voice
The Democrat Reporter
The Dolphin Corporation
The Dothan Eagle
The Dothan Progress
The Enterprise
The Gadsden Times
The Gateway-Beacon
The Greenville Advocate
The Hickox County
The Islander
The Jacksonville News
The Luverne Journal
The Martin Firm Law Offices
The McMullin Group, Consultants
The Monroe Journal
The Montgomery Advertiser
The Monthly View
The Munford Weekly
The Nature Conservancy
The Nature Conservancy Georgia Chapter
The Nature Conservancy of Alabama
The New Times
The News Observer
The North Jefferson News
The Norton Agency
The Outlook
The Panther
The People News
The Peoples Voice
The People's Voice Weekly News
The Piedmont Journal
The Progressive Farmer
The Randolph Leader
The Samford Crimson
The Selma Times-Journal
The Shelby County Reporter
The Signal
The Stephen W. Wright Company
The Summerville News
The Technique
The Thomasville Times
The Times
The Trussville News
The Tuscaloosa Shopper
The Tuskegee News
The Union Sentinel
The Vanguard
The Washington County News
Thompson Engineering Testing
Thompsons Coverings
TIMES
Times Courier
Times Georgian
Tommy Mike Guide Service
Trout Unlimited
Tuscaloosa News
Two Daze Pleasure Club
Tyson Foods, Inc.
U.S. Alliance
Underwood Building Supply Company
Union Foundry Company
United Steelworkers
University of Alabama Center for Public Television
Upper Etowah River
Valley Times News
VCCI
Vinings Marine Group
Volkert and Associates
Volkert Environmental Group, Inc.
WABB
WABM (Channel 68)
WABW (Channel 14), PBS Georgia Public Broadcasting
WACS (Channel 25) PBS
WAGA Fox 5 Atlanta
WAGT (Channel 26) NBC

WAKA (Channel 8)
WALB (Channel 10), NBC
Walker County Messenger
WAPR
Warrior and Gulf Navigation
Warrior-Tombigbee Development Association
Waterways Towing and Offshore Service
WATL-TV
WATV Urban
WAWL 91.5 FM
WBAC 1340 AM
WBHJ
WBHK
WBHM
WBLX
WBMQ 630 AM
WBPT
WBRC (Channel 6)
WCLE 104.1 FM
WCLE 1570 AM
WCNN Dickey Broadcasting Company
WDEF (12), CBS
WDEF 92.3 FM
WDJC
WDUN Talk/News Radio
WDXX
Weekly Post
WEGL, Public Radio
Weideman and Singleton
Weiss Lake HOBO Group
Weiss Lake IMD
Weiss Lake Improvement
Welker and Associates, Inc.
WELR Eagle 102.3
West Alabama Planning and Development Council
West Georgia Regional W.A.
West Georgian
West Point Lake
West Point Lake Advisory Commission
West Point Lake Development
West Point Pepperell
West Point Stevens, Inc.
Westover Plantation
WestPoint Pepperell
Wetland Resources
WFXG (Channel 54)
WFXX
WGAC News Talk Radio
WGFS Caribbean
WGLC (Channel 46)
WGOW 1150 AM
WGST 640 AM
WGST Spanish Contemporary
WGTV (Channel 8) PBS Georgia Public Broadcasting
WGXA (Channel 24)
WHIL
White Excavating and Construction
WIAT Channel 42
Wiedeman and Singleton
Wilcox County Extension Office
Wiregrass Audubon Club
Wiregrass Fruit Growers Association
WJBF (Channel 6) ABC
WJCL (Channel 22)
WJOC 1490 AM
WJOX
WJSP (Channel 28) PBS
WJWZ and WBAM
WJXS
WKRG (Channel 5)
WKSJ
WLAG 1240 AM
WLBF
WLJR
WLJS
WLLJ 103.1 FM
WLTZ (Channel 38) NBC
WLWI, WMSP, WMXS
WMAZ (Channel 13) CBS
WMBV
WMBW 88.9 FM
WMGT (Channel 41) NBC
WMJJ
WMN
WMSR 1320 AM
WMXC
WNCB
WNCF (Channel 32)
WNEX 1400 AM
WNSP Sports
WOGT 107.9 FM
Woodstock View
WOOP 99.9 FM
World Wildlife Fund
WPGA (Channel 58) ABC
WPMI/WJTC (Channel 15)
WQEN
WRBC (3), NBC
WRBL (Channel 3) CBS
WRCG

WRDW (Channel 12) CBS
WREK GA Tech Student Radio
WRFG Radio Free Georgia
WRGA 1470 AM
WRST Point Lake
WSAV (Channel 3)
WSB (Channel 2), ABC
WSFA (Channel 12)
WSGM 104.7 FM
WSKZ 106.5 FM
WSMC 90.5 FM
WSST (Channel 55)
WTBC
WTBS (Channel 17) Independent Peachtree TV
WTJB Troy University Public Radio
WTOC (Channel 11) CBS
WTSU
WTTO (Channel 21)
WTVC (9), ABC
WTVM (Channel 9) ABC
WUHT
WUOG 90.5 FM
WUPA (Channel 69) CW
WUSY 100.7 FM
WUTC 88.1 FM
WVAS
WVSU
WVTM (Channel 13)
WVUA (Channel 7)
WWGC
WWIO Public Radio
WYXI 1390 AM
WZEW
WZRR
WZZK
YMCA of Selma ý Dallas County, Walker-Johnson Family Center
Youth Achievers USA
Youth Task Force
Youthusa.org
Zeneca Ag Products

10.8 Individuals

Acora, Ram
Adams, Ernest
Adams, Pat
Affolter, Jim
Alderman, Richard
Alford, Stephen
Allen Sr, James
Allen, A.
Allen, Barbara
Allen, Charles
Allen, Don
Alley, Glynn
Amason, Charles
Anastasia, James
Anderson, Charles
Anderson, Jerry
Anderson, Melvin D.
Anderson, Robert
Ankerson, Doug
Armstrong, Ken
Atkins, Charles
Atkins, Stanley B.
Atkinson, Scott
Augusfish, Andy
Austin, Randy
Avery, Martin
Avery, Ronnie
Bailey, Robert
Bain, Andrew
Bain, Kay
Baker, Bruce
Baker, Jerry
Baker, Steve
Baker, Robert
Baker, Roy
Banks, Harold
Barbaree, Tommy
Barke, Richard
Barnes, A.
Barrett, Lonice
Barry, J.
Bartlett, Charles
Baumhauer, C. A.
Beadle, Frank
Beauchamp, John
Beck, Michael
Becton, Wendell
Beisser, Gary
Bell, Bobby
Bell, Neil
Bennett, Tommie
Berry, Bill
Bickford, Roger
Blankenship, Kim
Bloch, John
Bolton Jr., H. E.
Bomar, Robert
Boner, Rex
Booker, Betty
Bowman, Pam
Boyston, Peggy
Bradley, Dorothy C.
Braswell, Vance
Brazones, Richard
Breault, Doug
Bricker, Vicky
Bridges, E.
Briggs, M.
Broadwell, Tom
Brown, Atkins
Brown, Bob
Brown, Charlie
Brown, Clarence
Brown, James
Brown, Jerome
Brown, Merdith B.
Brown, Milton
Brown, William
Brumbacle, Kate
Bruswell, Floyd
Bruton, Angi

Bryans, Charles
Bullock, Louise
Bunzli, Nancy
Burch, Madge
Burnett, Tom
Burns, Bill
Burns, O.
Burrell, Alvin
Bush, Jesse
Bush, Jr., Veston
Bush, Malcolm
Butler, James
Butts, James
Cagle Jr., W. M.
Cain, F.
Calderwood, Gene
Calhoun, John
Calhoun, Sam
Callaway, Ira R.
Callaway, Ronald F.
Campbell, Jack W.
Campbell, Robert
Campbell, S.
Cane Jr., P. Grey
Cape, J.
Carlisle, Anthony and Renee
Carmichael, Abb
Carr, Carolyn
Carr, Roger
Carrier, Jim
Cauthen, Stephen
Chameau, Jean-Lou
Chandler, Barry
Channell, Susan
Chastain, Delmar F.
Chastain, Lucius B.
Check, David
Cherney, Paige
Chrisenberry, Debbie
Chunn, James
Cider, W.
Clark, Sara
Clark, Tom
Clayton, J.
Clement, Richard
Clements, Bill
Cleveland, John
Clifton, C.
Cobb, William
Cochran, Jr., I.
Cochran, Ken
Cochran, M.
Coffey, Jack
Coggins, Raba
Coleman, James
Coleman, Tommy
Coley, Don
Collins, Phyllis
Coltman, Barnet and Ellen
Colvin, Rosemary
Conley, Roy
Conner, M.
Cook Jr., Walter M.
Cook, Joe
Cook, W.
Cooley, Don
Cooley, Kathy
Cooper Jr., James
Coskrey, Jim
Cosper, H.
Couper, Jack
Covington, Hank
Cox, Richard
Cox, Teresa
Coyle, Bruce
Craig, James
Crane, Jack
Crawley, Miriam
Crittenden, Jr., A.
Crockett, Nikki and Jeanie
Cropp, H.V.
Crowder, Jack
Crutcher, C. C.
Cummings, Antoinette
Cummings, L.
Cummings, Marl
Cummings, Susan
Cummins, John
Currie, Les
Curry, Danny
Curtis, Wayne C.
Cushing, Dr. Fred
Cutcliff, Chip
Daniel, Betty
Danphell, Jack
Dark, John
Darlow, Sr., Warren
Dasher, Troy
Daughtry, J.
Dauphin, Alex
Davenport, T.V.
Davis, Jim
Davis, Rick
Deal, Billy
Deal, Connie
Dean, Byron
Dean, Jimmy
Dean, Reggie
Dean, Robert
Debolt, Bruce
Deese, Wayne
Delbrey, Margarita
Diehl, Kenneth
Diprima, Paul
Doak, Perry
Dodson, Hubert
Dollar, Mason
Donofro, Joseph
Doody, J.
Doss, Jamie
Dossett, John
Douglass, Kathryn
Downing, Jean
Dozier, Richard T.
Drake, Jr., John
Draper, Stephen
Draught, Mary Ann
Drew, Jack
Dubac, Carole
Duchon, Kip
Duncan, Boyd
Duncan, Horrie
Dunlap, David R.
Dunn, Joe
Durniak, Jeff
Dyess, Danny
Eadie, John
Earnest, O.
Edmondson, W.
Edwards, Helen
Eichelberger, Vivian
Eisenhauer, Bill
Elbrecht, George K.
Elder, T.
Eley, John
Ellars, Joan
Ellis, Mary Ann
Ellis, Tom
Elton, Patricia
Engel, Lanetie
Engel, William
Epperson III, E.
Everett, Jerold

Everett, Pamela
Fagan, Ralph
Fain, Joe
Farmer, Jr., James
Farrington, Suzy
Fellows, Fred
Fessenden, Price
Fiegle II, Francis
Fillingim, Lagina
Finch, Bill
Fisher, Felix
Fobas, Daniel
Folger, Gray
Folts, Allen
Forrester, Ernest
Fortson, Buford
Foster, Judy
Fowler, Sam
Franklin, Paul
Frasier, Llyod
Freda, Joe
Freeman, Mrs. Cook
Freeman, Judson
Freeman, Virginia
French, James
Frost, William
Frye, Robert
Gadilhe, Phillip
Gage, Ann
Gaillard, T. O.
Gaines, Jack
Galer, Robert
Gamble, Mary
Gardiner, R. M.
Garner, Elmor Lee
Garrett, Fred
Garrett, James
Garrett, John A.
Garris, Elizabeth
Gay, Dallas
George, David
Gessendanner, Joe
Gibson, Anne
Gilbet, Billy
Gilham-Allen, Wendy
Giordano, John
Glasier, John
Glover, Reginald
Godwin, Ronald
Golden, B.
Gonzalez, R.
Gossett, W.
Graddy, Lillian
Graham, James
Gravenhurst, Elizbeth
Gray, Bruce
Green, Frank
Green, L.
Green, Martha
Green, Milford
Green, Rufus
Greene, Wallace
Greer, Greg
Griffin, Jerry
Griffin, Robert
Griffin, W.
Griffin, Will
Griggs, James
Grimsley, Charley
Grisby, Curtis
Groover, R.
Groszmann, Glynn
Grubbs, Nola
Guill, Daniel
Gunter, John
Gushuc, Charles
Guynes, Jo
Haber, Greg
Hall, Barry
Hall, Charles
Hall, Lavaughn
Hall, Sr., Jack
Hall, Wayne
Hallinah, Jean and Jim
Hamilton, Archer
Hamlin, Joanne
Hammond, George
Hanahan, Jr., Labruce
Hancock, Jim
Hanna, Kathy
Hanson, Emmette
Harber, Greg
Hardin, Taylor
Hardwick, Robin
Harness, Ron
Harowich, Jr., Robert
Harper, Bonnie
Harrell, Sidney
Harrington, Gene
Harrington, James
Harrington, Jr., James
Harris, Mike
Harris, Richard E.
Harron, Jack
Harwell, Jerry
Hasselevander, Mary
Hatcher, Alfornia
Hawkins, Andy
Haylwood, Daryl
Haynes, J.
Hays, William
Hayward, Bob
Hedden, Allan
Hegyan, Gildana
Hegyan, Melanie
Held, Steve
Hendricks, J.
Hendrix, David
Henry, Carolyn
Herndon, Arthur
Herndon, R.
Hester, Arthur
Hewes, Bobby
Hicks, John
Hiers, Mary
Highley, Ruth
Hill, Forest
Hill, Luther
Hill, Randy
Hill, Wayne
Hillis, Mark
Hines, Carol
Hines, Pamela
Hites, Mary
Hodges, Carlos
Hoekenga, Steven
Holbrook White, Sheila
Holland, Henry
Holland, Naomi
Hollandworth, Barbara
Hollis, Dannie
Hollomon, Charlie
Hollums, Mark
Holmes, Jimmy
Holmes, Robert
Holmes, Thaddeus
Holt, Fred
Hong, David
Hooks, David
Hopf, Marvin
Hopkins, Evelyn
Horn, Charles
Hornsby, Phillip

Houston, Billy
Howard, H.
Howard, John
Howerin, David
Hudgens, Harold
Hudson, Clyde
Hufham, Jr., H.
Hughes, E.
Hunt, Ronnie
Hutchings, Thomas H.
Hutchison, Kenneth
Hutto, James
Ibeanusi, Victor
Ilgenfritz, Wolt
Ingram, Harry
Inlow, Marsha
Innis, Dr. Larry
Janssen Jr., Gerald R.
Jeffers, Charles
Jeffers, William
Johnson, David
Johnson, Evert
Johnson, Freddie
Johnson, Judge Walker
Johnson, Lynn
Johnson, Gwen
Johnson, Robert
Johnston, Gilbert
Johnston, Jenny
Jones, H.
Jones, Jimmy
Jones, Mikell
Jones, Myrt
Jones, Perry
Jones, Verna
Jordan, Frank
Joseph, William
Julian, William
Kahaner, Larry
Kahn, Bernd
Karr, James
Karvelas, Leah K.
Keene, Pamela
Keenum, Billie
Keitges, Robert
Kelley, Charles
Kelley, Larry
Kelly, Tom
Kelly, Walter
Kelman, Edith
Kelsey, Frank
Kennedy, Bobby
Kennedy, Martha
Kennedy, R.
Kensey, Robert
Ketcham, Clark
Killebrew, James
Killimett, Pat and Julia
Kimling, Eugene
King, Lynn
Kinney, Larry
Kirk, Ann
Kirkland, Kay
Klass, L.
Knepp, Loren
Knight, Bill
Knight, Charles
Knighton, Ted
Kohen, Robert
Kornewald, Dick
Koscia, Walter
Kown, Shannon
Kulstad, James
Kupferer, Dawn
Lackey, Lynn
Ladd, Russell
Laird, Richard J.
Lambert, Jimmy
Land, Clay
Land, William
Landrum, Louise
Lane, Michael A.
Langwell, James
Lanier, Charles
Larson, Jeff
Leach, Gary
Ledbetter, Scott
Lee, Milt
Legate, Eurie
Lehner, Eleanor
Lester, Jim
Lester, John
Lester, Lee
Lett, Samuel
Lewandowski, Edward
Lewis, Herbert
Lewis, Linwood
Liles III, Duncan
Lincoln, Jack
Lingo, Billy
Lisenby, Forrest
Locke, Morris
Loper, Nora
Lowe, Glenda
Ludi, Gary
Luka, Earl
Lynn, Katheyn
Lynn, Terri
Lyons, G. Sage
Macindoe, James
Maher, Joseph L.
Mallory, Jack C.
Mamend, Frances
Manasco, William
Mann, Henry
Marks, Al
Marks, Thomas
Marriott, Amber
Martens, Lawrence
Martin, Ben
Martin, John
Martin, Larry
Martin, Merlin
Martin, Michael
Martin, Rodney
Martin, William
Maske, Winfred
Mather, John
Maxwell, Ken
Maye, Pete
Mayes, Joseph
Mcalister, Robert E.
Mcardle, James
Mcclure, E.
Mcclure, Lloyd
Mcclure, N.D.
Mcclure, Pam
Mcconnell, Gary
Mccorvey, Sandy
Mccue- Jackson, Jean
Mcdonald, Sarah
Mcelroy, W.
Mcgee, Dianne
Mcgibboney, Charles
Mcgowan, Jennifer
Mcgowan, Jerry
Mckensie, Ken
McKenzie, Tom
McKinley, Jim
Mckinney, Vera
Mckinnon, Craig K.
Mcknight, Mickey
Mcnab, Fred

Mcneal, Mary
Mcneil, W. C.
Mcswean, R.
Mcvicar, Ashley
Mcwhirter, Christopher
Meeks, Betty
Meier, Danna
Meinert III, Richard
Melcher, Margaret
Melech, Peter
Menendez, Jack
Menton, Karen
Merritt, Edna
Merritt, Tim
Meshejian, Mark
Meyers, Jim
Middlebroo, Tex
Milam, Genie
Milam, Wade
Miller, Martha
Miller, W.
Millians, James
Mills, Tom
Milner, Douglas
Mims, George
Mims, Ron
Mock, James
Molloy, Elizabeth
Moncriet, Chester
Montbach, Robert
Montgomery, Freeman
Moody, Charles
Moon, Nancy
Moore, Eddie
Moore, Gus
Moore, Ralph
Moore, Robert
Morgan, Ronnie
Morin, James
Moring, Stuart
Morris, Charles
Morris, James and Betty
Morris, Jo Ann
Morris, Lydell
Morris, W.
Morrisroe, Neil
Mortonson, Ray
Mosher, Dean
Mosley, H.
Moss, Jerry
Mueller, Paul
Murphy, Mike
Nagle, Paul
Nail, Merrill
Nash, Alvin
Nelson, David
Neuhauser, Hans
New, Ward
Newman, Dan
Newman, Michelle
Nichols, Offa
Nichols, Sarah
Noles, Judy
Norman, Jerry
Norman, Robert
North, Ron
Norton, Jr., Frank
Nosakhere, Akilah
O'Keefe, John
Oakley, Deborah
Odom, Kathy
Odum, Kathy
Ogren, Helen
Okime, Amba
Olds, Donald H
Oliver Mike A.
Olson, Eric
Oropeza, Mark
Osingd, Mel
Overton, Lee
Owen, Ben
Owen, James
Owen, Janis
Owens, Jimmy
Page, Mimi
Palde, Uldis
Parham, Ben
Parker, Fred
Parker, Jim
Parker, Steve
Parks, J. Boyd
Partridge, Thad
Passey, George
Patrick, Clyde
Patrick, Gary E.
Patterson, Jim
Patton, Robert
Paul, Robert and Verna
Pauley, Alta
Paulk, J.
Peace, Christena
Peacock, Tommy
Peak, Dan
Peel, Sam
Penberton, Grady
Pender, Joseph
Penn, John
Pepper, Brenda
Phillips, James
Phillips, Tommy
Pierce, Scott B.
Pietrzykowski, Virginia
Pilcher, Dwan
Pindar, Georgine
Pitts, Ronald
Poellnitz, Robert W.
Pointevint, II, Alec
Pool, Leland
Posey, Melissa
Potts, Harry
Pound, R.
Powe Jr., Frank
Powell, Andy
Powell, Billy
Powell, Dr. William E.
Powell, Holland
Poynter, Randy
Prescott-Lowry, Bonnie
Prince, Teddy
Proctor, Bain
Proctor, Edward
Provence, Dan
Provence, John
Pullen, George
Pykes, Cecil
Quin, Hillrie
Raboli, Chuck
Radney, Larkin
Radney, Tom
Ragsdale, Jennifer
Ragsdale, Steve
Rainwater, Archie
Rainwater, Lem
Randall, Kelly
Rankin, Jr., David
Ransom, Griff
Rawson, Bill and Martha
Ray, B.
Ray, Kathy
Reed, Ph.D., Morton
Reeves, Billy
Reid Jr., Robert R.
Reidmiller, David

Reynolds, Vernon
Rice, John
Richardson
Richards, George
Ritchie, David
Roberts, Frank
Roberts, G.
Roberts, William
Robinson, Peter
Rockwell, Tommy
Rogers, Lewis
Rogers, Mark
Rollins, Sheri
Royal, Tim
Rudd, A.
Rumsey, Joel
Ryan, D.
Sackor, James
Salamone, Pete
Salhany, Wayne
Salter, Betty
Sanders, Donald
Santiago, Richard
Sappington, Michael
Saunders, Grace
Scharlau, Laurie
Schwimmer, David
Scott, D.
Scott, Monica
Scruggs, Barbara
Seabrook, Charles
Seville, Dean
Sewell, Billy
Sewell, Charles
Shaddix, Walter
Shakleford, Wayne
Shaneay, Robin
Sharman, Michael
Shaw, Wyndol
Shealy, Jr., Bill
Shealy, Sr., W.
Shell, Coy
Sherman, Richard
Sherrill, Frank
Shiflet, Steve
Shirley, David
Shirley, Jill
Shirley, L.
Simmions, Jr., Walter
Simmons, Ed
Simpson, Earl
Simpson, Tim
Singh, Shiva
Singuefield, Charles
Sisk, Len
Slay, Leonette
Small Morgan, Barbara
Small, Robert
Smalley, Jerrel
Smith, Charles
Smith, Gerald
Smith, Howard E.
Smith, Joseph
Smith, Larry
Smith, Lofton
Smith, Roberta
Smithson, Philip
Snell, David
Snell, Denvard
Sparks, Amos
Spivey, Chris
Spivey, H.
Spraitzar, Curtis
Springer, E.
Stabler, Clay
Stallings, Brian
Stancil, Guy
Stanford, John and Dorothy
Stanley, E.
Stanley, J. B.
Stanton, Lee
Steadman, Vivian
Steed, A.
Steele, Vicki
Steinbruegge, Robert
Steinliper, Frank
Steinmetz, John
Steinmetz, Patti
Stendahl, Teresa
Stephenson, J.O.
Steusloff, Tom
Stevens, Greg
Stewart, Darryl
Stewart, Herman
Stewart, James
Stewart, John
Stiffler, L. E.
Still, Horace
Stoker, Steve
Stone, Dell
Stoops, Ernest
Story, Troy
Stow, Frances
Straum, Tom
Strickland, Keith
Strother, Ken
Stuardi, A. E.
Stuardi, Fred
Stuart, Betty
Sullivan, Michael
Sutton, Mary J.
Swancy, James
Tabb, Michael
Tallon, Wes
Tanner, David
Tate, Ann
Tatum, Diane
Taylor, Charles
Taylor, Mike
Taylor, Rhett
Taylor, Sandra
Teter, Paul
Thomas, Chuck
Thomas, Glenn
Thompson, Arthur
Thompson, Ben
Thompson, Charles
Thompson, Kenneth
Thompson, O.
Thompson, Paul C.
Thornton, R.
Tiffany, John
Tillery, Louie
Tillis, Sr., Lowell
Timm, D.
Timpone, Andrea
Tipton, Betty
Tolleson, Robert
Tomlin, James
Tondera, Bonnie
Tonsmeire, Skipper
Townes, Albert
Trammell, Paul
Trippe, Charles
Trotter, Richard
Tullos, Clyde
Tumlin, Dave
Turgeon, Michael
Turner, Jr., Leroy
Turner, David
Turner, Myron
Tuttle, W.
Vann, John

Vaughan, Ron
Veenstra, Linda
Vickery, Robert
Vincunas, Marge
Vittor, Dr. Barry
Voellinger, Joy
Voellinger, Otto
Von Heister, A.H.
Vrachalus, Sam
Waggoner, M.
Walden, Martin
Waldon, Don
Waldrup, Nancy
Wolf, Tom
Walker, Charlie
Walker, Cynthia
Walker, W.
Wallace, W.
Walthall, T.
Ward, Edward
Ward, Virginia
Washington, Betty
Watford, Gene
Watford, Ruby
Watkins, Fredra
Watkins, Miller
Watson, Charles
Watson, Gerald
Watson, John
Watts, Gregory
Watts, Mac
Wayman, May
Weathersby, Arnold
Weaver, Mary
Webb, Jerry
Webb, Perry
Webster, Martha
Weerts, Burt
Weese, Wayne
Weidler, Mary
Weinstein, Ruth
Welch, Charles
Welch, Stine (Bo)
Wells, Dave
Wells, Harold
West, Frances
Westmoreland, David
Weston-Smart, Gloria
Wetstone, David
Weyman, Jere
Whatler, Bill
Whatley, Dick
Wherry, R.
White, David
White, Don
White, Joel
White, Kenneth
Whitmire, Douglas
Wickman, Diane Lynn
Wigington, John
Wilde, Peter
Williams, Beth
Williams, Carolyn
Williams, Earnest
Williams, Elizabeth S.
Williams, Freddie
Williams, J.
Williams, James
Williams, Jo
Williams, Jr., Larry
Williams, Larry
Williams, Roger
Willis, Francis S.
Willis, Steve
Willman, Darren
Wilson, Henry
Wilson, R.
Winchell, Douglas
Winchell, Edna
Windom, Steve
Wingate, Jack
Woodall, Dennis
Workman, Dr. William E.
Yancey, James
Yarbrough, Bob
Yates, Nelle
Yongue, Edie

10.9 Libraries

Adamsville Public Library
Adelia M. Russell Library
Alabama Public Library Service
Anniston Libraries – Main Library
Anniston-Calhoun County Public Library
Ashland City Public Library
Athens Regional Library
Atlanta-Fulton Public Library
Atmore Public Library
Attalla-Etowah County Public Library
Auburn Public Library
Auburn University Libraries
Autauga-Prattville Public Library
Baldwin County Library Cooperative
Bartow County Library
Bay Minette Public Library
Bessemer Public Library
Birmingham Central Library
Birmingham Public Library
Blountsville Public Library
Brantley Public Library
Brent-Centreville Public Library
Brewton Public Library
Calhoun-Gordon County Library
Carnegie Library
Chambers County Library
Chatsworth-Murry County Library
Cheaha Regional Library
Cherokee County Public Library
Chilton-Clanton Public Library
Citronelle Memorial Library
Crossville Public Library
Dalton Regional Library
Daphne Public Library
DeKalb County Public Library
Demopolis Public Library
Dougherty County Public Library
Douglas County Public Library

East Hall Branch Library
Emmet O'Neal Public Library
Escambia County Cooperative Library
Eunice Kelly Worthington Public Library
Evergreen Public Library
Fairhope Public Library
Flomaton Public Library
Foley Public Library
Forsyth County Public Library
Fort Deposit Public Library
Fultondale Public Library
FultonVestavia Hills Public Library
Gadsden Public Library
Gadsden-Etowah County Public Library
Gainesville College Library
Gardendale-Martha Moore Public Library
Georgia State University Library
Geraldine Public Library
Graysville Public Library
Greenville-Butler County Public Library
Griffin Spalding County Library
Grove Hill Public Library
H. Grady Bradshaw-Chambers County Library
Hayneville/Lowndes County Public Library
Homewood Public Library
Hoover Public Library
Houston Love Memorial Library
Hueytown Public Library
Ider Public Library
Ina Pullen Smallwood Memorial Library
Irondale Public Library
Jacksonville Public Library
Jacksonville State University Library
Jefferson County Library Cooperative
Kennesaw State University Library
Lagrange Memorial Library
Leeds Jane Culbreth Library
Lewis Cooper Jr. Memorial Library
Lineville Public Library
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Lucile L. Morgan Public Library
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Macon County-Tuskegee Public Library
Macon/Bibb Public Library
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Marengo County Public Library
Marjorie Younce Snook Public Library
Midfield Public Library
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Mount Vernon Public Library
Newnan-Coweta Public Library
North Columbus Branch Library
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Oneonta Public Library
Orange Beach Public Library
Oxford Public Library
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Piedmont Public Library
Pleasant Grove Public Library
Price-Gilbert Memorial Library
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Rainbow City Public Library
Rainsville Public Library
Rainwater Memorial Library
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Rome-Floyd County Library
Rufus Floyd Public Library
Sardis City Public Library
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Selma Public Library
Selma-Dallas County Public Library
Southside Public Library
Southwest Georgia Regional Library
St. Clair County Library
State University of West Georgia Library
Tarrant Public Library
Thomas B. Norton Public Library
Thomasville Cultural Center Library
Thomasville Public Library
Trussville Public Library
Union Springs Public Library
University of Alabama at Birmingham Library
University of Georgia Libraries
University of Southern Alabama Library
Walter J. Hanna Memorial Library
West Blocton Public Library
Westside Public Library
Wetumpka Public Library
White Hall Public Library
White Smith Memorial Library

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11 Glossary

Number/Symbol

7Q10 flow. The lowest 7-day average flow that occurs on average once every 10 years at a flow-measuring station or gage.

A

Action zones. Partitions of a reservoir's conservation storage, as defined in the reservoir water control manual and designated according to a range of surface elevations of the water pool for a reservoir; action zones are used to guide reservoir managers in meeting project purposes under a wide variety of hydrologic conditions. Each action zone has a set of specific operational rules or guidelines that govern water management operations for the reservoir when the pool elevation is within that zone.

Allocation formula. See *water allocation formula.*

Anadromous fish. Fish with a migratory life cycle in which they live most of adult life in ocean water but breed in freshwater, with individual adults often returning from the sea to the rivers where they were spawned.

Assimilative capacity. The amount of pollutants that a waterbody can accommodate without violating a water quality standard or impairing the designated use.

Authorized project purpose. The legally mandated purpose for which the USACE must manage each ACT project.

Available precipitation. The net available moisture in a system resulting from the balance between total precipitation (input) and potential evapotranspiration (loss). Also see *evapotranspiration*.

B

Bankfull Capacity (or channel capacity). The discharge, or stage, at which a stream or river is at the top of its banks such that any further increase or rise would result in water moving into the flood plain.

Baseflow. The portion of streamflow from groundwater; not attributed to overland runoff.

Brackish. Describes water at the interface of freshwater and saltwater where river discharge is diluting salinity concentrations and average water salinity is between that of seawater (about 35 parts per thousand) and freshwater (upper threshold of about 0.5 parts per thousand).

C

Canopy. Tallest vegetation in a community, usually trees more than 30 feet tall or 3 inches in diameter; the tallest grasses or other herbaceous species.

Catadromous fish. Fish with a migratory life cycle in which they live most of adult life in freshwater but breed in the ocean.

Channel forming discharge. High river flows, with recurrence intervals of about 1.5 years, which are dominant in shaping the river channel.

Compact. See *River basin compact.*

Composite storage (or composite system storage). A designation in the APC draft *Alabama Drought Operations Plan* developed by Alabama and the Alabama Power Company (APC) that is defined as the combined amounts (sum) of conservation (active) storage in five APC reservoirs (Weiss, HN Henry, Logan Martin, Harris, and Martin) available at a given point in time resulting from each reservoir's current elevation (see Section 4.2.2.5).

Comprehensive Study. A consensus-based study in the 1990s to determine the capabilities of the water resources of the basin, describe the water resource demands of the basin, and evaluate alternatives that would use the water resources to benefit all user groups in the basin. The study was commissioned in the 1992 tri-state (Alabama, Florida, Georgia) Memorandum of Agreement. It collected much valuable data but was never completed.

Confluence. The point of juncture of two or more streams.

Conservation pool. The portion of reservoir storage usually reserved for serving project purposes other than flood risk management, such as hydropower production, water supply, and recreation.

Conservation storage. The volume of reservoir storage available to meet authorized project purposes other than flood risk management (e.g., hydropower, water supply, recreation, etc.); equivalent to the storage volume between the top of the inactive pool and the top of the conservation pool.

Consumptive use (or consumptive water use). The portion of water withdrawn from a waterbody for beneficial use that is evaporated, transpired (see *transpiration*), incorporated into products or crops, consumed by humans or livestock, or otherwise removed from the environment.

Critical drought. The most severe drought for a region, either recorded or constructed.

Critical period. The time during which the critical drought occurs. Usually the time starts as the drought begins and reservoirs are full. The time ends after the reservoirs have been returned to full condition.

Critical yield. The maximum amount of water that can be consistently removed from a reservoir(s) through releases from the dam and/or withdrawals from the reservoir, during the most severe drought in the hydrologic period of record, exactly depleting the reservoir conservation storage once during the period of record.

D

Delta. An increment of a variable; measure of change in a variable.

Designated use. A use that is established by state or tribal regulation as appropriate for individual waterbodies (rivers, streams, lakes, and such) under their jurisdiction and that is to be achieved or protected under water quality standards; regulatory designated uses include public water supply; aquatic life protection (protection of macroinvertebrates, fish, shellfish, and wildlife); and recreational (fishing and swimming); agricultural; industrial; and navigational purposes.

Detrital carbon. Fresh to partly decomposed plant and animal matter.

Draft Environmental Impact Statement (EIS). The publication that documents the environmental conditions, issues, and effects associated with an action affecting the environment and on which the public is invited to review and comment. Comments received from regulatory agencies, organizations, and individuals are addressed in the final EIS (see *final EIS*).

Drainage area. All the surface area, including land and any waterbodies, from which water upstream of a location on a stream, river, or waterbody drains to that location.

Drainage basin. The region or area drained by a river and all its tributaries, where water from rain and melting snow or ice drains downhill to that river.

Drawdown. The act of lowering a reservoir's water level by beginning or increasing reservoir releases.

E

Ecoregion. An *ecological region*; a geographic area of broadly similar physiographic and environmental conditions (e.g., landforms, climate, and soil conditions) such that it supports broadly similar terrestrial and aquatic plant and animal communities.

Emergent. Describes aquatic plants that are mostly above water or entirely above water with only the base remaining submerged.

Endemic. Characteristic of, or prevalent in, an area or environment.

Estuarine (noun: *estuary*): Describes deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land.

Euryhaline: Describes an aquatic organism that is able to tolerate wide fluctuations in salinity (contrast *stenohaline*).

Eutrophic (noun: *eutrophication)*. Describes a body of water—commonly a nonflowing body such as a lake, pond, or reservoir—that has high primary productivity resulting from excessive nutrients and can be subject to algal blooms resulting in poor water quality (compare *mesotrophic*).

Evapotranspiration. From *evapo*ration + *transpiration*; the combined discharge of water from the earth's surface to the atmosphere by evaporation from lakes, streams, and soils and by transpiration from plants.

F

Fall rate. The vertical drop in water surface elevation that occurs over a given period.

Final EIS. The final product of the environmental impact statement process, which responds to comments received on the draft EIS (see *draft EIS*).

Fish Passage Operations. The USACE operation of Alabama River projects (Claiborne and Millers Ferry) to facilitate downstream-to-upstream passage of Alabama shad and other anadromous fish.

Fish Spawning Operations. The USACE operation of the Allatoona project of the ACT Basin to provide favorable conditions for annual fish spawning, primarily for largemouth bass during the annual period between March and May, such that the lake level avoids fluctuating more than 6 inches to avoid stranding or exposing fish eggs.

Flood risk management (FRM). A systematic approach to both manage flood waters to reduce the probability of flooding (through structural measures such as levees and dams) and floodplains to reduce the consequences of flooding when it occurs. In the context of reservoirs, FRM includes water management operations using dedicated flood storage and additional storage attained by drawing down reservoirs beginning in the late fall into early spring to reduce risk of downstream flooding and the potential for loss of life and property damage.

Flood Storage. The volume of reservoir storage between the elevation of the top of the conservation pool and top of the flood storage pool, specifically for storing peak flows into the reservoir until those inflows can safely be passed through the downstream channel system with no or minimal flood damage.

G

Guide curve. The seasonally variable desired pool elevation in a reservoir, normally defined as the elevation at the top of the conservation storage (synonymous with *rule curve*).

H

HEC. Hydrologic Engineering Center, an organization within the U.S. Army Corps of Engineers that, among other things, developed the HEC-ResSim hydrologic modeling software used to analyze reservoir operations (see *HEC-ResSim*).

HEC-5Q. Water quality computer modeling software linked to reservoir operations modeling software, developed by the USACE Hydrologic Engineering Center (see *HEC*).

HEC-ResSim. Reservoir operations computer modeling software, developed by the USACE's Hydrologic Engineering Center.

Herbaceous. Describes nonwoody plant species, such as grasses.

Hydroelectric power (hydropower). Electricity produced by converting the energy released by water falling, flowing downhill, moving tidally, or moving in some other way into electrical energy.

I

Inactive pool. The portion of reservoir storage below the conservation pool that contains inactive storage. The top level of the inactive pool is defined for each reservoir as the elevation below which, if the reservoir surface drops to that level, no reservoir releases are made.

Inactive storage. The portion of reservoir storage in the inactive pool.

Interbasin transfer. The process of withdrawal of water from one river basin for beneficial use in another basin that is not naturally connected, resulting in a net loss of water from the donor basin and a net increase to the receiving basin.

M

Master Water Control Manual (Master Manual). A record of basin-wide water control objectives and operational guidelines developed with thorough consideration of all project purposes to cover a full array of all foreseeable hydrologic conditions, from flood to drought.

Mesic. Describes a condition of moderate moistness, as in a mesic soil.

Mesotrophic. Describes a body of water, commonly a nonflowing body such as a lake, pond, or reservoir, that has a moderate amount of dissolved nutrients and an intermediate level of primary productivity, usually not excessive enough to lead to conditions associated with water quality impairments caused by nutrient overload (compare *eutrophic*).

Minimum flow (minimum stream flow). A low river flow at a specified point in a river. The minimum flow can be a regulated minimum flow or a specific level needed for water supply or other purpose.

Mitigation. Additional actions taken to avoid, minimize, rectify, reduce, eliminate, or compensate for impacts. The Council on Environmental Quality requires federal agencies, in preparing an environmental impact statement, to identify appropriate mitigation measures not already included in the proposed action or alternatives.

N

Navigation. The act of directing and conveying waterborne vessels from place to place. Navigation is an authorized project purpose for some of the USACE projects in the ACT Basin.

No Action Alternative. The baseline or current operation condition against which the action alternatives are compared. The No Action Alternative provides the baseline flows needed to assess the impacts of the Proposed Action Alternative.

Non-consumptive use (or non-consumptive water use). An activity, such as hydroelectric power generation, that uses water from the basin without a net loss of water from the system.

Nonpoint source. Describes water pollution that does not originate only or exclusively from a single location (such as a pipe discharge) but rather is diffuse in origin. Nonpoint sources generally include runoff from broad areas of land wherein the runoff accumulates varieties of pollutants, such as from urban, industrial, agricultural, or silvicultural land areas, and delivers them to waterbodies.

O

Orographic effect: The effect that occurs when a moving air mass approaches a mountain range and is rapidly forced upward by the elevated land surface, thereby causing the air temperature to cool and the moisture in the air to condense and fall as precipitation.

P

Palustrine wetlands. Generally, refers to nontidal wetlands lacking flowing water and dominated by trees, shrubs, persistent emergents, or emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 parts per thousand. Examples include marshes, swamps, bogs, and floodplains (see Section 2.4.1.1).

Peaking project. A project in which hydroelectric power is generated several hours a day, typically on weekdays in the afternoons and early evenings, in response to peak demands on the power system.

Period of record. Typically, the time for which published records exist for a data collecting station, usually referring to a streamflow gaging station. The HEC-ResSim hydrologic modeling efforts used streamflow data from gages with periods of record ranging between 1939 and 2011.

Precipitation, available. See *available precipitation*.

Project site. For the proposed action of this EIS, the entire ACT Basin.

Proposed Action Alternative. Also known as the Preferred Alternative, this is the alternative that the USACE proposes to implement in the ACT Basin. It consists of Plan G as described in Section 5.4 of the EIS.

R

Record of Decision (ROD). A document that states the decision with respect to the update of the ACT Basin Master Manual and the individual project water control manuals, summarizes alternatives that were considered and relevant factors that were balanced in making the decision, and identifies means that have been adopted to mitigate for adverse effects. Federal agencies are required to prepare a public decision document that demonstrates consideration of the environmental impacts described in the EIS before a decision or a major federal action. The ROD can also outline additional actions or conditions that may be required before implementing the allocation formula or other management actions in the basin.

Region of Influence (ROI). An area with natural boundaries or geopolitical boundaries that covers the likely extent of impacts on a resource.

Regolith. The layer of loose material (consisting of soil, sand, weathered rock pieces, volcanic ash, glacial till, or other unconsolidated residual or transported earthen material) covering bedrock that constitutes the surface of most land.

Return flow. Surface water withdrawn from the ACT system that is not consumed when used (see *consumptive use*) and that, subsequent to use, is returned (discharged with appropriate treatment) to the surface water system, generally at or near the point of withdrawal.

River basin compact (compact). An interstate agreement to equitably apportion the surface waters of the river basin. Compact negotiations to reach agreement on water allocation formulas took place between 1998 and 2003 without success, and the compacts were allowed to expire in August 2003 (ACF Basin) and in July 2004 (ACT Basin).

River reach. The stream length between two specified points.

Riverine. Relating to, resembling, or having to do with a river.

Rock outcrop. Area of exposed bedrock.

Run-of-river project. A project in which the reservoir does not fluctuate appreciably on a seasonal basis, or that does not seasonally redistribute flows.

S

Salinity. The measure of the salt concentration in water. For reference, average ocean salinity is about 3.5 percent (commonly expressed as 35 parts per thousand [ppt], and variable between about 32 and 37 ppt with precipitation, snowmelt, evaporation, runoff, geography, and other factors), while the salinity of freshwater is usually less than 0.05 percent (0.5 ppt).

Saprolite. Soft, disintegrated, mostly to thoroughly decomposed rock, often rich in clay, formed by the in-place weathering of rock and that remains in its original place.

Scoping. The process used to determine the range of issues to be addressed and to identify the significant issues to be analyzed in depth with respect to the proposed action and alternatives.

Shoreline. The points in a lake, river, or the ocean where the body of water and the land meet.

Stakeholders. Members of the public and representatives of various interest groups, all of whom have a vested interest, or stake, in the outcome of a project and who might have differing or competing values.

Stenohaline. Describes an aquatic organism that can only survive within a narrow range of salinity, e.g., a freshwater fish that cannot survive in seawater or an ocean fish that cannot survive in freshwater (contrast *euryhaline*) (see Section 2.5.3.3).

Storage project. A reservoir designed to reregulate natural streamflow, providing more dependable yield during the low-flow season. That involves redistributing flow volumes on a seasonal basis. In general, reservoirs are filled in high-flow seasons (winter and spring), and lowered during low-flow seasons (summer and fall).

Streamflow gage. Data collecting location and device on a river at which water levels, streamflows, and sometimes other data are measured.

Subcanopy. Vegetation less than 30 feet tall or 3 inches in diameter in a vegetative community.

Submersed. In reference to vegetation, plants that are adapted to living in and normally occur entirely below water.

Summer deficit. The available precipitation minus reservoir water withdrawals in June, July, and August—typically the three warmest months of the year which correspond to increased municipal, thermoelectric cooling, and irrigation water demand.

Surcharge storage. The portion of reservoir storage above the dedicated flood storage pool that temporarily stores water above the emergency spillway.

T

Tailwater. The water immediately downstream of a hydraulic structure, such a dam.

Tailwater rating. The unique relationship between flow (cfs) and water surface elevation (feet), that exists immediately downstream of a dam.

Transpiration. Discharge of water vapor from land plants into the atmosphere through a variety of biological processes, including evaporation through pores in leaves and through root surfaces; the continuous process caused by the evaporation of water from leaves of plants and the corresponding uptake of water from the soil by plant roots. See *evapotranspiration*.

Trophic level. Classification of organisms in an ecosystem according to feeding relationships.

U

Unimpaired flow. Historically observed flows adjusted to account for, and computationally remove the effects of, some of the human influence within river basins, such as the construction of large surface water reservoirs, withdrawals and returns for municipal and industrial water uses, and withdrawals for crop irrigation, that have altered the otherwise naturally expected flow regime of the system. An unimpaired flow data set is necessary to determine *critical yield* by removing (to the extent possible) identifiable and quantifiable alterations in flow regime attributable to man-made changes in the river basin.

W

Water allocation formula (allocation formula). As defined by the river basin compact, a means of equitably apportioning the surface waters of the basin while protecting water quality, ecology, and biodiversity. Compact negotiations began in early 1998, with a December 31, 1998, deadline for reaching agreement on a water allocation formula. The state commissioners (governors of each state) were unable to reach an agreement on an equitable apportionment of the waters, and the ACT compact was allowed to expire in July 2004.

Water control manual (WCM). A document in which water control objectives and operational guidelines for USACE reservoirs in the ACT Basin are recorded. The manuals include water control plans for each project and a master water control manual for the basin as a whole (see *Master Water Control Manual*).

Withdrawal. The act of removing water from a river system; water so removed from a river system.