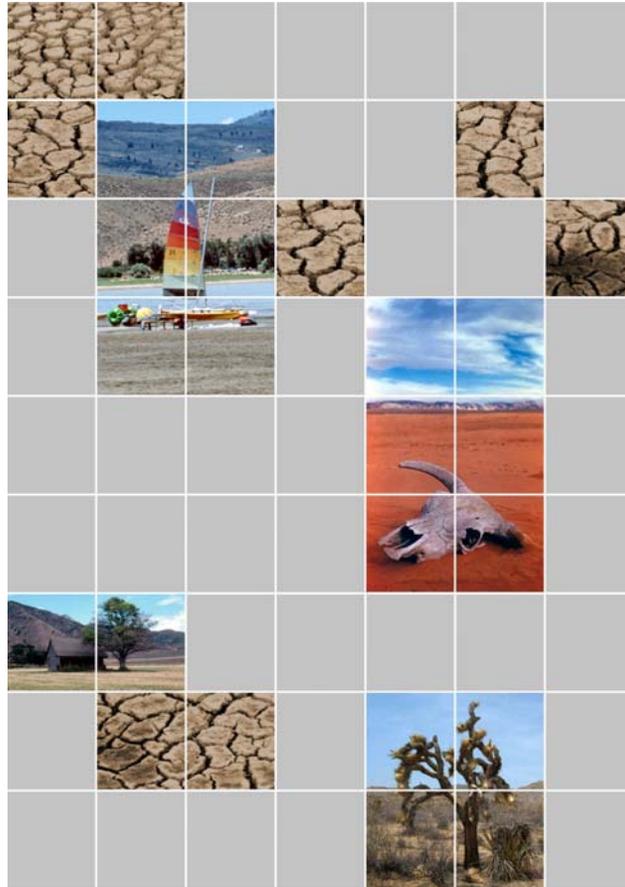


Drought Management Toolkit for Public Water Suppliers



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Drought Management Toolkit for Public Water Suppliers

INTRODUCTION

The Utah Division of Water Resources (Division) in cooperation with other state and local agencies and entities developed this drought management toolkit to help public water suppliers better prepare for and manage future droughts. This toolkit consists of two main elements: a model drought mitigation plan and a model drought response plan (or contingency plan, which can also be used to address other water shortages). The Division recognizes the importance of drought planning at the water supplier or local level (town, city, county) and recommends that these entities develop such plans or incorporate them into existing water management plans. Drought planning at the local level and the use of this document is not mandatory; however, it could prove extremely useful to a water community of any size. The Division recommends that Utah water suppliers and/or cities and other local entities, develop a drought management plan, either using their own or outside resources, which contains both drought mitigation and drought response elements. This plan can be separate from or developed as a component of existing water management plans or other plans such as, the Vulnerability Assessments and Emergency Response Plans that are required (for populations greater than 3,300) as part of the President's Bio-Terrorism Act (P.L. 107-188).

In this document, the *model drought mitigation plan* outlines a broad step-by-step process for assessing a water system, identifying “weaknesses” or vulnerabilities within that system and then developing a plan of action to address the identified weaknesses. Drought mitigation is defined as action taken well in advance in order to eliminate or lessen the impacts of a future drought. This may be a relatively new focus in the planning arena with regard to drought and in order to facilitate such planning the Division developed this model to be used and foster mitigation-oriented planning activities.

The *model drought response plan* (or contingency plan) is intended to differ from components within the drought mitigation plan and current management or conservation plans in that it presents more aggressive demand management actions to be taken in response to drought or other emergency water shortages. This contingency plan should compliment and add to current management plans with regard to potential prolonged water shortages, primarily drought. Several water suppliers, cities and counties include drought response as part of conservation plans; however, it may be beneficial to address drought and water shortages separately or in more detail or as part of a broader water management plan. This model plan outlines a procedure for developing a response plan, largely based on “triggers,” objectives, and response actions aimed at incrementally reducing water use, and is geared toward smaller water communities.

Ideally, a community would implement a drought mitigation plan geared to lessening the impacts of drought, and then implement the response plan if needed during a drought event as a secondary measure. Both the mitigation and response model plans are comprised of two documents; the information guide or “instructions” and the “fill-in the blank” template. The documents have been developed with corresponding sections and the information guide should be read simultaneously with the “fill-in the blank” template.

Model Drought Mitigation Plan

Model Drought Mitigation Plan

INFORMATION GUIDE

Utah Division of Water Resources

Instructions: This guide is intended to provide additional information to aid in the development of a drought mitigation plan. It is designed to be used in tandem with the Utah Division of Water Resources' "Model Drought Mitigation Plan: Template." This document contains direction and discussion regarding each section found within the model plan template. It is a shortened and modified version of the document entitled "How to Reduce Drought Risk," authored by National Drought Mitigation Center (NDMC) and the U.S. Bureau of Reclamation (BOR) staff members as part of the Preparedness and Mitigation Working Group for the Western Drought Coordination Council. The document is accessible online at: <http://www.drought.unl.edu/mitigate/mitigate.htm> and will be referred to the "NDMC/BOR document."

Note: In this document, the term "water supplier(s)" includes and is not limited to, towns, cities, counties and water suppliers in general.

Introduction

The *Model Drought Mitigation Plan* is not intended to be "just another plan" for water suppliers to do. There is no requirement to fulfill. The Utah Division of Water Resources, however, does encourage water suppliers to perform mitigation planning to some degree. This plan is viewed as an initial step toward mitigation planning that should be reviewed regularly and which may be built upon over time.

Mitigation within this document refers to assessment and subsequent action taken well in advance of a drought in order to lessen the effects of impacts to the water supplier and end-user.

The *Model Drought Mitigation Plan* (information guide and template) is a simplified or "skeletal" outline to give the water supplier ideas from which to initiate mitigation planning; every situation is different and the water supplier will need to decide the best way to plan and ultimately mitigate for drought. Mitigation planning can occur at all levels within a water supplier's system, no matter the size and/or complexity of the system. The Division encourages water suppliers to incorporate mitigation planning into their overall water management methodology, either by developing a separate mitigation-oriented plan or a mitigation-oriented component(s) that can be integrated into existing plans. Mitigation planning may require a change in perception and planning fundamentals with regard to drought, since existing plans are often based on response. The Division also encourages water suppliers to review the process presented within this document and integrate any useful ideas or assessment techniques into their current water planning and management processes.

For more information regarding drought and drought mitigation, please refer to the Division's report entitled *Drought in Utah: Learning from the Past—Preparing for the Future*. It contains valuable information regarding drought (indices, impacts, historical drought, drought variability, and

mitigation and response strategies). The report can be accessed online at:
<http://www.water.utah.gov/>.

Important Note

Some water suppliers may have plans similar to the process presented within this document. For example, some mitigation actions identified here may be similar to those presented in conservation plans. However, the difference between these two plans (drought mitigation versus conservation) is one of scope and intent. A conservation plan is developed with the general intent to conserve, use water wisely and instill a long-term water conservation “ethic” within the community, whereas a drought mitigation plan is intended to lessen the effects of negative drought impacts through action taken in advance of a drought. A drought mitigation plan may be better understood by asking “What can be done in order to reduce the need and frequency of using a drought response or contingency plan?” Similar actions may be used in both conservation and mitigation plans but used in a different manner in order to obtain specific end-results.

If mitigation planning is deemed valuable by the water suppliers, the Division encourages the use of this document as a starting point for developing a drought mitigation plan that is inline with the goals and ideals of the community and water supplier.

The First Steps

It is essential to bring together and invite key stakeholders and personnel to participate in the planning process and development of a drought mitigation plan. Involving the “right” people and providing them with sufficient information and data regarding the water supply will allow them to make efficient assessments and aid with planning decisions regarding drought risk management. Due to the far reaching impacts of drought, the planning group should be knowledgeable in relevant broad aspects of social, economic and environmental topics that are germane to the communities within the water supplier’s area. Information that may prove useful to collect and provide to the planning group is presented in Table 1. In addition, “worksheets” that outline some of the items in Table 1 are presented in Appendix A. These worksheets are intended to assist with gathering information, conducting an assessment and are not necessarily intended to be part of the actual plan. Some of the items presented in Table 1 may not relate to your system nor fall within the scope of your planning and management responsibilities. However, it is presented with intent to help facilitate ideas relevant to your community and water system.

The following sections correspond with the sections contained within the *Model Drought Mitigation Plan Template* and are intended to provide additional information and instruction needed to develop a plan. This document is relatively broad based and it is left to the water supplier or planning group to appropriately tailor its contents for application to specific water systems and communities.

Section I Purpose

This section states the purpose and intended results of implementing the mitigation plan. A plan without specific purpose and intent of implementation will yield limited, if any results. The water supplier is encouraged to include its institutional goals and mission to add depth and enrich the meaning of the plan. The water supplier is also encouraged to adopt the plan and state its intention

TABLE 1
Useful Information to Collect and Use in the Planning Process

Environmental	Economic	Social
Precipitation	Economic Linkages and Trends	Public Health and Safety
Water Supply Sources	Drought Awareness Programs	Community Perception of Droughts
Effects of Drought on Soil	Drought or Emergency Loans	Community Diversity
Effects of Drought on Surface and Ground Water Levels	Drought Recovery Funding	Local Government and Nongovernmental Interaction
Air Temperature and Moisture Levels	Crop Insurance	Local Political and Governmental Perspective
Effects of Drought on Wildlife and Plant Communities		
Drought and Wildland Fire		

Source: Adapted from information contained in the National Drought Mitigation Center's report, "How to Reduce Drought Risk" found at: <http://www.drought.unl.edu/mitigate/mitigate.htm>

to implement the plan or integrate it into an existing plan in a timely and appropriate manner. The water supplier should, in this section, describe the reasoning behind the development of the plan and present support for doing so (potential for more severe drought, economic impact of drought, etc.).

Section II Public Participation

The effects and impacts of droughts are largely felt by the water user, the public. Involvement of the public throughout the planning process or during times deemed appropriate by the water supplier is critical for the success of this or any other plan. Public involvement or review, will likely build trust and understanding between the general public and the water supplier or planning group as well as garner support for the implementation of actions presented within the mitigation plan.

The public may be involved through:

- locally organized community meetings
- newspaper article updates
- local news and other media relations
- written document reviews and
- other ways deemed appropriate by the water supplier or planning personnel

In this section, the water supplier or planning group should outline how the public was involved in the development of the mitigation plan and any significant changes regarding the planning process or plan concept due to this interaction.

Section III Public Education

When the plan is completed and implementation commenced, the public may benefit from regular updates and opportunities to learn about the progress made with regard to the implementation of mitigation actions outlined within the plan. By keeping the public involved throughout the entire process, it will ideally foster a sense of ownership and community, thereby resulting with public support of the water supplier’s plan and future needed actions.

This section should outline actions that will be taken to educate and inform the public about the “on-going activities” and progress made with the implementation of the plans proposed recommendations and mitigation strategies.

Information may be presented to the public by:

- posting it online
- distributing fliers
- presenting it in informational booths during “Water Week,” and
- any other means, which is left to the discretion of the water supplier or planning group

Section IV Drought Impact Assessment

The purpose of conducting an impact assessment is to identify the drought-related impacts. For example, such impacts may be crop failure, reservoir and ground water depletion, habitat loss, water restrictions and more. Many of these impacts can be linked to other “second-tier” or “secondary” impacts and so on, such as unemployment, loss of revenue and physical or emotional stress. Impacts can be generally categorized as environmental, social and economic.

The initial assessment in this section identifies the direct impacts of a drought; however, it does not identify the basal or underlying causes of the direct impacts.

In this section, the water supplier or planning group is encouraged to create a list, identifying direct impacts from droughts of the past as well as consider those that could be manifested in the future. Several of the identified impacts may not relate directly to the water supplier, however, the underlying or basal cause of the impacts, which is identified later, may be something that relates to or is influenced by the water supplier. An “Impact Assessment Checklist,” developed within the NDMC/BOR document, is provided to facilitate the identification of drought-related impacts. The water supplier or planning group is encouraged to use and add upon this checklist. However, before doing so, the type of drought that the plan will be intended to address must be decided. For example, the plan may be intended to address the region’s drought of record (most severe drought on record), other severe droughts or average droughts. The plan can also be modified to address a combination of these types of droughts as well. It is left to the discretion of the water supplier or planning group to decide which type of drought (level of severity) to base the assessment.

Depending on the type of drought chosen (from which to base the assessment), check the appropriate box, contained in the checklist, to identify the impacts of such a drought. For example, to identify direct impacts of the “drought of record” (if chosen to be the “base” drought), check the “Historical”

boxes. Next, using current knowledge about the area of interest, ask what would happen today if a drought comparable to the drought of record were to occur? What would the direct impacts be? Check the “Current” boxes. Lastly, a look into the future is needed. What would the direct impacts be of such a drought in five, ten, fifteen years from now? Check the “Potential” boxes taking into account population growth and other factors.

Ultimately, the identified direct impacts indicate sectors of the local community and water supply system that may be vulnerable to droughts, which could be addressed in the drought mitigation plan.

The checklist provided is meant to assist with identifying possible drought-related impacts. Everything contained in the list will not apply to every water supplier. Several of the impacts may appear to be “out-of-line” with the responsibilities of the water supplier, however, as many impacts as possible should still be identified for additional assessment (in the following sections), which will narrow the list down to a select few.

Impact Assessment Checklist*

*Source: National Drought Mitigation Center

List may be added upon by water supplier

H = Historical

C = Current

P = Potential

- | <i>H C P</i> | <u><i>Economic</i></u> |
|--|---|
| | <i>Loss from crop production</i> |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Annual and perennial crop losses |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Damage to crop quality |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Reduced productivity of cropland (wind erosion, etc.) |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Insect infestation |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Plant disease |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Wildlife damage to crops |
| | <i>Loss from dairy and livestock production</i> |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Reduced productivity of rangeland |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Forced reduction of foundation stock |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Closure/limitation of public lands to grazing |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | High cost/unavailability of water for livestock |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | High cost/unavailability of feed for livestock |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | High livestock mortality rates |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Disruption of reproduction cycles (breeding delays or unfilled pregnancies) |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Decreased stock weights |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Increased predation |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Range fires |
| | <i>Loss from timber production</i> |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Wildland fires |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Tree disease |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Insect infestation |
| <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Impaired productivity of forest land |
| | <i>Loss from fishery production</i> |

- □ □ Damage to fish habitat
- □ □ Loss of young fish due to decreased flows
- □ □ Income loss for farmers and others directly affected
- □ □ Loss of farmers through bankruptcy
- □ □ Unemployment from drought-related production declines
- □ □ Loss to recreational and tourism industry
- □ □ Loss to manufacturers and sellers of recreational equipment
 - □ □ Increased energy demand and reduced supply because of drought-related power curtailments
- □ □ Costs to energy industry and consumers associated with substituting more expensive fuels (oil) for hydroelectric power
- □ □ Loss to industries directly dependent on agricultural production (e.g., machinery and fertilizer manufacturers, food processors, etc.)
- Decline in food production/disrupted food supply*
- □ □ Increase in food prices
- □ □ Increased importation of food (higher costs)
- □ □ Disruption of water supplies
- Revenue to water supply firms*
- □ □ Revenue shortfalls
- □ □ Windfall profits
 - □ □ Strain on financial institutions (foreclosures, greater credit risks, capital shortfalls, etc.)
 - □ □ Revenue losses to federal, state, and local governments (from reduced tax base)
- □ □ Loss from impaired navigability of streams, rivers, and canals
- □ □ Cost of water transport or transfer
- □ □ Cost of new or supplemental water resource development
 - □ □ Cost of increased ground water depletion (mining), land subsidence
- □ □ Reduction of economic development
- □ □ Decreased land prices

H C P *Environmental*

- Damage to animal species*
- □ □ Reduction and degradation of fish and wildlife habitat
- □ □ Lack of feed and drinking water
- □ □ Disease
 - □ □ Increased vulnerability to predation (from species concentration near water)
 - □ □ Migration and concentration (loss of wildlife in some areas and too many in others)
- □ □ Increased stress to endangered species
- □ □ Damage to plant species
- □ □ Increased number and severity of fires
- □ □ Loss of wetlands
- □ □ Estuarine impacts (e.g., changes in salinity levels)
- □ □ Increased ground water depletion, land subsidence
- □ □ Loss of biodiversity
- □ □ Wind and water erosion of soils
- □ □ Reservoir, lake and drawdown (including farm ponds)
- □ □ Reduced flow from springs
 - □ □ Water quality effects (e.g., salt concentration, increased water temperature, pH, dissolved oxygen, turbidity)

- Air quality effects (e.g., dust, pollutants)
- Visual and landscape quality (e.g., dust, vegetative cover, etc.)

H C P **Social Impacts**

- Mental and physical stress (e.g., anxiety, depression, loss of security, domestic violence)
- Health-related low-flow problems (e.g., cross-connection contamination, diminished sewage flows, increased pollutant concentrations, reduced fire fighting capability, etc.)
- Reductions in nutrition (e.g., high-cost food limitations, stress-related dietary deficiencies)
- Loss of human life (e.g., from heat stress, suicides)
- Public safety from forest and range fires
- Increased respiratory ailments
- Increased disease caused by wildlife concentrations
- Damage to landscapes
- Indoor use restrictions
- Water supply shortfalls
- Outdoor use restrictions
- Increased conflicts*
- Water user conflicts
- Political conflicts
- Management conflicts
- Other social conflicts (e.g., scientific, media-based)

Section V Impact Ranking

In this section, after the direct impacts have been identified, either by using the provided checklist or by other means, the “Current” impacts should be ranked by importance—the “Historical” and “Potential” impacts can be used to help identify and rank the most notable impacts.

Impact ranking will help prioritize the impacts and facilitate the identification of the basal causes and appropriate mitigation actions to be taken. The ranking process should take into account, with regard to the “Current” direct impact, economic losses, areal extent (percent of area or specific population immediately affected by the impact), public opinion, public health, ability of the impacted area to bare the impact as well as recover and other factors deemed appropriate by the water supplier or planning group.

The NDMC/BOR document recommends using a decision matrix to better facilitate the ranking process. Not all direct impacts from the ranked and prioritized list will need to be addressed in the mitigation plan. Some may not be severe enough or may be “too small” to warrant attention in the plan, but should be addressed at a later time and others may be beyond the scope and responsibilities of the water supplier.

A simplified decision matrix is presented in Table 2. A “one through five” point or other weighted system could be used to rank the impacts: “one” being “less important or relevant” and “five” being “extremely important or relevant” to the impact being analyzed. For example, if the direct impact

was “damage to crop quality” (as shown in the decision matrix, Table 2), how important or relevant are the factors being considered to the direct impacts? Does it result in economic losses, can the farming community recover quickly (5 being slow recover time or poor ability), is it an important issue to the public or is the impact far-felt (are a large percentage of farmers feeling the brunt of this impact)?

TABLE 2
Decision Matrix (Direct Impacts Ranking)

“Current” Direct Impact	Economic Losses	Areal Extent	Public Opinion	Public Health	Ability to Recover (5 being slow recovery time)	Total
Damage to Crop Quality	3	2	3	2	4	14

This process should result in a prioritized list of relevant “Current” direct impacts to be further analyzed and addressed. The impact(s) with the highest “score” or total ideally represents the direct impact(s) warranting the greatest amount of attention and action.

Public Involvement

Public perception and opinion regarding impacts may be the single most important driving force as to which impacts are ultimately addressed. In rural areas agricultural impacts may be extremely important whereas in urban environments, outdoor water restrictions may be of utmost importance in the public’s opinion. Once the list of “Current” direct impacts has been narrowed down through the ranking process, it should be presented for public review. Most mitigation strategies have an associated cost and ultimately it is the public who pays for it. Public “buy-in” and support is critical. What impacts are viewed by the public as important enough to need to be addressed? Ultimately, what impacts do they want to alleviate and are they willing to invest financially as well as socially in finding a “solution?”

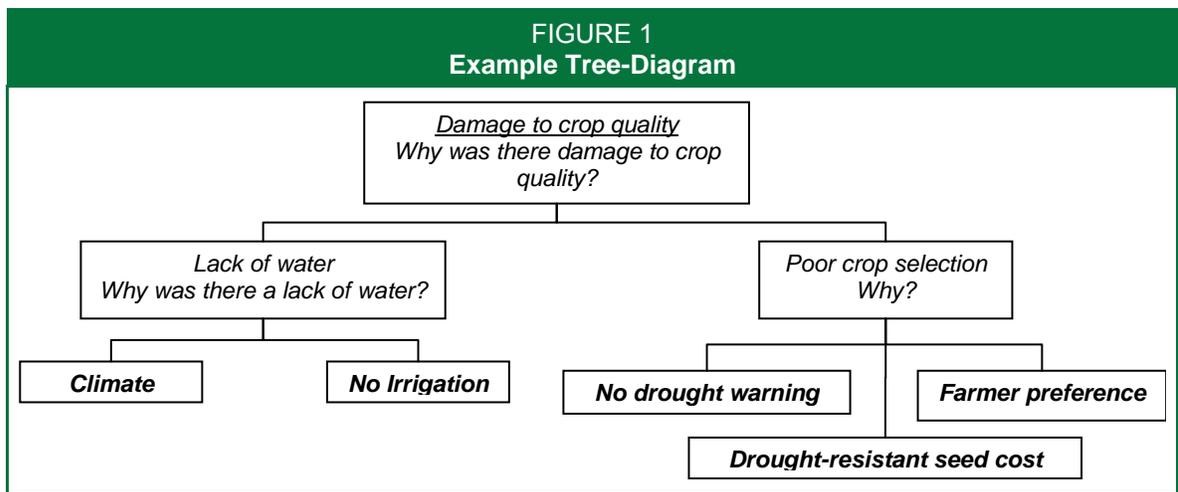
Once ranked, provide a table or list of these impacts in order of importance (prioritized list) in the drought mitigation plan template.

Section VI Vulnerability Assessment

The vulnerability assessment is one of the most important parts of this mitigation planning process. Vulnerability as described in this document differs from vulnerability as presented in the *State of Utah Natural Hazard Mitigation Plan* (available online at: http://des.utah.gov/nathaz/pdm_pub_st.htm). The discussion regarding vulnerability in the state’s hazard mitigation plan pertains primarily to the identification of areas or counties, vulnerable to drought, largely by

agricultural-based guidelines. A vulnerability assessment in this document builds upon this. The planners or water suppliers however, are encouraged to review the state hazard mitigation plan’s discussion of drought (primarily contained in “Section 2” of the state’s plan) as a preliminary step to conducting a vulnerability assessment as detailed in this document.

The purpose of a vulnerability assessment, pertaining to drought mitigation as described in this document, is to identify the “root” or basal causes of the “Current” direct impacts previously identified and ranked in Sections IV and V, respectively. This allows policy and mitigation strategies to be directed and focused on the actual cause of the vulnerability instead of the resulting direct impact itself. In order to determine what the basal causes are (ultimately assessing vulnerability), the water suppliers or planning group will need to ask why. Why did the impacts occur? Why might these impacts occur? The answers to these questions may result in second- and third-tier impacts until what is deemed as the basal cause(s) is reached. The NDMC/BOR document recommends the use of “tree-diagrams” to facilitate this process in a logical and understandable manner. Example tree-diagrams can be found in the NDMC/BOR document and in Figure 1 shown below (direct impact is underlined and the basal causes are in bold). Such diagrams can be produced for each of the ranked “Current” direct impacts and be extremely informative.



Drought-related impacts that initially appear to have little or nothing to do with the water supplier’s operations may have basal causes that are influenced by and therefore can be addressed by the water supplier through implementing a mitigation strategy. Some basal causes may not be appropriate for a water supplier to address and therefore the water supplier must choose the most relevant basal cause to address, such as “No drought warning” in the example in Figure 1.

In the corresponding section of the *Model Drought Mitigation Plan Template*, the water supplier or planning group should provide a table or list that presents the identified basal cause(s) to be addressed, the associated direct impact(s) and pertinent discussion or details (see Table 3; example impact and basal causes are italicized).

TABLE 3
Direct Impact and Basal Cause(s)

Direct Impact	Basal Cause(s)	Discussion
<i>Damage to Crop Quality</i>	<i>No Drought Warning</i>	

Public Involvement

For any given impact, several contributing basal causes may be identified. It is up to the water supplier or planning group to then decide which basal causes should be addressed and fall within the scope of the water supplier’s operations and goals. Again, at this point in the process, public involvement may prove to be invaluable. If the public assists with deciding what basal causes to address, they are more likely to be supportive (financially and socially) of mitigation actions needed. The identified basal causes are then used to identify mitigation actions as presented in the following sections.

Section VII Possible Mitigation Strategies

In order to reduce future impacts of droughts and decrease vulnerability, mitigation strategies need to be identified by the water supplier or planning group. This step in the process is intended to help identify as many relevant mitigation strategies as possible from which to select those to be implemented. Some mitigation strategies will likely address several basal causes while others may be more specific in nature. The NDMC/BOR document poses a few questions that the water supplier or planning group should ask themselves:

- Can the basal cause be mitigated?
- How can the basal cause be mitigated?
- Does the basal cause or some aspect of it have to be accepted as drought-related risk?

This step will require a lot of “brainstorming” in order to come up with several ideas or probable “solutions” to lessen the negative influence of the basal causes. Ideally mitigation strategies should be identified first and then response strategies, and when there are no feasible mitigation options, the basal cause(s) may need to be accepted as a drought-related risk for the system and managed accordingly.

A modified list of possible mitigation actions developed in the NDMC/BOR document is provided. Several of these actions may not apply to your situation; however the list is presented to give ideas of mitigation actions and different categories. Also refer to Appendix B of the state’s hazard mitigation plan for additional possible mitigation strategies (available online at: http://des.utah.gov/nathaz/pdm_pub_st.htm).

Possible Mitigation Actions

Assessment

- Develop criteria -- "triggers" -- for drought-related actions
- Develop or support the development of early warning systems
- Inventory water bank contracts to find new water supplies for drought-stricken areas
- Evaluate water quantity and quality from new sources
- Evaluate use of ground water
- Evaluate conjunctive use strategies
- Establish new data collection networks
- Study public willingness to pay more for more reliable water supplies
- Study effectiveness of conservation measures
- Establish alert procedures for water quality problems

Legislation and Public Policy

- Prepare position papers for legislature on public policy issues
- Examine statutes governing water rights for possible modification during water shortages and make appropriate suggestions
- Establish or participate in a regional water bank
- Lobby for legislation to protect instream flows
- Lobby for legislation to protect and manage groundwater
- Lobby for legislation providing guaranteed low-interest loans to farmers
- Support limits on urban development
- Lobby for legislation to facilitate water recycling

Water Conservation/Demand Reduction

- Establish stronger economic incentives for private investment in water conservation
- Encourage voluntary water conservation
- Require water users to decrease reliance on ground or surface water sources and implement conservation measures
- Improve water use and conveyance efficiencies
- Implement water metering and leak detection programs
- Support local development of conservation programs
- Improve water scheduling
- Reduce consumptive use by changing the type of water application system or using water meters
- Institute conjunctive use of surface and ground water

Water-saving measures for urban areas:

Modify rate structure to influence consumer water use, including:

- shifting from decreasing block rates to uniform block rates
- shifting from uniform rates to increasing block rates
- increasing rates during summer months
- imposing excess-use charges during times of water shortage

Modify plumbing system, including:

- distributing water-saving kits, including replacement showerheads and flow restrictors
- supporting the change or improvement of plumbing standards
- requiring or offering rebates for ultra-low-flow toilets

Reduce water-system losses, including:

- using watermain-leak-detection survey teams followed by watermain repair or replacement as necessary to reduce system losses

- monitoring unaccounted-for water
- conducting indoor-outdoor audits
- starting a meter-replacement program
- recycling filter plant backwash water
- recharging groundwater supplies

Reduce water use for landscaping, including:

- imposing lawn watering and other landscape-irrigation restrictions
- developing a demonstration garden
- publishing a xeriscape manual
- using nonpotable water for irrigation
- imposing mandatory water-use restrictions during times of water shortage
- Conduct water-conservation education of the public and of school children, including special emphasis during times of water shortage
- Meter all water sales and replace aging or defective meters in a timely way

Water-saving measures for farms:

- Use lasers for accurate land leveling
- Install return-flow systems
- Line canals or install piping to control seepage
- Control exotic phreatophytes
- Use sprinkler and drip irrigation systems
- Schedule irrigation by demand
- Use soil-moisture monitoring
- Use deep pre-irrigation during periods when surplus water is available
- Improve tillage practices
- Use evaporation suppressants
- Use lower-quality water
- Install underground pipelines
- Grow drought- or salinity-tolerant crops

Increasing Water Supply/Supply Augmentation

- Provide pumps and pipes for distribution
- Propose and implement programs to rehabilitate reservoirs to operate at design capacity
- Undertake water supply vulnerability assessments
- Inventory self-supplied industrial water users for possible use of their supplies for emergency public water supplies
- Inventory and review reservoir operation plans
- Implement water quality management and wastewater reuse
- Use carryover storage in a reservoir to "bank" a conserved water supply
- Use ground-water banking concepts to allocate and store surplus, inactive, or reclaimed water
- Establish water banks for voluntary sale, transfer, or exchange of water
- Establish water banks and transfers in conjunction with voluntary farmland idling programs

Public Education and Participation

- Establish a public advisory committee
- Include public participation in drought planning
- Organize drought information meetings for the public and the media
- Implement water conservation awareness programs
- Publish and distribute pamphlets on water conservation techniques and drought management strategies
- Organize workshops on special drought-related topics
- Prepare sample ordinances on water conservation

- Establish a drought information center
- Set up a demonstration of on-site treatment technology at visitor center
- Include the media in drought planning
- Establish tuition assistance so farmers can enroll in farm management classes
- Develop training materials in several languages
- Provide education on different cultural perspectives of water resources
- Consult a marketing firm for strategies to draw public attention
- Employ public participation and public information specialists

Health and Nutrition

- Support crisis counseling centers and hotlines (especially in rural areas)
- Support food subsidy programs for drought-affected individuals
- Support shelters for domestic violence cases
- Conduct public information campaigns on the health dangers of drought (e.g., heat stress, low-flow cross-connections, fire risk, reduced water quality, etc).

Media Participation

- Select official representatives for media contacts
- Establish a list of authorities regarding drought issues
- Organize education activities for the media
- Write reports for the media early in the event
- Include media personnel in drought planning
- Keep the media updated about new conditions and plans

Conflict Resolution

- Resolve emerging water use conflicts
- Investigate complaints of irrigation wells interfering with domestic wells
- Negotiate with irrigators to gain voluntary restrictions on irrigation in areas where domestic wells are likely to be affected
- Work with community-based organizations to promote public participation in conservation programs
- Maintain communication between the public, policy makers, scientists, and the media

Drought Contingency Plans

- Adopt an emergency water allocation strategy to be implemented during severe drought
- Evaluate worst-case drought scenarios for possible further actions
- Establish a public advisory committee

Technical Assistance

- Advise people on potential sources of water
- Recommend adopting water conservation measures
- Conduct workshops on various drought topics, including crop survival during drought
- Conduct workshops on design and implementation of water rationing programs
- Promote innovative technologies such as irrigation system improvements, indoor water saving devices, and/or monitoring technologies

Emergency Response

- Stockpile pumps, pipes, water filters, and other equipment
- Support or establish water hauling programs for livestock
- List livestock watering spots
- Establish hay hotline and provide emergency shipments

- Fund water system improvements, new systems, and new wells
- Fund drought recovery program
- Lower well intakes on reservoirs for rural water supplies
- Extend boat ramps and docks for recreation
- Tell farmers about sources of federal assistance

Section VIII Actions to be Taken

From the list of possible mitigation strategies, those deemed suitable and feasible should be identified, taking into account cost-benefit ratios, public opinion, effectiveness, environmental concerns, etc. Again, a decision matrix or comparable method could be used to facilitate this process of selecting appropriate drought risk or vulnerability reducing actions. Refer to the NDMC/BOR document for an example decision matrix or to Table 4 below.

TABLE 4
Decision Matrix (Mitigation Strategies)

Direct Impact	Basal Cause	Possible Action(s)	Feasible	Cost Effective	Public Opinion	Equitable	Environmentally "Friendly"
Damage to Crop Quality	No Drought Warning	Develop plan with "triggers" or indicators to "warn" of impending drought					

Once the pertinent mitigation strategies have been identified using the decision matrix or by another process, a table or "plan of action," should be developed, such as the simplified example shown in Table 5. It should include, at the very least, the basal cause, the mitigation strategy or recommendation to address the basal cause, whom will be involved, a cost estimate and a schedule for implementation followed by discussion regarding the expected outcome of implementation and process of implementation.

This table or plan of action is the intended end result of this mitigation planning/vulnerability assessment process. It is a simplified mitigation plan to be implemented by the water suppliers and community.

Note: Refer to Section 3 and Section 5 of the state’s hazard mitigation plan for information regarding mitigation strategies used at the state and county levels, respectively (available online at: http://des.utah.gov/nathaz/pdm_pub_st.htm). This may help the planning group or water supplier to implement strategies that are inline with the local and state governments, in essence extending the scope of and possibly amplifying the positive effects of such strategies. Public and local support to implement such mitigation strategies may also be easier to obtain and maintain.

TABLE 5
Drought Mitigation Actions for *(water supplier's name)*

Recommendation/Action	Participants	Cost Estimate	Implementation Year
Basal Cause: <i>Insufficient amount of available water to meet essential needs</i>			
Mitigation Strategy/Goal: <i>Create mechanism to allow temporary water redistribution (water bank and needed infrastructure)</i>			
<i>Initiate dialogue with appropriate water suppliers and state agencies</i>	<i>Water suppliers, state agencies</i>	<i>\$XXXXXX</i>	<i>2008</i>
<i>Develop DRAFT of water banking mechanism</i>	<i>Water suppliers, state agencies</i>	<i>\$XXXXXX</i>	<i>2008</i>
<i>Implement water banking mechanism</i>	<i>Water suppliers, state agencies</i>	<i>\$XXXXXX</i>	<i>2009</i>
<i>Develop infrastructure where needed</i>	<i>Water suppliers, state agencies</i>	<i>\$XXXXXX</i>	<i>2010</i>
Basal Cause: <i>No Drought Warning</i>			
Mitigation Strategy/Goal: <i>Create a procedure or mechanism to facilitate the informing of the public regarding the water supply conditions and drought potential</i>			
<i>Appoint a media contact</i>	<i>Water suppliers, media</i>	<i>\$XXXXXX</i>	<i>2008</i>
<i>Study the most effective way to inform the public</i>	<i>Water suppliers, state agencies</i>	<i>\$XXXXXX</i>	<i>2008</i>
<i>Create procedure</i>	<i>Water suppliers</i>	<i>\$XXXXXX</i>	<i>2008</i>
<i>Develop a Drought Response Plan</i>	<i>Water suppliers, community</i>	<i>\$XXXXXX</i>	<i>2008</i>

Additional Resources

Water Suppliers/planning groups are encouraged to refer to the following documents when developing a drought mitigation plan/component:

—“Drought Preparedness Planning: Building Institutional Capacity”
Available online at: <http://www.drought.unl.edu/mitigate/mitigate.htm>.
Prepared by the National Drought Mitigation Center.

— “How to Reduce Drought Risk”
Available online at: <http://www.drought.unl.edu/mitigate/mitigate.htm>.
Prepared by the Preparedness and Mitigation Working Group of the Western Drought Coordination Council. Primary authors: National Drought Mitigation Center and Bureau of Reclamation.

Appendix 1
Model Drought Mitigation Plan
WORKSHEETS

These worksheets are not part of the plan per se, but are intended to help facilitate initial data gathering and planning or thought processes.

Worksheet 1

Water System Profile

The Water System Profile worksheet will help you describe key elements of your water system. In order to better facilitate the development of the drought mitigation plan, the following information will be useful to gather and distribute to the planning group.

Population

Collecting and incorporating current population data and future growth projections into the development of the drought mitigation document will allow for better decisions regarding the potential severity of impacts and mitigation strategies to implement. If needed, state-projected population numbers can be obtained from the Governor’s Office of Planning and Budget (<http://www.governor.utah.gov/gopb/default.html>).

- Current Population: _____
- 5-year Projection: _____
- 10-year Projection: _____
- 20-year Projection: _____
- 30-year Projection: _____

Annual Water Supply & Purchase

List the sources of your water supply (name and type), along with any associated water right number. Total culinary and/or secondary water obtained from that source should also be reported. Indicate annual water purchases and price for the past water year. It will be beneficial to “categorize” sources as surface or sub-surface and further flesh out surface water using reservoir or stream/rivers classifications, as drought affects each of these sources differently.

Source Name	Type	Right Number	Culinary (acre-ft)	Secondary (acre-ft)

Purchases		Source
Acre-ft	\$ per acre-ft	

Connections & Use

Break up the total number of service connections into the following categories: agriculture, residential, industrial, commercial, institutional and other. Total water use should be provided for the previous water year. Total yearly water use should then be divided by population and 365 to calculate the current per capita water use in gallons per capita per day (gpcd).

	Connections	Acreage	Use (acre-ft/yr / kgal/yr)
Agricultural			
Residential			
Industrial			
Commercial			
Institutional			
TOTAL			

Gallons per Capita per Day

$$(\text{Total Use in Gallons}) / (\text{Population}) / (365 \text{ Days}) = \text{gpcd}$$

Projected Water Use

Current Use _____ (acre-ft/yr or kgal/yr)
 30-year Growth _____ % (percent increase in water use)

$$\text{Projected Use} = (\text{Current Use}) * (\text{Growth}) + (\text{Current Use}) =$$

_____ (acre-ft/yr or kgal/yr)

It may also be appropriate to factor in conservation when calculating the projected water use. The state’s conservation goal is a 25% decrease, by 2050, of the baseline per capita water use of the year 2000. Monitoring the effect of conservation on the water supply and use rates would be rather informing.

Secondary Water Use

List all secondary irrigation companies/systems that exist in the service area. Include your entity if you have a secondary water system. Estimate the percentage of connections that are serviced by secondary water companies for their lawn and garden needs.

Secondary Water Companies		
Name	Contact	Phone

Percent of Customers with Secondary Access

Agricultural	_____	Commercial	_____
Residential	_____	Institutional	_____
Industrial	_____	TOTAL	_____

Worksheet 2

Environmental Information

The Environmental Information worksheet is intended to aid with the collection and organization of information pertaining to the water supply and effects of drought on the surrounding environment.

Precipitation

Collect and examine local and regional precipitation (rainfall and snowpack) characteristics. Much of this data can be found online at: <http://www.wcc.nrcs.usda.gov/snotel/Utah/utah.html>; <http://climate.usurf.usu.edu/products/data.php>; http://hdsc.nws.noaa.gov/hdsc/pfds/sa/ut_pfds.html and <http://www.ut.nrcs.usda.gov/snow/data/>.

Average Annual Precipitation _____
 Annual Precipitation Maximum _____
 Annual Precipitation Minimum _____

The monthly precipitation totals give a better idea of natural variability (extremes) and are as follows:

Monthly Precipitation Totals

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean												
Maximum												
Minimum												

From analysis of local and regional data, any trends that can be identified should be noted, such as earlier than normal snow melt or peak surface flows. This information could be integrated into overall water supply management.

Drought

Collect and examine local and regional information regarding drought. It is recommended that data from instrumental records or drought indices (Palmer Drought Severity Index, Surface Water Supply Index, Standardized Precipitation Index) be used to conduct an assessment of local and regional drought in addition to analysis of any pertinent records kept by the community or water supplier. Refer to the State of Utah Division of Water Resources’ report entitled: *Drought in Utah: Learning from the Past—Preparing for the Future* available online at: <http://www.water.utah.gov/>. Drought index information can be found at: <http://www.ut.nrcs.usda.gov/Snow/watersupply/swsi.html>, <http://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp#> and <http://www.cdc.noaa.gov/USclimate/map.html>.

Example drought information is shown in the following table:

Drought Characteristics

Drought Event	Severity			Duration (yrs)	Recurrence (every # years)	Areal Extent (% of region in drought)
	Mild	Moderate	Severe			
1999-2004			X	6	10 (every 10 years a drought such as this occurs in this region per analysis of drought indices and other records)	90 (90% of the water supplier's area of distribution was effected in some way by the drought)

Once all droughts on record and characteristics of these droughts have been identified (characteristics deemed appropriate for the region by the water supplier/planning group), identify the “drought of record” (most severe drought on record) or other drought to be used as the standard or base from which planning decisions may be made.

Base Drought

This is the drought or conditions from which additional planning decision are made.

Drought Event: _____ Severity: _____
 Duration: _____ Recurrence: _____
 Areal Extent: _____

It may be useful to gather information regarding impacts associated with this drought and how it was managed by the water supplier and community.

Surface and Ground Water

If applicable, it may be beneficial to collect and examine local reservoir storage levels and ground water levels depending upon water supply source type. This data could be compared to precipitation data and the occurrence of drought in order to gain a deeper understanding of the relationship between these factors and the variability associated with them (extremes: low and high levels).

Additional Information

It may also be beneficial for the planning group to also develop a working understanding of climatological cycles such as El Niño and La Niña (what they are and how they affect local and regional climate). Climate change is another item that would be beneficial for local water suppliers to stay abreast with. The Division of Water Resources encourages water suppliers to study issues pertinent to their water supply in order to make well-informed decisions.

Model Drought Mitigation Plan

TEMPLATE

Utah Division of Water Resources

Instructions: The following is a “model” or template drought mitigation plan that can be utilized as a stand-alone plan or integrated into current water management plans and long-term planning activities. Every situation is different and the entirety of this document may not apply to your system. This document may be altered to make it more applicable to your system. The use of this model plan is not mandatory; however it is encouraged by the Utah Division of Water Resources and seen as a starting point for drought mitigation planning. It is designed to be used in tandem with the “Model Drought Mitigation Plan: Information Guide,” which provides additional “section-by-section” instruction and examples.

Note: In this document, the term “water supplier(s)” includes and is not limited to, towns, cities, counties and water suppliers in general.

(Name of Water Supplier)

(Address, City, Zip Code)

(Date)

Section I Purpose

For the purpose of protecting, conserving and efficiently utilizing the waters of our state, maintaining public health and safety, and providing as reliable as possible public water supply while minimizing or mitigating effects of future drought impacts, the _____ (*name of water supplier*) has developed and intends to implement the following drought mitigation plan.

(Add description and detail as appropriate, such as definitions of terms that may be used within the plan, i.e. conjunctive management, reclaimed water, and municipal and industrial water. Also describe the reasoning behind the development of the plan or component and present support for doing so.)

This plan is intended to supplement current water supply management plans and applies to _____ (*name of water supplier*) and to all persons, customers, and property which receive and utilize water from _____ (*name of water supplier*).
(*If the plan has been formally adopted, attach or reference appropriate documentation. Also state the intent to implement the plan and if developed, refer to a timeline for doing so.*)

Section II Public Participation

Throughout the development of this plan or during opportunities as deemed appropriate by the _____ (*name of water supplier*), the general public or customers were involved in and/or informed regarding the development of this plan by means of _____ (*describe methods used to involve and inform the public with regard to the development of this plan and how opportunities were provided for public input and review*).

From interacting with the public during the planning process, the following issues were identified and/or addressed:

- (*List and discuss any pertinent issues or concerns that were brought up during periods of public participation. This is done to show that the public’s concerns, if any, have been appropriately considered and addressed.*)

Section III Public Education

The _____ (*name of water supplier*) will conduct public education and outreach programs as well as provide updates to the public as to the implementation of items contained within this plan, pertaining to progress, changes or addendums to this plan and other information deemed appropriate. This information will be disseminated and made available by means of:

- (*Describe the methods to be used to update the public as well as what type of information will be expressed to the public and the frequency of doing so.*)

Section IV Drought Impact Assessment

The _____ (*name of water supplier*) has chosen, through analysis and discussion, the _____ (*drought or drought conditions from which to base the impact assessment, such as the “drought of record,” a specific severe drought or average drought*) as the base drought from which the impact assessment was conducted (*provide rationale for choosing the “type” of drought from which the assessment was conducted. In other words, detail justification for the base drought chosen.*). Through utilizing the provided “checklist” and/or by _____ (*describe steps taken to identify direct impacts of the chosen base drought. If the Checklist was not utilized, describe the main method of identifying the direct impacts*), the _____ (*name of water supplier*) has identified the following direct impacts of historical, current and potential droughts:

- (*Provide list or table of identified historical, current and potential direct impacts and/or add to the checklist provided in the “Information Guide.”*)

Section V Impact Ranking

The _____ (*name of water supplier*) has ranked the identified “Current” direct impacts according to priority and need of being addressed by means of _____ (*Describe the method used to rank the impacts, such as a decision matrix (see the “Information Guide”), and list and discuss the factors taken into consideration, such as public opinion. Discuss why these factors were chosen and how these factors were used or weighted in the ranking process. If the public was involved, describe how and identify the impacts that are of greatest concern to the public.*).

The “Current” direct impacts identified as high priority and relevant to the aforementioned water supplier’s operations are as follows:

- (*Provide a list or table of the ranked high priority direct impacts, see “Information Guide.”*)

Section VI Vulnerability Assessment

The _____ (*name of water supplier*) has completed a vulnerability assessment, to identify the basal or “root” causes of the ranked and prioritized “Current” direct impacts found in Section V of this document by means of _____ (*describe and discuss methods used to conduct the vulnerability assessment, such as tree-diagrams (see the “Information Guide”) and how the public was involved.*).

The results of the vulnerability assessment or identified basal causes and the associated “Current” direct impacts are (listed below or presented in the following table):

- (*Provide a list or table of the identified basal causes and the associated “Current” direct impact previously identified. Provide discussion with regard to the relationship between the basal cause and the direct impact and other information as deemed appropriate.*)

Section VII Possible Mitigation Strategies

The _____ (*name of water supplier*) has identified the following potential actions that may be taken to mitigate and address the basal causes of the “Current” direct impacts. These actions are listed as follows:

- (*Provide a list of potential mitigation strategies that can be implemented to address the basal causes, see “Information Guide” for a list of possible mitigation strategies.*)

Section VIII Actions to be Taken

In order to address and mitigate basal causes of the “Current” direct impacts, thereby reducing the risk of such impacts or basal causes from being realized during future droughts, the

_____ (*name of water supplier*) has chosen the following applicable mitigation strategies from those presented in Section VII:

- (*Provide a list or table of mitigation strategies to be implemented, see “Information Guide.”*)

These strategies have been chosen by means of _____ (*briefly discuss methods, such as a decision matrix and factors involved, see “Information Guide,” and reasons for choosing these strategies as well as expected outcome.*).

The _____ (*name of water supplier*) has developed the following implementation plan (*include applicable information such as timeline, estimated costs, identified basal cause, goal/recommendation or action, and participants in a table or other appropriate format, see “Information Guide” for an example*):

Model Drought Response Plan

Model Drought Response Plan

INFORMATION GUIDE

Utah Division of Water Resources

Instructions: This guide is intended to provide information to aid in the development of a community drought response plan. It is designed to be used in tandem with the Utah Division of Water Resources' "Model Drought Response Plan: Template." This document contains direction and discussion regarding sections found within the template.

Note: In this document, the term "water supplier(s)" includes and is not limited to, towns, cities, counties and water suppliers in general.

Introduction

The Utah Division of Water Resources encourages communities and water providers to take a proactive approach to the threat of drought and other water-shortages through long range planning and development. Although the Division recommends mitigation as the preferred drought management approach, response to drought is still a crucial component to drought management. This Information Guide is included as a companion document with the *Model Drought Response Plan: Template*, which is designed to assist communities in their drought response and management efforts.

In some cases, drought mitigation efforts alone will not entirely eliminate the negative impacts of drought. In the event of a severe drought, or some other water supply shortage, it will often be necessary for even the most well prepared communities to respond to drought impacts. Some impacts may also be seen as acceptable and allowable, such as outdoor watering restrictions (i.e. letting lawns turn brown). The purpose of a Drought Response Plan (or Water Shortage Contingency Plan) is to layout a thoughtful and useful pattern for how to respond.

Each community is distinct and unique, even from other communities in the immediate area. Variables such as population, developed water supplies, age and reliability of existing infrastructure, variations in topography, and even micro-climate are just a few of the many factors that make each community unique. Consequently this document and the *Model Drought Response Plan: Template*, may not be directly applicable to every community, without modification. It will be important for each community or water provider to determine the amount of detail and complexity it desires to include in its own Drought Response Plan.

Many communities may not desire to have a stand alone Drought Response Plan. Communities must prepare for many potential hazards such as earthquake, landslides, flooding, severe wind, wildfires and mudflows to name a few. Instead of preparing a separate plan for each hazard many communities may prefer to develop a single hazard mitigation document. In that case the plan presented here (as well as the drought mitigation model plan) could be adapted as a component of

the community's overall hazard mitigation and response plan. Another option is that communities might choose to make it a component of their overall water management plan.

Section I Drought Response Levels

This model plan outlines three drought response levels, addressing progressively more serious drought conditions as they occur. Some large communities may feel a desire to increase the number of drought response levels beyond three. For most of the state's communities, however, three levels of drought response should be adequate. Furthermore, the establishment of three, parallels the state's own Drought Response Plan which designates three drought response phases. The use of the term "level," rather than "phase," at the local level will help to provide a distinction between its own drought conditions evaluation and that of the state. The need for this distinction will become apparent as explained below.

The three drought response levels are:

Level 1 – Drought Advisory

Level 2 – Moderate Drought

Level 3 – Severe Drought

Level 1—Drought Advisory

This early stage of drought is characterized by mild drought conditions and moderate concern about future water supplies. The primary focus at this early level is to initiate public awareness of the drier than normal conditions and encourage voluntary reductions in water use. The Level 1 Drought Advisory could be triggered by the same criteria that triggers statewide Phase 1 drought response, that being a SWSI (Surface Water Supply Index) for the basin (in which the water supplier and water suppliers are located) of between -1 and -2.¹ (The SWSI is a numeric evaluation of how much water is in the watershed. It is a statistical analysis of historic precipitation, stream flow and reservoir data.) This trigger will insure that the community enters the drought advisory level early enough to accomplish the public awareness goals and develop early drought management strategies.

Potential Trigger

The Basin's Surface Water Supply Index drops below -1.

Potential Objectives

- To prepare the community, Public Utilities, relevant agencies, and water customers for a potential water shortage thereby providing all parties adequate time for planning and coordination.

¹ Surface Water Supply Index values by basin can be found at: <http://www.ut.nrcs.usda.gov/snow/watersupply/swsi.html>. Additional drought indices, the Palmer Drought Severity Index and Palmer Hydrological Drought Severity Index as well as the Standard Precipitation Index can be found at: <http://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp> and <http://www.drought.unl.edu/monitor/currspi.htm>, respectively.

- To initiate supply management actions that will forestall or minimize the need for later more stringent supply or demand management actions.
- To minimize the waste of water through carelessness, either intentional or accidental.
- To reduce water demand in an attempt to meet target consumption levels through voluntary customer actions.
- To minimize disruption to customers' lives and businesses while meeting target consumption goals.

Potential Response Actions

- Provide press releases informing the public of the Drought Advisory Level designation.
- Provide details in community newsletters and/or "bill stuffers."
- Setup information booths in public high traffic areas.
- Encourage newspaper stories covering the dry weather condition.
- Where possible, seek to have public service announcements made by local media outlets that will point out the need to voluntarily reduce outdoor water use.
- Monitor closely the current and projected water supply and compare it with the projected demand in anticipation of the possible need to upgrade to Drought Level 2 - Moderate Drought.

Level 2—Moderate Drought

This level of drought signifies that current and projected water supplies will likely be inadequate to meet the communities present or near-future water demands.

The State Drought Response Plan calls for the movement into Phase 2 drought response based upon the decline of the basin's SWSI to below -2. Local communities, however, should determine their move to a Level 2 based upon the community's actual water supplies compared with its projected demand. It may be possible for the State's basin-wide drought assessment to remain at Phase 1 (based upon the SWSI), even though some local communities may designate themselves as experiencing Level 2 - Moderate Drought conditions, because of local water supply problems. Past experience, however, indicates the more likely scenario is that while declining SWSI numbers cause the State to move its drought designation for the basin to Phase 2, many of the basin's communities, through diligent mitigation and planning efforts, will remain at Level 1 - Advisory Drought, with water supplies that are adequate to meet near future water needs.

Because Level 2 - Moderate Drought will reflect the situation of the local community and should not be arbitrarily triggered by the basin's Surface Water Supply Index, it will be important for the community leaders to develop a meaningful and quantifiable criteria that will be used to trigger both Level 2 – Moderate Drought and Level 3 – Severe Drought; likely based on actual condition of the water supply in concert with drought indices' values.

It might be helpful if the public were involved in the development of the criteria or at least aware of the logic behind the criteria. That way the individual citizen will be more likely to react favorably to the imposing of water use restrictions.

Potential Trigger

Projected water supplies appear inadequate to meet water use demands in the near future.

Potential Objectives

- To ensure that adequate water supply will be available for the duration of the drought situation to protect public health and safety.
- Achieve targeted consumption reduction goals through imposed water use restrictions.
- Minimize the disruption to customers' lives and businesses while meeting target consumption goals.
- Maintain the highest water quality standards throughout the water shortage period.
- Promote equity amongst water customers by establishing clear restrictions that affect all customers.

Potential Response Actions

- Impose outdoor watering restrictions.
- Consider the possibility of applying for and drilling an emergency temporary well.
- Investigate the possibility of purchasing and converting any available agricultural water supplies.
- Investigate the possibility of buying or leasing from neighboring water supply systems.

Level 3—Severe Drought

This drought level is triggered when it becomes apparent that the actions taken during Level 2—Moderate Drought, have not significantly reduced the demand. At this point, drought conditions are continuing and existing and projected water supplies have become critically short of the current water use levels. Once this level of drought designation is reached (through criteria developed by the water supplier, based on water supply conditions and/or drought indices' values) the community must consider more aggressive measures such as eliminating all outdoor water use, drilling temporary emergency water wells, hauling water from outside sources and appealing to various state and federal agency for disaster relief and assistance.

Potential Trigger

Further deterioration of projected water supplies despite Level 2 response actions.

Potential Objectives

- To achieve targeted consumption reduction goals by further restricting defined water uses.
- To ensure that adequate water supply will be available for the duration of the drought.
- To protect public health and safety.
- To minimize the disruption to customers' lives and businesses while meeting target consumption goals.
- To maintain the highest water quality standards throughout the drought.
- Promote equity amongst water customers by establishing restrictions that affect all customers.

Potential Response Actions

- Ban all outdoor water use.
- Drill a temporary emergency well.
- Haul water in from outlying areas.
- Appeal to the state and Federal Agency for disaster assistance.

Section II Response Actions

The reason for establishing three levels of drought is that the designated drought response actions fit well into three levels or categories. The first level is Advisory and is typified by information sharing and education. Results at this level are accomplished through voluntary actions as a response to education and information.

Level 2 – Moderate Drought is moved into when the necessary water use reductions will not be achieved without mandated actions. Initially, the most effective action that can be taken is to reduce outdoor water use. Although this action is effective, it should not be undertaken lightly or without consideration to how the public will respond. Studies have shown that if the public does not share the administrators concerns for the water supply, mandated restrictions are not very effective. This is particularly true with regard to even/odd-day watering restrictions. Confronted with the restriction of only watering on odd days a customer who watered every third day, now waters every other day, while his neighbor who prior to the restriction watered every day, now water twice as long or longer on his allowed even- watering day. Time-of-day watering restrictions, not allowing outdoor watering during the hottest hours of the day, have proved somewhat more effective. But even here it is incumbent upon the customer to not only shift his watering time but also to reduce the watering time duration.

Level 3 – Severe Drought is only initiated when actions taken at the Moderate Drought Level have proven inadequate to alleviate the water shortage and in fact there has been further reduction in the water supply despite the Level 2 designation and response actions taken. Response actions taken at this third Level are the most extreme in nature.

Section III Enforcement

With each increased drought level there will be increasing need for enforcement. Community leaders need to evaluate just how much effort should be expended to enforce the imposed outdoor watering restrictions. The penalties for violations will need to be spelled out in the plan, and will most likely need to be legitimized by an Ordinance. Community leaders will need to decide whether or not they will issue written warning(s) before imposing fines for violations. The level of enforcement can also be a function of the level of the drought with swift and significant fines being levied for violations during a Level 3 – Severe Drought.

Model Drought Response Plan

TEMPLATE

Utah Division of Water Resources

Instructions: The following is a “model” or template drought response plan that can be utilized as a stand-alone plan or integrated into current water management plans and long-term planning activities. Every situation is different and the entirety of this document may not apply to your system. This document may be altered to make it more applicable to your system. The use of this model plan is not mandatory; however it is highly encouraged by the Utah Division of Water Resources and is seen as a starting point for the development of a drought response plan. It is designed to be used in tandem with the “Model Drought Response Plan: Information Guide,” which provides additional instruction and examples.

Note: In this document, the term “water supplier(s)” includes and is not limited to, towns, cities, counties and water suppliers in general.

(Name of Water Supplier)

(Address, City, Zip Code)

(Date)

Introduction

In this section, a short description of the plan, its purpose and intended scope should be provided. It may be appropriate to provide definitions of terms used within the plan, such as time-of-day outdoor watering restrictions.

Section I Drought Response Levels

The _____ (designated official) shall monitor the water supply versus demand as deemed appropriate on a _____ (weekly, monthly—describe) basis. Through this monitoring, the _____ (designated official) shall determine when conditions warrant initiation or termination of each level within the plan.

The “levels” of drought, triggers and objectives are based on _____ (describe the rationale for using the number of “levels” chosen as well as the reasoning behind the triggering

criteria developed. Are the triggers based upon system capacity limitations, past droughts or a vulnerability assessment?)

Refer to the “Model Drought Response Plan: Information Guide” for examples and further discussion regarding the different drought levels, triggers, objectives, targets and response actions.

Level 1—Drought Advisory

Trigger: The Surface Water Supply Index (SWSI)—or other drought index, for the area(s) in which the water supplier and water supply are located, drops below -1.

Target: To achieve a voluntary _____ percent reduction in _____ (*total water use or daily water demand, etc. This is largely an information sharing and monitoring level; however reduction goals may still be set and achieved through public outreach if so desired*).

Objectives: Through achieving the stated water use reduction target the _____ (*water supplier*) also will work towards accomplishing the following objectives or goals: _____ (*provide discussion detailing additional efforts and goals. Refer to the “Information Guide” for examples.*)

Response Actions: The _____ (*water supplier*) will respond in effort to reduce _____ (*total water use or daily water demand, etc.*) through: _____ (*describe actions that will be taken*).

Level 2—Moderate Drought

Trigger: Customers shall be required to comply with restrictions and/or actions to be implemented as set forth in this plan when _____ (*describe triggering criteria; such as projected water supplies appear inadequate to meet water use demand in the near future and conditions are sustained or worsening, i.e. SWSI values is decreasing*).

Target: To achieve a _____ percent reduction in _____ (*total water use or daily water demand, etc.*).

Objectives: Through achieving the stated water use reduction target the _____ (*water supplier*) also will work towards accomplishing the following objectives or goals: _____ (*provide discussion detailing additional efforts and goals. Refer to the “Information Guide” for examples.*)

Response Actions: The _____ (*water supplier*) will respond in effort to reduce _____ (*total water use or daily water demand, etc.*) through: _____ (*describe actions that will be taken*).

Level 3—Severe Drought

Trigger: Customers shall be required to comply with restrictions and/or actions to be implemented as set forth in this plan when _____ (*describe triggering criteria; such as projected water supplies are inadequate—despite actions taken in Level 2—to meet water use demand in the near future and conditions are sustained or worsening, i.e. SWSI values is decreasing*).

Target: To achieve a _____ percent reduction in _____ (*total water use or daily water demand, etc.*) or eliminate all outdoor water use.

Objectives: Through achieving the stated water use reduction target the _____ (*water supplier*) also will work towards accomplishing the following objectives or goals: _____ (*provide discussion detailing additional efforts and goals. Refer to the “Information Guide” for examples.*)

Response Actions: The _____ (*water supplier*) will respond in effort to reduce _____ (*total water use or daily water demand, etc.*) through: _____ (*describe actions that will be taken*).

Section II Enforcement

Note: This section corresponds with Section III in the “Model Drought Response Plan: Information Guide.”

- 1) No person shall knowingly allow the use of water supplied by the _____ (*water supplier*) for any purpose that is contrary to the provisions as stated within this plan without the approval of the _____ (*designated official or representative of the water supplier*).
- 2) Any person found in violation of the said provisions contained in this plan will be warned and if continues to violate the provisions, will be fined not less than _____ dollars and not more than _____ dollars for each offense after the initial warning. Each day after the initial warning is issued will constitute a separate offense and be fined accordingly.
- 3) Water service may be discontinued if any person is found to have more than three separate offenses. It is left to the discretion of the water supplier to evaluate each offense and determine if the water service should be discontinued. The water will be restored only after any associated costs/fees are paid for by the water user.