

CPWS



Columbia Power & Water Systems



Drought Management Plan

July 2016

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I. Introduction

A. General Overview

Due in part to the drought of 2007, the Tennessee Department of Environment and Conservation (TDEC) requires all public water systems to prepare and adopt a drought management plan. TDEC provides guidance documents for the development of such plans. Columbia Power and Water System's Drought Management Plan complies with the purposes described in T.C.A. § 68-221-710 and T.C.A. § 69-3-102(b). Furthermore, this plan complies with the TDEC's Safe Drinking Water Supply Rules, specifically 0400-45-001.17(7).

As stated in the TDEC's rules, "All community water system shall prepare and maintain an emergency operations plan in order to safeguard the water supply and to alert the public of unsafe drinking water in the event of natural or man-made disasters. Emergency operation plans shall be consistent with guidelines established by the Department and shall be reviewed and approved by the Department. Systems shall include a drought management plan as a part of the emergency operations plan."

Prior to the State's action, CPWS had an established drought management plan. In addition to water use restrictions, that plan recognizes an agreement between CPWS and other public water entities of the Duck River Agency (DRA) to jointly implement drought-related water use restrictions based on water elevations in Normandy Reservoir. As a result of the drought of 2007, CPWS unilaterally prepared an update to their adopted drought management plan in 2008.

To address issues included in TDEC's recent guidance documents, this drought management plan is an update of the 2008 plan and the more recent December 2011 drought management plan. In addition to this document, DRA has prepared the Duck River Regional Drought Management Plan. The DRA Regional Plan contains activities and requirements that impact and overlap the CPWS Drought Management Plan (DMP).

Until the DRA's Regional Drought Management Plan is formally adopted, the intent and purpose of this document is to identify local actions to be taken during drought conditions; thus complying with TDEC mandates regarding drought management plans. A secondary purpose of the CPWS DMP is to identify regional issues affecting the water system.

B. Regional Concerns

According to TDEC's guidance document, the primary goal of the CPWS Drought Management Plan is to assist in the protection of the aquatic environments of the Duck River while sustaining economic and social activities of the region. Meeting this goal requires the development and implementation of regional solutions and, subsequently, requires the participation of regional entities that use and withdraw water from the Upper Duck River. The DRA's Duck River Regional Water Management Plan is an important planning resource when considering the management of the Duck River.

Based on experience since the impoundment of Normandy Reservoir, the protection of the water quality of the Duck River – during severe and prolonged drought conditions – is best accomplished by practicing good stewardship of water stored in the Normandy Reservoir.

A majority of the water released from Normandy Reservoir is not used by public water systems. Consequently, conservation by public water systems affects only a relatively small portion of the overall flow in the Duck River and does not have a large influence on the total river flow.

A second regional concern of CPWS deals with a water withdrawal permit restriction imposed on CPWS by TDEC. That permit restriction reads, in part, "*water withdrawals by CPWS shall not result in a reduction of flow in the Duck River to less than 100 cubic feet per second (65 MGD) downstream of the CPWS water intake.*" This water withdrawal restriction imposed on CPWS is not supported by historical low flow data. Relative to minimum flows in the Duck River, an Environmental Impact Statement (EIS) titled *Future Water Supply Needs in the Upper Duck River Basin – December 2000*, prepared by the Tennessee Valley Authority (TVA), states that the true historical statistical 7Q10 flow (seven-consecutive-day flow during a ten-

year period) of the Duck River at Columbia prior to the construction of Normandy Dam was 34 cfs, which equates to a daily flow of about 22 million gallons per day.

Relative to the concern regarding the 100 cfs flow restriction placed on CPWS, TVA's current operating guideline controlling the release of water from Normandy Reservoir has been adequate—in the past—to meet the 100 cfs flow requirement downstream of the CPWS water intake. However, changes to TVA's current operating guideline will need to ensure that during severe drought conditions, sufficient water reaches Columbia to meet CPWS' water demands as well to provide sufficient water to meet environmental concerns downstream of the CPWS water intake.

Any reduction in minimum stream flow reaching Columbia will need to be offset with an equivalent reduction in the 100 cfs flow limitation currently imposed on CPWS. Similarly, any upstream use of water that wholly consumes or transports it from the Duck River watershed is a permanent removal of water from the river, resulting in a loss of stream flow at Columbia.

Recently, in response to CPWS concerns with maintaining public health and welfare in the event the Duck River flow drops below 100 cfs, TDEC included the following statement in CPWS' latest withdrawal permit, dated February 12, 2016: *"To ensure uninterrupted drinking water service to Columbia Power and Water Systems' customers during unique circumstances associated with emergency conditions, Columbia Power and Water Systems may submit for review, alternative withdrawal conditions and associated conservation measures to protect public health and welfare under emergency conditions."*

C. Basic Requirements of the Drought Management Plan

Implementation features of the Drought Management Plan include the following actions:

- Drought declarations will be issued by the CPWS Board of Public Utilities;
- CPWS will coordinate drought mitigation with other Duck River water systems;

- CPWS will unilaterally implement drought mitigation measures if such measures are needed to protect the health of citizens served by the CPWS water system and to protect aquatic environments while sustaining economic and social activities;
- Drought stages will be based on Normandy Lake levels, TVA discharge rates, Duck River flows at Columbia's river gauge, and Old Columbia Dam Reservoir levels;
- Public education and "how to" information will be disseminated by CPWS;
- The Public will be informed of drought stages and benefits of water-saving efforts;
- Large users will be targeted for specific reductions through one-on-one contact by representatives of CPWS;
- CPWS will monitor water savings to determine if user efforts achieve desired levels;
- A temporary increase in enforcement staff may be needed. Enforcement personnel can be redirected from existing staff at CPWS or from temporary employees;
- The strategy calls for local governments to respond to water use reduction measures;
- The drought management team for CPWS will report to the Board, City, and County officials as appropriate; and
- CPWS will provide appropriate press releases and public information on drought stages, reduction measure success rates, and other information of public interest.

The mechanism for water use restrictions are described in this document. Failure to comply with these requirements can result in enforcement actions.

The DRA, in its Regional Drought Management Plan, has proposed drought triggers based on water levels at Normandy Reservoir. DRA's drought triggers have been incorporated into CPWS' Drought Management Plan, and are included as an appendix to this document.

II. Purpose of the Drought Management Plan

For sustenance, humans require, on the average, about 2 quarts of water per day. The intake of water can be in the form of beverages or water in food. Other basic needs for water include cleaning, cooking, bathing, and carrying away sanitary waste. Without water for these basic needs, the quality of life will be reduced to something less than acceptable standards.

In addition to basic needs, water supplied by a public water system is also needed for fire suppression, protecting life and property, and for the support of agricultural endeavors.

For the most part, the Columbia Power and Water System (CPWS) supplies potable water to citizens, businesses, and other establishments within the City of Columbia and to the majority of the citizens and businesses of Maury County. The supply of water by CPWS is either by direct sales or by wholesale water sales to other public water supply entities.

Components of the Drought Management Plan serve to facilitate the reduction of water use during periods of severe drought conditions; and, should critical water shortage occur, to supplement water supplies in the most practical way possible. However, the most critical component of the CPWS Drought Management Plan (DMP) and the DRA Regional Drought Management Plan is to promote better management of the waters within the Duck River and, in particular, the release of water from Normandy Reservoir.

Though CPWS operates its water system in a professional manner, CPWS cannot and does not guarantee either a sufficient supply of water or the delivery of water at an adequate or uniform pressure. Further, CPWS is not liable for any damages or losses resulting from an inadequate or interrupted supply; for any pressure variations; or for damages from the resumption of service when such conditions are not due to willful neglect on the part of CPWS.

In the situation of persistent and worsening drought conditions, the DMP calls for restrictive measures to be taken to reduce water use. The plan recognizes the importance of maintaining adequate water supplies for public health needs and sufficient water to

support the commercial and industrial establishments needed for the economic viability of the community.

Therefore, the plan must identify critical water supply needs. The plan also must identify water supply demands where reductions can be made without sacrificing health and safety considerations. In worsening drought conditions, steps must be identified with established procedures to enforce reduction in non-essential water supply demands.

The mission of the DMP is to protect the health of the citizens served by the CPWS water system while balancing the protection of aquatic environments and sustaining economic and social activities. A goal of the Drought Management Plan process is to promote dialogue among those who utilize the waters of the Duck River. From this dialogue, appropriate measures are defined to meet the challenges brought on by drought. Some of these measures are implemented locally, while others require regional coordination.

III. Implementation of Drought Management Plan

A. Authority

The City of Columbia is chartered as a municipal body politic and corporate in perpetuity by the State of Tennessee. The current charter provides that the City of Columbia operates as a “*Council-Manager Government.*” Pursuant to the provisions of the City Charter and subject to the limitation imposed by the Tennessee Constitution, all powers of the City are vested in the elective council, which has the responsibility to enact local legislation, adopt budgets, determine policies, and appoint the city manager, who shall execute the laws and administer the government of the city.

In accordance with these powers, the Columbia City Council has adopted, amended, and codified a “*municipal code*” to govern the operation of the city government.

Title 18 – Chapter 3 of the Columbia Municipal Code states “*there is vested in the Board of Public Utilities (Columbia Power and Water Systems), all powers, duties and responsibilities placed upon the Board of Waterworks and Sewerage Commissioners by Pub. Acts 1933, chapter 68, and the Board of Public Utilities is hereby granted full jurisdiction over the waterworks plant, distribution system, all real estate, or interest in real estate, all personal property, and all equipment and other things interest in real estate, all personal property, and all equipment and other things appertaining thereto; provided, however, that the funds derived from the sales of bonds and all revenues received from the operation of the municipal waterworks system shall at all times be kept separate and handled in the manner provided under said Pub. Acts 1933, chapter 68, and provisions of the waterworks revenue bond ordinances.*”

Title 18 – Chapter 3 further states the following:

Restricted use of water. In times of emergencies or in times of water shortage, the City, through the Board of Public Utilities, reserves the right to restrict the purposes for which water may be used by a customer and the amount of water which a customer may use. Such conditions may be specified in the current drought management plan as it may be amended from time to time.

Declaration of water shortage. A water shortage may be declared by the Board of Public Utilities with the concurrence of the mayor at such times as the water supply is deemed inadequate from its source or from the water treatment plant or because of the distribution system.

Interruption of service. The City will, through its Board of Public Utilities, endeavor to furnish continuous water service, but does not guarantee to the customer any fixed pressure or continuous service. The City shall not be liable for any damages for any interruption of service whatsoever.

Waiver of notice. In connection with the operation, maintenance, repair and extension of the City's water system, the water supply may be shut off without notice when necessary and desirable, and each customer must be prepared for such emergencies. The City shall not be liable for any damages from such interruption of service or for damages from the resumption of service without notice after such interruption.

Therefore, as established in Title 18 – Chapter 3 of the Columbia Municipal Code, the authority to prepare and activate / de-activate, when necessary, a drought management plan is vested with the Board of Public Utilities. Preparation of a Drought Management Plan and recommendations to adopt a Drought Management Plan by the Board of Public Utilities are the responsibility of the Executive Director of CPWS.

Upon adoption of the Drought Management Plan by the Board, CPWS will request the City Council to adopt any recommended city ordinances needed to enable implementation of the Drought Management Plan and, if special fees or water rate changes are required, to adopt such fee or rate ordinances.

Activation and de-activation of the drought management plan are vested with the Board of Public Utilities, acting upon the recommendation of the Executive Director of CPWS. The Executive Director of CPWS has the responsibility of notifying and obtaining the concurrence of the City of Columbia Mayor / City Manager and the County Mayor for the activation or de-activation of the drought mitigation provisions of the DMP.

B. Input from Other Stakeholders

CPWS recognizes that local officials and the business community share a mutual interest in ensuring that abundant water is available to support the growth and vitality of the local economy. In January 2015, CPWS hosted a meeting of local leadership to discuss Maury County's water supply and review the Duck River Agency's current plans for securing the region's long-term water supply.

In October 2015, the Maury County Commission established an Ad-Hoc Water Supply Committee to consider Maury County's water supply. CPWS and the DRA attended the committee's meetings and provided data at the committee's request. After several months of study, the committee issued a report dated March 21, 2016, providing 10 recommendations related to Maury County's long-term water supply needs.

A summary of the Maury County Ad-Hoc Water Supply Committee's recommendations follows:

- Research possible solutions other than those currently recorded in the Duck River Comprehensive Regional Water Supply Plan (DRCRWSP) exploring, e.g., an off-stream storage reservoir, watershed lakes, and other potential structural solutions for Maury County, including studies and financing.
- Review the pending Duck River Agency report regarding the relocation of the downstream intake closer to Columbia.
- Investigate reservoirs constructed in other areas, including permitting, financing, and cost/benefit analysis, to consider the feasibility of a Maury County reservoir.
- Request that the DRA Executive Director make regular presentations to the Maury County Health and Environment Committee providing updates on water demand projections, population growth projections, and activities toward advancing the five components of the DRCRWSP.

- Support DRA in partnership with all the water systems located in the Upper Duck River region to meet the needs of all who depend on these systems for clean and dependable water resources. Consider asking TDEC to impose “flow by” restrictions on other systems besides CPWS.
- Generate support from local elected officials and stakeholders to:
 - Understand and acknowledge Maury County’s current vulnerability to an inadequate water supply during extended drought conditions.
 - Recognize through education and advocacy the importance of establishing and maintaining long-term clean and dependable water sources to protect the health and welfare of those within the Duck River Watershed.
 - Support water solutions presented in the DRCRWSP and embodied in the recommendations of the Water Committee’s report.
- Request that the DRA and the seven water systems encourage all communities located upstream of Maury County to use the Duck River wisely and keep it clean, and also educate those communities about water conservation practices.
- Request that all four water systems in Maury County (Columbia, Spring Hill, Maury County, and Mt. Pleasant) work together to develop infrastructure to meet growing populations and support strong economic development.
- Petition for the assistance of state legislators and the DRA Board to strongly encourage government agencies to expedite actions necessary to implement the components of the DRCRWSP.
- Petition for the assistance of state legislators and for the DRA Board to encourage government agencies to relax restrictive environmental controls that limit water available for consumption.

CPWS will continue to work with local stakeholders on educating the public on the efficient use of water within Maury County, and communicate to local leaders any plans for needed infrastructure to support water needs for the region.

IV. System Characteristics and Risks

A. Historical Information

According to city records from September 1811, the Columbia municipal water system dates back to the early nineteenth century. These records contain a reference to the formation of a water company. Portions of that early water system are evident from sections of wooden pipe uncovered during street work along Garden Street in downtown Columbia. These wooden pipes were formed by a hole drilled lengthwise through square sections of timber. The ends of these wooden pipes were rounded to form a joint for connection to the adjoining pipe; thus creating a water system network.

Later in the 1800s, additions to the water system were made. In a publication entitled *Century Review 1805 - 1905 Maury County* reference is made to a two-million-gallon reservoir constructed in 1883 on Mt. Parnassus. Water was supplied to this reservoir by a pumping station located “*upstream of all sewer outlets.*” Consistent with the times, the pump suction probably pulled water through sand and gravel filters to remove a measure of suspended solids (turbidity) to make the water visually acceptable.

B. Raw Water Considerations

After the flooding of its predecessor plant in the Duck River Flood of 1948, CPWS’ current Water Treatment Plant was constructed in 1954 at a site south and adjacent to Nashville Highway and north of 8th Avenue. It is believed that this location was chosen because it facilitated the withdrawal of water from the Duck River at a point upstream of the Old Columbia Dam; constructed earlier for the purpose of electrical power generation. Undoubtedly, the location of the water intake above the Old Columbia Dam provided greater water depth needed to accommodate raw water pumps and to enable the withdrawal and use of impounded water during periods of drought and low stream flow conditions.

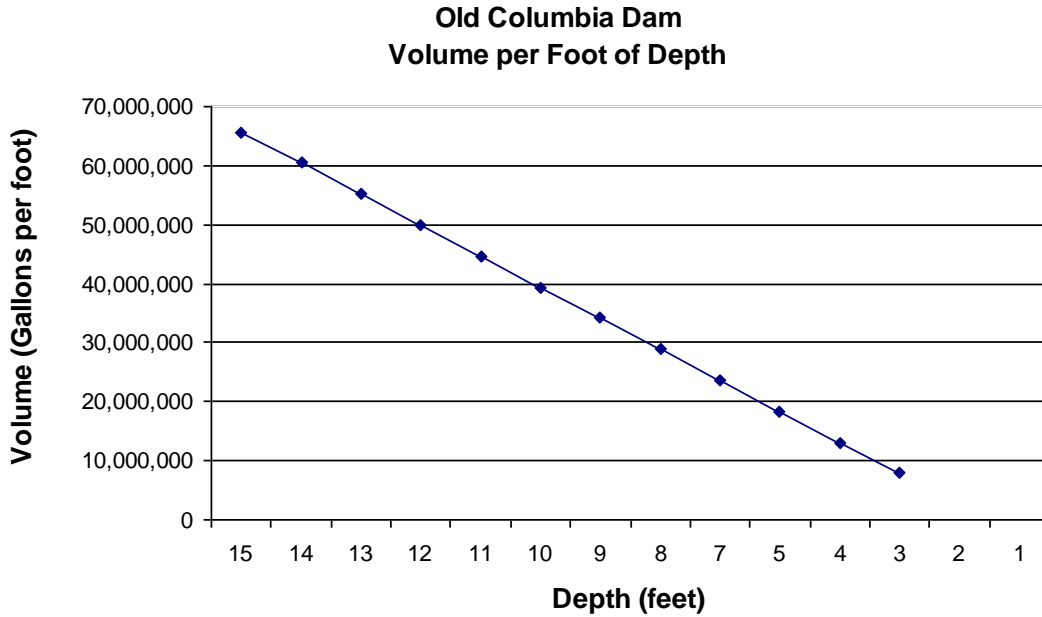
Accordingly, a raw water intake structure was constructed concurrently with the mid-1950s water treatment plant construction program. This intake facility was constructed at about river mile 134 on the Duck River or about 0.5 miles upstream of the Old Columbia Dam.

Concerning the Old Columbia Dam, it was constructed in 1925 at mile 133.53 on the Duck River for the purpose of hydro-electric power generation. The dam is a reinforced concrete structure approximate 22 feet high and about 572 feet long and consists of a non-overflow section, four spillway sections, and the old power house structure.

The non-overflow section forms the right abutment (northern side) of the dam and is about 112 feet long with a crest elevation of 566.2. To the left of the power house structure is a 111-foot overflow spillway section with a crest elevation of 557.2. Adjoining this section is a spillway section that is about 162 feet long with a crest elevation of 555.5. To the left of this section is another spillway section that extends about 47 feet to the left bank of the river. The crest elevation of this final spillway section is 557.5.

The bottoms of the existing raw water intake structures are elevation 547 and the minimum pool of the water reservoir formed by the Old Columbia Dam is about elevation 555, resulting in a minimum water depth of about 18 feet inside the raw water pump structure.

During the drought of 2007, calculations of the amount of water impounded by the Old Columbia Dam were made. The following graph was developed based on those calculations. A three-foot drop in the reservoir elevation equates to a volume of about 183.5 million gallons. A 10-foot drop in reservoir elevation equates to a volume of about 430 million gallons. In situations of dire water shortage which, at a minimum, would be following a depletion of water from the Normandy Reservoir, the impounded water behind the Old Columbia Dam is available to meet essential water needs. Depending upon stream flows and water needs, this volume could easily provide water for three months or longer following the amount of natural flow in the Duck River.



C. Regional Use of Duck River Waters

A portion of the waters of the Upper Duck River are withdrawn for treatment and distribution by public water systems. At the head of the system is the Duck River Utility Commission, which withdraws water from within Normandy Lake. Below Normandy Lake, Shelbyville, Bedford County Utility District, Lewisburg, Spring Hill, and Columbia Power and Water Systems (CPWS) withdraw water from the Duck River.

In addition to water withdrawals, the waters of the Duck River are also used to receive treated surface wastewater discharges from wastewater treatment systems. Public wastewater systems disposing of treated wastewater to the Upper Duck River include Manchester, Shelbyville, Lewisburg, Spring Hill, and Columbia (though Spring Hill and Columbia currently deposit wastewater into the river downstream of CPWS' intake).

Considering the importance of the water from the Duck River, the Tennessee Duck River Agency (DRA) was created by an Act of the General Assembly of the State of Tennessee *“to develop, protect, and sustain a clean and dependable water resource for all citizens of the Duck River Region.”*

Following its formation, the DRA proposed the development of a water supply grid system to serve a four-county area that included Maury, Marshall, Bedford, and Coffee counties. The purpose of the water program was to aid industries requiring treated water and to supply water to small communities and rural areas of the four counties. To assist in this effort, DRA requested that Tennessee Valley Authority (TVA) investigate water resource development for the four-county area.

Subsequently, TVA determined that a multi-purpose reservoir development on the Duck River offered the best potential to meet the objectives outlined by DRA. This multi-purpose reservoir called for the construction of two reservoirs—the Normandy Dam Reservoir and the Columbia Dam Reservoir. In 1971, TVA entered into an agreement with DRA and the participating water systems, which established TVA’s obligation for supplying water availability from the Duck River. Under the provisions of that agreement, TVA’s obligation was as follows:

<u>Water System</u>	<u>Million Gallons per Day</u>
Manchester	6
Tullahoma	14
Shelbyville	9
Lewisburg	8
Columbia	26

Following TVA’s completion of the Environmental Impact Statement (EIS) process, construction on Normandy Dam and Reservoir began in June 1972 and was completed in 1976. Since operation begin, Normandy Dam has reduced downstream flooding, particularly at Shelbyville, and has supplemented low flows necessary to meet water supply and to enhance water quality in the Duck River. Construction on the Columbia Dam and Reservoir began in August 1973.

However, following passage of the Federal Endangered Species Act in 1973, the U.S. Fish and Wildlife Service added a number of freshwater mussels to the list of endangered species, including five species found in the Duck River. After considerable studies and legal objections, TVA concluded in 1995 that the Columbia Dam Project could not be completed due primarily to cost increases.

That decision by TVA prompted the preparation of an EIS to evaluate the effects of alternative ways to meet future water needs in the Columbia area. With the assistance from the DRA, Tennessee Department of Environment and Conservation (TDEC), U.S. Army Corps of Engineers (USACE), the U.S. Geological Survey (USGS), and the U.S. Fish and Wildlife Service (USFWS), TVA published the final EIS titled *Future Water Supply Needs in the Upper Duck River Basin – December 2000*.

Upon the recommendation of the Duck River Agency Technical Advisory Committee (DRATAC) in June 2003, the DRA Board approved the Duck River Water Supply Plan. Essentially this plan is based on the TVA EIS document with three modifications. These modifications provide that the plan treats the watershed above and below Normandy Dam as a single system; the plan use USGS demand projections for Coffee County updated in August 2001; and the 2002 Duck River Model developed for DRA by Hydro Logics, Inc. In adopting the plan, DRA developed the following actions to be taken:

- Explore impact of increasing demand on Normandy water quality utilizing TVA's Normandy water quality model in conjunction with the DRA flow model;
- Evaluate potential/actual impact on down-stream water quality from increased flow or reliability resulting from operational or physical changes to Normandy;
- Duck River Utility Commission complete a water pathogen study; and
- Fully consider raising Normandy Dam because of the unique potential that different variations of these actions will have to benefit flood control, water supply, water quality, recreation and land use.

In addition to the above, the DRA completed a comprehensive regional water supply study in 2011 for Bedford, Coffee, Marshall, Maury, and southern Williamson counties.

The purpose of the *“Duck River Comprehensive Regional Water Supply Plan”* completed in 2011 was to provide a recommendation of projects and programs necessary to meet future water needs and to address concerns about water shortages resulting from periodical drought conditions. The goal of the comprehensive plan is to develop a 50-year projection of water needs and a 100-year planning horizon to provide direction for the management of available water resources, including the implementation of specific water supply projects as deemed appropriate.

Regarding this comprehensive plan, the following specific activities are currently planned or under way for each of the plan’s non-structural and structural components. This information is taken from the website of the Duck River Agency.

Regional Drought Management Plan - The regional drought plan was completed in late 2012 and has been submitted to TDEC and TVA for approval.

Water Use Efficiency Program - This program is now referred to as the Water Management Program and is currently being developed with a completion date of late summer 2016.

Optimize Normandy Reservoir Release (ONRR) - The ONRR program was completed in 2014 and has been submitted to TDEC and TVA for approval, along with the DMP.

Normand Reservoir Capacity Improvements (NRCI) - This program component will increase the Winter/Spring pool level by approximately five feet without increasing the Summer/Fall pool level. The expanded reservoir will increase water storage during drought, reduce shoreline exposure, improve flood protection for downstream communities, and enhance the reliable yield available for all Duck River users. DRA is currently collaborating with TVA on preliminary engineering to assess the requirements for raising the dam to

accommodate for loss of flood storage that will be needed for flood control. Currently TVA is conducting a safety analysis for each of their dams. When they have completed the Normandy Dam analysis, a review will be initiated to consider the NCRI project.

New Maury County Intake - This structural component will provide an additional intake for Columbia's water withdrawal. The new intake will be downstream of Columbia and the current withdrawal constraint where there is adequate flow in the Duck River during droughts to satisfy Columbia's projected needs. This component addresses the potential deficit in Maury County and southern Williamson County with a local, highly reliable supply, and eliminates their sole reliance on Normandy Reservoir during severe dry weather conditions.

D. Current Duck River Water Management Practices

The discharge or release of water from Normandy Reservoir is in accordance with operating guidelines adopted in an agreement between the State of Tennessee and TVA. The basic concept of the agreement is that releases are made to maintain acceptable water quality downstream from the reservoir. The agreement provides the following:

- 40 cubic feet per second (cfs) of minimum instantaneous flow immediately downstream of the Normandy Dam;
- 120 cfs minimum instantaneous flow at Shelbyville (December through May) at the USGS gauge located at Duck River mile 221.4;
- 155 cfs minimum instantaneous flow at Shelbyville (June through November) at mile 216.2 gauging station; and
- Up to 10 cfs additional instantaneous flow at Shelbyville's water supply intake at mile 221.9.

Related to an issue that resulted from the establishment of the agreement in 1996, during the planning stages of the final EIS titled *Future Water Supply Needs in the Upper*

Duck River Basin – December 2000, TDEC was asked by the U.S. Army Corps of Engineers (COE)– a participant in the preparation of the EIS–to specify a minimum flow in the Duck River in order to protect the stream for its classified uses. A letter dated March 27, 1996, from Joe E. Holland, Jr. with TDEC read, in part, “...to ensure this section of the Duck River supports recreational use and protects habitat for fish and aquatic life, stream flow should be maintained such that the daily flow at river mile 132.8 (Columbia USGS gauge) does not fall below 100 cubic feet per second (cfs).”

Mr. Holland included with his letter a table where he presented his analysis of the flow record that existed from 1961 to 1976, which was a period without severe drought conditions. This period was chosen because the old Columbia Dam ceased operation in 1961 and Normandy Dam closed in 1976. Based upon that 15-year period of record, Mr. Holland concluded that the seven-day consecutive drought flow in 10 years (7Q10) would be equal to 74 cfs. The 14Q2 of 99 cfs (rounded to 100 cfs) was selected as a conservative flow value to be applied as a one-day minimum.

In his letter Mr. Holland stated that, *“The in-stream flow criterion of 100 cfs is based on the rationale that in order to support recreational use and protect fish and aquatic life, stream flow during critical low flow periods should be maintained close to the level expected under ‘natural’ (without flow regulation or water withdrawals) conditions. At this level, the water body would provide the same recreational opportunities and habitat for fish and aquatic life as expected under natural flow conditions.”*

While it is noted that the 100 cfs low flow criteria is quite conservative compared to Mr. Holland’s calculated 74 cfs (7Q10), it should be pointed out that TVA’s calculations indicated a much lower ‘natural’ low flow number. TVA’s Reservoir Water Quality Section did research to indicate that the true historical statistical low flow of the river at Columbia (pre-Normandy) was 34 cfs (7Q10). This fact is confirmed in numerous citations in the TVA EIS (2000). For example, on page 21: *“This is a significant increase over the 34 cfs of minimum flow at Columbia that would have occurred before Normandy Reservoir was built.”*

If it was the intent of the Tennessee Division of Water Pollution Control to establish low-flow criteria that mimicked natural conditions, it should be noted that the 100 cfs minimum is extremely conservative when compared to their calculated 74 cfs, 7Q10. The legitimacy of the TDEC-established 100 cfs really comes into question when compared to the TVA calculated natural low flow figure of 34 cfs.

Although the TVA EIS is based upon how to get enough water and still preserve the TDEC-established 100 cfs at Columbia, it should be noted that the criteria appears to have been set in an excessively conservative manner. It could even be argued that the river flow should be allowed to drop down to historical natural flow levels, at least on a similar statistical frequency to the natural (pre-Normandy) conditions.

Taking these factors into consideration suggests that proper management of water available from the Normandy Reservoir could satisfy the need of the Upper Duck River Basin for years to come while preserving, during drought conditions, 'natural' flow conditions in the river. Proper management therefore includes optimizing the release of water from Normandy Reservoir.

As currently structured, the DRA Regional Drought Management Plan will require water conservation by the participants of DRA including CPWS when certain stage elevations are reached. While CPWS recognizes its role in the regional management of the Duck River, the imposition of the DRA drought plan is anticipated to have the following effects:

- The implementation of water conservation by CPWS has no effect on the water level in Normandy Reservoir. If the flow below the CPWS water intake is significantly more than the minimum 100 cfs rate, the imposition of a CPWS water conservation effort places a burden on water customers served by the CPWS water system. In this instance, water conservation by CPWS does nothing to protect the citizens served by CPWS, while causing a degree of distribution to social activities and economic welfare of the community.

- If, on the other hand, the flow below the CPWS water intake drops below the 100 cfs, CPWS will be in violation of the water withdrawal permit requiring drastic curtailments in water use and a likely petition that TDEC review the flow restriction in light of the impact on public health and welfare. A reduction to 80 cfs in the TVA targeted flow at Shelbyville under DRA's proposed drought-release schedule has a high probability of reducing flows at Columbia below the minimum 100 cfs rate, even with minimal water withdrawals by CPWS. Currently, the TVA target flow (June through November) is 155 cfs.

E. Other Regulatory Requirements and Issues

Chapter 1200-4-7 contains the TDEC rules for aquatic resource alterations. 1200-4-7-.01(3) states that it is unlawful to carry out any activity which may result in the alteration of the physical, chemical, radiological, biological, or bacteriological properties of any waters of the State. These activities included, but are not limited to, the discharge of dredge or fill material, dredging, stream channel modifications, water withdrawals, etc. State permits for these activities are either §401 water quality certifications or aquatic resource alteration permits.

With the adoption of Chapter 1200-4-7, there were several exemptions provided. 1200-4-7-.02(4) states that one of those exemptions are water withdrawals existing as of July 25, 2000, which do not adversely alter or affect the classified use of the source stream. While the CPWS intake was in existence prior to July 25, 2000, TDEC claims that the water withdrawal permit is required for two (2) reasons. First, CPWS modified the raw water intake after the July 25, 2000 date. Under that circumstance, the exemption due to an existing intake was voided. The second reason is that TDEC claims the CPWS withdrawal conflicts with 1200-4-3-.06 Anti-Degradation Standards' anti-degradation rule and, therefore, adversely affect the classified use of the source stream. These anti-degradation rules are very complex, but are limited primarily, but not necessarily, to streams classified as "*Exceptional Tennessee Waters.*" The Duck River is classified as an "*Exceptional Tennessee Waters.*"

Water withdrawals subject to the anti-degradation standards require an Aquatic Resource Alteration (ARAP) permit before granting an approval for a withdrawal. Again, there are exemptions, one of which is a “*de minimus*” impact. 1200-4-3-.04 (4) states “*that the definition of de minimus is alteration, other than those resulting in the condition of pollution or new domestic wastewater discharges, that represent either a small magnitude or short duration shall be considered a de minimus impact and will not be considered degradation for the purposes of implementing the anti-degradation policy.... Water withdrawals will be considered de minimus if less than five percent of the 7Q10 flow of the stream is removed.*” CPWS’ existing and proposed water withdrawals exceed five percent of the 7Q10 flow; therefore, the CPWS withdrawal is not *de minimus* and an ARAP permit is required.

After proper submittal of required information and input from a public hearing, CPWS was issued its first withdrawal permit effective September 24, 2009, and with an expiration date of September 23, 2014. The special conditions of that withdrawal permit were as follows:

- The maximum instantaneous withdrawal rate shall be limited to 31 cubic feet per second (a rate of 20.0 million gallons per day).
- The withdrawal shall not result in a reduction of flow in the Duck River to less than 100 cubic feet per second as measured downstream of the intake.

In addition to the above, CPWS was required to prepare a water conservation plan within 180 days of the effective date of this permit with the following requirements:

- Such plan shall be consistent with the Environmental Protection Agency’s Water Conservation Plan Guidelines: August 6, 1998 (document number EPA-832-D-98-001).
- The water conservation plan shall describe measures utilized or in place.
- The water conservation plan shall provide a schedule of implementation or otherwise address additional measures that are not already in place and that is called for by the guidelines.

In previous documents, in discussions with regulatory officials, and in this document, CPWS maintains that the permit limit for the minimum flow requirement of 100 cfs downstream of the CPWS water intake is not supported by historical flow data. Therefore, under severe drought conditions, it is deemed to be inappropriate and unreasonable to limit water withdrawals to maintain this 100 cfs flow while requiring CPWS to curtail water production to levels below minimum standards required for basic water needs.

F. Modification to Duck River Flows During Droughts

In addition to the voluntary and mandatory water conservation measures called for through the DRA's Regional Drought Management Plan, cooperation and flexibility is needed on the part of regulatory agencies and TVA to conserve water within the Normandy Reservoir and evaluate the enforcement of the Columbia flow restriction. In October 2007, TVA, at the request of TDEC, implemented certain changes in the flow releases from Normandy Reservoir. This request was in response to ongoing drought conditions that occurred in 2006 and 2007. This temporary response was prepared by TVA in partnership with TDEC and with the assistance from the U.S. Fish and Wildlife Service and the Tennessee Wildlife Resources Agency.

Based on that 2007 experience, the onset of any future perceived drought condition should be accompanied by a modification to the Operation Guide for the release of water from Normandy Reservoir. The purpose of such change would be to conserve water within the reservoir while maintaining reasonable minimum flows downstream in the Duck River.

In the absence of such modifications, CPWS withdrawal rates may need to impinge upon the 100 cfs minimum flow below the CPWS water intake. Such impingement would be taken following the implementation of mandatory conservation measures and a request from CPWS to TDEC for emergency considerations to protect public health and welfare. Conversations with TDEC have involved TDEC acknowledging this

possibility and allowing CPWS to re-negotiate terms of the permit in the event of a drought necessitating a reduction in flow below the prescribed 100 cfs minimum.

G. Water Treatment, Transmission and Water Storage Reservoirs

As stated previously, the existing water treatment facility was constructed in the 1950s with a design capacity of 5.0 million gallons per day (MGD). In the mid-1960s, a major expansion of the plant increased the design capacity to 10.0 MGD. In the mid-1980s, a third major expansion increased the design capacity to 15.0 MGD, and in 2002 a fourth expansion increased the design capacity to the current capacity of 20.0 MGD.

The water treatment facilities consist of dual rapid mixing facilities, flocculation basins, settling basins, gravity filters, ultraviolet light, granulated activated charcoal filters, clearwells, and high service pumps all sized to accommodate a design flow of 20 MGD. Currently, there are two raw water pumping stations that withdraw water from the Old Columbia Dam impoundment and pump raw water to the treatment facilities through a combination of 24-inch and 36-inch raw water transmission mains. The length of these raw water transmission mains is about 2,500 feet.

Relative to the current water demand on these facilities, a review of water records for a 12-month period beginning in July 1, 2014, and ending June 30, 2015, finds the average daily amount of finished water pumped during this period was 8.04 MGD. During this period, the maximum daily flow reported was 10.44 MGD.

The water treatment facility has high service pumps that deliver water to the City pressure zone (elevation 854) and to the Saturn Tank pressure zone (elevation 930). The following are water storage reservoirs serving the City pressure zones and the Saturn Tank pressure zone:

City Reservoirs

Location	Size	Year Constructed	Tank Height	Tank Diameter	Overflow Elevation
W. 6th Street	2.0 M Gals	1982	20 Ft.	131 Ft.	854.4
W. 6th Street	1.5 M Gals	1956	20 Ft.	113 Ft.	854.4
W. 14th Street	2.0 M Gals	1962	35 Ft.	98.9 Ft.	854.7
Cayce Lane	1.0 M Gals	1967	36 Ft.	69.0 Ft.	854.4
Saturn Tank	6.0 M Gals	1987	49 Ft.	145 Ft.	930.0

The other water storage tanks of CPWS are referred to as the rural reservoirs. As noted below, some of these reservoirs have the same overflow elevation as the City reservoirs. However, due to remote locations of these reservoirs, each of the rural reservoirs is served by remote water booster pump station. In all cases, CPWS has a SCADA system that monitors operation and levels of the reservoirs and any associated pump stations.

Rural Reservoirs

Location	Size	Year Constructed	Tank Height	Tank Diameter	Overflow Elevation
Culleoka Tank	0.25 M Gals	1967	32 Ft.	35.5 Ft.	942.0
Hampshire Pike Tank	0.15 M Gals	1970	32 Ft.	28.3 Ft.	854.4
Pulaski Pike Tank	0.10 M Gals	1979	32 Ft.	23.3 Ft.	978.0
Williamsport Pike Tank	0.15 M Gals	1970	32 Ft.	28.3 Ft.	854.4
Santa Fe Pike Tank	0.15 M Gals	1970	40 Ft.	25.3 Ft.	977.0
Hilltown Tank	0.10 M Gals	1975	32 Ft.	22.1 Ft.	976.0

Highway 99 Tank	0.10 M Gals	1975	40 Ft.	19.8 Ft.	960.0
Highway 99 Tank	0.40 M Gals	1988	41 Ft.	40.0 Ft.	960.0

Of the reservoirs listed above, the City Reservoirs, the Saturn Tank, and the two Highway 99 tanks also serve a role in fire suppression. In addition to maintaining adequate water pressure for rural CPWS water customers, the Rural Reservoirs serve a role in supplying wholesale water to the Maury County Water System.

To meet the basic water needs of CPWS customers, adequate water must be maintained in the water storage reservoirs. Without the controlling water pressures provided by these storage reservoirs, the safe delivery of water to customers is not possible.

H. Profile of the Water System

Determining water demands on CPWS' water system requires a review of historical flow and customer information. For this purpose, CPWS maintains records that include quantities of water treated, pumped, and consumed as well as the number of customers and customer classifications.

A review of these records since 2000 shows one of the highest 12-month periods began in July 1, 2008, and ended June 30, 2009. During this period, the average daily amount of finished water pumped during this period was 8.3 million gallons per day (MGD). During this 12-month period, the maximum daily flow reported was about 12.6 MGD, and the minimum day flow was found to be about 6.5 MGD. The maximum flow occurred on August 29 and the minimum flow occurred on March 1. As expected, the maximum flow—which is about 1.5 greater than the average flow number—reflect outdoor water usages. The minimum flow is about 75 percent of the average flow number, reflecting a minimum amount of outdoor usage. The daily average for the minimum month was March when average daily flow was about 7.5 MGD. For the months of June, July, and August, the average daily demand was about 9.5 MGD.

A summary of the information reported in these records for the year ending June 30, 2009, is reported in the following tabulation:

	Gallons / Year (1,000 gallons)	Average Gallons per day
Water Produced	3,026,239	8,291,066
Consumed		
Residential	1,241,518	3,401,419
Commercial	460,547	1,261,773
Industrial	341,069	934,436
Bulk & Wholesale	506,225	1,386,918
Fire Suppression & Flushing	<u>33,449</u>	<u>91,641</u>
Total	2,582,808	7,076,186
Unaccounted Water	443,431	1,214,879
	Number of Customers	Average Gallons per day
Residential (Inside City)	12,431	2,365,776
Residential (Outside City)	<u>5,138</u>	<u>1,035,643</u>
Sub-total	17,569	3,401,419
Commercial (Inside City)	1,917	1,100,982
Commercial (Outside City)	<u>288</u>	<u>160,791</u>
Sub-total	2,205	1,261,773
Industrial (Inside City)	16	17,287

Industrial (Outside City)	9	<u>917,150</u>
Sub-total	25	934,438

In addition to the above water customers, CPWS provides wholesale water to Maury County Water System on a continuous basis and, on an “as needed basis”, wholesale water to the cities of Mt. Pleasant and Spring Hill. As indicated previously, during the year ending June 30, 2009, CPWS sold an average of 1,386,918 gallons per day to bulk and wholesale customers.

Using population data published by the U.S. Census Bureau for calendar year 2008, the following population figures are used for Columbia and Maury County.

City of Columbia	34,402
City of Mt. Pleasant	4,443
City of Spring Hill (Maury Co.)	9,705
Unincorporated Maury County	<u>33,388</u>
Total for Maury County	81,938
City of Spring Hill (Williamson Co.)	<u>16,525</u>
Total for Spring Hill	26,230
Total for Columbia & Unincorporated Areas of Maury County	67,790

Based on the above population and water demand data, the average per capita water demand for Columbia, the combined population of Columbia and the unincorporated areas of Maury County served by the CPWS water system are as follows:

	Average Daily Water Demand	Population Served	Average per Capita Water Demand	Percent Based on Average Flow
Columbia				
Residential ^a	2,365,776	34,402	68.8	56.5
Commercial	1,100,982	34,402	32.0	26.3
Industrial ^b	108,928	34,402	3.2	2.6
Unaccounted System Losses ^c	<u>613,894</u>	34,402	<u>17.8</u>	<u>14.7</u>
All Customers & Demands	4,189,580	34,402	121.8	100.0

Columbia and Unincorporated Areas of Maury County (less Mt. Pleasant & Spring Hill)

Residential ^a	4,788,337	67,790	70.6	57.8
Commercial	1,261,773	67,790	18.6	15.2
Industrial ^b	1,026,077	67,790	15.1	12.4
Unaccounted System Losses ^c	<u>1,214,879</u>	67,790	<u>17.9</u>	<u>14.7</u>
All Customers & Demands	8,291,066	67,790	122.3	100.0

^a Residential flow of 4,788,337 include Columbia residential of 2,365,776 plus wholesale of 1,386,918 gallons

^b For accounting purposes, industrial use includes 91,641 gallons per day of fire suppression and flushing.

Based on the above, an estimate of reduction of water uses following implementation of mandatory drought water use restrictions can reasonably expect that the average daily demand of the minimum month (7.5 MGD) could be achieved without an undue disruption of normal activities. The estimate assumes that industrial demand (less the

91,641 gallons per day for fire suppression and flushing) and unaccounted water losses will remain constant.

A tabulation of that estimate is as follows:

	Average Daily Water Demand	Population Served	Average per Capita Water Demand	Percent Based on Average Flow
Columbia and Unincorporated Areas of Maury County (less Mt. Pleasant & Spring Hill)				
Residential	4,236,875	67,790	62	56.5
Commercial	1,105,610	67,790	16	14.8
Industrial	934,436	67,790	14	12.5
Unaccounted System Losses	<u>1,214,879</u>	<u>67,790</u>	<u>18</u>	<u>16.2</u>
All Customers & Demands	7,491,879	67,790	111	100.0

As tabulated above, this level of reduction in water demand requires about a 12 percent reduction in the average daily water use of residential and commercial customers, which equates to about a 10 percent in overall water use.

V. Monitoring of Drought Conditions

Droughts occur from time to time in virtually all climates worldwide. Because of that fact, water providers must have plans to accommodate the impacts of droughts, which are certain to occur. Defining the onset of a drought can be difficult, since a drought is not a distinct event such as a flood, fire, or hurricane. In drought conditions, many complex factors act and interact with the environment to create water shortages, which is the concern of water providers.

The National Weather Service defines drought as *“a period of abnormally dry weather sufficiently prolonged for the lack of water to cause serious hydrologic imbalance in the affected area.”* The severity of a drought depends upon the degree of moisture deficiency, the duration of the moisture deficiency, and the size of the affected area.

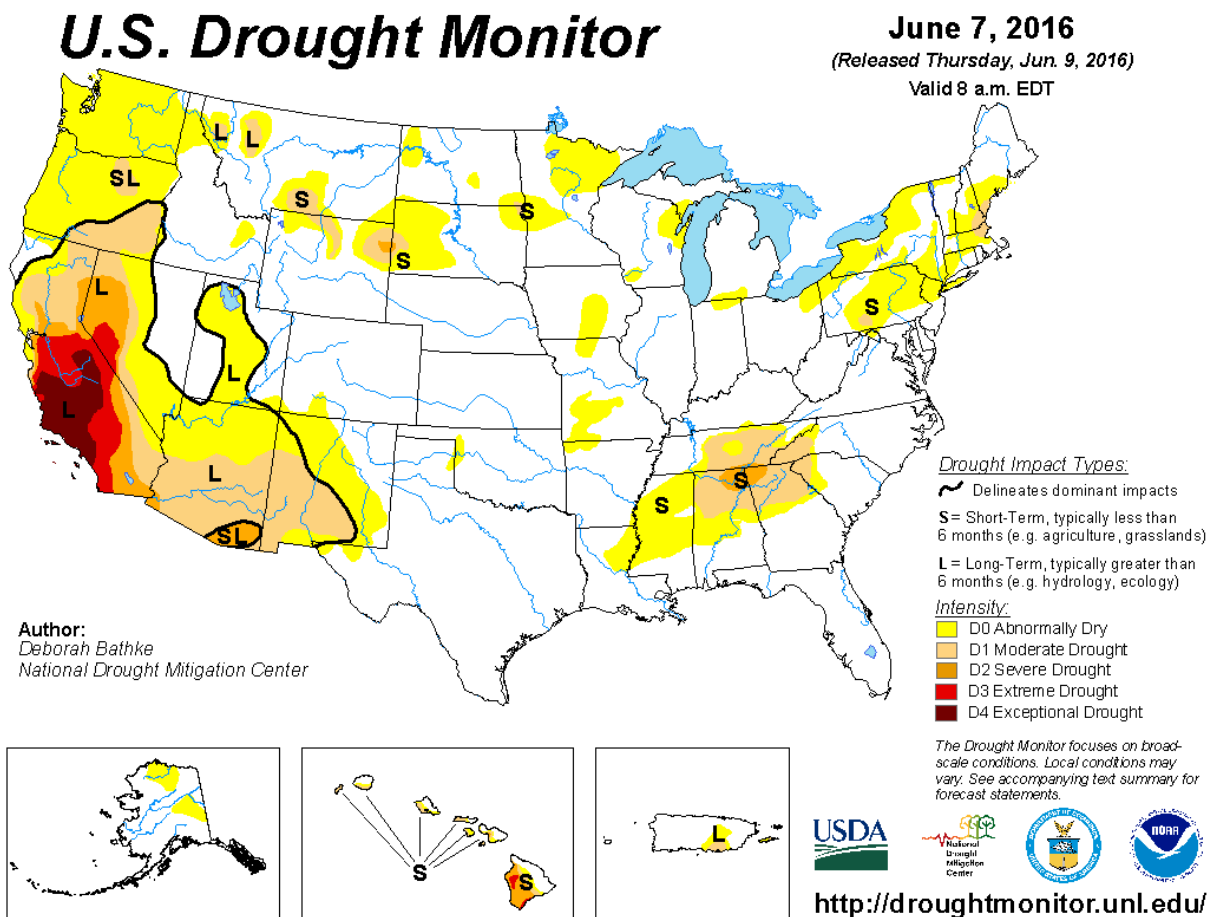
The National Weather Service, National Oceanic and Atmospheric Administration, National Climatic Data Center, and National Drought Mitigation Center have web sites concerning drought conditions. These web sites contain information on various levels of drought conditions. The more common drought levels are meteorological, agricultural, and hydrological droughts. A meteorological drought is defined usually on the basis of the degree of dryness in comparison to normal or average rainfall and the duration of the dry period.

Agricultural droughts link various characteristics of meteorological droughts to agricultural impacts; focusing on precipitation shortages, soil water deficits, reduced ground water, and other items that impact agricultural endeavors. For water systems, agricultural droughts place demands on the water system to meet irrigation demands of water customers. Such demands may overload treatment and transmission mains. Under these conditions, there may or may not be a shortage of raw water.

A hydrological drought is associated with the effects of periods of rainfall shortfalls on surface and subsurface water supplies. The frequency and severity of hydrological drought is defined on a watershed or river basin scale. Although all droughts originate

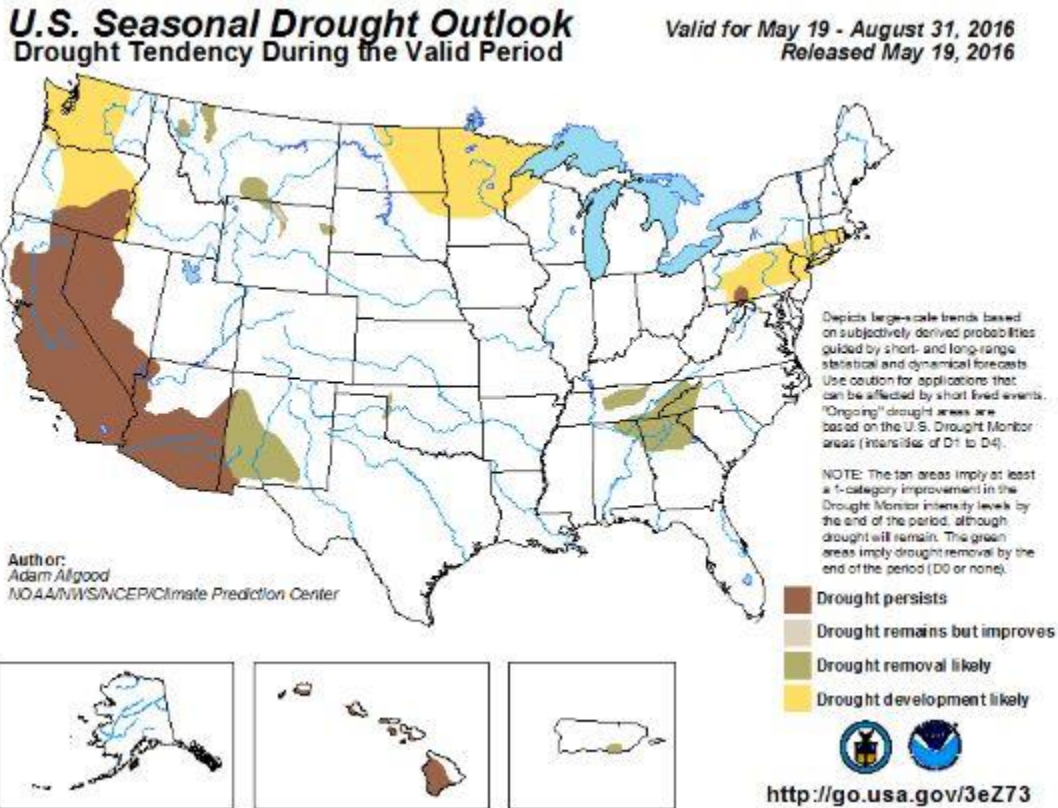
with a deficiency of precipitation, hydrologists are concerned with how rainfall shortages impact watersheds or river basins.

Hydrological droughts lag the onset of meteorological and agricultural droughts. This is because hydrological droughts take longer for rainfall deficiencies to show up in reduced stream flows and reservoir levels. In other words, an agricultural drought will be experienced before the onset of a hydrological drought. Conversely, on exiting from drought conditions, agricultural conditions will improve before increases in stream flows and reservoir levels are evident.



For drought management purposes, various levels of drought should be monitored. A web site (<http://droughtmonitor.unl.edu/>) maintained by the National Drought Mitigation Center is a source to monitor drought conditions. This site, shown below, is useful in the evaluation of the extent and severity of meteorological and agricultural

droughts, but not as useful in monitoring hydrological droughts. However, significant meteorological and agricultural drought conditions occurring throughout the upper Duck River drainage area will be a forewarning of hydrological drought conditions to be expected on flows in the Duck River.



In assessing drought conditions, the National Weather Service's Climate Prediction Center (<http://www.cpc.ncep.noaa.gov/>) is also a very useful site. This web site, which is shown on the following page, contains information on the short and long term outlook for precipitation and temperature conditions. These graphics are examples of the information that is available on the internet.

While the above web sites are useful in assessing the severity and the outlook for continuing drought conditions, websites maintained by TVA and U. S. Geological Service (USGS) are useful in assessing hydrological drought conditions affecting the CPWS water system. Continuous stream metering stations are in operation by USGS at Shelbyville and Columbia.

Streamflow Monitoring on the Duck River

In cooperation with the Tennessee Duck River Agency, Tennessee Department of Environment and Conservation, Tennessee Department of Transportation, City of Wartrace, City of Dickson, and Arnold Engineering Development Center

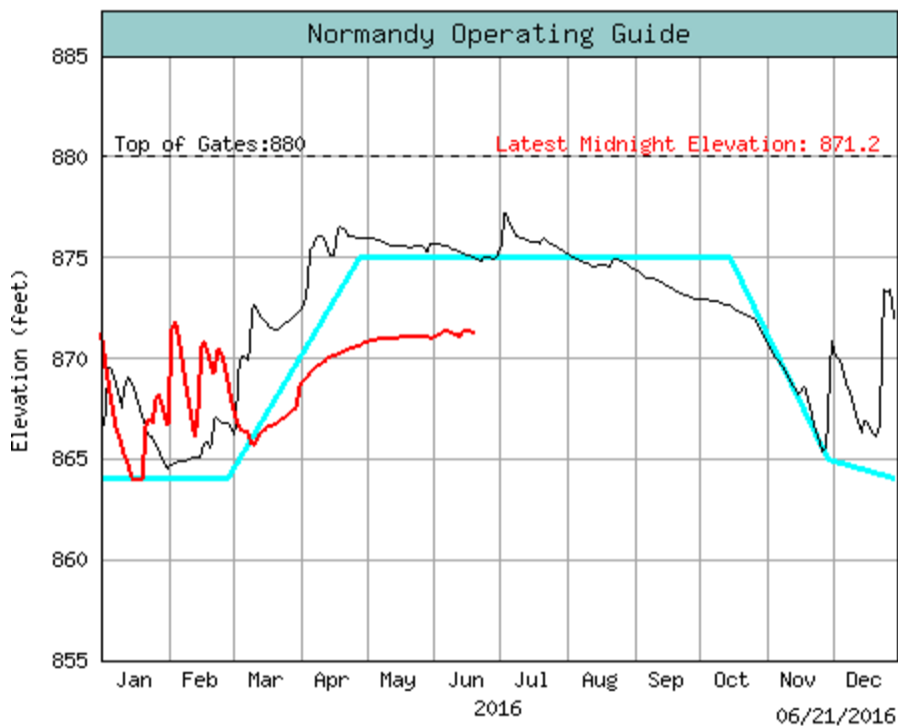
Mainstem Monitoring Stations

- [Duck River at Shelbyville, TN \(03597860\)](#)
- [Duck River near Shelbyville, TN \(03598000\)](#)
- [Duck River above Milltown, TN \(03599240\)](#)
- [Duck River at Mile 166.1 near Pottsville, TN \(03599407\)](#)
- [Duck River at Columbia, TN \(03599500\)](#)
- [Duck River at Hwy 100 at Centerville, TN \(03601990\)](#)



Duck River at Milltown, Tennessee

The Shelbyville and Columbia stream monitors can be viewed on the internet at http://tn.water.usgs.gov/Duck_Streamflows.htm. Normandy Reservoir levels can be viewed at <https://www.tva.gov/Environment/Lake-Levels/Normandy/Normandy-Operating-Guide>.



Since river flows at Columbia are heavily influenced by the controlled release of water from the Normandy Reservoir, monitoring of stream flows and the reservoir levels at the above websites is critical in monitoring drought conditions.

VI. Drought Stages and Response Measures

A. Overview of Water Conservation

One of the primary goals of the CPWS Drought Management Plan is to protect the Duck River from drought damage in the immediate area of Columbia. During severe and prolonged drought conditions, this goal is best accomplished by preserving stored water in Normandy Lake, enabling extended release of water to maintain minimum flows in the Duck River.

However, public water systems' total usage from the Duck River is a fraction of the river's average flows. For example, since the impoundment of Normandy Reservoir, the average daily flow for the months of June through October is 600 cfs (390 MGD). During drought years, the average daily flows for these months drop to 262 cfs (169 MGD). Appendix A of this document contains a summary of USGA-reported monthly average and minimum stream flows recorded at the Columbia metering station. According to the TVA EIS, the average water withdrawals by water systems on the Upper Duck River are about 20 MGD. Much of that 20 MGD is returned to the river by sewage disposal systems.

While conservation by public water systems is important, a majority of the water released is not used for public consumption. Consequently, conservation by water systems affects only a relatively small portion of the overall Duck River flow and, therefore, conservation of water by water systems will not have a large influence on the total river flow.

What is important is the preservation of water in Normandy Reservoir during drought conditions so that the release of water from Normandy can maintain minimum flows in the Duck River. Modified operating guidelines for the release of water from Normandy Reservoir are the primary means of conserving water within the Normandy Reservoir.

Nevertheless, common sense dictates, and regulatory agencies require, water conservation be practiced during drought conditions. In addition, regional issues such as the incapacity of the Normandy Reservoir could require emergency restriction on water use. Therefore, water conservation by water users is an important consideration.

B. Water Conservation Based on Drought Stages

Drought Stages 1, 2, 3, and 4 as further identified herein will be implemented by CPWS. It is expected that all other water systems along the Duck River would enact similar drought management stages.

When approved by the CPWS Board of Public Utilities, water conservation will be “triggered” by the declining Normandy Lake levels, low flows in Duck River at Columbia’s river gage, excess usage by customers, hot and dry weather causing a large increase in demand, or a combination of all the above factors. To implement water conservation procedures, the Board will take into consideration the mission of the Drought Management Plan to protect the health of the citizens served by the CPWS water system and to protect aquatic environments, while sustaining economic and social activities of the area served by the CPWS water system.

The Normandy Lake target points are elevations 872, 868, 864, and 856. At elevation 868, the public is asked to voluntarily conserve and reduce water waste. If drought conditions continue and lake levels or river flows continue to decline, subsequent drought stages will be declared and more serious and mandatory measures will be implemented.

Stages 3 and 4 require water conservation. The level of conservation required for Stage 3 is a targeted 10 percent reduction. Stage 4 calls for targeted reductions of 20 percent.

During a Stage 4 event, situations may occur that require a further reduction or conversely, improvements may occur that will allow some relaxation of prohibited

activities. In either case, water customers will be informed of any change in the Stage 4 requirements.

Stage 4 events will require residential and most commercial users eliminate all outdoor uses of water, thus limiting water consumption to essential and domestic uses. Definitions of these uses are as follows:

***Essential Use:** Use of water is strictly for firefighting, safety, sanitation, health and medical purposes; and, the use of water to satisfy federal, state and local public health and safety requirements. Watering livestock shall be considered an essential use pursuant to this policy.*

***Domestic Use:** Any use of water for household purposes such as drinking, bathing, heating, cooking, sanitation or cleaning, whether the use occurs in a residence or in a commercial or industrial establishment.*

The following tabulation summarizes the various stages that may be implemented and the response measures that will be required of each water customer:

STAGES	ACTION
<p>STAGE 1</p> <p>Drought Monitoring</p> <p>Stage 1 begins when summer time level of Normandy Reservoir drops to elevation 872</p>	<p>CPWS and DRA officials monitor drought conditions, initiate drought forecasts, and prepare for stage escalations.</p>
<p>STAGE 2</p> <p>Drought Alert</p> <p>Stage 2 begins when the level of Normandy Reservoir drops to elevation 868</p>	<p>CPWS notifies customers of drought conditions and provides informational and educational resources to support voluntary conservation measures.</p>

<p>STAGE 3</p> <p>Drought Warning</p> <p>Stage 3 begins when the level of Normandy Reservoir drops to elevation 864</p>	<p>All customers to reduce average summer time usage by 10 percent.</p> <p>Watering of lawns, flowers, trees, shrubs and/or vegetable gardens are restricted to nighttime watering on alternating days.</p> <p>Watering of golf course fairways and ball/athletic fields is prohibited</p> <p>All non-mandated hydrant and line flushing is suspended.</p>
<p>Stage 4</p> <p>Drought Emergency</p> <p>When Normandy Reservoir drops to elevation 856 and/or the Duck River water flows at Columbia are measured below 100 cfs.</p>	<p>All customers to reduce average summer time use by 20 percent.</p> <p>Residential and most commercial users are restricted to essential and domestic uses.</p> <p>All outdoor uses of water, except for fire-fighting, sanitation, health and medical purposes are prohibited.</p> <p>Water served for drinking purposes at restaurants or other public or non-public eating establishments is restricted to be served only as requested by the patron or customer.</p>

Based on a review of other water conservation programs, water reductions required by Stage 4 may require implementation of surcharges on water bills. If deemed necessary, the Board of Public Utilities will recommend such fees for the Columbia City Council’s approval.

As stated in the objectives of this Drought Management Plan, an essential factor is to minimize the economic impact on commercial and industrial customers and the region’s economy. Since Stage 4 imposes severe limitations on water use, it is deemed essential that the implementation of a rationing program under Stage 4 minimize the negative impact on employment. Therefore, CPWS will contact all industrial water customers and commercial customers, as necessary, to establish and maintain workable operation of effected enterprises while achieving needed reduction in water consumption.

C. Coordination of Drought Management Activities

Considerable amounts of effort will be necessary on the part of the Board of Public Utilities and CPWS management to coordinate with other parties as the above Drought Stages are implemented.

The list of affected parties and stakeholders include TDEC, TVA, and other federal agencies, City of Columbia, Maury County, other public water and wastewater systems, Duck River Agency, local industries, and emergency management agencies.

Because of the regional nature of the conservation effort, notifications of Drought Stages should be coordinated with the Duck River Agency.

D. Public Notification and Education about Drought Conditions

Education efforts include a combination of all forms of media:

- CPWS' Columbia TNTV Channel
- CPWS' website
- Printed brochures
- Outdoor advertising
- Bill stuffers
- Newspaper ads and press releases

Educational materials will be produced to communicate what people can do to meet the water reduction goal.

E. Enforcement Features

The overall purpose of the Drought Management Plan is to encourage water use efficiency and conservation. Otherwise, the resource is wasted and waste may lead to more severe restrictions and result in community-wide economic and public safety hazards.

The Board of Public Utilities does not have the implicit authority to fine water customers for non-compliance of CPWS policies and guidelines. However, all customers are required to comply with CPWS policies and guidelines as a condition of service.

CPWS may discontinue service to a customer for justifiable reasons in accordance with CPWS cut-off procedures; therefore, after due process procedures are followed, CPWS may discontinue service to a customer that fails to follow water conservation goals.

Enforcement Action Summary Steps:

- Most water waste cases begin with a complaint from the public.
- Water waste is observed and documented by CPWS enforcement staff.
- A notice of violation is given to customer either by door hanger, personal contact, and/or written notice. The notice will inform customer that customer has violated CPWS Service Agreement and cut-off procedure is initiated.
- A customer may contact CPWS to ask questions or arrange to discuss the violation in person.
- A customer who received a Notice of Violation may contest the cut-off by filing a written request for a due process hearing with the CPWS Executive Director and/or delegate.
- CPWS must receive the customer's written request within 24 hours of the Notice of Violation delivery to the customer's premise. The request must state the property address, customer account number, and reasons why the customer thinks they were not violating the water waste restrictions.
- The due process hearing will be scheduled within 24 hours of the request during CPWS normal working hours.
- If the Notice of Violation is not contested or upheld, CPWS will discontinue service to the customer. A warning will be issued for the first offense.

- Customer may reapply for water service but will be subject to any normal or special charges set by the Board of Public Utilities.
- Customer may appeal the results of the “Due Process Hearing” to the Board of Public Utilities. Any appeal must be in writing. The Board may conduct the appeal hearing at its regular scheduled meeting or at a special-called meeting at its discretion. CPWS is under no obligation to continue water service after disconnection (due to water waste restrictions) during any Board appeal process. Any customer not contesting the Notice of Violation may elect to pay any necessary reconnect charges.

VII. Management Coordination

As stated in in this document, the declaration of a water shortage is the responsibility of CPWS. Procedures for declaration of water shortages are contained in Title 18 – Chapter 3 of the Columbia Municipal Code.

In compliance with this established procedure, the Executive Director of CPWS shall coordinate with the Board of CPWS and the Columbia City Manager that a declaration of a water shortage is necessary. Following concurrence of the Mayor of Columbia and upon the approval by the Board of CPWS, the Executive Director shall issue a water shortage declaration.

As indicated previously, CPWS has established 4 levels of water shortage ranging from moderate, severe, extreme, and emergency conditions. Approval by the CPWS Board of Public Utilities is required with each “*step-down*” change in water shortage level.

When a severe shortage level is declared, the CPWS Executive Director shall activate an advisory team. The purpose of this team will assist the Executive Director and CPWS staff by providing input regarding drought mitigation measures to be taken by CPWS. As the implementation of these mitigation measures begin, the team shall provide comments on the effectiveness of the measures and offer recommendations for changes that could enhance the effectiveness of these measures, if needed. Because the team represents various segments of the community, the team could serve to assist in the dissemination of information concerning the severity of the drought and the need to conserve water.

The time and frequency of the team meeting would be established by the Executive Director. The team would be deactivated by the Executive Director upon cancelation of the severe water shortage level.

As selected by the CPWS’ Executive Director, the team will include, at a minimum, the following:

- Manager of Maury County Water System;
- Appropriate Official(s) from the City of Columbia;
- Representative from Duck River Agency;
- Maury County Mayor or Mayor's designated representative; and
- Representatives from public health and large commercial users.

VIII. Review and Update the Drought Management Plan

In accordance with TDEC guidance, the Drought Management Plan shall be reviewed and updated at a three-year intervals.

In addition, this document may need to be updated based on changes to the DRA Regional Drought Management Plan. However, such updates would be contingent upon the adoption by the CPWS Board of Public Utilities.

**Appendix A –
Duck River Average and Minimum Flows July, August,
September, October, and November Since
Operation of Normandy Reservoir**

Monthly Average Daily and Minimum Flows (cfs): Columbia

1 cfs = 646,272 gallons per day & 1 MGD = 1.547 cfs

	July		August		September		October		November	
Year	Average Daily Flow	Min. Daily Flow	Average Daily Flow	Min. Daily Flow	Average Daily Flow	Min. Daily Flow	Average Daily Flow	Min. Daily Flow	Average Daily Flow	Min. Daily Flow
1977	238	181	196	145	828	137	1,359	324	5,186	742
1978	426	203	453	229	291	199	267	204	935	198
1979	481	209	606	234	3,832	267	1,490	505	5,334	1,500
1980	407	222	266	200	200	184	204	184	236	187
1981	381	159	268	138	229	142	303	137	449	172
1982	331	192	939	170	342	106	215	86	1,085	151
1983	636	182	279	101	168	105	252	157	3,153	187
1984	947	226	867	191	163	146	2,259	177	5,650	1,570
1985	227	175	385	177	264	157	266	122	690	244
1986	232	182	229	172	475	195	317	131	5,925	262
1987	291	155	189	154	205	151	180	157	391	151
1988	220	149	227	153	253	159	241	151	2,295	199
1989	4,740	891	416	272	1,301	261	3,642	409	2,670	395
1990	516	180	209	159	264	155	673	186	935	254
1991	711	231	185	142	211	117	275	171	642	213
1992	828	255	705	228	2,626	247	659	372	3,357	1,280
1993	354	203	268	166	232	149	188	158	452	152
1994	390	183	345	196	334	177	787	233	1,952	292
1995	328	214	630	205	698	180	2,845	269	3,841	795
1996	381	184	1,065	270	690	265	560	269	2,368	500
1997	717	236	256	173	650	141	685	216	1,020	551
1998	1,161	313	1,365	250	188	155	225	186	377	198
1999	992	190	172	149	150	138	160	145	285	164
2000	292	206	246	174	249	168	177	161	792	164
2001	399	202	1,174	206	375	235	902	245	1,123	406
2002	346	186	218	174	675	161	1,110	302	3,347	669
2003	863	339	423	223	1,249	199	295	225	1,610	424
2004	2,216	400	524	240	1,035	242	1,209	236	2,411	705
2005	301	200	300	168	371	192	195	166	258	170
2006	194	168	200	163	189	153	200	158	789	229
2007	210	154	152	122	163	136	174	131	378	126
2008	177	121	359	119	229	141	337	137	273	183
2009	274	137	285	150	2,266	152	2,050	712	1,735	664
2010	315	169	275	148	145	126	204	134	505	176

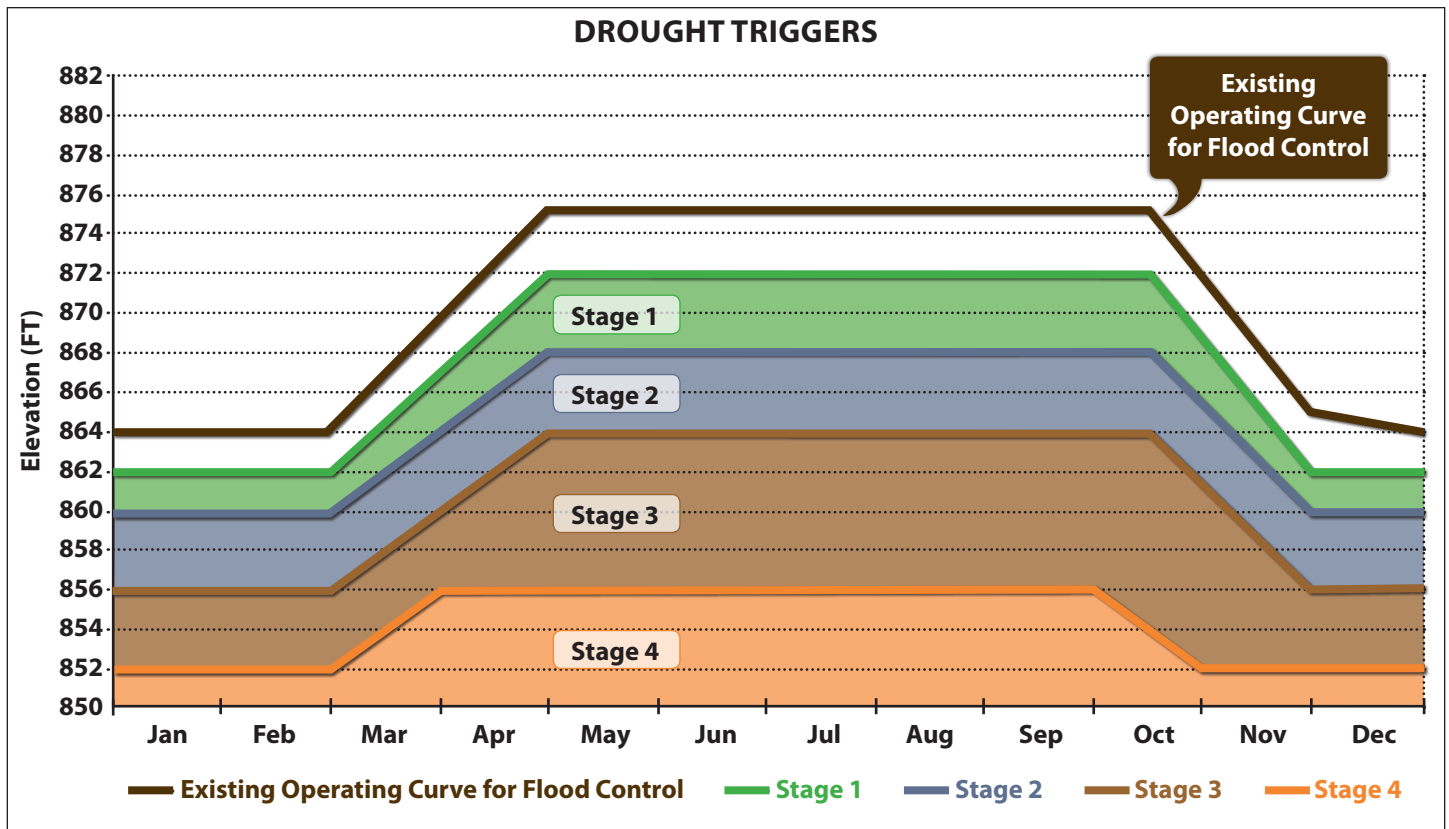
2011	727	236	409	137	1,338	141	366	257	2,642	377
2012	592	120	239	148	992	133	834	286	255	204
2013	3,910	319	625	234	225	176	212	173	467	185
2014	395	190	694	172	427	167	2,099	162	2,475	660
2015	1,418	267	734	155	353	189	402	188	1,622	508
Average	732	224	446	180	638	170	739	221	1793	416
Drought Average	278		316		229		226		743	
Min. Daily Flow		121		101		105		86		126
'07 Drought	210	154	152	122	163	136	174	131	378	126

Drought Years show in Red

**Appendix B –
Duck River Agency Drought Trigger for Normandy Reservoir**

DROUGHT TRIGGERS

for Normandy Reservoir and the Duck River



DROUGHT TRIGGERS

STAGE 1	STAGE 2	STAGE 3	STAGE 4
Drought Monitoring	Drought Alert	Drought Warning	Drought Emergency
<ul style="list-style-type: none"> Initiate Drought Monitoring 	<ul style="list-style-type: none"> Alert Drought Committee Initiate Public Awareness 	<ul style="list-style-type: none"> 10 cfs / week reduction of Shelbyville target (down to 120 cfs) 10% reduction of public water use 	<ul style="list-style-type: none"> 10 cfs / week reduction of Shelbyville target (down to 80 cfs) 20% reduction of public water use

- Impose 28 day waiting period between stages
- Move out of stage if above trigger for at least 7 days