Guidance for Developing Community Water System Drought Management Plans

Tennessee Department of Environment and Conservation
Division of Water Resources

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Part One

Executive Summary
Guidance for Developing Community Water System
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Overall Goal of this Guidance

The **Safe Drinking Water Act** states:

> Recognizing that the waters of the state are the property of the state and are held in public trust for the benefit of its citizens, it is declared that the people of the state are beneficiaries of this trust and have a right to both an adequate quantity and quality of drinking water.

Similarly, the **Water Quality Control Act** of Tennessee states:

> Recognizing that the waters of Tennessee are the property of the state and are held in public trust for the use of the people of the state, it is declared to be the public policy of Tennessee that the people of Tennessee, as beneficiaries of this trust, have a right to unpolluted waters. In the exercise of its public trust over the waters of the state, the government of Tennessee has an obligation to take all prudent steps to secure, protect, and preserve this right.

It is the overarching mission of the state's drought management plan not only to protect the health of this state's citizens and aquatic environments but to sustain economic and social activity. One goal of the drought management plan is to promote dialogue among those who utilize and depend on the water resources of the state and to promote and increase the preparedness of those utilizing Tennessee's water resources when drought impacts them so as to

mitigate adverse impacts. Within the context of the state's broad and comprehensive plan framework it is the responsibility of local water systems to work with and manage available resources meeting their identified goals. This guidance is an effort to assist community water systems in developing drought management plans within the context of the state's overall drought management plan (summarized below).

State Drought Management Plan Overview

The need to develop a state drought management plan, defining the roles and responses of agencies under water shortage conditions, is evident considering the drought impacts experienced over much of the state in 2007. In addition, recent drought-related impacts indicated a need for local water resources development, emergency planning and clarification of current state, federal, local and private responsibilities and authorities.

On February 6, 2009, the Tennessee Department of Environment and Conservation (TDEC) published a Drought Management Plan for the department. It is available online at: http://tn.gov/assets/entities/environment/attachments/droughtmgtplan.pdf

One of the most important aspects of that plan is that Community Water Systems (CWSs) will develop their own drought management plans as stand-alone documents, separate from their Emergency Operation Plans (EOP). This guidance explains in more detail what CWSs should include in their plans. It is the Department of Environment and Conservation's guide for the development of drought management plans by community water systems, industry, agriculture and others. It also serves as the emergency water management plan authorized under the Tennessee Safe Drinking Water Act (T.C.A., Sections 68-13-710) and T.C.A. 69-3-102(b)) and the Water Quality Control Act (WQCA).

Overview of the Drought Management Planning Guide

Collectively the two statutes (cited in the first paragraph of this document) advocate for the citizens of Tennessee the right to have safe drinking water in adequate quantities to meet their needs. Those statutes may not necessarily make it rain in places when there is a severe

drought, or cause rivers to flow on mountains, but where public water lines have been laid, customers are entitled to sufficient amounts of drinkable water.

To meet this obligation, public water systems, particularly community water systems must plan and manage their supply, treatment, storage and distribution of water with great diligence. It is an incredible responsibility. This guidance has been designed to assist water systems in meeting these objectives. It provides direction to systems recognizing that water systems can be complex and uniquely different with respect to types and number of source(s), source limitations and constraints, water quality, treatment processes, hydraulics and storage, distribution system size, types of water use (interruptible and those that are absolutely essential), seasonal variations in demand, and even the risk tolerance of customers.

The "Guidance for Developing Community Water System Drought Management Plans" consists of eight (8) steps or tasks. Although this guidance can be used by industry, agriculture and public water suppliers, the guide focuses on the development of plans by Community Water Systems (CWSs). This focus should benefit water systems. Also, several of the eight steps or tasks correspond to elements addressed by the "Public Water System Emergency Operations Plan Guidance Document" (October 2007) produced by TDEC in 2007. For reference, the "Public Water System Emergency Operation Plan Guidance Documents" can be found on the internet at: http://tn.gov/assets/entities/environment/attachments/pws_eop_guidance.pdf

TDEC recommends that CWSs take the eight steps or components of this guide in the order given below, but concedes that the planning process (the steps outlined below) can be an iterative process, revisiting components or steps of the planning process, refining goals, modifying policies, identifying new resources, enforcement, because as the plan unfolds the component parts need to close any gaps and ultimately work together as a whole. It can be a complicated process because, not only do drought management phases need to work for communities, water systems also must expand to accommodate growth in phased- development.

Table 1, "Community Water System Drought Phases" illustrates what actions a water system might plan in the event of a continuing drought. (The reduction amounts used below are arbitrary.)

Table 1

Community Water System Drought Phases

Program Phase	Goal	Triggerpoints	CWS Actions
		Public Water Suppliers	
Normal Conditions • Water supply is adequate; water quality is acceptable under normal management	• None	• None	• Develop Emergency Water Management Plans • Develop additional storage and treatment facilities; evaluate distribution system • Adopt standby rates, other necessary ordinances and codes and establish mutual aid agreement, interconnections, conservation education, etc.
Drought Alert • Lower than normal precipitation, declining streamflow and lower groundwater levels; greater than normal demand	• None	• D0 or D1 US Drought Monitor Classification (Abnormally Dry or Moderate Drought)	• Monitor water sources and daily water use for specific purposes and anticipate user demand
Voluntary Reductions • Water suppliers/water quality deteriorating or conflicts among users	• 7 percent reduction per day	• 90-day supply (reservoir)	• Implement "Reductions" phase at plan triggering point(s). Potential water use reduction measures include curtailment of outside uses, education and pricing • If reduction goal is not obtained, implement mandatory restrictions • Notify TDEC of source conflicts
Mandatory Restrictions • Continued decline in water supply and/or water quality	• 17 percent reduction per day	• 60-day supply (reservoir)	• Implement "Mandatory Restrictions" phase at plan triggerpoints; restrictions could include banning of some outdoor water uses, per capita quotas and percent reductions of non- residential users • Notify TDEC of source conflicts
Emergency Management • Severe water supply or water quality problems due to very limited resource availability	• 30 percent reduction per day	• 7-day supply (reservoir)	• Notify TEMA and request emergency declaration • Provide bottled water and sanitation suppliers to users • Make hospitals, firefighting, etc. priority • Initiate hauling of water • Comply with Commissioner's Orders

Problems and needs that are regional or statewide should be addressed by agencies having a state or regional water management responsibility. Some problems may be beyond the state's authority or ability to manage or may have a national impact. The general drought responses and roles of state, federal and local agencies are found in the state's drought management plan.

This document builds on that plan by providing guidance to community water systems on how to develop a drought management plan.

Table 2

Drought Management Planning Steps
Simple Overview of Steps

Step	Action
1	Preplanning
2	Organize the Process
3	Identify Existing Plans, Partnerships, Policies and Procedures
4	Coordinate with State and Regional Agencies
5	Plan the Management Phase Responses
6	Plan for Implementation – Monitoring, Detection and Triggerpoints
7	Identify the Management Team
8	Review, Evaluate and Up-date the Management Plan

PART TWO

An Eight-Step Drought Management Planning Guide

The eight steps of local drought management planning were outlined in Appendix D of TDEC's drought management plan.

TDEC recommends that CWSs take the eight steps in the order given below, but recognizes that steps of the planning process will likely need to be revisited or modified as the plan is implemented.

Step 1 - PREPLANNING

The initial step of a plan is to recognize what agency, task force, or group is to be tasked with developing a plan, generally state its purpose or goals, identify the major factors that may affect achievement, and identify the available and needed resources necessary to develop a plan.

- **Authority and Status to Plan** Those developing plans must be recognized and have the authority to develop a management plan.
- **System Characteristics and Risks**

Water system features which should be recognized include source(s) of water, limitations and constraints, water quality, treatment processes, hydraulics and storage, uses by type, seasonal variations in demand, and risks to systems. When it comes to risks, often, it is best to begin with what the question, "What problems have occurred in the past?" Then elaborate on those problems with a few what if questions like, "What would have happened if….?" A particularly good question might be, "What would have happened if the drought had continued for another 6 or 8 months?"

- **Drought Management Plan within the Context of an EOP** CWSs are required to have an Emergency Operations Plan (EOP). The drought management plan is a component of the EOP. However, TDEC is requiring systems to adopt freestanding drought management plans because of the benefits that result from public input into their development. Unlike most of the events associated with an EOP, drought conditions typically worsen over an extended period of time, often making it difficult to make the hard decisions to restrict water among users. How much is used and what uses should have priority?

No "template" or "fill-in the blank" plan exists that can satisfy every system because every system is unique in terms of its customers (their expectations and goals), water uses, source(s), infrastructure, etc. Because of these differences, water systems need to involve their customers (people, businesses and organizations who are supplied water) in a dialogue to identify potential user impacts as well as inform consumers of their plan's approach to managing the system under increasingly difficult circumstances.

Step 2 - ORGANIZING THE PROCESS

The beginning steps should establish a framework for developing a plan, who and how others will participate in its development, determine its scope, and timeline for completion. Essentially those tasked with developing a management plan must outline a process and build on whatever existing planning, experiences, and mandates already exist.

- **The Planning Committee, Task Force, Individual or Other Group.** A group or an individual must be made responsible for developing the plan.

- **Planning Process**. Those responsible shall ensure that the process is fair, orderly, reasonable and functional.

- **Public Involvement and Public Review.** The process of developing the plan shall include public involvement. At a minimum there shall be notification of the public and a public hearing process prior to the adoption of the plan.

- **Identification of Goals.** At a minimum the over-arching mission of a CWS during a drought might be:

Maintain the provision of water throughout the water system in order to meet the water system's established objectives and priorities under increasing worsening drought conditions in order to minimize adverse effects on public health or safety, economic activity, environmental resources or life activity.

The goals of the plan shall at a minimum include:

- To detect and monitor the type and severity of the situation (source, hydraulic or water quality issues);
- To take the appropriate action in order to minimize adverse impacts, damage or losses, protect health and save lives;
- To ensure water is safe to drink and establish a plan to notify customers of any necessary and appropriate protective actions (e.g., issue Boil Water or Do Not Drink Notices);
- To remain in compliance with state and federal Drinking Water Regulations during an emergency response; and
- To address and repair damaged water system components in a prioritized schedule.

Those involved in developing the drought management plan should also consider the following principles:

- Identify drought triggerpoints and corresponding management stages which are not overly optimistic and managerially realistic.

- Utilize a process in developing the plan that allows customers not only to participate in its creation, but also better anticipate what will be expected of them whenever the plan is implemented.

Though the goals and principles may be the same for many CWSs, their plans will be unique as they must recognize that the circumstances of individual CWSs and the risks each face are different. Water systems utilizing a "Big River" source may not need to develop as detailed a drought management plan with respect to dealing with a long-term source shortage, but may still need to address drought-related hydraulic problems. Other systems will need to develop extensive drought management plans addressing source, hydraulic plan implementation and other issues related to an extended drought. Even water systems that have "modeled" their source need some sort of drought management plan. Modeling rainfall chances, streamflows (water transfers, imports and exports) may be helpful in developing a risk-based plan but models do not guarantee that rain or streamflow will come by a certain date.

Objectives and Priorities

Health (Medical, Elderly, Nursing Homes, Sanitation) Safety (Fire Protection if applicable) Environment (Erosion Control and Aquatic Habitat) Economic (Product, Process, Cooling) Recreation (Pools, Spas, Athletic Fields, Golf Courses) Aesthetic (Landscaping, Lawns, Fountains)

Plans shall establish water use priorities among uses: medical facilities, nursing homes, residential, industry (process, cooling, general sanitation), lawn-watering, recreation (pools, spas, athletic fields and golf courses) and fire protection. Many small water systems do not serve hospitals and medical facilities, etc. Other systems maintain no fire hydrants and have no fire protection function. Many water systems must also consider impacts on their source(s) and any identified aquatic habitat needs. Not all management tools work equally well in ensuring that water is available to priority uses.

Step 3 - IDENTIFY EXISTING PLANS, PARTNERSHIPS, POLICIES AND PROCEDURES

The CWS shall take an inventory of existing Operating Procedures and Requirements and Other Agreements that apply and consider any existing Partnerships. These may include: nearby utilities, fire departments, Local Emergency Planning Committee (LEPC); public health officials, associations, laboratories, and regulators.

- **Existing Emergency Operations Plans and Drought Management Plans.** A CWS should review any existing EOPs or drought plans it has developed and consider reviewing such plans of other water systems to ensure it is aware of all potential issues and responses. If interconnections are not already in place with adjoining systems opportunities for making interconnections may be identified. EOPs that have been successfully implemented may provide additional insight into what management tools worked well, activation of phases and responses to public notification, enforcement issues and other plan features. Considerable work may have already been done preparing an older EOP and data contained in it may only require verification or updating. Although existing EOPs can be useful, it is also important to bring a fresh perspective to the updating process.

- **Interconnections, Mutual Aid Agreements and Backup Sources.** These are essentially management resources which need to be re-evaluated in terms of their potential contribution to new conditions and system demands.

- **Ordinances, Policies, Legal Requirements.** Finally, it is important to identify any new or revised rules, ordinances, policies or legal requirements that may affect the planning process or the management plan itself. New federal, state or local legal requirements may be proposed or have become effective which place additional constraints or demands on the system in terms of providing water during emergencies or continuing drought.

Step 4 - COORDINATE WITH STATE OR REGIONAL AGENCIES OR OTHER CWSs

The response to a single-point or isolated emergency may well fall to a single agency responding to an identifiable, single system impact (i.e., widespread water demand, the loss of a critical component or an asset). However, droughts may also impact other service providers within a larger context and the responses of each affected player must be coordinated in a unified manner in order to address multiple-CWS or large scale impacts. Other agencies relying on common water resources should be identified in order to work with them prior to a severe drought.

Identify Applicable Regional Considerations / Stakeholders.

- Non-potable (Agricultural – Livestock and Crop)
- Temperature (Thermoelectric power)
- Reservoir Conservation (Hydropower, Navigation and Recreation)
- Aquatic Habitat (Streamflows and Stream Classification Issues)
- Water Quality Issues (NPDES Discharges, natural and seasonal problems)
- Dam Safety (e.g., Center Hill and Wolf Creek Dam repair)
- Other Community Water Systems (Water allocations)

Clarify and Address Limiting Factors.

It is vital in developing a drought management plan to identify source risks, institutional barriers and other limiting factors. In this step water systems are encouraged to determine streamflow requirements, reservoir operational policy, agricultural, municipal and industrial water use needs. In determining low-flow data it may be critical to engage in dialogue with state and federal officials to understand those requirements. In some cases new information may require that current policy to be changed.

Reservoirs are generally managed according to an "operating curve." These operating guidelines specify the amount of water released from a reservoir downstream. If the reservoir has its pool

allocated into "components" a certain amount of water in the reservoir has been set- aside for a particular use. These components depending on the functions the reservoir was built to serve. Many tributary dams were designed to provide for hydropower generation and flood protection. A reservoir designed to provide for flood protection will generally be drawn down in the winter and allowed to come up to summer pool after the potential for spring floods have passed. Reservoir operating guides ensure there is sufficient flow downstream to assimilate waste discharges from industry and urban wastes as well as aquatic life needs.

Water systems depending on reservoirs should engage in discussions with TDEC (DWR), TVA, ACOE, and others to determine what resource limits apply, whether allocations can be re-assigned, re-negotiated, or purchased, and if wastewater releases can be modified to address unusual drought flows. Such conversations may lead to discharges of particular pollutants being treated to a higher level so that water once needed for assimilation can be reallocated. Water systems need to be aware of NPDES, ARAP, 404 and other resource program permits in the context of public drinking water needs at those times when supplies are most limited. Withdrawals that could affect a public water supply source are restricted under T.C.A. 68-221-711(8). Current and projected water use should also be considered within this context and agreements with upstream and downstream users' waste allocations and instream flow needs critically examined.

Drought management plans must take into account how streams are classified (fish and aquatic life, recreation, etc.) and thought must be given to any ramifications caused by stream classification (whether it is classified as a "wet-weather conveyance or for recreation use), TMDLs, etc. during extended and severe droughts. For example, It may be important to understand that a stream used for recreation is protected in order to provide sufficient instream flow for canoeing. Managers need to identify what standards and policies are being used in order to discuss their merits relative to any other public values associated with a particular source.

Intake design is another critical issue water systems need to consider when evaluating source risk. In 2007-08 several major dams were deemed in need of repairs and pools were lowered to facilitate those repairs. When the reservoirs were created and water system intakes were built, the combination of lowered pools and drought placed some water systems at a much higher risk than

expected. Several water systems have determined that floating intake designs are less vulnerable to drought.

Other community water systems within the region, some of which may be interconnected, need to be evaluated as a whole in terms of risk. When one water system supplies water to several other systems, any source risks associated with that system are assumed by all the systems served by it. Water systems need to determine the reliability of the parent system, the impact of any contract limitations to any served by it, and to what extent there may be any cascading of impacts to others.

Step 5 - PLAN THE MANAGEMENT PHASES AND TRIGGERPOINTS TO THOSE PHASES

As droughts emerge and according to Tennessee's Drought Management Plan, TDEC will rely on the latest U.S. Drought Monitor which can be found at the following website: http://droughtmonitor.unl.edu/Home/StateDroughtMonitor.aspx?TN

Every CWS drought plan should begin with TDEC's first Drought Alert. This phase should initiate whatever monitoring is required by the triggerpoints established in the CWS's plan.

The DWR recommends three management phases (in addition to a "Drought Alert" phase) to address worsening drought conditions.

CWSs may identify other phases to address more specific situations, such as hydraulic ones that may focus on specific areas of a distribution system, or user groups. However, these phases should not be complex or overly complicated so as to create confusion among customers as to what is required. Some actions, such as imposing contract conditions with an industry or other large volume water customers, may not require notifying the public (with implementation behind the scene). At the same time, no one single approach may be effective for a water system in

making it through a severe water shortage. Instead, a basket of actions – restrictions, standby rates, enforcement, incentives, and monitoring - is recommended to create an overall program that encourages reducing water use. Community water systems are required to have water conservation rates (also commonly referred to as a drought management surcharge or stand-by rates) to provide an additional incentive during drought management phases. Actual rates are not prescribed by this guide, but rates must be effective in reducing water demand. In addition, the water supplier should attempt to focus on providing customers with information that helps customers to reduce their water use while still allowing them flexibility and choice in how water is used. Public support and cooperation is likely to be higher if actions appear equitable, that is, all customers are experiencing a similar service level and degree of hardship and if they have been given an opportunity for voluntary reductions prior to mandatory ones.

Phased Management (See TDEC Drought Management Plan)

- Drought Alert
- Voluntary Reductions (or Measures)
- Mandatory Restrictions
- Emergency Management

Use Risks.

Identify water uses that would be classified under the 4 general categories below. Other categories may be identified. The plan should identify priorities relative to accomplishing identified missions, i.e., protecting certain user communities or groups (e.g., hospitals, nursing homes, veterinary clinics, etc.), and identify any groups that might be more severely impacted as a result of any restrictions to their supply (e.g., senior residential housing, child care centers, schools, industries that incorporate water into their product, etc.)

- Essential Uses
- Fire Protection and Suppression
- Economically Important
- Non-essential

Identify Management Phase Triggerpoints

Identifying realistic triggerpoints which are tied to plan phases will require making a detailed study of the critical factors limiting water availability. Several points may be applicable at which actions are to be taken. These are often referred to as triggerpoints. The value of triggerpoints is that these are rationally identified during times when fear and other emotions are not necessarily overriding. Triggerpoints are identified based on calculated and known factors, not ignorance. They may be based on issues of water quality (e.g., taste and odor), system limitations (e.g., pump capacity) or the loss of critical resources (e.g., declining lake levels). Specify what enforcement actions are to be taken, when and by whom. When will the informational and educational steps be taken and by whom? The establishment of triggerpoints is a critical consideration in this step. Water systems using reservoirs need to examine the capacity of their reservoirs to supply water and to what extent water stored in a reservoir is dedicated to meeting other needs.

Possible triggerpoints (by source) and phases include:

Reservoir (Major River and Tributary) Large rivers, tributaries and reservoirs (TVA and Corps) are regulated, meaning streamflows downstream of the reservoir are managed according to an "operating guide." Please Step 4 regarding the topic "Coordinate with state and regional agencies." Reservoir Operating Guides can be modified to better meet water supply needs during drought. Water systems that promote water conservation (by having leak detection programs, regular meter replacement, etc.) may not be able to reduce water demand as easily as industry and other dischargers can provide additional treatment.

Also, water systems that seriously examine their source's capacity under extreme drought conditions may find their drought management plan cannot reasonably sustain users without unacceptable consequences. Even with the best of plans, it may be determined that the best solution is a long-term regional resource development plan. It is within this context that a drought management plan may be thought of as "a plan within a plan." As mentioned earlier, water system officials need to engage state, federal and regional agencies with regard to stream classification, NPDES and ARAP requirements and wildlife needs to identify short-term opportunities that also have the potential to satisfy long-term resource needs as well.

90-day. It may be determined that the reservoir generally has in excess of 90-days supply of water. In a drought it might be that when water supplies in the reservoir fall below 90-day supply users would request "voluntary reductions." The goal of this phase of management might be a 7 or more percent reduction in water demand. This phase of water management might include public education efforts on ways to conserve water, etc.

60-day. If demand is not reduced by 7 percent (given an established level of production) or reservoir water supplies fell below a 60-day supply, system managers might then impose "mandatory restrictions" on its customers. The goal of this management phase might be to reduce overall demand of the system 21or more percent. Mandatory restrictions might include limiting lawn watering from sunset to dawn, etc.

10-day. If demand is not reduced by 21 percent (of an established level of production) or the reservoir falls below a 10-day supply, the system might then impose "Emergency" management restrictions, with the goal of reducing overall demand by 35 or more percent.

3-days or less. Identify actions which need to be taken to provide drinking water to customers that are likely to be without drinking water or who are without drinking water.

Run-of-River (First Order and Lower Order Streams) Triggerpoints for run-of-river water systems will depend largely on the demand for water both up-stream and downstream, the amount of water needed and withdrawn at either of those points, instream flow needs (waste assimilation and critical habitat), and the amount of water the system can physically withdraw. Run-of-river water systems should also monitor upstream for unauthorized withdrawals, reporting any withdrawals to the DWR. Statutes are in place to prevent any detrimental withdrawals. Reductions in water demand must correspond to streamflow, intake design and weir dam considerations. Triggerpoints must "lead" actual shortages, due to the time needed to notify customers and achieve reductions in demand.

Groundwater (Wells and Springs) Groundwater based systems must analyze their source in terms of their source's recharge capacity (based on geology such as West Tennessee aquifers, east

or middle Tennessee regolith or bedrock wells, pump test data, pump capacity and historic production (seasonally and during previous droughts). Like run-of-river systems, Triggerpoints will require making a detailed study of these critical factors. Groundwater systems that do not or cannot identify "limiting" factors with regard to their source other than their current or "normal" water use should still consider water management phases because unforeseen events do happen. Water wells and springs sometimes suddenly decline in yield. Water quality may change; particularly turbidity may increase 100 or 1000 percent. Water systems experiencing such changes have included: Pikeville Water System (Dec 1998), Savannah Valley UD, and Siam Utility District (Apr 2008).

Public Water System (Purchase Systems and Cascading Declines) Systems that purchase water from other water systems also need to design water management schemes based on reductions of water from their parent sources. Exceptional droughts can affect large regions, causing demand to escalate and source supplies to decline. All of the systems on a large regional water system may need to curtail water demand. For systems that might be classified as a "large regional water system" (or a number of water systems dependent on one or two regional suppliers) water management phases need to be coordinated, based on hydraulic realities, common or similar phase reductions and restrictions.

Ponds, Cisterns and Other Sources Many smaller water systems utilize ponds, rock quarries, mines, and other sources. Identifying triggerpoints relative to using one of these sources must be made cautiously as most of these sources can be variable with respect to their potential recharge and subsequent yield. Water systems may even need to monitor the condition of area farm ponds as a triggerpoint, because owners of livestock may be customers of the water system and when ponds and streams fun dry serving their livestock, they may purchase quantities of water much greater than they normally do in order to keep their livestock alive. (Monitoring ponds, etc. would be a "supply-side" element in the plan, while monitoring rural customer water use would be a "demand-side" element of the plan).

Purchase Water Limitations Water systems purchasing water from another system or systems may be limited by their contract as to the amount of water they can purchase or that can be

delivered given a system's design constraints. These limitations may define the triggerpoints needed to manage a water system.

Non-Source Related Triggerpoints.

Hydraulic Capacity Also, all water systems will need to identify Triggerpoints corresponding to hydraulic limitations in their systems. Treatment plant, high service pump, main size, and tank storage capacity issues are a system's most common limitations. Some hydraulic limitations may be experienced only in a limited area of the system. Planned responses to address these kinds of problems may be very helpful to managing a water system. Areas within the water system's service area for which the system is having difficulty serving, that is maintaining flows and pressure, may need to be managed more specifically.

- **Treatment Plant**. When water use demand approaches or exceeds a water system's treatment capacity it is imperative that demand reducing measures be implemented. Water use cannot exceed treatment for very long. A water system must identify in combination with what it can purchase from other systems the amount of water it can treat and establish an appropriate triggerpoint. When the water treatment plant reaches 80 percent of capacity, it is required by regulation that the water system submits plans to the DWR to increase treatment capacity.

- **Pump (High Service, Pumping Stations)**. Other useful indicators pertaining to a water system's hydraulic capacity include its ability to pump water and storage tank issues, particularly maintaining storage levels needed to maintain adequate pressure and fight fires.

- **Storage Issues (Tank Depletion).**

- **Main Sizes.** The diameter of the pipes feeding the service area is an important factor in meeting water demand.

- **Maintaining Pressure (Low-Pressure, Out-of-Water**). Areas in a distribution system that chronically experience low pressure while other areas have acceptable pressure may determine the triggerpoint implementing a management phase for the entire system. If an area cannot be isolated and managed so that minimum water pressures are maintained, the entire water system must be managed so that minimum water pressure is maintained throughout the system.

Water Quality The plan must address how the system will respond to water quality concerns, such as taste and odor complaints, etc., that exceed what is normal for summer months. To address these issues a water system should address how it will adjust its water treatment processes, adding sodium or potassium permanganate or activated carbon, flushing lines, etc.

- **Taste and Odor.**

- **Turbidity.**

Precipitation / Soil Moisture. Monitoring soil moisture may be a useful indicator in terms of activating a drought management team and calling for officials to become aware of the potential to initiate increased monitoring of demand and supply conditions. The US Drought Monitor is a reliable indices of precipitation and soil moisture: http://droughtmonitor.unl.edu/Home/StateDroughtMonitor.aspx?TN

Complaints CWSs having higher than normal taste and odor complaints, loss of water pressure, etc. should consider using these numbers as a triggerpoint for implementing taste and odor treatment techniques, or reason for reducing water use in the system.

Forestry – Fire Hazard Like loss of water pressure, a heightened risk of fire within a water system's area may also warrant identifying a triggerpoint whereby water supplies are conserved (increasing the amount of water held in tanks and reservoirs) in the event of a major fire.

Balancing Supply and Demand

This step in developing a drought management plan is the most complicated from the standpoint that system personnel must anticipate drought-available supplies and manage demand while keeping an eye on system priorities. Balancing supply and demand within phases will be an iterative exercise, initiated by identified triggerpoints. In this process, where acceptable quantities of water cannot be identified and water use groups cannot even theoretically reduce demand, it may be necessary to re-visit issues (and look to developing a reservoir, drilling investigative wells, etc.). In other words, the water system may need to go beyond preparing immediate responses where a drought is severe or exceptional to investigating options and developing water supply plans referred to elsewhere as "regional water supply planning". Such actions would constitute "pre-planned" drought management actions which would be implemented prior to the implementation of a drought management plan. In this sense, a drought management plan is a plan which fits within a larger long-term scheme of regional water supply planning and development. These efforts often occur in phases.

Management Goals and Objectives

Once key triggerpoints have been identified, planners need to establish the levels of water use that best correspond. In some cases, this may be reserved, with triggerpoints being established in response to levels of water use reduction. The point is that triggerpoints and target levels of water use (that call for reductions in water use) are essentially matched. If a permit or source contract with a water wholesalers establishes a given amount of available water, reductions must be called for that equal or exceed that objective. The management plan below attempts to strike that balance for each phase identified below.

Variances

One final consideration for drought management officials to include in a drought management plan is the need to allow for "Variances." Variances are a means to provide for customers who are unable to comply with the system's Mandatory Water Restrictions, and Emergency Water Management Phases. Variances allow for customers to petition the water system to allow for additional consideration with respect to a potential issue involving health, safety or extreme economic hardship. Other conditions may also be established based on the facts of the case.

Step 6 - PLAN FOR IMPLEMENTATION

Monitor Supply. Droughts can be monitored using rainfall, temperature and soil data. The US Drought Monitor is a very useful monitor. Weather forecasts are also useful. In addition, the availability of drinking water can be assessed by monitoring reservoir levels, river stages and streamflows, depth to water in water wells, spring discharges, storage tank levels and water treatment plant production. Electrical demand and production can also be monitored. Drought sensitive users must develop detection schemes to monitor their situation and determine what conditions or circumstances call for action.

Monitor Demand.

By Water Use Category A water system serving customers who own livestock or engage in activities that may meet "priority" requirements but do not normally purchase water from the system to satisfy these needs should consider potential demand for these uses during drought conditions. Water system officials might encourage livestock owners to maintain water wells to provide water to cattle and other animals when ponds, streams and springs become dry. They might also encourage such owners to enlarge and maintain ponds. Water system officials may even consider working with county and agricultural officials to look at programs for hauling non-potable water for livestock during extremely dry weather.

Geographic Area Areas within the water system's service area in which the system is having difficulty maintaining flows and pressure, may need to be managed more specifically.

Time of Day Much of the water used to irrigate lawns, golf courses, gardens, athletic fields, wash cars, fill swimming pools and spas, water shrubs, wash dairy milking parlors and sidewalks, etc. is lost by evaporation. To minimize this loss, water systems can restrict such uses to times when less evaporation occurs, usually after sunset and until after sunrise. Such restrictions shift some demand to off-peak times leveling use throughout the day, and reduce demand related hydraulic issues.

Public Notice – Plan Activation The water system must determine how it will notify customers of plan activation in a timely and effective manner. To ensure that notices (whether letters, door hangers, news releases for the media etc.) communicate accurately and well the

DWR recommends that such notices be drafted before the drought begins. Additional specific details, such as effective dates, etc. can be added when the plan requires activation.

Notices (letter, door-to-door notices, etc.)
Media (radio, TV and internet)
Public Meetings

Plan managers must also be aware that there will be response lag-times to the activation of the various phases. The activation of each phase will not occur as if in response to a light-switch. Reductions in water use will occur over a few days despite a system's best informational-public notification efforts. Many customers today do not listen closely to radio or television, many do not subscribe or read newspapers daily, and some customers will be out of town. Public awareness of each phase and a clear understanding of what is required will take some time. To achieve the plan's goals other measures must accompany a water system's public notification efforts. Unfortunately, it will require a compliance and enforcement plan.

Compliance and Enforcement The plan must include how it will be enforced. A plan without staff and equipment to determine compliance and follow-up with enforcement will ultimately fail. If measures require staff, changes to software or equipment (such as vehicles, fuel, etc.), it is important to plan for them. In addition to preparing the public notification measures ahead of time (discussed above) the plan must establish procedures to respond to customers who have been reported as not complying, determine and establish a process for warning customers, developing a schedule of escalating penalties, and determining when shut- offs occur. A Water system must make sure it is capable of undertaking the actions and measures specified by the plan. This activity may necessitate budget considerations by the water system:

Staff and Vehicles (Meter Reading, Hang Door Notices, etc.)
Complaints Procedures
Warnings, Citations, Penalties
Water Shut-offs

Water Conservation A "Water Conservation Program" is distinctively different from temporary reductions in water demand during a period of drought. For the purposes of this guide, the phrase "Voluntary Water Reductions" is not a substitute for the term "Water Conservation Program."

This guide does not use the term "Water Conservation" for a phase of drought management, preferring instead "Voluntary Water Reductions." This has been done in order to distinguish between two types of conservation measures. During periods of drought it is impossible to significantly reduce water use by promoting the use of low-flush commodes, shower flow-restrictors, car wash water recycling equipment, and adopting xeriscape landscaping, etc. These generally take time to for customers to adopt. Also, once these technologies are employed water savings are generally permanent. These water conservation practices translate into reductions in water use over the long-term.

Voluntary Water Reductions Voluntary Water Reductions are public appeals to customers to engage in short-term measures to reduce water use. These might include reducing landscape watering, forgoing the home-washing of a vehicle, not allowing children to play under a sprinkler, waiting to do laundry until bigger loads can be done and flushing the commode less often. The emphasis is on reducing water use, increasing (at least for a short- time) efficiencies and preventing water losses. A water system's appeal to customers for "Voluntary Water Reductions" (and even more so under the "Mandatory" and "Emergency" phases) may place heightened attention on conserving water during periods of drought. The appeal, unlike a conservation program is for the most part a temporary emphasis to identify water uses that can be made more efficient given much greater attention. It is in fact, an appeal to customers to take a look at their uses, identify maintenance and use practices that can be given (at least over a limited or short term period of time) increased attention. For water system managers, this means water

line breaks and distribution system leaks need to be addressed more quickly and diligently once a system calls for "Voluntary Water Reductions."

On the other hand, a true, year-around water conservation program will carefully flush distribution system lines, have an on-going leak detection program, regularly replace old meters, optimize water treatment processes (so as to not waste water as a result of excessive backwashes), fund a low-flow commode replacement program, educate customers regarding landscaping alternatives, etc. An on-going water conservation program may even mandate water efficiency requirements relative to landscape irrigation and require developers to utilize drought resistant turf and plantings, etc. The goal of water conservation is to allow water purveyors and users to make the most efficient use of a seemingly diminishing and valuable resource. It is often pursued in conjunction with the recycling and reuse of water and has an objective, a reduction in hydraulic and operational requirements. The components of a model water conservation program and state policy may be detailed in another document at a future date.

Step 7 - IDENTIFY THE MANAGEMENT TEAM – PURPOSE, STRUCTURE, ROLES AND FUNCTIONS.

Establish Management Team. The plan must designate an appropriate management team (Task Force or other group) to monitor conditions (supply, demand, etc.) and implement actions according to the pre-determined triggerpoints. Issues to focus on include: Management Team Structure – Membership, Reporting to Whom, etc. Who is involved may depend on whether there is a city manager, mayor, water system director, etc.

Activation of Team. The plan must specify when the team is to be activated. Activation of the team should precede activation of phases and should roughly coincide with the "Alert" phase. The triggerpoint for this event might be based on a soil moisture level or an intensity level in the

US Drought Monitor for the area: http://droughtmonitor.unl.edu/Home/StateDroughtMonitor.aspx?TN

A reasonable level for activation of the team might be the "Moderate" level drought identified by the US Drought Monitor for the area. Once the team is activated, those responsible for monitoring source, demand and hydraulic conditions would activate phases based on previously established triggerpoints.

Function and Roles Depending on the scope of the drought and area impacts (refer back to step 4), the management team may need to subordinate their actions with other entities (e.g., Soil Conservation District, TVA, County Mayor). This may only require that some actions taken be coordinated with to a higher-level authority, ensuring that actions are parallel. In such larger events, a water system may not be the appropriate agency to take charge. Utilities, cities, regional agencies and private sector organizations must work together in a coordinated fashion in response to some situations or emergencies, having multiple impacts. It is essential that the plans define the roles of each agency in an emergency situation and identify who is likely to assume authority under various scenarios.

Decision-making There must be someone designated as having the responsibility to activate phases at any given time. Someone must be in-charge of making decisions to hire temporary employees and lease vehicles. Indicators and circumstances are not always clear or decisive. It is important to have identified who's responsible for news releases, phase activation, contacts with neighboring systems and hiring part-time employees. Some decisions may need to be made that are not scripted by the plan, because events and conditions demand that they be addressed. Droughts are dynamic and plans adjusted because of new conditions or oversights.

Records and Documentation Water systems need to maintain records of water supplies from various sources, demand data by water uses, management phase implemented, issues and problems confronted by the system, response lag-times to the activation of various phases and any other circumstances that should be noted. These records can be very useful in determining what changes need to be made in the system's management plan. The system must identify what information is needed and who will collect it.

Deactivation A water system should have procedures for clearly stepping down its management phases leading to the deactivation of its plan. Failure to announce changes may lead to credibility issues and skepticism of the plan and officials responsible for implementing the plan when customers observe other customers not complying with provisions of the plan and enforcement isn't being taken.

Step 8 - REVIEW, EVALUATE AND UP-DATE THE MANAGEMENT PLAN

Evaluation after Implementation If a water system has had to implement its plan, it is important to identify any problems that may have been identified with its implementation. Those who own the plan should then address any identified problems.

Update the Plan. It is essential that the plan be completely reviewed, evaluated and up-dated at least **every 3 years**. It is important that the water system work with the DWR when the plan is updated to ensure that any changes to their plan meets any new state requirements.

Adopt the Plan. The plan must be formally adopted by the governing body of the CWS.

Part Three

Fictitious City Drought Management Plan

This portion of the state's guidance to community water systems is intended to be an example to municipal water systems and utility districts as to how a drought management plan might unfold and what it might contain. Fictitious City contains elements of several actual water systems. The example here is meant to show how a hypothetical water system went about identifying levels of water availability and various triggerpoints corresponding to levels of managed demand. This planning model does not contain every detail it could have contained because the circumstances differ vastly among systems and the possible responses are endless. General guidance is contained in the preceding section. To provide guidance to possible solutions many details used by Fictitious City are mentioned only generally (e.g., penalties and shut-offs). Plans must be customized to fit the water system. System officials can discuss these components with other systems, the Tennessee Association of Utility Districts, etc. if they are interested in how particular plan management features or tools might be included in their plan.

Step 1 – Preplanning.

Authority and Status to Plan

Fictitious, Tennessee is a municipal corporation chartered (e.g., Priv. Acts 1903, ch 294 or Priv. Acts 1967, ch. 126) and organized under the laws of the State of Tennessee.

Among the city's chartered powers (a copy of the charter and subsequent private acts should be attached) is the authority to "acquire, construct, own, operate and maintain, or sell, lease, mortgage, pledge, or otherwise dispose of public utilities or any estate or interest therein, or any other utility of service to the city, its inhabitants, or any part thereof."

In the Fictitious City, Tennessee all powers of the city are vested in its mayor and city council which oversee the water and wastewater department. In addition, the council may prescribe the manner in which the powers of the city are to be exercised. Specifically, the city's charter also enables it to: "Prescribe reasonable regulations regarding the construction, maintenance, equipment, operation and service of public utilities and public services and from time to time compel the reasonable extension of facilities for such services." In accordance with the city's powers, the mayor through his (her) designated representative(s) has the authority to activate drought management responses as outlined in this plan.

It was reviewed by the city's attorney, departmental managers and by executive authority was adopted (provide the date it was officially adopted) by the mayor as the city's plan for addressing drought. Concurrence with city and county departments and agencies was sought because some of the responses and measures outlined in the plan would need to be taken and or coordinated with other agencies, potentially impacting staffs and budgets. The only other component of the plan that required separate public hearing was the adoption of a three-tier rate structure providing for emergency-drought standby surcharges that can be activated during a declared drought according to pre-established triggerpoints and a process as prescribed by the plan. Additional revenues collected as a result of the surcharges are dedicated to monitoring and compliance activity, public education and providing funds to one agency deemed most affected, the city's fire department. Because the plan calls for the use of fire department tankers to haul water from area streams (having available water) to farmers with livestock whose ponds, springs and/or streams have dried up, additional funds would be use to support these activities. (More on this aspect of drought management planning later.)

System Characteristics and Risks.

Fictitious City, Tennessee is home to an estimated population of 17,366 people. Fictitious City operates the Fictitious Water System (hereinafter the "system") which is a community public water system located in Humble County, Tennessee. The system obtains most of its water from the Heron Mountain Utility District. It has 2.0 million gallons per day (mgd) contract agreement for the purchase of water from Heron Mountain Utility District. In addition, Fictitious City has an intake and a .7 mgd water treatment plant on the Little Creek, a limited surface water stream. At

times the flows in the Little Creek diminish to such an extent that withdrawals are discontinued as a condition of its Water Pollution Control (WPC) permit (on average flows range from 1.9 cubic feet per second (cfs) to 10.7 cfs). Historically, low-flows are recorded at .9 cfs. The system's permit requires it to discontinue (cut-off) withdrawals from Little Creek when its flow reaches 2 cfs to emulate the natural flow regime and to maintain whatever aquatic life that might survive at that low-flow. However, the system is permitted to "harvest" water from the Little Creek during normal flows, utilizing a 20 acre city reservoir (with 60 million gallons capacity). Average daily flows over a 30-year period amount to just over 2 cfs. The city's withdrawal permit allows the city to harvest up to 35 percent of the flow above 2 cfs. The system must carefully manage its water use when streamflows and reservoir sources are diminished, but it may also purchase additional water (at the discretion of Heron Mountain) and often does to meet peak demand. The city's treatment process includes conventional filtration, fluoridation, and disinfection. Upon treatment, water is pumped to the distribution system which supplies 5,660 service connections serving approximately 17,366 individuals. The water system has a finished storage capacity of 3.2 million gallons in 7 elevated tanks. The system maintains 7 pressure zones within its distribution system.

More specifically, Fictitious City has 5,660 connections of which 5,185 are residential. On an average day, 56 percent of the system's water is sold to residential accounts. A number of residential connections are to users who have farms (and use ponds and springs to water livestock). The city has 475 connections classified as "commercial-institutional." 33 of the 475 connections are apartment complexes, representing approximately 2775 individual residential units. Other commercial-institutional customers include a hospital, several dental-medical office buildings, several nursing homes and elderly care facilities, a high school, 3 elementary schools and 6 day care facilities. The remaining commercial connections serve a mix of manufacturing facilities, retail, restaurant and motel establishments, auto services, athletic fields, golf courses, religious facilities, city administration and government, entertainment facilities, animal clinics, and a mortuary. 18 percent of all water sold is to commercial-institutional users. The city's two industrial connections represent approximately 8 percent of all water sold. Public use and water loss amounts to 18 percent of the system's water both treated and purchased. Uses include water for firefighting, two parks, line flushing, line-breaks and leaks.

On days of peak water demand (but not a severe drought) customer account-categories typically reflect the following demands:

59.5% - Residential (human consumption including domestic sanitation, livestock watering and residential lawn watering)
21.0% - Commercial - Institutional (medical, nursing homes, elderly, apartments, restaurants, offices, retail space, schools, commercial car washes, recreation including golf courses, etc.)
14.0% - Public Use and system losses (fire protection, flushing to maintain water quality, line breaks and leaks, erosion control)
5.5% - Industrial (sanitation, process, cooling)

On average, water use demand is 2.1 million gallons per day. Lowest monthly use or base demand occurs in November and March, dropping to 1.9 million gallons per day. Peak demand typically occurs in June, July and August with average peak demands of 3.1 million gallons per day.

Purpose of the Drought Management Plan

The purpose of this plan is to reduce water demand and supplement available drinking water supplies in the event of a drought where existing water supplies are inadequate to meet current demand for potable water.

The significance of taking into account water use on average" and during peak water demand (though it may not reflect an extreme or exceptional drought) is that system officials can identify water uses that have the potential to be reduced more easily. The point here is to identify potential discretionary or non-essential water uses. It is evident from the data above that water use by residential users typically increases 56.3 percent over average water use (and even more over base use). Managers might also note that this increase is primarily lawn and landscape watering, swimming pool, sidewalk-driveway washing, and personal bathing-clothes washing. The 71.7 percent increase in commercial use was due to increases in apartment complex lawn and landscape water use, pool and spa use, golf course irrigation and commercial car washes.

Internally, decreases in commercial water use were a result of the summer closure of schools. "Public" use increased slightly, due to increased flushing to maintain water quality. Less water is actually used to fight structure fires. Because of larger increases in other uses, public water use decreased 14.4 percent. Similarly, industrial water use increased only slightly (1.1 percent) due to some landscape watering around some facilities. Overall, peak water use over base demand was 47.1 percent greater.

Water Use – Average and Peak Demand

Water Use Category	Water Use in Gallons (March – Average	Water Use (Percent of Total)	Water Use in Gallons (August – Peak	Water Use as (Percent of Total)	Increase in Gallons	Percent Increase (Peak over Base Use)
Residential	1,179,920	56	1,844,678	59.5	664,758	56.3
Commercial	379,260	18	651,063	21	271,803	71.7
Public	379,260	18	434,042	14	54,782	14.4
Industry	168,560	8	170,517	5.5	1,957	1.1
Total	2,107,000	100	3,100,300	100	993,300	47.1

[Use a blank copy of this table to summarize your own water system's use.]

Because water use data reflects a typical peak summer water use but not necessary a moderate, severe or extreme drought, managers believed additional water use could be expected by residential customers on the system to water cattle and other livestock, though they usually rely on ponds and small streams which are likely to be depleted in a severe drought. Where a drought level and water use can be correlated, planning for a drought can be more finely tuned. Lacking that information, water system managers might assume they could reduce demand to base water use plus some additional uses (such as for cattle) to be the system's drought management goal. This level of use would likely correspond to the water system's average monthly use of 2.1 mgd.

Total water system demand was met obtaining .7 mgd from the city's Little Creek water treatment plant (utilizing its reservoir) and 2.0 mgd from its connection with Heron Mountain

Utility District. The city's contract allows the city to purchase all Heron Mountain can sell, but contractually it may limit sales to 2.0 mgd to the city if other utilities utilize their water contract options. Given these two limitations, Fictitious City must be able to manage water demand so as not to exceed 2.7 mgd. This amount does not allow for any unforeseen circumstances; therefore, accounting for a major fire, water line break, interruption or reduction in supply from Heron Mountain, or unrecognized high priority water use, water system officials must be able to limit water use to 2.7 mgd.

Given the increases in water use (peak over average) during the summer months, it would appear that most of the increase in demand is the result of lawn and landscaping watering, including golf courses and athletic and sports field watering. Analyzing a system's water use is extremely important, because a drought management plan is in reality a comprehensive risk assessment of all water uses. The smaller the difference between peak and average water use, the more difficult the task in establishing priorities and reducing non-essential water use, given a fluctuating source.

Drought Management Plan within the Context of an EOP

Development of the city's drought management plan and EOP were assigned to the director of the city's water department. He organized a team of individuals, including customers and business owners to help organize and frame the plan. The city's EOP addresses line breaks, ice storms, tornados, thunderstorms, railroad and truck spills and potential terrorist threats. The drought management plan focuses attention on managing supplies and demand during a declared drought.

Step 2 – Organizing the Planning Process

The Planning Committee, Task Force, Individual or Other Group. Planning Process, Public Involvement and Public Review.

For Fictitious City, the drought management plan is a separate component of the Emergency Operation Plan (EOP). It was developed by Water Department staff of the city, but included a focus group in its development and review. Unlike the EOP to which the drought plan is an

"annex," the drought plan includes a standby rate structure, restricts some water uses and in some cases bans other water uses at times. The drought management plan was adopted by the mayor and city council. The final adoption process was the normal process used by city council to adopt ordinances allowing for public comment. (Attach a timeline or chronology of high-points involved in the plan development process, including dates discussed by council and the date of its final adoption.)

The Identification of Goals – Objectives and Priorities

The initial goal of the drought management plan was to provide water to all priority uses as established by the water system under worsening drought conditions (three levels). The water uses and levels of water availability take into account the maintenance of public health and safety, sustaining economic activity, preserving critical environmental resources and life activities.

It is important to note also that the priority given to uses may actually vary among communities. In some communities the relative importance of non-essential uses may be higher relative to other communities and therefore the need to have a reliable and sustainable supply would be greater. Because of these differences, every community will assess risk in their own way and want to minimize the risk to the uses they value. In some community's landscape and lawn irrigation will be highly valued water uses. Unlike rural and less affluent communities some users will be more willing to build larger impoundments, construct larger transmission lines, or do whatever it takes to maintain lawns and landscapes. Where communities regard the risk to uses as too great, water system managers may need to undertake water resources planning to develop needed resources (wells, caves, springs, streams or rivers) and/or storage (abandoned quarries, or impoundments, either in- or off-stream). Where these resources have already been developed, managers may need to explore any commitments to the use of any resource to determine if additional water can be made available as a result of modifying an operating curve or instream flow requirement, such as for waste assimilation or aquatic species. To determine if an existing allocation can be modified, it may be the water system will need to develop a hydrologic model and engage in a dialogue with the appropriate regulatory agencies. For some communities

with little capacity for risk, water availability to sustain all necessary uses may mean substantially higher water rates to fund needed infrastructure.

Modeling the flow or supply of a source to assess its reliability and understanding the priorities and needs of customers and their willingness to reduce water use is both science" and "art when it comes to planning for a potential and uncertain drought. Because no one can predict events with 100 percent certainty, a water system needs some sort of drought management plan despite what is modeled.

Additional water use is the result of increased flushing (to reduce disinfection byproducts).

General Water Uses in Order of Priority:

- Hospital and medical facilities
- Nursing homes and elderly care facilities
- Human Consumption (Drinking water, domestic cooking, bathing, toilet use)
- Fire protection (structural facilities, and hazardous situations)
- Pets (animal hospitals, kennels) and livestock
- Environment (Erosion, Aquatic Habitat)
- Commercial Uses (Restaurant, Laundry, Office, Retail)
- Industry and Manufacturing (Sanitation, Process, Cooling)
- Recreation (Pools, Spas, Athletic Fields, Golf Courses, Fountains)
- Landscape (shrubbery) watering (Home and Commercial)
- Lawn watering, Vehicle Washing (Home and Commercial)

The recognition of specific uses within this ordering of priorities does not preclude the water system's expectations regarding efficiency and/or use prescriptions as prescribed in the system's 3 management phases (i.e., "Voluntary Water Reductions," "Mandatory Water Restrictions" and "Emergency Water Management") as outlined later in this document. Water systems with sources that are substantially unreliable may even need to include a rationing phase, where only the highest priority uses are provided minimal amounts of water.

The Larger Resource Planning Context

Systems which cannot live with the reductions required by the severest drought have no other alternative than to augment their source of water by finding and developing new sources (either raw or purchased), increasing their raw water storage, reevaluating/updating any existing reservoir operating curves. They should also reevaluate any existing instream flow requirements that affect them, examine their regional arrangements, establish agreements with other water systems where needed, make improvements to storage, make pumping improvements, or take several of the above listed actions. Unsustainable water demand must be seen as a clear red flag to water systems as a call to address its resource needs.

In other words, a system may determine that its drought management plan is just barely a band- aid and will not really do what people want and that as "a plan" within "a larger plan" (i.e., a drought management plan lies within a greater regional resource scheme) the larger, more comprehensive perspective needs to be taken. Armed with clear priorities, the system may determine that its best course of action is to develop regional resources and embark on a plan of capital improvements to address it.

Even so, systems staying within their drought management plan, may determine to undertake a few small but critical capital expenditures that will significantly improve their water system's ability to manage a severe or exceptional drought. Improving a system's ability to deal with droughts may also help a system's ability to meet future water system needs and growth. Regardless, developing a drought management plan can help a water system examining its water needs.

Step 3 – Identify Existing Plans, Partnerships, Policies and Procedures.

Existing Emergency Operations Plans and Drought Management Plans

Fictitious City has an Emergency Operation Plan (EOP) addressing major line breaks, tanker truck spills, major electrical failures, water treatment plant flooding, a major area fire, potential

terrorist attack schemes, and ice storms. The EOP is separate from the city's "Drought Management Plan." The EOP is unavailable for public scrutiny.

Because droughts emerge more slowly, pubic involvement in the development of a drought management plan can have significant advantages. Communities generally deal with limited water availability over a much longer period of time requiring longer-term reductions in water use during a drought. Public involvement when the plan is developed greatly increases community understanding and acceptance of it when it has to be implemented.

Interconnections, Mutual Aid Agreements and Backup Sources

As a result of customers with livestock on the system with potentially inadequate streams, the plan calls for the use of fire department tankers to haul water from area streams (having available water) to assist farmers with livestock. A portion of the additional funds needed to support this activity would come from revenues generated by standby rates with the remaining funds from fees for services from farmers. Other water systems may identify other special needs that may need to be addressed in their plan. Public meetings and hearings may be useful in identifying these issues.

Ordinances, Policies and Legal Requirements

The city's drought management plan, rules, ordinances, and policies are available for review and download from the city's web-site. Actual copies can be examined at the city's public libraries. (Provide the URL and the offices or libraries customers and other interested individuals can assess the plan.)

Step 4 – Coordinate with State and Regional Agencies

Identify Regional Stakeholders. Clarify and Resolve Conflicts

Fictitious City in the development and adoption of this drought management plan is continuing its dialogue with the Division of Water Pollution Control and the Tennessee Wildlife Resources Agency relative to the study of streamflows and policy regarding the allocation of flows to be

harvested. Reallocation of flows may be an on-going process and therefore may be described as iterative planning process. In some cases, not enough may be known relative to the values which are deemed to be protected. Where critical aquatic habitats have been identified (for threatened and endangered species), extensive instream flow studies may be needed to determine exactly what kind of flows benefit the species that might be impacted. Rather than a sustained minimum low-flow, a modified flow prescription addressing habitat structure, flow characteristics, etc. may be needed. Well-researched responses provide a scientific basis for the protection threatened and endangered species rather than subjective conjecture. This may also be true with respect to protecting and mitigating for recreational values. This issue is important in determining a system's Triggerpoints. (See Step5) To facilitate a discussion between stakeholders and the state, the water system(s) also may want to consult with hydrologic modelers, the United States Geological Survey (USGS), consulting engineers and others to identify flow management schemes that are protective of values (aquatic habitat, waste assimilation, alternative aquatic habitat, etc.), alternative actions to those flows and the provision of water to meet other public needs.

If streamflow is a critical issue to water supply and should be an important component of this plan. A discussion by a water system with state and region stakeholders regarding the development of resources and policies regarding their use acknowledges the fact that drought management must occur within the context of available regional resources. Where the level of risk to a population is unacceptably great during periods of drought, the development of additional resources (e.g., tributary impoundments, regional transfers of water, etc.) may need to be considered.

The concept of safe yield (under various terms, including firm yield, and sustainable yield) is a critical factor in developing a drought management plan. Miscalculations of streamflow needs may require the curtailment of withdrawals to meet various urban uses. Where critical aquatic habitats have been identified extensive instream flow studies may be needed to determine exactly what kind of flows benefit the species that might be impacted. Rather than a sustained minimum low-flow, a modified flow prescription may better sustain critical species. Critical flow characteristics, in regard to flow may actually be pulsating, rather than a continuous consistent flow. Other critical characteristics may be a temperature-related water quality issue, stream

canopy, or the nature of a ripple or pool area (habitat structure). The more critical factors affecting a species may involve shade or some other feature rather than flow. The best ecological solution (e.g., reservoir released flow) may be to mimic or simulate the natural drought low-flow of the stream to maintain a healthy, resilient population. Understanding the critical connections involved will allow water managers to develop plans that are better able to meet all critical needs.

Step 5 – Plan Management Phases and Responses

Phased Management

The drought response plan is broken into four phases: Drought Alert, Voluntary Water Reductions, Mandatory Water Restrictions and Emergency Water Management. The drought management phases and sets of triggerpoints along with their associated goals are described below. Failure to achieve a management phases goal within a reasonable time shall call for the next phase to be implemented.

Drought Alert

In the drought alert phase, no reduction in water use demand is planned. Fictitious City will focus on monitoring conditions, prepare for the possible implementation of "Voluntary Reductions," and call its drought task force group together to review the plan and next-step actions.

Voluntary Water Reductions

Under "Voluntary Reductions" Fictitious City has established a water use reduction goal of 13 percent. This figure corresponds to approximately 2.7 million gallons per day water use, the level of supply available to the city when its contract limitation with Heron Mountain Utility District is observed (or enforced). As a first step, system managers thought it was essential to reduce water demand to this more sustainable level. Daily water use above 2.7 mgd places the system at risk. Water use at higher levels cannot be maintained, excessively drawing down

water levels in tanks, and stressing the system hydraulically. Managers believe encouraging customers to the more efficiently use water allows the system to have breathing room. In Fictitious City the goal of a 12 percent reduction in water use (from historical peak demands) would be accomplished by a public appeal to customers to reduce water use, educational effort and a 5 percent surcharge in water rates above 4,000 gallons per service connection per month. Among the triggerpoints for implementing this phase would be the observance of the 2.0 mgd water supply contract limitation by Heron Mountain UD. Other triggerpoints would include system hydraulic issues (the inability of the system to handle the volume of water demand by customers resulting in inadequate water pressures in areas), water pressure falls below 40 psi in one of the zones of the system, etc. (See "Triggerpoints by Management Phase.")

The public appeal would consist of news releases to the media (weekly newspaper, local radio and regional television stations). In addition, a few city staff would be assigned to visit major users of water (schools, businesses, golf courses) to distribute information regarding reducing water use during the various management phases outlined in the city's drought management plan. Fictitious City, Tennessee would also have the city's chief drought spokesperson arrange to speak at various civic clubs, schools, and other places of business regarding the need to reduce water use and the implementation of the phases outlined in the city's drought management plan.

Customers can be encouraged to use efficient water practices, e.g., watering lawns between sunset and sunrise, along with the more careful watering of shrubs and other landscape plantings.

Mandatory Water Restrictions

The goal of activating a "Mandatory Water Restrictions" phase would be to reduce water demand by customers by 33 percent (from estimated peak demand) corresponding to the system's base demand of approximately 2.1 mgd. The level of demand was deemed by Fictitious City to be "do-able" given it has a reliable supply of 2.0 mgd from Heron Mountain Utility District and limited, but Little Creek (and its associated city reservoir) are still supplying. (Additional triggerpoints are identified in the section, "Triggerpoints by Management Phase.")

Reductions in use would be accomplished by requiring customers to observe timeframes for watering shrubs and landscape plantings and these only by hand held means, imposing a ban on lawn watering, water for ornamental or decorative purposes (fountains, reflecting pools), sidewalk and parking lot washing and other non-essential uses (as prescribed in the city's plan under its "Mandatory Water Restrictions Phase"), monitoring, compliance and enforcement activities (using fines and disconnections) and a 15 percent surcharge in water rates. Restrictions to car/vehicle washing might apply to commercial washes that do not re-cycle water and to the domestic washing of cars, etc. The cost of compliance activities would be partially funded by fines, reconnection fees and the increase in water rates.

For some water systems, out-right bans of lawn watering and other non-essential uses might be less restrictive where the required reduction in overall water use is less. For example, a water system that needs to reduce water use by only 18 percent in order to meet its water demand objective, might only require that lawn watering be done between sunset and sunrise by odd and even numbered households on odd and even numbered calendar days. Planners must carefully consider water system goals and objectives as they craft a management plan.

Emergency Water Management

The "Emergency Water Management" phase of the drought plan would be triggered by severe water pressure or other hydraulic issues, or the city's reserve water falls below a 10-day supply. The purpose of this phase would be to reduce water use to 85 percent of its base water use, a reduction of 42 percent from its peak demand (of 3.1 mgd). The purpose of that goal would be to preserve water in the city's reservoir to meet any unexpected critical need. (See "Triggerpoints by Management Phase.") Drought management actions taken in this phase have as their goal to reduce water demand to 15 percent of base use or 1.8 mgd.

Reductions in water use would be accomplished by a 25 percent increase in water rates and adherence to the city's water use priorities as described in the city's plan under its "Emergency Water Management Phase." Additional uses that might be further restricted or even banned could include: commercial and industrial uses, maintenance of medians and athletic fields, landscape shrubs, trees, flowers and vegetable produce gardens.

Step 6 – Plan for Implementation

Monitor Supply and Demand.

Balancing Supply and Demand (Category, Area and Time of Day)

Fictitious City established 3 drought management phases in addition to a "Drought Alert" Phase. All four phases are described below. In addition, numerous triggerpoints were identified signaling the beginning of a phase. In the event the issue is a water pressure or tank issue, the water system can activate a management phase for a specific distribution zone (one of seven pressure zones). If three or more zones are pressure or tank related or a source (e.g., city reservoir, streamflow or purchase water limitation) is the issue, the system must activate the management phase over the entire system.

Assigning Triggerpoints to Management Phases. Drought Alert

US Drought Monitor includes the service area of city in the "D1" classification (Moderate Drought, resulting in either agricultural or hydrologic impacts). Once an area is included in this classification officials responsible for monitoring drought triggerpoints will initiate monitoring activities.

Voluntary Water Reductions (the triggerpoint for this phase is any one of the following):

- The city reservoir falls below a 90-day supply (at current daily usage and current levels of water purchases from Heron Mountain UD and assuming normal evaporation and no rainfall to augment storage).
- Streamflow in Little Creek falls below the permitted limit of 3.3 cubic feet per second (CFS) or 1500 gallons per minute to withdraw water. (Note: The harvesting of water is permitted at flows above ___ CFS.)
- Water purchases from Heron Mountain UD are being curbed to contract levels.

- The capacity of transmission line(s) or pump(s) transferring water from Heron Mountain UD has become a limiting factor to meeting water demand.
- The city's water demand exceeds the capacity of its Water Treatment Plant (WTP) plus its current level of purchases from Heron Mountain UD.
- Water pressure in any one of the 7 zones of the distribution system falls below 40 psi.

The goal of this phase is to bring water use demand to a level that at users current demand supplies would be met for at least 90 days. This phase calls for some restraint by users, with the expectation that rainfall is likely (at least statistically). The phase would likely correspond to conditions described by the US Drought Monitor as either abnormally dry or moderate drought however it is possible that conditions might even be described as a severe drought.

Mandatory Water Restrictions (the triggerpoint for this phase is any one of the following):

- The city reservoir falls below a 51-day supply (at current daily usage and current levels of water purchases from Heron Mountain UD and assuming normal evaporation and no rainfall to augment storage).
- Water purchases from Heron Mountain UD are being curbed to less than contract levels (for whatever reason), further limiting supplies.

- Water pressure in any one of the 7 zones of the distribution system falls below 30 psi (based on pressure complaints and/or field verification).

- Any one of the system's storage tanks cannot fully recover overnight.

The goal of this phase is to bring water use demand to a level that at users current demand supplies would be met for at least 45 days. This phase calls for some restraint by users, with the expectation that rainfall is likely (at least statistically). The phase would likely correspond to conditions described by the US Drought Monitor as either a severe or extreme drought however it is possible that conditions might even be described as an exceptional drought.

Water Emergency Management (the triggerpoint for this phase is any one of the following):

- The city reservoir falls below a 10-day supply (at current daily usage and current levels of water purchases from Heron Mountain UD).
- Water pressure falls below 21 psi in any one of the 7 zones of the distribution system (based on pressure complaints and/or field verification).
- One or more of the system's 7 storage tanks is unable recover to 30 percent overnight.

The goal of this phase is to bring water use demand to a level where water supplies would meet demand for an extended period of time beyond the 7-day supply currently. This phase calls for sacrifices by users, with the expectation that rainfall is not likely to occur) and that extremely limited supplies must be reserved for supporting life and necessary sanitary uses (human consumption). The phase would likely correspond to conditions described by the US Drought Monitor as an exceptional drought.

Rationing Although Fictitious City has not included a Rationing Management phase, it could be necessary for some water systems with sources that are substantially unreliable to include a "Rationing" phase, where only the highest priority uses are provided minimal amounts of water. If a water system and its customers find the level of risk too great and are unwilling to live with the necessary reductions in water use, find them unreasonable or unsustainable, they in essence have seen a clear red flag to address their water resource needs.

Systems unable to live with the reductions required by the severest drought have no other alternative than re-consider their goals and priorities. System management should review Step 2, the section "The Larger Resource Planning Context."

Water Quality Issues

- Taste and odor complaints which appear isolated (i.e., 75 percent of the complaints located in one or two of the seven distribution area zones) will be addressed by increased flushing.

- Taste and odor complaints which appear widespread throughout the system will be addressed by feeding potassium permanganate to the treatment process and increased flushing (as long as the system is not in "Emergency Management."

Fictitious City has included in its drought management plan the naming of a drought manager with responsibility/authority to hire/contract/assign staff to hang door notices, conduct additional meter reading, issue warnings and citations (with penalties for non-compliance according to a well-developed scheme), along with staff to shut-off water to customers who repeatedly do not comply. Funds for these additional activities are to come from the additional monies collected when the various phases are implemented. Each phase calls for activation of water customer rate changes, which include drought surcharges of 5 percent, 15 percent and 25 percent, corresponding to each more restrictive phase.

Fictitious City utilizes billing software that can be programmed to add surcharges to customer's bills. In addition, meters can be read more frequently than monthly, although requiring additional staff and expenditures. Bills can include additional verbiage regarding the surcharges and their effective timeframes, along with meter-reading dates.

Part-time employees will be hired to patrol the 7 distribution zones of the water system to identify customers not in compliance with plan phase requirements. Staff utilize a manual with draft media releases for the various phases (templates), a protocol for issuing warnings (with accompanying educational materials), citations (with a schedule of escalating penalties), and shut-off procedures. Materials have also been prepared to inform customers of how to how to pay penalties and when and how to restore water service.

In addition, there is a calendar for when drought management plan team members are to meet. The plan tentatively calls for the team to meet every Tuesday morning at 10:00 am to review the status of the system: water supply (raw and/or purchased), overall demand and by user group, system hydraulics (time of day and accumulative), current staffing and resources (such as vehicle availability, in-print educational resources, etc). The plan also calls for additional meetings (or teleconferences, phone trees) if they are needed and allows for the tweaking or fine tuning of the plan.

The drought management team drafted several media releases corresponding to the management phases. Each was direct and clear about phase goals, requested or mandated responses, effective time and date of activation, and information on who customers could contact (with name and phone number) for clarification or additional information. In addition, door-knob notices were drafted corresponding to the "Restrictions" and "Emergency" phases including information regarding those phases. The media and door-knob notices could then be revised and pertinent details included when phases were activated.

In addition to establishing triggerpoints and general media related activity, Fictitious City adopted the following enforcement provisions:

(1) *Penalties.* Any person violating the mandatory restriction provisions of or the emergency management provision of the drought management plan shall be issued a citation and a penalty of $200.00.

(2) *Discontinuance of Water Service.* Water service may be discontinued for a period of 30 days for the willful disregard of water mandatory restrictions or emergency water management provisions. In the event of continued noncompliance, the meter will be removed and service discontinued. Connection fees and deposits will be forfeited.

(3) *Drought Surcharges*. During periods of extended and extreme drought when mandatory restrictions and emergency water management restrictions are necessary, an additional 5%, 15% and 25% drought surcharge will be applied to bills based on phase.

Step 7 – Identify the Management Team – Purpose, Structure, Roles and Functions

Establish Management Team.

Fictitious City designated the water system manager to be the drought plan implementation Manager. He is ultimately in charge of managing the water system. In addition, the mayor of the city, the chief of the fire department, a commercial account representative and two (2)

residential account representatives make up the drought management group responsible for overseeing the implementation of the plan. They advise and assist the manager in gathering information, assessing the situation and recommend/advise/approve the Manager's actions. The task group is activated and will meet as necessary, but no less than once a week, once a "Drought Alert" has been initiated. A "Drought Alert" corresponds to the US Drought Monitor's categorization of the water system's service area as being characterized as under "Moderate" drought conditions. The task group monitors water system conditions, including water demand, water supply, forecasted conditions, hydraulic conditions, water quality issues, impacted communities, public notification, plan modifications, staffing, triggerpoints and other issues related to the implementation of the plan. The task group and water system manager must also maintain records of their actions, system conditions at the time of management actions taken, and their effects. Finally, the drought management group and plan implementation manager must also determine and announce the step-down and/or deactivation of the plan. This is particularly important if water rates are tied to a drought management phase. Customers need to know when rates go up and down.

Step 8 – Review, Evaluate and Up-date the Management Plan.

Periodically Review and Up-date the Management Plan. Evaluation after Implementation Update the Plan. Adopt the Plan.

The drought management plan was adopted on July 22, 2008 by the city. It also adopted a policy to review their plan within 6 months after any phase of the plan has been implemented (referred to an "Activation Review") and/or every 3 years (referred to as a "3-Year Review"). The 3-Year Review requires consideration of any new circumstances affecting water supply and/or demand. The Activation Review requires a review of the procedures activating the phases and their effectiveness. Refinements to the drought management plan will be made as necessary. The drought manager is responsible for making the review and presenting that review before council.

Part Four

Drought Management Plan Checklist

Step 1 – Preplanning.

___ Has the city council, board of aldermen, mayor, utility district board (appropriate governing body) adopted the plan)? (Draft or Outline Plans have no authority.) Page(s) _____ of plan.

___ Was a task force, commission or other group created to develop the plan? If adopted by that board or commission, was there authorizing power for that group to do so? Page(s) _____of plan.

___ Has the city or utility district attorney certified that the plan has authority to be implemented? Page(s) _____ of plan.

___ Is the drought management plan a stand-alone plan? (It should not identify or address system vulnerabilities or security risks that are not general, universal to other systems or drought related.) Page(s) _____ of plan.

___ Does the Plan adequately describe the system in terms of water sources, treatment capacity, interconnections, contract limitations, permit limits, etc.? Page(s) _____ of plan.

___ What percent of total demand do the above listed use-categories have on a maximum water use day? Page(s) _____ of plan.

___% - Institutional Health (Medical, Nursing Homes, Elderly, Handicapped)

___% - Human Consumption (Drinking and domestic cooking)

___% - Safety (Fire Protection)

___% - Pets and Livestock,

___% - Environment (Erosion, Aquatic Habitat)

___% - Domestic Sanitation (Bathing, Toilet Use)

___% - Commercial Uses (Restaurant, Laundry, Office, Retail)

___% - Economic (Sanitation, Process, Cooling)

___% - Recreation (Pools, Spas, Athletic Fields, Golf Courses)

___% - Landscape (shrubbery) watering (Home and Commercial)

___% - Lawn watering, vehicle washing (Home and Commercial)

___ How do the uses vary seasonally? Describe "Base," "Average" and "Peak Demand". Page(s) _____ of plan.

Step 2 – Organizing the Planning Process.

___ Does the plan include a statement of mission, goals, or objectives? Are priorities (water users) identified? Do they recognize / prioritize the following user groups or uses?

Institutional Health (Medical, Nursing Homes, Elderly, Handicapped)

Human Consumption (Drinking and Domestic Cooking) Safety (Fire Protection)

Pets and Livestock

Environment (Erosion, Aquatic Habitat) Domestic Sanitation (Bathing, Toilet Use)

Commercial Uses (Restaurant, Laundry, Office, Retail) Economic (Sanitation, Process, Cooling)

Recreation (Pools, Spas, Athletic Fields, Golf Courses) Landscape (shrubbery) Watering (Home and Commercial)

Lawn watering, vehicle Washing (Home and Commercial)

Page(s) _____ of plan.

___ Do identified priorities correspond to reality? (In other words, does the system have fire hydrants, serve hospitals, nursing homes, etc.? Could area livestock operations be vulnerable to shortages?) Page(s) _____ of plan.

___ Did the group, consultant, utility manager, employee responsible for developing the drought management plan develop the plan or set-out a process for developing the plan? Page(s) of plan.

___ Does the plan specifically identify those responsible for developing the plan (i.e., does it identify those assigned to the task force, on the committee, those groups with who they consulted, public meetings allowing for public input and the dates those meetings were held, and public hearings necessary for its adoption)? Page(s) _____ of plan.

___ Did the process or plan include or address all of the eight (8) steps included in the state's guidance? Some evidence of each step should be reflected in their plan. Page(s) _____of plan.

___ Have public hearings or meetings been held to receive the feedback necessary to evaluate and modify the plan? Page(s) _____ of plan.

___ Are copies of Public Notifications, meeting agendas, etc. and a list of attendees to those meetings included as attachments? Page(s) _____ of plan.

Step 3 – Identify Existing Plans, Partnerships, Policies and Procedures.

___ Has the water system experienced significant drought management problems in the recent past (within the past 5 years)? How would you characterize the system's level of risk? Page(s) of plan.

___Does the system's plan (existing or if it is new) consider and at least address:
___Source Problems (Source inadequate)
___Declining Source (Source supplying but concerned about source due to declines)
___Contract Limitation (wholesale or parent system limitation)
___Inadequate Treatment Plant Capacity
___Distribution Hydraulic Capacity (tanks and/or transmission line capacities)
___Inadequate Pump Capacity
___Taste and Odor
Page(s) _____ of plan.

___ Characterize the problems encountered by the water system during the most recent drought (based on the list above). How would you summarize the reaction of most customers?

___ Has the level of risk been considered or attention given to the system's most critical needs? Page(s) _____ of plan.

___ Does the water system have any partnerships in place to assist them in obtaining additional water (interconnections, auxiliary sources of water), ensuring the provision of drinking water to meet critical needs, or making water available to users not generally served but experiencing hardship or loss (e.g., hauling water to sustain area livestock, providing bottled water to people whose wells have gone dry)? Page(s) _____ of plan.

Step 4 – Coordinate with State and Regional Agencies.

___ Have efforts been made by water system personnel to engage regional agencies in dialogue regarding applicable TVA, Corps of Engineers, etc. reservoir operating curves, or changes to NPDES permits which would be more favorable to human water resource needs, etc.? Page(s) _____ of plan.

___ Has thought been given to approaching other water systems about the regional development and operation of sources, facilities, staff or other resources, now or in the future? Page(s) _____ of plan.

___ Have instream flow needs been considered? If critical aquatic habitats or waste assimilation needs have been identified, has the flow been modeled and/or the actual flows needs been re-evaluated? Page(s) _____ of plan.

Step 5 – Plan Management Phases and Responses.

___ Have at least three (3) phases of demand management been identified and appropriate labels applied so that customers can readily identify the phase and their corresponding response?

___ Do the phases of management correspond to various levels of water supply availability or significant problems related to demand? Page(s) _____ of plan.

___ Does the plan include water conservation rates (i.e., drought management surcharge or standby rates that are activated when drought management phases are implemented)? And will the rates be effective in reducing water demand? Page(s) _____ of plan.

___ Does the plan recognize the system's water treatment capacity and address that capacity in the plan in combination with other sources? Page(s) _____ of plan.

___ Does the plan identify the water system's distribution limitations (pump capacities, line-size and pressure sensitive areas) and address those limitations? Page(s) _____of plan.

___ Does the plan identify storage tank capacities and does it address those limitations in managing water demand (either system-wide or by system or geographic sub-areas)? Page(s) of plan.

___ Are the system's interconnection sources likely to be impacted by drought? To what extent would reductions in the parent system's supply affect the supplies to purchase water customers (i.e., cascading declines in supply)? Page(s) _____ of plan.

___ If the system purchases water from another water system, have contract limitations been considered? How would any cascading declines affect implementation of your drought management plan? Page(s) _____ of plan.

___ Can transmission lines between the connected systems meet the water demands that would be required? Page(s) _____ of plan.

___ Have wells been pump tested and / or measured over a long, established period of time (during severe drought) to determine how well they hold up under extreme drought conditions? Page(s) _____ of plan.

___ Has the number of days of remaining water supply in the system's reservoir lake been calculated assuming no additional runoff inflows? Page(s) _____ of plan.

___ Have the critical low-flow requirements (to meet downstream waste assimilation needs and / or to maintain critical aquatic habitat) of surface water streams been determined? Page(s) of plan.

___ Have alternate sources of water supply (in the event that the system's primary sources become inadequate) been identified? Has the system undertaken efforts to develop an additional source(s) or discuss with state/federal agencies the use or allocation of water to existing uses? Page(s) _____ of plan.

___ Has the actual potential for each of the sources of water (listed above) been reasonably estimated and the life of the supply calculated under extreme drought conditions? Page(s) of plan.

___ Have changes to water quality (turbidity, temperature, pollution concentration, potential for disinfection byproducts formation) been considered as possibly occurring during an extreme drought? Page(s) _____ of plan.

___ What level of risk applies to the system's raw sources of water under the various phases of management? Page(s) _____ of plan.

___ What level of risk applies to the system's interconnection sources under the various phases of management? Page(s) _____ of plan.

___ Does the plan include connecting to alternative sources (interconnections to other systems, etc.) and are timelines or dates for bringing them on-line included in the plan? Page(s) _____of plan.

___ Either singularly or in combination, what are the critical water supply events or situations that can be identified from the above list (30-year low flows, depletion of water well or

spring yields, reservoir levels (estimated storage), maximum treatment capacity, pumping-distribution limitations, tank storage dropdowns, taste and odor complaints, etc.) which would limit the system's ability to supply water? Page(s) _____ of plan.

___ Have triggerpoints been identified along with a corresponding estimate of supply that fit one of the management phases (proposed reduced level of water use and actions employed to reduce use). Page(s) _____ of plan.

___ Do proposed water reduction measures have a realistic chance of meeting anticipated water supply conditions? Page(s) _____ of plan.

___ Can first tier priority demands be met throughout the range of available water resources? Page(s) _____ of plan.

___ Does the plan ban or severely limit non-essential water uses in the second or third management phase to the point that "normal" or average water use is reached? Page(s) _____of plan.

___ Has the plan considered increased water use (despite demand reduction measures) as a result of providing system water to non-customers (tanking water to people who are without water) and additional use due to meeting livestock needs (because ponds and streams have gone dry)? Page(s) _____ of plan.

___ Have estimates been made regarding reductions in system water use as a result of strategic plan activities, such as hauling to assist non-customers and meet livestock needs? Page(s) _____ of plan.

Step 6 – Plan for Implementation – Monitoring, Key Elements and Triggerpoints.

___ Have the ordinances/policies, stand-by rate structures, process provisions allowing for drought declarations and various levels of response been duly adopted by the local government/water system? Page(s) _____ of plan.

___ Does the plan identify a drought management team (whose designated to monitor conditions, implement plans and take decisive actions), roles and responsibilities been defined? Page(s) _____ of plan.

___ Has someone been designated as having the responsibility to make decisions and coordinate with other agencies and water systems? Page(s) _____ of plan.

___ Does the plan monitor water use by category of user (industry, commercial, agricultural, domestic)? Page(s) _____ of plan.

___ Have industries, dairies, golf courses, chicken barns, etc. been considered (for their impacts on water sources and their need for water) in the development of the plan. Page(s) of plan.

___ Does the plan consider time-of-day water use demand? Page(s) _____ of plan.

___ Has the distribution system been zoned into areas which can be managed separately from the rest of the system in order to maintain service? Page(s) _____ of plan.

___ Have notification, monitoring and enforcement procedures been outlined that can be implemented from a practical standpoint? Page(s) _____ of plan.

___ Have adequate lead-time periods been set-aside (allowing for public notice and implementation) for each phase of drought management prior to the source actually reaching the critical water supply level where the water system would encounter problems? Page(s) of plan.

___ Do the various drought management phases have appropriate and adequate enforcement measures? Page(s) _____ of plan.

___ Does the plan include pre-drafted Public Notices (door-to-door notices, newspaper or radio announcements, etc. Page(s) _____ of plan.

Step 7 – Identify the Management Team – Purpose, Structure, Roles and Functions.

___ Does the plan direct water system staff (such as the system manager, or city official) to contact the Division of Water Supply when the various management phases have been activated (in compliance with state rules)? Page(s) _____ of plan.

___ Have specific individuals been charged with monitoring conditions (water supply and / or water use)? Page(s) _____ of plan.

___ Does the water system have a plan for winding or stepping down management phases and finally declaring an end to the management actions required by the drought? Page(s) _____of plan.

Step 8 – Review, Evaluate and Up-date the Management Plan.

___ Did the plan (management phase, media releases, measures monitored, etc) work as anticipated? Were water reduction goals achieved? Did customers believe the plan was equitable and fair? Were any features of the plan criticized and were any criticisms valid? What changes are needed to make the plan more effective, and equitable?

___ Once implementation of the drought plan is over, does the plan provide a means or process to modify provisions, and / or evaluate the plan? Page(s) _____ of plan.

___ Does the plan include an expiration date or establish a date for updating (within 3-years)?

Page(s) _____ of plan.

___ Once implementation of the drought plan is over, does the plan provide a way or process to be modified, and / or evaluate the plan? Page(s) _____ of plan.

___ Does the plan include an expiration date or establish a date for updating (within 3-years)? Page(s) _____ of plan.