

GEORGIA DROUGHT MANAGEMENT PLAN

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March 26, 2003

GEORGIA DROUGHT MANAGEMENT PLAN

Preamble

The Georgia Drought Management Plan as approved by the Department of Natural Resources Board on March 26, 2003 consists of pre-drought mitigation strategies and drought response strategies.

Pre-drought mitigation strategies are measures designed to minimize the potential effect of drought. They are water conservation measures predominantly.

Drought response strategies are measures or actions to be implemented during various stages of drought.

The Georgia General Assembly and the Board of Natural Resources have previously assigned the Environmental Protection Division director significant drought management responsibilities and mandates. The director also shall have those designated responsibilities and mandates contained herein.

Divisions of DNR are required to implement provisions of this plan as soon as practicable.

Non-DNR state, federal, and local agencies and other organizations identified herein are encouraged to implement those aspects of the plan identified as appropriate to the entity as soon as practicable.

The actions and responses contained in this document are the result of a collaboration of approximately 85 citizens with an interest and expertise in water related matters.

These citizens represent a geographical and political cross section of the state, as well as a cross section of business, industry, environmental, and water management.

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Section 1) DROUGHT DECLARATION PROCESS

The following is the process for declaring drought conditions and responses:

1A): The State Climatologist's office and EPD will routinely monitor and evaluate stream flows, lake levels, precipitation, groundwater levels, and other climatic indicators that are supplied by several cooperating entities, principally the U. S. Army Corps of Engineers, the US Geological Service, and the National Drought Mitigation Center. These indicators reflect the health of the hydrologic system. They are referred to as drought indicators in this document. The indicators for each of Georgia's nine-climate divisions are described in section six of this document.

Each of the nine-climate divisions has several indicators. If any one of the indicators in any one or more of the nine climate divisions reaches or passes a certain prescribed condition for two consecutive months, a preliminary evaluation by the state climatologist and the EPD director is triggered.

If the preliminary evaluation indicates the possible need for a drought response declaration for that climate division and all or part of the relative hydrologic regions in and adjacent to that climate division, the director will consult with members of the Drought Response Committee (see 1E) 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, if any, to be made. Response guidance for each level of drought severity is provided by this plan, but particular drought conditions may require greater or lesser responses than those contained herein.

The director and, as appropriate, other members of the committee will notify the local RDC's, 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 EPD will continue to monitor the drought indicators for indication of changing conditions, and will act in response to those changing conditions. The director will consult with the Committee as necessary and will keep the Committee apprised of changes in climate conditions.

As further explained in the Drought Indicators section of this plan, as conditions improve a conservative approach is to be taken. All of the drought indicators for the climate division should be in a more favorable condition for at least four consecutive months before the director takes action to decrease the level of drought response requirements.

1B): Numerous agencies and organizations are tasked in this plan with some level of water resource or water related management responsibilities. EPD and those agencies and organizations shall coordinate closely and share information about their drought or water conservation concerns and solutions.

1C): The Drought Response Committee shall review this plan at least every five years, and after each drought event to evaluate the performance and suitability of the drought indicators, the effect of the pre-drought and drought responses, and to what extent the plan is being followed. Based on this evaluation, the Committee shall make appropriate changes.

1D): The pre-drought strategies contained in this plan are principally water conservation strategies. They should be implemented and followed at all times, not just during a drought situation. The DNR water conservation coordinator, as well as some agencies, RDC's, local governments, and water supply providers have (or will develop) water conservation plans. Those plans and this drought management plan should be as seamless and non-conflicting as possible. As water conservation plans are developed, they should, at a minimum, reflect the pre-drought strategies of this plan as appropriate to the responsibilities and audience of the planning entity. As those plans are developed, they shall be provided to EPD. If appropriate, this plan shall be modified to reflect the measure(s) contained in those plans.

1E): The director shall convene as necessary a Drought Response Committee. The committee membership shall include the EPD Director as convener and chair, as well as senior managers of DNR's WRD, P2AD, and CRD and the water conservation coordinator. Also, DCA, GDOA, GEMA, GFC, GSWCC, GW&PCA, OSC, ARC, GUAC, USACE, USGS, USF&WS, one RDC, one NGO, and one representative organization each of the business community and agriculture industry, shall be represented.

1F): This plan recommends incentives and actions that may require funding. Funding requests (grants and/or appropriations) shall be developed by the participating agencies and supported by the committee.

Section 2): Agencies and organizations:

Acronyms

ACCG	Association County Commissioners of Georgia
ARC	Atlanta Regional Commission
CE	Cooperating Entities
CES	Cooperative Extension Service
CRD	Coastal Resources Division, Georgia Department of Natural Resources
DCA	Department of Community Affairs
DNR	Department of Natural Resources
EPD	Environmental Protection Division, Georgia Department of Natural Resources
FB	Farm Bureau
GDHR	Georgia Department of Human Resources
GDOA	Georgia Department of Agriculture
GEFA	Georgia Environmental Facilities Authority
GEMA	Georgia Emergency Management Agency
GEP	Georgia Environmental Partnership
GFA	Georgia Forestry Association
GFC	Georgia Forestry Commission
GMA	Georgia Municipal Association
GRWA	Georgia Rural Water Association
GSWCC	Georgia Soil and Water Conservation Commission
GUAC	Georgia Urban Agriculture Coalition
GW&PCA	Georgia Water and Pollution Control Association
ME	Marine Extension
NGO	Non-Government Organization
OSC	Office of the State Climatologist
P2AD	Pollution Prevention Assistance Division, Georgia Department of Natural Resources
RDC	Regional Development Center(s)
UGA	University of Georgia
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USG	University System of Georgia
USGS	U.S. Geologic Survey
WRD	Wildlife Resources Division, Georgia Department of Natural Resources

GEORGIA DROUGHT MANAGEMENT PLAN

PRE-DROUGHT STRATEGIES AND DROUGHT RESPONSES

SECTION 3 - PRE-DROUGHT STRATEGIES

“Pre-drought strategies” are longer-term actions, implemented before a drought, for the purposes of preparedness, mitigation, monitoring, and conservation. “Drought responses” are shorter-term actions, implemented during a drought, according to the level of drought severity.

Section 3A: MUNICIPAL AND INDUSTRIAL-- PRE-DROUGHT STRATEGIES

1. State actions

- Formalize the Drought Response Committee as a means of expediting communications among state, local, and federal agencies and non-governmental entities. [EPD, OSC, CE]
- Establish a drought communications system between the state and local governments and water systems. [EPD, OSC]
- Provide guidance to the local governments and water supply providers on long-term water supply, conservation and drought contingency planning. [DNR, EPD]
- Review the local governments and water supply providers’ conservation and drought contingency plans. [EPD]
- Work with the golf course and turf industry to establish criteria for drought-tolerant golf courses. [EPD, P2AD]
- Encourage water re-use as opposed to additional withdrawals of raw water. [EPD, P2AD]
- Work with local water systems to provide water efficiency education for industry & business. [P2AD, CES]
- Through the Georgia Environmental Partnership, conduct voluntary water audits for businesses that use water for production of a product or service. [P2AD]
- Identify vulnerable water dependent industries (e.g. poultry, seafood, urban horticulture), and, as necessary and as funding is available, fund research to help determine impacts and improve predictive capabilities. As a long-term strategy, develop programs to assist communities impacted by drought effects on vulnerable industries. [P2AD, USG, CE, GDCA]

- Develop criteria for a voluntary certification program for landscape professionals (landscapers, golf course managers, irrigation installers). [GUAC, EPD]
- The DNR water conservation coordinator is charged with developing and implementing a statewide water conservation program to encourage local and regional conservation measures. [EPD, DNR conservation coordinator, CE]
- Develop and implement an incentive program to encourage more efficient use of existing water supplies. [DNR, EPD, GDCA]
- At all times, including non-drought conditions, unless further restricted by the director or local authorities, outdoor watering shall follow the schedule specified in Section 4A. Exemptions to such schedule will be in accordance with Section 4A.

2. Local/regional actions

- Develop and implement a drought management and conservation plan, incorporating as many of the actions as are appropriate to the local or regional entity
- Assess and classify drought vulnerability of individual water systems (e.g., # of days/weeks supply remaining under certain drought conditions, water source, and soil moisture).
- Define pre-determined drought responses, with outdoor watering restrictions being at least as restrictive as the state minimum requirements listed below.
- Establish a drought communications system from local governments and water supply systems to the public.

SECTION 3B: AGRICULTURE -- PRE-DROUGHT STRATEGIES

1. Farmer Irrigation Education

- Recommend that farmers attend classes in best management practices and conservation irrigation, prior to (i) receiving a permit, (ii) using a new irrigation system, or (iii) irrigating for a coming announced drought season. [EPD, OSC, CE]
- Provide for additional continuing education opportunities for farmers throughout the year. [CES]
- Distribute to existing permit holders and encourage the use of best management practices, conservation irrigation, efficient use of irrigation systems, and the Cooperative Extension Service's water conservation guidelines. [EPD, P2AD, CES]
- Collaborate with Cooperative Extension Service to develop web-based information directly linked to Stripling Irrigation Research Park and supporting faculty, the Hooks-Hanner Center, and other research facilities. [EPD]
- Develop electronic database for communicating with permit holders. [EPD, CE]
- Encourage the development and distribution of information on water efficient irrigation techniques. [EPD, P2AD, CES]

2. Field / Crop Type Management

- Encourage the use of more drought resistant crops, subject to market conditions. [CES, CE]
- Encourage the use of innovative cultivation techniques to reduce the amount of water needed or lost by a crop during summer. [CES, CE]
- The appropriate agencies should conduct crop irrigation efficiency studies. [CES, UGA]
- Provide farmers with normal year, real time irrigation, irrigation scheduling, and crop evaporation/transpiration information. [EPD, OSC, CES]
- Monitor soil moisture and provide real time data to farmers. [EPD, CES, OSC]

3. Irrigation Equipment Management

- For new systems, encourage the installation of water efficient irrigation technology. [EPD, CE, CES, GSWCC]

- For older systems, recommend retrofitting with newer and better irrigation technology (e.g., travelers or water cannons replaced by spray on drops or under plastic drip irrigation for vegetable crops). Set goal for complete overhaul in 5 to 7 years. Recommend updating any system over ten years old. [EPD, CE, CES, GSWCC]
- Provide information and encourage farmers to take advantage of available financial incentives (tax credits, BMP cost share programs, buy-back programs, etc.) for retrofitting and updating older or less efficient systems. Prepare and distribute a list of such incentives. [GSWCC, FB]
- Recommend irrigation system efficiency audits every five to seven years. [GSWCC, CES, EPD]

4. Government Programs

- Improve irrigation permit data to create a high degree of confidence in the information on ownership, location, system type, water source, pump capacity, and acres irrigated for every irrigation system in Georgia. Use this information to determine which watersheds and aquifers will be strongly affected by agricultural water use, especially in droughts. [EPD, CES]
- Improve on the agriculture irrigation water measurement and accounting statewide. [EPD, GSWCC]
- Improve communications and cooperation among farmers and relevant state and Federal agencies regarding available assistance during drought conditions. [EPD, GDOA, GSWCC, GEFA]
- Support legislation and efforts (research, loan opportunities, and infrastructure improvements) to enhance the ability of farmers to secure adequate water supplies during drought conditions. For instance, establish low interest loan program for construction of on-farm off-stream storage facilities (ponds for surface water irrigation). [EPD, DNR, GEFA, CES, CE, GSWCC]

SECTION 3C: WATER QUALITY, FLORA, AND FAUNA -- PRE-DROUGHT STRATEGIES

1. State actions

- Encourage all responsible agencies to promote voluntary water conservation through activities such as:
 - Developing and distributing information (e.g., public service announcements) to all user groups about:
 - Efficient irrigation methods and techniques,
 - Efficient home water use,
 - Available services (i.e., audits, literature, technical information including evaporation – transpiration rates, and other information).
 - Recommending and explore providing for incentives, or requiring installation and use of automatic rain shut-off devices for irrigation systems.
 - Providing for and conducting “Home and Farm Assist” water conservation audits.
 - Encourage and explore providing for incentives for irrigation users to have irrigation system audits performed.
 - Providing updated information and incentives for water efficient/low impact landscaping.
 - Establishing conservation pricing rate structures.
 - Encourage agriculture and industry to maximize water use efficiency at all levels of production and services. [EPD, P2AD]
- Monitor streamflow and precipitation at selected locations on critical streams [USGS, EPD,]
- Monitor water quality parameters, such as temperature and dissolved oxygen at selected critical streams [USGS, EPD]
- Provide the streamflow and water-quality data in real time for use by drought managers; and work with drought managers to optimize information delivery and use [USGS, EPD]
- Evaluate the impact of water withdrawals on flow patterns, and the impact of wastewater discharges on water quality during drought [USGS, EPD, USF&WS, WRD]
- Investigate indicators and develop tools to analyze drought impacts for waterways such as:
 - Coastal ecosystems (considering flows, flooding periods, salinity, and previous season’s spawning or harvest success of sensitive species)
 - Thermal refuges such as the Flint River
 - Trout streams
[CRD, WRD, ME, UGA]

- Improve the agencies capabilities and resources to monitor land-disturbing activities that might result in erosion and sedimentation violations. This capability is important because, during drought, dry soil surfaces can increase the rate of runoff while low stream-flows make streams more vulnerable to the effects of storm-water runoff. [EPD, GSWCC, CES]
- Identify funding mechanisms and develop rescue and reintroduction protocols for threatened and endangered species during extreme events. [USFWS, WRD]
- Develop and execute an effort to identify pollutant load reduction opportunities by wastewater discharge permit holders (i.e., below levels in wastewater discharge permits). These reductions will be implemented during drought flow periods as a voluntary commitment on the part of permit holders. [EPD]
- Develop and execute an effort to identify opportunities for industry to decrease water use during drought periods (i.e., use less water in producing products and services during drought, and thereby potentially reducing quantity of wastewater discharged). Incentives ought to be considered to encourage voluntary participation. [P2AD]
- Evaluate the impact of water withdrawals on flow regimes and the impact of wastewater discharges on water quality during drought. [EPD, USGS, CE]
- Develop and promote implementation of sustainable lawn care programs based on selected BMPs and/or integrated pest management practices. Educate landscape professionals and individual homeowners on proper application of pesticides and fertilizers and conservation of water in order to reduce effects on water quality. The target audiences among landscape professionals include lawn maintenance contractors, landscape installation contractors, golf course superintendents, commercial lawn care providers and retail garden centers; education could be provided as part of a voluntary certification program for landscape professionals (see pre-drought M&I strategies). [P2AD, GUAC, GDOA, UGA, CES, CE]
- Encourage protection and restoration of vegetated stream buffers, including incentives for property owners to maintain buffers wider than the minimum required by state law. [EPD, CE]
- Provide for protection of recharge areas through measures including land purchase or acquisition of easements. [EPD, CE]
- Encourage and explore wildland fire mitigation measures (such as pre-suppression firebreaks, fuel reduction burning, mowing, and outdoor fire safety measures for homesteads and farms). [GFC, GFA]
- Enhance programs to assist landowners and farmers with outdoor burning. [GFC, GFA]

PRE-DROUGHT STRATEGIES AND DROUGHT RESPONSES

SECTION 4: DROUGHT RESPONSES

“Pre-drought strategies” are longer-term actions, implemented before a drought, for the purposes of preparedness, mitigation, monitoring, and conservation. “Drought responses” are shorter-term actions, implemented during a drought, according to the level of drought severity.

Section 4A: MUNICIPAL AND INDUSTRIAL -- DROUGHT RESPONSES

1. Outdoor Watering Reduction Schedule:

- **Outdoor watering other than those exempted activities is to occur only on scheduled days**
- **Prior to onset of declared drought conditions, outdoor water use can occur during any hours on the scheduled days.**
- **During declared drought conditions, outdoor water use will only be allowed during scheduled hours on the scheduled days.**

“Scheduled days are defined as follows”:

- Odd-numbered addresses may water on Tuesdays, Thursdays, and Sundays.
- Even-numbered or unnumbered addresses may water on Mondays, Wednesdays, and Saturdays.

“Scheduled weekend day is defined as follows”:

- Odd-numbered addresses may water on Sundays.
- Even-numbered or unnumbered addresses may water on Saturdays.

Schedule for Outdoor Water Use during Declared Drought Response Levels:

Declared Drought Responses: Level One:

Water on scheduled days - 12 midnight to 10 a.m - and - 4 p.m. to 12 midnight.

Declared Drought Response: Level Two:

Water on scheduled days - 12 midnight to 10 a.m.

Declared Drought Response: Level Three:

Water on scheduled weekend day - 12 midnight to 10 a.m.

Declared Drought Response: Level Four:

Complete outdoor water use ban

1a. Landscape Irrigation – Established Landscapes

Residential, commercial, industrial, governmental, and recreational landscapes:

- Established Landscapes using small capacity wells not requiring EPD water withdrawal permits for groundwater use are exempt from the above schedule.
- EPD will grant exemptions from the above schedule for use of recycled treated wastewater as determined on a case-by-case basis by EPD.
- Irrigation of personal food gardens is exempt from restrictions.
- Irrigation of landscapes (turf, ornamentals, annuals, and containerized plants) follows declared drought response levels schedule (above).

1b. Landscape Irrigation – Newly Installed Landscapes (in place less than 30 days)

Residential, commercial, industrial, governmental, and recreational landscapes

- Irrigation of landscapes (turf, ornamentals, annuals, and containerized plants) allowed any day of the week, during allowed hours for the level in effect, for a period of 30 days following installation. After this 30-day period, irrigation of newly installed landscapes follows schedule for established landscapes.
- For landscapes installed by licensed professionals, please see commercial exemptions below.

1c. Golf Courses

- Irrigation of fairways shall follow landscape irrigation schedules above, for unnumbered addresses.
 - Golf course using small capacity wells not requiring EPD water withdrawal permits for groundwater use are exempt from the above schedule
 - EPD will grant exemptions from the above schedule for use of recycled treated wastewater as determined on a case-by-case basis by EPD.
- Irrigation of greens and tees are exempt from restrictions.

1d. Other Restricted Outdoor Water Uses

Follow Basic schedule for Levels One and Two: Listed Activities are prohibited for Levels Three and Four.

- Filling installed swimming pools (except when necessary for health care or structural integrity)
- Washing vehicles, such as cars, boats, trailers, motorbikes, airplanes, golf carts
- Washing buildings or structures (except for immediate fire protection)
- Non-commercial fund-raisers, such as car washes
- Using water for ornamental purposes, such as fountains, reflecting pools, and waterfalls (Except when necessary to support aquatic life)

Basic schedule for Level One: Prohibited for Levels Two, Three, and Four.

- Washing hard surfaces, such as streets, gutters, sidewalks, driveways
(Except when necessary for public health and safety)

Prohibited during all Levels

- Using hydrants for any purpose other than firefighting, public health, safety, or flushing.

2: Commercial Uses Exempt from State-Mandated Outdoor Water Use Restrictions

- Professional licensed landscapers, golf course contractors, and sports turf landscapers: during installation and 30 days following installation only. Professional landscapers must be licensed for commercial exemptions to apply.
- Irrigation contractors: during installation and as needed for proper maintenance and adjustments only
- Sod producers
- Ornamental growers
- Fruit and vegetable growers
- Retail garden centers
- Hydro-seeding
- Power-washing
- Construction sites (e.g., to re-implement vegetation after earth moving)
- Producers of food and fiber
- Car washes
- Other activities essential to daily business

Prudent water management will be expected of all commercial uses.

Note that some of these state allowed exemptions may be curtailed in drought response levels 3&4 by locally imposed restrictions

3: Local and Regional Options:

In the event of an emergency at the local water supply provider or government level, contact EPD and GEMA for assistance as appropriate.

In addition to the mandated requirements outlined above, local and regional authorities retain the option of going beyond the State's minimum provisions and specifying additional pre-drought strategies or drought responses within their jurisdiction. Action items to consider at the local/regional level include, but are not limited to, the following: developing system integration and interconnection to reduce drought vulnerability, placing additional water use restrictions on specific commercial uses, and placing additional restrictions on outdoor watering.

Water conservation and drought mitigation strategies should include conservation pricing. Local governments and water supply providers are strongly encouraged to evaluate a number of conservation pricing options and select the one that most readily satisfies their goals for water conservation. DNR's Water Conservation Manager, EPD and P2AD, as well as DCA, ARC and the RDC's can provide assistance in this effort.

- Non-conservation pricing: Defined, as decreasing or flat pricing as quantity used increases - should be eliminated.

- Conservation pricing: Defined as; 1) rates in which the unit price increases as the quantity used increases – or- 2) seasonal rates or excess-use surcharges to reduce peak demands during summer months - should replace non-conservation pricing.
- The conservation pricing base price should be sufficient to cover the costs of operating and maintaining the system. Income above this amount derived from increased charges to heavy users should be used to fund incentive programs to effect efficiency in water use.

Section 4B: Agriculture Drought Response:

- Implement the Flint River Drought Protection Act whenever severe drought conditions are predicted in the Flint River Basin. Measure and improve the effectiveness of the protective activities called for in the Act. [EPD]

Section 4C: WATER QUALITY, FLORA, AND FAUNA -- DROUGHT RESPONSES

1. Declared Drought Response Level One:

a. State actions

- Maintain minimal water quality parameters by:
 - Providing special releases from reservoirs and implementing innovative reservoir management to meet critical needs (e.g., alternative release patterns, controlling temperature of releases, changing storage purposes/authorized uses). (Implement only when not in violation or conflict with Federal Energy Regulatory Commission or Congressional authorizations.)
 - Reducing water withdrawals through implementation of the municipal and industrial section of this drought management plan.
 - Encouraging utilities and local governments to increase surveillance for sewer spills and leaks that may be more apparent as drought conditions worsen. [EPD, CE]
- Implement voluntary pollutant load reduction opportunities (i.e., below levels in wastewater discharge permits) when flows are less than the flow upon which discharge permit limits were established. [EPD]
- Implement industrial water reduction opportunities previously identified (i.e., use less water in producing products and services during drought, and thereby reducing quantity of water in waste stream). [P2AD, EPD]

b. Local /regional actions

- Require water conservation, building on on-going water conservation and education during non-drought periods and drawing on GUAC as a resource for urban irrigation. In addition to outdoor watering restrictions specified for M&I users, conservation-related drought responses at the regional or local level could include:
 - Running public service announcements about proper watering techniques, frequency.
 - Providing daily evaporation-transpiration rates for irrigation scheduling.
- Increase fire prevention measures during drought. [GFC, GFA, CES]

2. Declared Drought Response Levels Two through Four

- Continue Level one measures.
- Implement rescue and reintroduction of threatened and endangered species as previously identified thresholds are met. [USFWS, WRD]
- Evaluate pre-drought protocols and enhance if necessary to minimize any future drought impacts to threatened and endangered species. [USFWS, WRD]

SECTION 5 -- DROUGHT INDICATORS AND TRIGGERS

March 24, 2003

5A): Drought Indicators:

Drought indicators are variables that help to detect, characterize, and monitor changing climatic and drought conditions. This plan will use four primary indicators: precipitation, reservoir levels, groundwater levels, and streamflows. Indicators are selected for each of the nine climate divisions (CDs) in Georgia.

CD	Drought Indicators
1	SPI-3, SPI-6, SPI-12 Lake Allatoona Chattooga River at Summerville
2	SPI-3, SPI-6, SPI-12 Lake Lanier, Lake Allatoona Etowah River at Canton Chestatee River near Dahlonega
3	SPI-3, SPI-6, SPI-12 Lake Hartwell, Clark Hill Broad River near Bell Chattahoochee River near Cornelia
4	SPI-3, SPI-6, SPI-12 Flint River at Montezuma
5	SPI-3, SPI-6, SPI-12 Groundwater Wells (2) Oconee River at Dublin Ocmulgee River at Macon
6	SPI-3, SPI-6, SPI-12 Lake Hartwell, Clark Hill Ogeechee River near Eden
7	SPI-3, SPI-6, SPI-12 Groundwater Wells (9) Spring Creek near Iron City Ichawaynochaway Creek at Milford
8	SPI-3, SPI-6, SPI-12 Alapaha River at Statenville
9	SPI-3, SPI-6, SPI-12 Satilla River at Atkinson

PRECIPITATION

Standardized Precipitation Index (SPI-3, 6, 12 months compared to the same months historically)

RESERVOIR LEVELS

Lake Allatoona
Lake Lanier
Lake Hartwell

Clark Hill

GROUNDWATER LEVELS

CD5 wells:
11AA01, 21T001
CD7 wells:
13L180, 12M017, 11K003, 13J004,
12K014, 10G313, 08K001, 08G001,
09F520

STREAMFLOWS

Chattooga River at Summerville (02398000)

Etowah River at Canton (02392000)

Chestatee River near Dahlonega (02333500)

Broad River near Bell (02192000)

Chattahoochee River near Cornelia (02331600)

Flint River at Montezuma (02349500)

Oconee River at Dublin (02223500)

Ocmulgee River at Macon (02213000)

Ogeechee River near Eden (02202500)

Spring Creek near Iron City (02357000)

Ichawaynochaway Creek at Milford (02353500)

Alapaha River at Statenville (02317500)

Satilla River at Atkinson (02228000)

5B): DROUGHT TRIGGERS

- Drought triggers are specific values of indicators that help to determine when each level of drought response should begin or end. This plan contains four levels of increasing severity. A level is triggered when an indicator value reaches a certain percentile. By using percentiles, multiple indicators can be compared and combined within a consistent framework. Additional triggers are developed for reservoir levels based on zones, and streamflows based on average annual discharge (AAD) and monthly 7Q10 (M7Q10). (Analytic procedures are described in Section 5C.)
- Triggers are used for both going into a drought and coming out of a drought. Note that triggers do not automatically invoke a level and required response. Rather, the triggers prompt an evaluation (described in Section IA) about the possible need to declare a certain drought response level and take appropriate measures.
- Going into a drought: When any one of the triggers for any one of the CDs is at a more severe level for at least two consecutive months, then an evaluation is conducted about whether to increase the level of response.
- Getting out of a drought: When all of the triggers for that CD are at less severe level for at least four consecutive months, then an evaluation is conducted about whether to decrease the level of response.

Conditions	Percentiles for All Triggers: Precipitation, Reservoir Levels, Groundwater Levels, Streamflows
Level 1	0.20 – 0.35
Level 2	0.10 – 0.20
Level 3	0.05 – 0.10
Level 4	0.00 – 0.05

Conditions	Reservoirs Levels: Rule Curves
Level 1	< Zone 1
Level 2	< Zone 2
Level 3	< Zone 3
Level 4	< Zone 4

Conditions	Streamflows: AAD / M7Q10
Level 1	< 80/60/50 % AAD
Level 2	< M7Q10 + (2/3 ?)
Level 3	< M7Q10 + (1/3 ?)
Level 4	< M7Q10

5C: ANALYTIC PROCEDURES FOR INDICATORS AND TRIGGERS

The four levels of this plan were based on percentiles, relative to each month. This approach was designed to provide statistical comparability among indicators, temporal and spatial consistency, and ease of interpretation. For instance, percentiles can be related to probabilities of occurrence, and used to compare current conditions with historic conditions.

The indicators were selected through an analysis of several hundred combinations, using actual data, to generate the triggering sequences that would have occurred historically. These sequences were then compared to retrospective assessments of conditions in each of the climate divisions, and in each of the sectors of municipal and industrial, agriculture, and environmental, to determine the indicators and triggers that would have performed the best for the periods before, during, and after a drought.

To transform indicator data to percentiles, the following procedures were used:

- For precipitation, percentiles were calculated directly from the SPI value, which is a statistical Z-score, for each climate division. The SPI-3, -6, and -12 represents total precipitation during a 3, 6, and 12 month period, relative to those same months historically. Percentiles can also be determined by fitting a gamma distribution to the long-term record, and then determining 3, 6, and 12-month anomalies, relative to the historic record.
- For reservoir levels, percentiles were calculated using an empirical cumulative distribution function, which is a ranking procedure using the historic record of data, analyzed by each month. In addition, reservoir triggers were based on reservoir rule curves, and levels were associated with each of the zones.
- For groundwater, percentiles were calculated from U.S.G.S. duration analyses for probabilities of exceedance, using detrended data, and triggers were based on the most severe level for a majority of the selected wells.
- For streamflows, percentiles were calculated from empirical cumulative distribution functions, using long-term and equivalent records of average flow data, analyzed by each month. In addition to percentiles, an algorithm using average annual discharge (AAD) and monthly 7Q10 (M7Q10) was used for streamflow triggers. Here, delta (Δ) is the difference between 80/60/50% AAD and M7Q10, and 80/60/50% refers to 80%AAD for January through April, 60%AAD for May, June, and December, and 50%AAD for July through November.

Through evaluations of the drought plan and its performance (Section IC, it is likely that indicators, trigger levels, data sources, and calculation methods may change. This drought plan is designed to remain flexible, and to accommodate procedures that would provide the most useful guidance and ability to minimize the adverse impacts of drought.

SECTION 6: CLIMATE DIVISIONS OF GEORGIA