

Arizona Drought Preparedness Plan

OPERATIONAL DROUGHT PLAN



Governor's Drought Task Force

Governor Janet Napolitano

October 8, 2004

GOVERNOR'S DROUGHT TASK FORCE

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EXECUTIVE SUMMARY

The goal of the Arizona Drought Preparedness Plan is to:

1. Identify the impacts of drought to the various sectors of water uses;
2. Define the sources of drought vulnerability for water use sectors and outline monitoring programs to alert water users and resource managers of the onset and severity of drought events; and
3. Prepare drought response options and drought mitigation strategies to reduce the impact of drought to water users in Arizona.

To achieve these goals, State leaders have developed a “plan” that will be reviewed annually and if necessary updated to provide the most up to date information and technology to not only prepare for drought but to provide the tools necessary that can be implemented to reduce the impacts from drought. The information in the Arizona Drought Preparedness Plan will assist State leaders, in concert with water users, planners, and resource managers, prepare for and respond to current and future drought conditions in Arizona. The Arizona Drought Preparedness Plan consists of two components:

1. Background and Impact Assessment – defines drought in Arizona, provides an historical context of drought, and catalogues the historical impacts and sources of drought vulnerability of water use sectors and water supplies, and
2. Operational Drought Plan – identifies regional vulnerability to drought impacts, identifies drought response options, defines drought mitigation strategies, outlines monitoring activities and programs to alert water users and resource managers of the onset of drought, and provides an implementation plan to respond to drought events.

The Operational Drought Plan, contained herein, is the key component for responding to the current and future drought conditions in Arizona. The Operational Drought Plan recognizes that drought events are natural disasters that touch all sectors of community, region, and state. To facilitate a coordinated response to drought events, the Operational Drought Plan identifies a process for communication and coordination between Arizona state agencies, Federal agencies, tribal governments, state lawmakers, water users, resource managers, and scientists.

The long-term planning aspect of the Governor's Drought Task Force activities have been overshadowed as a result of the current drought conditions that Arizonans are facing today. Water users across the state are now experiencing the impacts of drought that are identified in this document. Principally this document emphasizes a drought monitoring system to provide early warning of future drought conditions and proactive mitigation strategies to help reduce the impacts of drought. The Governor's Drought Task Force has developed guidelines for communities and water providers, individual homeowners, and State government for responding to each stage of drought consistent with the mitigation measures in this plan. The following tables have been developed using options that were proposed in this Operational Plan as well as suggestions obtained through the public workshops. The guidelines are intended to provide this assistance and will be adopted for future drought:

GUIDELINES FOR DROUGHT RESPONSE & MITIGATION¹

DROUGHT STAGE	ACTIONS		
Normal (Reduce Vulnerability)	State Government Will:	Communities/Utilities Need to:	Individuals Need to:
	<p>Require all State Agencies to Develop & Submit a Drought Plan</p> <p>Distribute conservation tips to all regions of the state (Office of Water Conservation)</p> <p>Require all state facilities to separately meter and annually report monthly water use – Release this information through media or other public outreach.</p> <p>Maintain a water system database (being developed through Water Resources - Rural Study) containing information on:</p> <ul style="list-style-type: none"> • Number of customers and metered connections • Annual water use • Demographics • Existing conservation/drought measures <p>Explore the development of statewide water wasting ordinances</p> <p>Calculate annual water use information for each community and update statewide water use information by sector – publish information through website, media or other public outreach</p> <p>Provide grant writing assistance to communities/utilities (Office of Water Conservation)</p> <p>Work with communities/utilities on public awareness and outreach on conservation and water supply information</p>	<p>Develop, Submit & Implement Drought/Conservation Plan</p> <ul style="list-style-type: none"> • Develop and pass water waste and other appropriate drought response ordinances (e.g., turf requirements for non-residential customers, drought-related water schedules, etc.) <p>Discourage developers from requiring turf in residential developments</p> <p>Develop alternative supplies</p> <p>Improve infrastructure and storage facilities, if necessary</p> <p>Study water use efficiency of all customers</p>	<p>Practice appropriate conservation strategies</p> <ul style="list-style-type: none"> • Install low-water use landscaping • Repair leaks in irrigation system • Reset irrigation timers seasonally • Implement water harvesting techniques • Convert high water using plumbing and fixtures with low-flow fixtures • Avoid outdoor watering during hottest part of the day • Eliminate runoff from property and reduce overspray from sprinkler systems

¹ The Task Force has also asked that Guidelines be developed for Agricultural water users. This will need to be done within the first year of implementation by the Drought Coordinator in conjunction with the Irrigated Agriculture Workgroup.

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DROUGHT STAGE	ACTIONS		
Abnormally Dry (Raise Consciousness)	State Government Will:	Communities/Utilities Need to:	Individuals Need to:
	<p>Accelerate work with local governments and water providers on public awareness and outreach</p> <p>Communicate conditions, reinforce general conservation tips</p> <p>Publish community and state facility water use information through website, media and other public outreach</p> <p>Review State Drought Plan – modify as necessary</p> <p>Review State laws to reduce impediments to providing water supplies to communities in emergency need – modify as necessary (short-term)</p> <p>Seek funding to provide assistance to water systems in need of developing storage and infrastructure improvements (e.g., well deepening) only if communities have submitted a drought/conservation plan</p>	<p>Implement Conservation Program</p> <p>Implement Drought Plan</p> <p>Communicate conditions, increase outreach and provide conservation tips²</p> <p>Provide incentives for (or require) all new and existing large turf users (golf courses, common areas of subdivision) to be hook up to non-potable supplies (e.g., reclaimed effluent).</p> <p>Increase water use efficiency and/or promote use of reclaimed water for street sweeping, public facility landscaping</p> <p>Increase use of reclaimed effluent for commercial landscaping to reduce potable water supply shortages</p> <p>Develop and adopt increased conservation rate changes or surcharges to respond to increasing drought conditions</p>	<p>Conduct home water audits and leak detection. Fix leaking faucets and replace faulty fixtures.</p> <p>Practice appropriate conservation strategies</p> <ul style="list-style-type: none"> • Install low-water use landscaping • Repair leaks in irrigation system • Reset irrigation timers seasonally • Implement water harvesting techniques • Convert high water using plumbing and fixtures with low-flow fixtures • Avoid outdoor watering during hottest part of the day • Eliminate runoff from property and reduce overspray from sprinkler systems

² Office of Water Conservation can assist in providing Conservation Tips and brochures

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DROUGHT STAGE	ACTIONS		
Moderate (Voluntary Reductions)	State Government Will:	Communities/Utilities Need to:	Individuals Need to:
	<p>Communicate conditions, promote general conservation tips, provide information on drought mitigation and response options</p> <p>Require State facilities (including universities) to reduce water use by 5%</p> <p>Implement other reductions consistent with and similar to local community reductions</p> <p>Enhanced Media Outreach and provide assistance to communities for conservation and drought education</p> <p>Develop Emergency Action Plan (State Drought Coordinator) including:</p> <ul style="list-style-type: none"> • Developing information necessary for an Agricultural Emergency Disaster Declaration • Development of mandatory conservation measures • Development of mandatory curtailment measures • Identify priorities for surface water supplies (based on State Law and Colorado River Shortage Sharing Provisions) 	<p>Implement Conservation Programs – focus on measures that are especially visible to the public</p> <ul style="list-style-type: none"> • Require restaurants to provide water only upon request (table tent program) • Require hotel/motels to implement linen & towel replacement programs <p>Communicate drought level & conditions</p> <p>Increase education on conservation followed by voluntary reductions for communities</p> <p>Require public facilities to reduce by community-determined percentage</p> <p>Implement water waste ordinances</p> <ul style="list-style-type: none"> • Residential - must keep water on property • Non-residential / Commercial - Prohibit washing sidewalks or parking lots, fix irrigation system leaks <p>Develop temporary pumping, water hauling, emergency interconnects, and water rights transfers</p> <p>Explore additional opportunities for utilizing reclaimed water</p> <p>Provide incentives for water conservation for residences and businesses installing efficient alternative outdoor irrigation to meet percentage reduction needs</p>	<p>Implement conservation practices to voluntarily reduce water use</p> <ul style="list-style-type: none"> • Install low-water use landscaping • Repair leaks in irrigation system • Reset irrigation timers seasonally • Implement water harvesting techniques • Avoid outdoor watering during hottest part of the day • Eliminate runoff from outdoor watering systems (retain all water on property) <p>Comply with water wasting ordinances</p> <p>Voluntarily reduce discretionary outdoor water uses (e.g., home car washing, pool refills)</p>

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DROUGHT STAGE	ACTIONS		
Severe (Curtailement)	State Government Will:	Communities/Utilities Need to:	Individuals Need to:
	<p>Declare a Drought Emergency (Governor) in affected area(s)</p> <p>Communicate conditions, promote general conservation tips, provide information on drought mitigation and response options</p> <p>Require State Facilities to reduce water use by 15%</p> <p>Increased media outreach (and enhanced assistance to communities for conservation and drought education)</p> <p>Implement stress management program for water-dependent livelihoods</p> <p>Implement and Enforce Emergency Action Plan</p>	<p>Continue aforementioned restrictions from moderate</p> <p>Communicate drought level & conditions</p> <p>Increased emphasis on existing Conservation Programs</p> <p>Institute rationing through fixed allotments for large turf facilities</p> <p>Implement time of day/day of week schedules</p> <p>Require reductions in non-essential outdoor watering according to a community-determined percentage</p> <p>Reduce indoor water use (according to a community-determined percentage)</p> <p>Prohibit requirements in subdivisions that require turf in landscaping</p> <p>Prohibit use of outdoor misters</p> <p>Impose restrictions on fire and fireworks</p> <p>Prohibit car washing for fundraising and encourage use of commercial car washing facilities where water is recycled</p> <p>Discourage winter overseeding</p> <p>Implement supply augmentation strategies (temporary pumping, water hauling, emergency interconnects, and water rights transfers)</p> <p>Implement increased conservation rate changes or surcharges</p>	<p>Reduce outdoor watering</p> <ul style="list-style-type: none"> • Reset irrigation timers consistent with community time of day/day of week schedule • Convert to Xeriscaping or native plants • Utilize water harvesting practices • Use commercial car washes <p>Use covers to reduce evaporation from pools</p> <p>Take extra steps to reduce indoor water use (e.g., reduce shower times)</p> <p>Reuse water</p> <ul style="list-style-type: none"> • Reuse dishwater and rinse water for watering indoor and outdoor for plants • Capture shower water in buckets for use in watering indoor and outdoor plants • Divert pool back wash to landscaping rather than discharging into the street or alley³ <p>Comply with water wasting ordinances</p> <p>Comply with time of day/day of week outdoor watering restrictions</p>

³ Check with your local government or county government for rules/restrictions on reuse.

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DROUGHT STAGE	ACTIONS		
Extreme (Eliminate Non-Essential Water Use)	State Government Will:	Communities/Utilities Need to:	Individuals Need to:
	<p>Communicate conditions, promote general conservation tips, provide information on drought mitigation and response options</p> <p>Require State Facilities to eliminate watering of non-essential outdoor watering (exceptions for wildlife protection)</p> <p>Provide water hauling assistance/relief to communities</p> <p>Impose restrictions as needed for affected areas – Governor's Emergency Powers</p> <p>Facilitate voluntary water purchases/transfers from irrigated agriculture (at fair market price) or other permit holders for potable water deliveries or for environmental protection (Forbearance)</p>	<p>Continue aforementioned restrictions from moderate and severe stages</p> <p>Communicate conditions, increase outreach and promote conservation tips</p> <p>Eliminate outdoor watering: no misters in commercial or public facilities, limit residential car washing, prohibit water used in fountains, prohibit residential pool refills – publicize enforcement activities to customers</p> <p>Prohibit all public water uses not required for health or safety and publicize enforcement activities to customer</p> <p>ET monitoring – utility to turn off watering during peak periods (e.g., golf courses, common areas of developments, parks)</p> <p>Prohibit winter overseeding – (allowances for golf courses – e.g., greens only)</p> <p>Implement turf removal program</p> <p>Increase energy efficiency thereby reducing use of cooling tower water use at thermal power generating stations</p> <p>Consider a moratorium on building permits if current demand cannot be met</p> <p>Track water use and publish (through media) name of those customers with the highest water use</p> <p>Consider and implement (if current demand cannot be met) pressure reduction and/or emergency shut off of water during certain times of the day</p>	<p>Eliminate outdoor watering</p> <p>Use covers to reduce evaporation from pools</p> <p>Take extra steps to reduce indoor water use</p> <p>Reuse water</p> <ul style="list-style-type: none"> • Reuse dishwasher for plants • Capture shower water in buckets use for watering plants • Divert pool back wash to landscaping rather than discharging into the street or alley

BACKGROUND AND PURPOSE

The Operational Drought Plan contains the drought preparedness and response elements of the Arizona Drought Preparedness Plan that will be implemented by the State of Arizona. It contains the drought monitoring approach, the stages of drought and expected responses, the roles of government agencies, non-governmental organizations and drought-related citizen's groups, the communications process, an annual calendar of activities, legislative and resource needs and a process for updating the plan on an annual basis. It also contains suggested programs and activities that will limit vulnerability to drought within regions and sectors. It is intended that the Operational Drought Plan will be the core of the state's drought activities, while the larger document, the Arizona Drought Preparedness Plan, provides more background and documentation.

Arizona has been affected by drought conditions during most of the last decade. It is not known at this time whether the drought conditions will abate in the short term, or whether this is a multi-decade drought sequence as has occurred in the past. However, it is absolutely clear that this is not the last drought that will affect the state. The economic and environmental impacts of drought continue to increase as the population of the state increases. Recent climatic and water supply conditions on the Colorado River have initiated shortage-planning discussions because the last five years of drought in the Colorado River Basin has depleted water levels in Lake Mead and Lake Powell to the lowest level since the dams were built. Although in general Arizona has a reliable water supply, drought conditions in some rural parts of Arizona have had devastating personal and economic impacts. In addition, due to the Central Arizona Project's low priority on the Colorado River system, there is cause for some concern about potential supply availability in the case of a long-term drought that affects both the Colorado and the Salt-Verde system. Arizona has made huge investments in importing and storing water supplies for the major metropolitan areas, and those investments have significantly buffered the state from impacts during the current drought. However, there is a need for further preparedness in case conditions worsen.

The principal intent of the Operational Drought Plan is to establish a flexible framework to refine our drought monitoring process, our understanding of drought impacts, and our mechanisms for limiting future vulnerability. The most urgent need for drought planning is in the growing communities in the rural parts of the state, where alternative water supplies are generally very limited and the economy is strongly affected by drought (particularly grazing, recreation, tourism, and forestry-related sectors). There is also a need for improved drought preparedness on public lands, including wildfire and habitat protection. The intent of this Plan is to empower local governments, tribal entities, resource managers, and the general public through improved access to information on historic and current climate conditions and identification of options to enhance preparedness and response.

Drought is cumulative and its impact extends beyond the time when meteorological conditions return to "normal." Additionally, drought does not affect all economic sectors in the same ways. This Plan is designed to recognize and respond to the differences in water supply availability and drought vulnerability for each sector and geographic area. In light of this objective, the Operational Drought Plan contains a sector-by-sector summary of options that can be employed or are available today to mitigate the impacts of drought as well as response options that can be employed under increasing drought conditions. The options range from voluntary and incentive-type programs, that either exist today or have been successfully employed in the past, to mandatory restrictions that are designed by the local communities or individual management

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agencies or imposed by the State under an “emergency drought” stage. The level of restrictions has not been identified to allow flexibility to develop appropriate regionally-based programs that will meet the needs of each geographic area, however, there is a recognition that each community will need to plan for some level of mitigation or response in order to reduce the negative impacts of drought.

The Operational Drought Plan also provides an organizational structure for on-going drought preparedness and an implementation plan for each stage of drought identified through an extensive monitoring network and science-based analysis. The implementation plan includes a description of the processes involved in identifying the severity of drought conditions in different regions of the state, as well as an action plan for identifying the onset of future droughts. This early warning capability will provide water users, land managers, and decision-makers with advance notice so they can prepare for drought and reduces the need for costly emergency response measures. Key to the implementation of the Arizona Drought Preparedness Plan is the creation of three structural committees. Under escalating drought conditions, actions have been identified for each of these structural committees, with the Arizona Department of Water Resources providing overall guidance and facilitation between each committee.

- The Monitoring Technical Committee – providing year-to-year scientifically based data analysis of climatic and impact data to provide early detection and warning of impending drought conditions;
- Local Area Impact Assessment Groups – initiated under increasing drought levels at the local County-level to coordinate public awareness, provide impact assessment information to local and state leaders, and to implement and initiate local mitigation or response options as necessary; and
- An Interagency Coordinating Group – comprised of state, federal, tribal, and non-governmental organizations that will provide policy guidance for plan implementation, agency emergency response options, and plan review and modification.

Finally, in concert with the adoption of the Arizona Drought Preparedness Plan, the Governor's Task Force is proceeding with the development of a Statewide Water Conservation Strategy. This statewide effort, focused on rural communities, will create guidelines for more efficient use of water, build on the successes of existing programs, create new conservation tools for rural communities, promote water education throughout the state, and provide suggestions for funding and implementing conservation programs. This document supplements the Arizona Drought Preparedness Plan in assisting individual communities in reducing the potential impacts due to drought by proving tools to increase water use efficiency and promote a long-term conservation ethic.

DEFINING DROUGHT

For purposes of the Arizona Drought Preparedness Plan drought was defined to address the variable conditions that exist in this ecologically and economically diverse state. This definition was developed to provide the basis needed to guide the development of appropriate triggers and monitoring activities. ***Drought, in this context is defined as a sustained, natural reduction in precipitation that results in negative impacts to the environment and human activities.*** Although drought is a natural, recurring feature of climate, occurring in high as well as low rainfall areas, drought is more than just a moisture deficit. Beyond the definition of drought is the magnitude of the impacts on the environment and to human activities. The extent of drought impacts is dependent on multiple physical and social factors, including several climate variables, water use patterns and vulnerability. Drought affects various sectors of society in different ways, and can be defined in many ways- thus perception is an important element in qualitatively gauging the impact of drought. The risk associated with drought for any region is a product of both the region's exposure to the event (i.e. probability of occurrence at various severity levels) and the vulnerability of society and the environment to the event. Subsequent droughts in the same region will have different effects, even if they are identical in intensity and spatial characteristics, because societal and ecological characteristics will have changed (National Drought Mitigation Center).

DEVELOPMENT OF THE ARIZONA DROUGHT PREPAREDNESS PLAN

Governor Napolitano signed Executive Order 2003-12, establishing the Governors Drought Task Force, on March 20, 2003. The Governors Drought Task Force is comprised of state agencies and elected officials. Additionally, the general public and key stakeholders have participated through impact assessment workgroups created by the Governor's Drought Task Force. Over 1,000 people have been regularly notified of the Task Force's activities, and there have been numerous public meetings. Additionally, seven public workshops were held throughout the state to facilitate public input and response.

Drought response activities in Arizona were previously handled within the Department of Emergency Management. Recognizing the differences between drought and other types of emergencies and the need for proactive drought planning, the Governor directed the Arizona Department of Water Resources to provide leadership in this effort.

Within the Operational Drought Plan, the Arizona Department of Water Resources will continue to lead the drought monitoring and preparedness effort, and serve as the primary coordinator of the state's drought efforts. However, the Arizona Department of Water Resources will continue to work in cooperation with the Department of Emergency Management, and other state and federal agencies as outlined in the Operational Drought Plan. The Executive Order also required the development of a Statewide Water Conservation Strategy, which is being developed in parallel with the Arizona Drought Preparedness Plan. The Statewide Water Conservation Strategy encourages long-term improvements in water use efficiency within the state. In addition to these long-term strategies, there are suggested conservation activities incorporated into the Operational Drought Plan that tend to be shorter-term in nature.

Governor's Drought Task Force Membership

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Roy Tanney		AZ Dept of Real Estate
Senator Linda Binder		AZ Senate
Kirk Rowdabaugh	Mike Hart (alt.)	AZ State Land Dept.
Jim Dorre	Bill Higgins (retired)	AZ Dept of Transportation

Governor's Drought Task Force Mission Statement

The adopted mission statement for the Governor's Drought Task Force is to develop a sustainable drought planning process for Arizona that includes:

- Timely and reliable monitoring of drought and water supply conditions in the state and an assessment of potential impacts
- An assessment of the vulnerability of key sectors, regions, and population groups in the state and potential actions to mitigate those impacts
- Assisting stakeholders in preparing for and responding to drought impacts, including development of a statewide water conservation strategy and public awareness program.

The Arizona Drought Preparedness Plan has a number of important components, however, the most significant of these is a focus on preparedness rather than on a reactive approach. The focal point of the drought planning effort is the development of a long-term, comprehensive plan that promotes and emphasizes local drought planning efforts throughout the state and establishes a coordinated response framework. This longer-term effort recognizes and builds upon existing drought efforts, and reduces the impact of drought on economic activities, communities and habitat throughout the state. The ability to identify, in a timely manner, the onset of drought for water users throughout the State is seen as one of the most important tools in a long-term drought planning effort.

A sustainable drought planning process has been a key objective from the inception of this effort. A plan that quickly becomes obsolete and does not adapt to changing conditions makes no contribution to the long-term welfare of the state. Conversely, an adaptive program that facilitates institutional and stakeholder relationships and improves Arizona's information base over time will respond more effectively to changing conditions. This process is intended to evolve over time, as improved understanding of climate conditions, vulnerabilities, and response options develop.

Governor's Drought Task Force Monitoring Committee and Impact Assessment Workgroups

To develop the Arizona Drought Preparedness Plan, the Governor's Drought Task Force requested the assistance of climate and water supply experts to develop triggers for identifying the onset of drought conditions, creating a Monitoring Committee. Additionally, Impact Assessment Workgroups were identified to assess the impacts of drought, identify regional vulnerabilities, identify potential mitigation and response options, and identify adaptation strategies to reduce drought impacts within the major water using sectors.

The Impact Assessment Workgroups created by the Governor's Drought Task Force include the following:

1. Commerce, Recreation and Tourism;
2. Environmental Health, Watershed Management, Livestock, and Wildlife;
3. Irrigated Agriculture;
4. Municipal and Industrial; and
5. Tribal

The Monitoring Committee and Impact Assessment Workgroups are an integral component in the development of the Arizona Drought Preparedness Plan, as these groups have included and will continue to include input from the public and will be the primary focus point for public involvement and input throughout the development of the Arizona Drought Preparedness Plan. Members of the Monitoring Committee and the Impact Assessment Workgroups include members of the Governor's Drought Task Force, individuals with a wide range of expertise and experience within the sector. The workgroups were co-chaired by Arizona Department of Water Resources staff and external representatives of the sectors.

Monitoring Committee

The Monitoring Committee assists in the development of a comprehensive monitoring network and will be the core of the ongoing effort to monitor and assess drought conditions in the state forming the basis of the drought adaptation and response activities. The objective of this Committee is to develop a drought monitoring system that provides detailed assessment data for decision makers in key government and economic areas impacted by drought. A key outcome of this effort is that Arizona will have a web based Drought Monitor report that contains a climate assessment, weather outlook, stream flow/runoff forecast (Jan-May), reservoir storage assessment and identification of drought decision triggers. Although the approach is still evolving, existing observation networks will be utilized to the maximum extent feasible. For example, the USDA Natural Resources Conservation Service field offices will be preparing quarterly reports on conditions in each portion of the state. The University of Arizona Cooperative Extension, the US Department of Agriculture Farm Services, and the Arizona Game and Fish Department will be asked to collaborate on similar reports on a regular schedule.

The drought indices, monitoring techniques and trigger points will be further refined in the future to respond to the varied landscape types in Arizona's primary physiographic regions (basin and range, Mogollon Rim, Colorado plateau) and the influence of local and regional elevation-induced weather and climate patterns. This process will be amended over time as improvements are made and additional information becomes available.

Commerce, Recreation and Tourism Workgroup

The Commerce, Recreation and Tourism (CRT) Workgroup focused primarily upon the identification and evaluation of significant economic impacts associated with drought and the development of mitigation strategies to address these negative impacts. Key stakeholder groups include local, regional and state economic development professionals, land and resource professionals within Arizona State government, economists within academia, Federal land and resource program managers, and elected officials.

The workgroup report (found in Appendix VII of the Background and Impacts Assessment Section) identifies the key drought related events that cause impacts in these sectors including forest closures that affect park/forest visitation and associated activities such as camping, hiking, hunting, and fishing; wildfires and associated impacts on forest industries and environmental quality; low surface water flows and reservoir levels that limit water-based recreation such as boating and rafting; reduced snowpack affecting the length of the ski season and number of skiers; and potable water supply limitations that affect the service industry and rural communities. Any reduction in tourism and recreation activity is likely to affect the food service and hospitality industries, as well as the tourism and recreation services and outfitters that are prevalent in rural areas. All of these impacts likely have resulted in job losses as well as a reduction in revenues in the recent drought, though there is little documentation of these outcomes in Arizona.

Environmental Health, Watershed Management, Livestock & Wildlife Workgroup

The Environmental Health, Watershed Management, Livestock & Wildlife Workgroup focused on ecosystem health and those who depend on healthy ecosystems to function. The workgroups objectives include: (1) Identify the information and resources necessary to develop a statewide, comprehensive monitoring and assessment program to identify the onset of drought and its impacts on wildlife, livestock, and ecosystems in the State of Arizona; (2) Identify existing and alternative emergency response options that can be used to mitigate the impacts of drought on wildlife, livestock, and ecosystems in the State of Arizona; and (3) Develop mitigation and adaptation strategies to minimize to the extent possible the impacts of drought on wildlife, livestock, and ecosystems in the State of Arizona.

The workgroup report (found in Appendix VIII of the Background and Impact Assessment Section) describes the importance of Arizona's biotic communities, the importance of these communities to the industries that are dependant upon these, the impacts that drought has had in the past on the watersheds that contain these communities, and the vulnerability of these communities to future droughts. Additionally, the workgroup has focused primarily on identifying the primary indicators necessary to monitor to identify the onset of drought conditions. Finally, adaptation, mitigation, and response options are described in order to provide guidance and options to reduce the impacts of drought and to respond to immediate issues associated with extreme drought conditions.

Irrigated Agricultural Workgroup

The Irrigated Agricultural Workgroup focused on Arizona's irrigated agriculture sector, including individual irrigators and irrigation districts, dairies, and feedlots. Key stakeholders include individual farm operators, irrigation districts, and affiliated organizations. The objective of the Irrigated Agriculture workgroup is to assess the vulnerabilities, risks, and impacts of drought on the sector and to develop response, mitigation, and adaptation strategies to sustain the long-term economic viability of the State's irrigated agriculture.

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The workgroup found that although vulnerability to drought varied between irrigation districts across the state, the factors that increased vulnerability included: reliance on a single source of water, inadequate storage, widely varying precipitation, and low priority water rights. Furthermore, if current drought conditions continue, irrigation district managers expect increased groundwater depletion and water table declines, increased energy demand, reduced reservoir and lake levels, reduced supply availability, income loss for both farmers and irrigation districts, fewer planted acres, and lowered financial viability of districts.

The workgroup suggests a strategic focus on longer-term preparedness and the more important vulnerabilities revealed by the workgroup, particularly water supply. The workgroup identified several drought preparedness and response options. Most respondents favored the following creation of a drought property tax credit program for farmers, guaranteed low interest loans to drought-stricken farmers, short-term voluntary and market-driven) water transfers, investment programs to increase the flexibility of water supply sources, and improvement of the accuracy of seasonal run-off and water supply forecasts. More information can be found in the workgroup report contained in Appendix IX of the Background and Impact Assessment Section.

Municipal & Industrial Workgroup

The Municipal & Industrial Workgroup focused primarily on rural area municipal and private potable water providers. Key stakeholder groups include water providers, jurisdictions, rural watershed partnerships, and industry associations. The objective of this workgroup is to assess vulnerabilities, identify sector specific monitoring needs, and develop mitigation strategies to address drought related impacts on potable water supply systems, exempt wells, and public health conditions. The Arizona Department of Water Resources 2003 Rural Water Resources Study Questionnaire, the Arizona Corporation Commission and the Arizona Department of Environmental Quality programs, stakeholder input, the Conservation Committee, and other sources provided critical information for this process.

The workgroup found that vulnerability to drought varied between water providers and water users based on the source of supply. For instance, if an entire water supply is derived from precipitation events, lack of rain will cause an immediate effect. On the other hand, if a water supply is derived from large regional aquifers with little recharge, and with large amounts of water in storage, you may never directly see the impacts of drought, at least in the short term (several years to several decades). Other factors found to increase the potential impacts of drought include whether or not the system is located within an Active Management Area where the Assured Water Supply Rules are in effect, the effects of the Endangered Species Act, growth, and land subsidence.

To reduce the vulnerability to drought, the Workgroup also identified several mitigation strategies. One effective strategy includes long-term water supply planning as well as developing emergency operation plan to address short-term shortages or system disruptions. Supply side strategies include construction of additional storage facilities; acquisition of additional water sources, maximizing existing supplies by making capacity improvements to existing wells, water treatment plants, or through groundwater recharge; and water reuse. Additionally, demand side strategies have been identified including making distribution system improvements, water conservation, landscape irrigation requirements and water restrictions, conservation inducing water rates or rate structures, and implementation of innovative water collection techniques such as gray water reuse or rainwater harvesting to help reduce water demands. The Municipal and Industrial Workgroup Report is contained in Appendix X of the Background Section of the Arizona Drought Preparedness Plan and contains, in addition to the

information outlined above, a summary of the Municipal and Industrial Workgroup Drought Survey and Responses; an identification of vulnerability issues identified through the 2003 Rural Water Resources Survey; and a listing of Municipal Drought Management Plans, Curtailment Plans, and Ordinances.

Tribal Workgroup

The Tribal Workgroup focused on identifying the impacts of drought on Tribal lands within Arizona, integrating monitoring efforts with the tribal communities, and identifying response and mitigation options that could be implemented on tribal lands. There are 22 federally recognized tribes within the State of Arizona with an estimated combined population of 255,879 (2000 Census) occupying approximately 27 percent of the total land area in the State. Although tribal residents experience the same impacts as non-Indian communities across the State, some can be more vulnerable to drought conditions due to the reliance on individual domestic wells, lack of sufficient infrastructure and storage, and in some cases the remoteness of smaller communities, which is why it is extremely important to recognize and identify the impacts of drought on this sector. To facilitate this effort, the Governor's Drought Task Force has been working with the Inter-Tribal Council of Arizona and the Arizona Commission on Indian Affairs, as well as meeting individually with tribal representatives to solicit input into this process.

SECTOR IMPACTS, REGIONAL VULNERABILITIES, MONITORING EFFORTS & RESPONSE

Drought impacts and vulnerabilities are directly related to economic, social and environmental conditions in each sector and region of the state. This section describes the findings to date related to impacts and vulnerabilities, and makes recommendations regarding key monitoring information and potential mitigation and response mechanisms. It is important to note that impact evaluations will continue to be an integral focus of the continued drought planning effort to provide regional specificity and economic consequences. The tables contained in Appendices II and I summarize draft findings for: Commerce, Recreation and Tourism; Watershed Management, Livestock and Wildlife; Irrigated Agriculture; Municipal and Industrial; and Tribal Workgroups.

KEY DEFINITIONS:

Mitigation: pre-drought actions/programs that reduce risk and impacts and enhance recovery.

Response: reducing impacts and enhancing recovery.

Impacts and Vulnerabilities

Several themes related to impacts and vulnerabilities consistently emerged from the workgroup discussions. These themes focused on energy, health, and water quality, which are summarized below.

Energy

Drought has impacts on both the supply and demand component of electrical energy generation. From the supply perspective, there may be fewer opportunities to generate hydropower, and there may be limitations on access to surface or groundwater for steam plant energy production (oil, coal, and nuclear power plants). At the same time, demand related to cooling may increase during the hot, dry weather that is typical of droughts. Additionally, to meet potable and non-

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potable requirements associated with energy development, groundwater pumping may also increase. Peaking power may have to be purchased to offset high-energy demands if sufficient hydroelectric power is not available. This can have substantial impacts on energy costs.

The two major sources of hydroelectric generation in Arizona are the Colorado River reservoirs and the Salt River Project reservoirs and dams. Generally speaking, the amount of hydroelectric power produced is a function of two primary variables: flow (less water released means less energy produced) and reservoir elevation (lower level means lower head pressure and less turbine efficiency). During droughts, both of these variables can be negatively affected resulting in reduced power production.

There are four major dams on the Colorado that produce hydroelectric power for use in Arizona, all managed by the federal government. They are Glen Canyon, Boulder, Parker, and Davis Dams. Operations of the dams are controlled in various ways by contracts with customers, regulations such as those from the Western Area Power Administration, and the Federal Energy Regulatory Commission.

On the Salt River, the Salt River Project generates hydroelectric power in two ways: run of river (also known as flow through) and pump storage (also known as pump back). Hydroelectric power generated from Salt River Project operated dams make up less than five percent of its total generation capability with steam plants and other sources of electrical generation employed by Salt River Project.

For those thermal plants using groundwater, such as the Red Hawk Generating Station west of Phoenix, water supply and power production may be slightly impacted as pumping from greater depths increases cost.

Health

Key public health issues related to drought identified by the National Drought Mitigation Center include water quality and quantity, mental health and stress, air pollution, zoonotic diseases, and nutrition and hygiene. In addition, fires associated with drought often result in severe episodes of air pollution. Biomass burning can cause acute respiratory disease and exacerbate chronic respiratory disease in children and adults.

Mental Health and Stress

Mental health and stress impacts may include suicide, abuse, increased illness, stress, and physical injuries due to stress and fatigue. The agricultural industry is the most affected by adverse health effects and stress attributed to drought. Sensitive individuals within the agricultural community may be particularly at risk for these types of impacts. Ranchers faced with liquidating large parts of their herds due to a lack of water or forage are placed under an emotional, as well as financial burden.

Air Pollution

Drought may cause an increase in air-borne particulates due to reduced precipitation and increased risk of wildfires. Exposure to smoke and dust may cause short-term health effects including eye, nose, throat, and lung irritation, triggering coughing and sneezing. Reactions usually occur in the first day or so after a high-level exposure and include persistent shortness of breath, rapid breathing, chest pain or tightness, headache, dizziness, or fainting. Individuals with asthma, other lung conditions, or heart disease may be more vulnerable to the effects of dust and smoke.

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Short duration, high intensity exposures to smoke and dust are more likely to result in short term and reversible effects. Most dust-induced eye, nose, throat, and lung irritation does not result in long-term health effects. Asthma and symptoms like wheezing and difficulty breathing are occasionally caused by exposure to a high dose of an irritant.

Sensitive populations with or without pre-existing illness or chronic health conditions are susceptible to air pollution. In children, particulate pollution is associated with increased episodes of coughing, breathing difficulties, and decreased lung function. Children, particularly those with asthma, are likely to be the most affected by air pollution.

The Arizona Department of Health Services and the Centers for Disease Control and Prevention analyzed air quality data and conducted a community health survey following the 2002 Rodeo-Chedeski Fire. The survey suggested that smoke from the fire caused an increase in respiratory problems in area residents consistent with wood smoke inhalation. These data suggest that the fire represented an acute (short-term) public health hazard.

Zoonotic Diseases

Drought may impact the occurrence of zoonotic⁴ diseases. Human cases of diseases such as plague, hantavirus, and rabies is somewhat unpredictable under any condition, however, the primary effect of drought conditions on wildlife populations is that animals tend to concentrate around limited water sources, such as river drainages, lakes, and ponds. These concentrations may lead to an increased risk for animal disease exposure and exposures to people living or recreating near water sources.

Droughts may also contribute to the encroachment of wild animals into populated areas. Rural communities or developments on the outer fringes of urban areas are particularly susceptible. The Arizona Game and Fish Department receives calls/complaints about bears, bobcats, javelina, coyotes, skunks and other animals becoming nuisances in rural and outer-fringe neighborhoods. Wild animals may enter yards to eat or drink from pet bowls, drink from pools, or raid gardens and orchards. Urban encroachment can lead to an increased number of exposures or bites to pets and people from wild animals. Increased animal exposures may place additional demands on local animal control officers to provide animal control services, and the Arizona State Laboratory staff to provide rabies testing.

The concentration of wildlife around water sources may lead to increased transmission of diseases, particularly from mosquitoes and other parasites. Mosquito breeding depends on standing water. The concentration of wildlife around these breeding habitats may increase the risk of disease outbreak, particularly if the animals are stressed from drought impacts. Mosquito-borne disease outbreaks, such as West Nile virus, may be more prevalent under drought conditions as the increased concentration of wildlife in and around human populations may increase the transmission of diseases to the human population.

Nutrition and Hygiene

In Arizona, the major drought impact related to nutrition and hygiene are the impacts on food establishments and schools, due to insufficient quality or quantity of water supplies for food preparation and personal hygiene. The Arizona Department of Health Services has a guidance document that describes how to safely operate food establishments and schools during a

⁴ Relating to or constituting any infectious disease that can be transmitted from animals, both wild and domestic, to humans. The word is derived from Greek words *zoon* (animal) and *nosos* (disease).

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community water outage. The guidance documents are located on the Department's website at <http://www.hs.state.az.us/phs/oeh/fses/index.htm>.

Water Quality

The most often cited direct impact of drought on water quality is the concentration of pollutants (salts, inorganic elements and compounds, total organic carbon, turbidity, nutrients, and microbes) that occurs as a result of reduced precipitation contributing to lower flows through reservoirs, rivers and streams, and flood-irrigated fields. Other direct impacts of reduced water availability in surface water systems is increased temperatures, less buffering capacity of pH, lower dissolved oxygen, and increased color and odor from microbial growth and decay cycles. These impacts may affect animal health and vegetative cover, as well as impacting downstream potable users. Drought induced degradation of surface water quality may negatively impact groundwater quality through artificial recharge due to higher concentrations of pollutants due to reduced volumes. Short-term solutions for drought that are applied to systems relying on surface water and/or groundwater supplies need to be evaluated for their potential near and long-term quality side effects. Water quality degradation may affect environmental quality and the ability to use the water for potable purposes as well as industry, agriculture, ranching, mining, hydroelectric power generation, and recreation.

Prolonged drought has a higher probability of affecting groundwater quality, not only because of increased infiltration of constituents into the groundwater from higher concentration surface water flows, but also because groundwater pumping tends to serve as a backup to surface water supplies during drought. As groundwater pumping increases, groundwater levels drop, and pumping from lower depths may reach groundwater with lower quality due to higher concentrations of minerals at lower depths. Additionally, increased pumping depths and pumping volumes may lead to increased vertical movement of poorer quality water and movement of existing plumes of contaminated groundwater. Identification of areas of concern in advance of droughts can lead to development of alternative well sites that have lower impacts on water quality.

Fires also have a direct impact on water quality, related to increased erosion capacity and sedimentation after vegetation has been removed. The large-scale fire seasons of the past two years have resulted in increased ash flows, flash floods, and detrimental changes in water quality. Additionally, fires may cause the introduction of hazardous materials into the soil and water supplies from household chemicals and propane tanks. Soil instability and sedimentation result in reduced storage capacity, reduced oxygen in the water, limiting aquatic life, high nutrient loads, and high concentration of metals, waste and pathogens in the water supply. The sodium ferrocyanide (slurry) used in fire suppression may also negatively impact water quality. Activities that enhance soil stability and reduce fire hazards are the key to adaptation and mitigation in this area. Other preventative opportunities include controls of land uses and chemical applications, watershed management including forest, land, and range management techniques, waste management and discharge controls, and reservoir management techniques.

Water Management in Arizona

One of the primary purposes of the Arizona Drought Preparedness Plan is to provide individual water users, water providers, communities, and land managers with options to prepare and if necessary respond to drought as it progresses. However, it is important to describe the measures that have already been implemented within Arizona to prepare for the eventuality of drought.

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Inherent in Arizona's water management structure is the preservation of groundwater in times of drought and a surface water system that protects the rights of those with the earliest rights.

Groundwater Management

The 1980 Groundwater Management Act is the basis for protecting Arizona's groundwater not only in times of drought, but for future water users. The Arizona Groundwater Management Code (Code) was adopted in response to threats to the water supplies of two of the state's major economic sectors, mining and municipalities; to an ongoing threat by the federal government to halt the long awaited Central Arizona Project (CAP); and in recognition of severe overdraft conditions in several parts of the state.

The Code has three primary goals. The first is to control the severe overdraft occurring in many parts of the state. The second is to provide a means to allocate the state's limited groundwater resources to most effectively meet the changing needs of the state. The third goal is to offset Arizona's use of groundwater through renewable water supply development. To accomplish these goals, the Code set up a comprehensive management framework and established the Arizona Department of Water Resources to administer the Code's provisions.

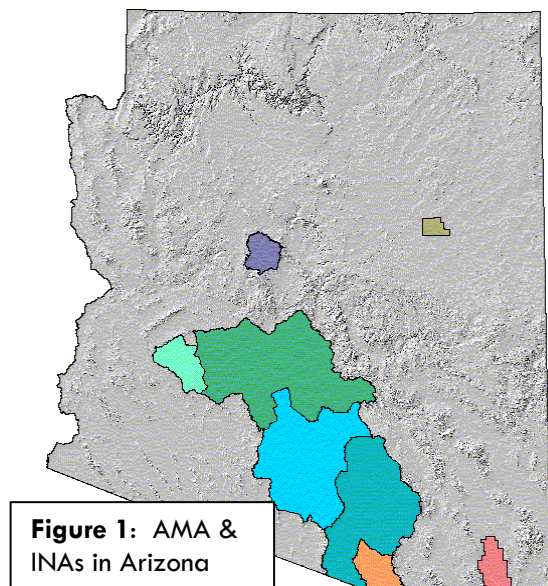
Active Management Areas and Irrigation Non-Expansion Areas

The Code created four initial Active Management Areas, the Phoenix, Tucson, Pinal and Prescott Active Management Areas, with a fifth, the Santa Cruz Active Management Area, established from a portion of the Tucson Active Management Area in 1994. Groundwater overdraft in these Active Management Areas was more severe than in other parts of the state. Three Irrigation Non-Expansion Areas were established in rural farming areas where the groundwater overdraft was less severe. The Douglas and Joseph City Irrigation Non-Expansion Areas were established in 1980. The Harquahala Irrigation Non-Expansion Area was later designated in 1982. The management objective in Irrigation Non-Expansion Areas is the prevention of further declines in groundwater supplies through prohibition of irrigation acreage expansion. Lastly, general provisions were created that apply to groundwater management on a statewide basis.

By far the most restrictive requirements for groundwater management were instituted in the Code for the five Active Management Areas. Within the Active Management Areas, the Code established a new groundwater rights system that strictly limits groundwater withdrawals; prohibits the development of new irrigated farmland; requires new subdivisions to have long-term, dependable water supplies; and requires measuring and reporting of groundwater withdrawals. Management goals have also been established, pursuant to the Code, for each Active Management Area, and a series of five Management Plans containing mandatory conservation requirements for agricultural, industrial, and municipal water users must be developed for the periods 1980-1990, 1990-2000, 2000-2010, 2010-2020, and 2020-2025.

Mandatory Conservation Measures

Mandatory conservation requirements are specified in the management plans for the



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agricultural, industrial, and municipal water use sectors. In general water use for irrigated agriculture is limited through the establishment of the maximum annual groundwater allotments for each irrigation grandfathered right. Alternatively, agricultural waters may be eligible to participate in a best management practices program, implementing measures designed to reduce overall water use and increase irrigation efficiencies. These conservation programs were implemented in addition to the prohibition on new irrigated agricultural acreage within the Active Management Areas. Industrial water use is defined as a non-irrigation (non-agricultural) use of water not supplied by a city, town, or private water company, including animal industry use and expanded animal industry use. Industrial water users include: schools, parks, golf courses, home owner associations, lakes, sand and gravel facilities, large-scale power plants, large-scale cooling facilities, dairy operations, and cattle feedlot operations. These industrial rights are generally regulated with annual volumetric groundwater allotments. The Code requires municipal water users (cities, towns, private water companies, and irrigation districts that supply water for non-irrigation uses) to develop programs that result in reasonable reductions in per capita use. These reductions are volumetrically identified in each management plan, allowing the water provider to develop its own conservation program/measures that will successfully achieve the targeted reduction set by the State. The measures that have been employed by most municipal water providers (many similar to what is being enacted recently by communities in neighboring States) to meet the state targets have been successful in reducing the overall per capita water demand in the within the Active Management Areas – even under non-drought conditions. These mandatory conservation programs are unmatched in Western states except during drought response.

Assured Water Supply Program

Additionally, water providers are subject to the Assured Water Supply Program. Within an AMA, developers must demonstrate, prior to plat approval, the existence of an assured water supply for its development or show that the development will be served by a city, town, or private water company that has been designated as having an assured water supply. An assured water supply means that there is water of sufficient quantity and quality to meet the demands of the subdivision for 100 years consistent with the management goal and management plan of the Active Management Area. Both municipalities and private water companies must continue to demonstrate the ability to provide sufficient water for existing and new development in order to be designated as having an assured water supply. This requirement has encouraged water providers to recycle wastewater to reduce overall water use. As a result, Arizona reuses more water than most Western states.

Outside of Active Management Areas there are no state requirements for conservation measures. Although the Adequate Water Supply Program does require that new subdivisions demonstrate the existence of a 100-year water supply, unfortunately there is no requirement for having a secure 100-year supply. If the demonstration does not show adequate water for 100 years, the developer must simply disclose (to the first homebuyer only) that the subdivision does not have an adequate supply and can still proceed with subdividing the land.

Surface Water Management

Arizona surface water laws apply statewide, except for the Colorado River, which is governed by the Law of the River described in the Background Section. Surface water is defined as “waters of all sources, flowing in streams, canyons, ravines or other natural channels, or in definite underground channels, whether perennial or intermittent, flood waters, wastewaters, or surplus water, and of lakes, ponds and springs on the surface.” A.R.S. § 45-101. “Surface” water also includes water located beneath the surface of the earth that is closely associated with a surface water stream.

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Under Arizona law, the utilization of surface water is subject to the “doctrine of prior appropriation,” which means that the first person to put water to beneficial use acquires a senior right over later (junior) appropriators. A surface water right includes the right to use a specified amount of water from a certain source for a stated beneficial use each year. In times of shortage, after the rights of senior appropriators have been satisfied, sufficient water supplies to satisfy the rights of junior appropriators may not be available.

A system to administer surface water rights during times of shortage has not been developed, and may be hindered by the current general stream adjudications that affect approximately two-thirds of the state. The general stream adjudications ultimately will determine the nature, extent, and relative priority of surface water rights within the Gila River and Little Colorado River watersheds, but they are not expected to be completed at least for several more years. In the meantime, the administration of surface water rights during times of inadequate supplies will need to be addressed in future plan modifications.

Mitigation/Response Options

The requirements of the Groundwater Code described above, are in place whether or not there is a drought. To address those areas outside of Active Management Areas, or times of potentially severe water shortages, the Governor's Drought Task Force has identified measures that could be implemented for each water-using sector. **Appendix I** identifies mitigation goals that will reduce vulnerability to drought impacts, thus reducing the need for potentially costly response options. **Appendix II** identifies specific response options that can be employed by individuals, land managers, local and state policy makers, or local communities. The mitigation and response options identified in Appendix I and Appendix II need to be evaluated by individual communities with respect to the needs of their respective community and water use characteristics. Thus, the mitigation and the response options described in the tables are general enough that the level of implementation can be designed by the local communities and land management entities to meet the drought conditions and impacts experienced in those areas, as well as the water using characteristics of the area. However, it is important that these or similar measures be employed to reduce the impacts of drought now and in the future. It is also important to point out that as conditions vary statewide the level of response needs to be correlated not only to the climatic conditions of the area, but also be based on existing regulations and the implementation of conservation programs. For more information on response and mitigation options, **Appendix III** describes the available Federal Emergency Assistance Programs.

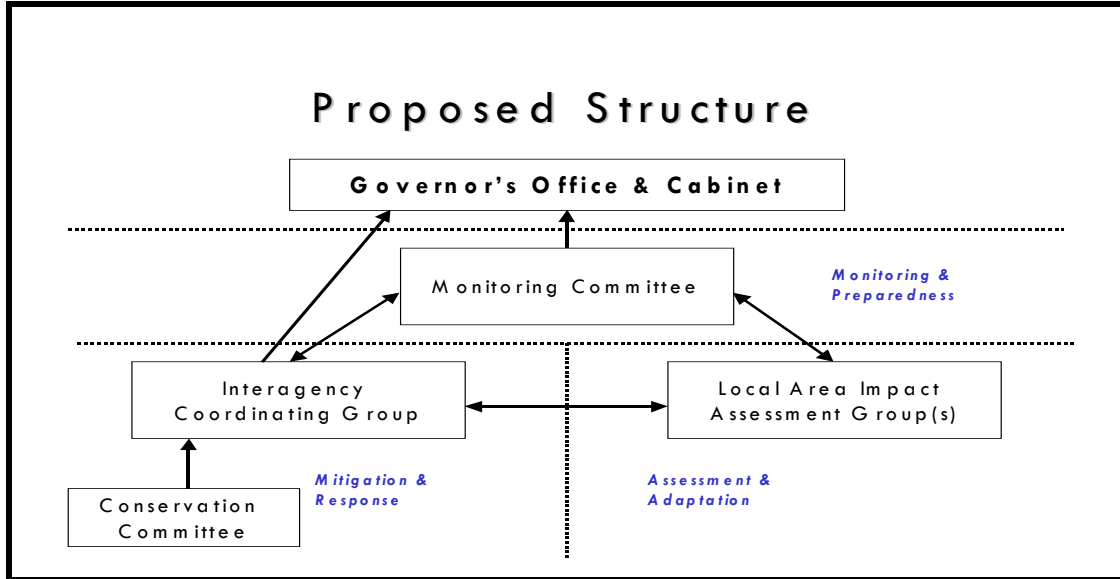
THE ARIZONA DROUGHT PREPAREDNESS PLAN

Structure

To provide staff support, leadership, and interagency coordination to successfully implement the Arizona Drought Preparedness Plan, the Governor's Drought Task Force has identified the Arizona Department of Water Resources as the lead agency in drought preparedness. The Arizona Department of Water resources will coordinate the activities of the committees and groups identified below to provide adequate preparedness, mitigation and response in the event drought conditions begin to emerge. Additionally, the Arizona Department of Water Resources will work cooperatively with the Monitoring Technical Committee to prepare relevant reports, coordinate with media outreach, and provide the necessary technical oversight for long-term drought planning.

Capacity building is an essential component of the proposed process. Implementation is focused at the local level, and encourages local responses to local conditions and concerns. The Arizona Drought Preparedness Plan recognizes the strengths inherent in local knowledge about conditions, practices, and values, while providing a comprehensive statewide support structure to help communities and impacted sectors prepare for drought in the future.

The Governor's Drought Task Force recommends the following structure to strengthen Arizona's efforts to respond to the current drought and to prepare for drought in the future.



MONITORING & PREPAREDNESS - Monitoring Technical Committee

The Monitoring Technical Committee will continue as the primary committee of the Drought Preparedness Plan, providing an essential role tracking changes in climate and physical conditions and providing forecasts of likely future conditions. Co-chaired by the Arizona Department of Water Resources and a partner with the State Universities, the Monitoring Technical Committee serves as the on-going technical data gathering and information dissemination group. The

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Monitoring Technical Committee will monitor and identify conditions throughout the state on an on-going basis and will detecting and requesting the drought status be changed as data/conditions warrant. The role of this Committee is critical in early warning and detection of impending drought to facilitate preparedness at the Federal, State and local levels. The proposed membership of the Monitoring Technical Committee may include, but not be limited to, the following entities:

Table 1: Monitoring Technical Committee	
Co-Chairs	
AZ. Department of Water Resources	State University partner (dependant on funding)
Membership	
AZ. Corporation Commission	National Weather Service
AZ. Commission on Indian Affairs*	USDA – Natural Resources Conservation Service
AZ. Department of Agriculture	USDA – Farm Services
AZ. Department of Emergency Management	USDA – Forest Service
AZ. Department of Environmental Quality	USDOJ – Bureau of Reclamation
AZ. Game & Fish Department	USDOJ – Bureau of Indian Affairs
AZ. State Land Department	USDOJ – Fish & Wildlife Service
AZ. State Parks	USDOJ – Bureau of Land Management
Arizona State University	USDOJ – National Park Service
Northern Arizona University	USDOJ - Geological Survey
AZ. State Climatologist	US Department of Defense
U of A Cooperative Extension	US Army Corps of Engineers
Salt River Project	Non-Governmental Organizations
University of Arizona – CLIMAS	

* Individual Tribes are also requested to participate

The Monitoring Committee will be required statutorily to meet monthly from November through April, or otherwise as necessary, depending on the severity of conditions, or drought status. Each month during drought conditions the Monitoring Technical Committee will provide a Climate Status Update to the Interagency Coordinating Group and will also provide an Annual Report each year by November 1st describing monitoring activities, drought status, and recommendations for Plan revisions related to their activities.

MITIGATION & RESPONSE - Interagency Coordinating Group

The primary role of the Interagency Coordinating Group is Mitigation and Response. The Interagency Coordinating Group directs state agency action to assess, implement and develop response options. Furthermore this group will identify pre-drought mitigation and adaptation options, and make recommendations to the Governor for resources necessary to provide assistance and continued implementation of the Plan. Including federal, tribal and non-governmental organizations on this Group provides an integral mechanism to coordinate and integrate drought planning and management on all lands within Arizona. The Interagency Coordinating Group will provide the Governor with updates on annual basis. If drought conditions are present the Interagency Coordinating Group will advise the Governor of changes in drought status and will request a declaration for a Drought Emergency by May 1 based on water supply status or by November 1, based on ancillary impacts (e.g., hardships from summer fires, failure of monsoon, failure of wells to rebound following poor monsoon, etc).

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As this is the first drought plan for the state of Arizona, it requires continuous monitoring to ensure that the strategies identified are appropriate and adequate in addressing drought. As such, the Interagency Coordinating Group will have the responsibility of reviewing the Plan, based on information from the Monitoring Technical Committee and the Local Area Impact Assessment Groups each year by November 15th and making recommendations for improving monitoring, implementation, and response (this annual review of the Plan may be reduced after five years to every other year). The Interagency Coordinating Group may include, but not be limited to, the following entities:

Table 2: Interagency Coordinating Group	
Co-Chairs	
AZ. Department of Water Resources	AZ. Department of Emergency Management
MEMBERSHIP	
Governor’s Office	Central Arizona Water Conservation District
AZ. Corporation Commission	USDA – Natural Resources Conservation Service
AZ. Commission on Indian Affairs	USDA – Farm Services
AZ. Department of Agriculture	USDA – Forest Service
AZ. Department of Commerce	USDOJ – Bureau of Reclamation
AZ. Department of Environmental Quality	USDOJ – Bureau of Indian Affairs
AZ. Game & Fish Department	USDOJ – Fish & Wildlife Service
AZ. Department of Health Services	USDOJ – Bureau of Land Management
AZ. Department of Real Estate	USDOJ – National Park Service
AZ. State Land Department	USDOJ - Geological Survey
AZ. State Parks	Salt River Project
AZ. Department of Transportation	Non-Governmental Organizations
State Forester	

* Individual Tribes are also requested to participate

The Interagency Coordinating Group will be required in statute to meet annually to be updated on annual conditions, assess response and mitigation efforts/programs, and to revise the Plan as needed. This group will also be called to meet within 30 days after a Stage 2, 3, or 4 drought has been announced and can meet more frequently as necessary to respond to unmet needs or requests for response in the local areas.

ASSESSMENT & ADAPTATION - Local Area Impact Assessment Groups

The role of Local Area Impact Assessment Groups is Assessment and Adaptation. The Local Area Impact Assessment Groups will identify local drought-related impacts, define and assess societal impacts, severity, loss and costs associated with impacts, identify response options, identify unmet needs or needs for response, and identify and facilitate efforts to mitigate impacts focusing on preparedness and reducing drought vulnerabilities. These Groups could be developed at the county level (or could employ the existing Rural Watershed Alliances or other existing groups). The Local Area Impact Assessment Group(s) may include the following entities:

Table 3: Local Area Impact Assessment Groups	
Co-Chairs	
County Emergency Manager	County Extension Agent
Membership	
AZ. Department of Water Resources	Natural Resources Conservation Districts
Local Governments	County Governments
Municipal/Private Water Companies	Other Local Water Providers
Irrigation Districts	AZ. Game & Fish Department
Tribal Governments	Federal Land Management Agencies
Watershed Groups	Local Non-Government Organizations

Local contacts/liaisons that have been identified by the Monitoring Technical Committee will provide on-going data to Monitoring Technical Committee. Local Area Impact Assessment Group(s) for a specific County (or Counties) will be triggered once the Monitoring Technical Committee has identified a moderate drought status for the County. The Local Area Impact Assessment Group(s) will continue to meet as needed throughout extreme drought conditions. The Local Area Impact Assessment Groups will provide an annual report on drought response or mitigation efforts and recommendations for changes to the Interagency Coordinating Group by October 1st. An important goal for these groups will be to encourage regional coordination to drought and conservation planning. Regional planning at the local level can provide assistance to smaller communities to address issues for which they may not have the resources, in addition to coordination with public land management agencies.

Roles of Proposed Drought Committees

Under each level of drought the Governor’s Drought Task Force recommends actions for each of the committees described above. These actions are identified in **Appendix IV** as discussed under Plan Implementation.

Monitoring & Preparedness / Indices & Triggers

Drought monitoring for the Arizona Drought Preparedness Plan will be accomplished through the efforts of the Monitoring Technical Committee, which is comprised of water resources, weather, and climate professionals from all levels of government and the state’s universities. The group is responsible for monitoring hydrological and climatological conditions, and analyzing other pertinent information necessary to determine the status of drought conditions in Arizona throughout each year. The group also reviews and reports on long-term forecasts to assist local communities in their preparedness and response actions. As necessary, the Monitoring Technical Committee will issue alerts based on various stages of drought that will trigger actions by the Local Area Impacts Assessment Group(s), the Interagency Coordinating Group, and the Governor. In order to implement this objective the Monitoring Technical Committee has developed, through input from the Impact Assessment workgroups and participation from various Federal and State Agencies, data that can be monitored and used as indicators of drought. Additionally, the Monitoring Technical Committee has/will develop triggers based on these indices to provide water users and decision-makers with sufficiently early notice and information to prepare for drought and make decisions before impacts cause undue hardship and become expensive to mitigate.

Integration of Climate and Weather Information

The Monitoring Technical Committee is faced with considerable technical and conceptual challenges in monitoring drought in Arizona, including the following:

1. Accounting for extremely diverse topography and dramatic elevation changes within relatively short distances;
2. Accounting for conditions in urban areas that receive supplemental water supplies from out-of-state sources dependent on short- and long-term hydroclimatic variations sometimes unrelated to those within Arizona – requiring the Monitoring Technical Committee to monitor climate and water supply conditions outside of state boundaries;
3. Major spatial gaps in climate and snow monitoring networks, especially at higher elevations, and spatial and temporal gaps in groundwater and soil moisture monitoring networks;
4. A need to take into account systems designed to buffer water supplies (i.e., water banking); and
5. The question of how to portray the multiple scales of drought that might affect well buffered urban/suburban core areas very differently than nearby outlying areas.

Drought Indicators

Ultimately, drought conditions of any type can be traced to the sole natural moisture input to the hydrologic cycle-precipitation. Likewise, a good measure of the overriding natural removal of water from a hydrologic system is the potential for evaporation, for which the surrogate of air temperature is most often used. Fortunately for drought monitoring, air temperature and precipitation are the two most commonly measured climatic variables. Often these two parameters are combined to produce relative measures of drought. Other indicators that are commonly used to monitor drought conditions include: snowpack, reservoir elevations and current storage, soil moisture, stream flow, groundwater levels, fire and fuel load, and information obtained through observations from local conditions of soil moisture, vegetation and forage, stock ponds, and wildlife habitat.

KEY DEFINITIONS:

Indicators: variables to describe drought conditions (examples - precipitation, stream flow, groundwater, reservoir levels, soil moisture, etc.).

Triggers: specific values of the indicator that initiate and terminate each drought status level, and suggested management responses.

The Monitoring Technical Committee has located available information for the datasets included on the table in [Appendix V](#) that will be used to continually assess conditions throughout the State of Arizona. These data have been selected from a larger set of potential indicators, mentioned above, because they have the following attributes: continuous and complete monthly records going back to the last multi-decade drought in Arizona (late 1940s-mid 1970s), high quality assurance, and, in the case of streamflow data, little or no human influence. The aforementioned data requirements eliminate data with short, incomplete, or sporadic records from being included as indicators. However, as elucidated in the section on Triggering Mechanisms and Alert Levels, such data will be consulted to corroborate drought status. Although it appears from the information contained in Appendix V that there is an abundance of information, the spatial distribution of the data may not be adequate to provide a complete depiction of conditions in all

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areas of the State. These circumstances will be identified and addressed accordingly as the Monitoring Technical Committee further develops the resources to do the needed data quality assurance to provide information at a more refined spatial scale.

Data Needs

The ideal precipitation and temperature monitoring system would make use of sub-regional and local-scale data from the several hundred individual meteorological stations across Arizona. The utility of this system is debatable, due to issues regarding processing this vast volume of data, assuring data quality, and factoring in problems associated with station distribution and density. At present, the Monitoring Technical Committee recommends that the assurance provided by the climate division database (climate divisions are subdivisions of the State and are discussed and illustrated on page 20) and the ease with which it can be smoothly incorporated into a monitoring program far outweigh problems associated with the lack of fine spatial resolution. As the method for climatic monitoring for the state of Arizona becomes established, it may well be worth exploring the option of using point data for assessing statewide drought status. However, at the outset of this process the data described above seem to be sufficient. Once a level of drought status has been triggered by climate division-scale monitoring analyses provided by the Monitoring Technical Committee, data from individual stations will be used to assess the need for drought mitigation and response actions at the local levels necessary for implementing those actions. The Monitoring Technical Committee has identified the following gaps in Arizona's Climate data monitoring network:

1. Additional stations are needed to provide sufficient station density and spatial data homogeneity; the highest priority needs for additional climate/weather monitoring stations to improve station density include northwestern and northeastern Arizona
2. High-altitude temperature and precipitation data are sorely lacking throughout the western U.S. Since the distribution of precipitation in Arizona is highly dependent on altitude, and because Arizona water supplies are highly dependent on snow accumulated during winter months, the addition of mountaintop stations, especially in snow-bearing regions, is crucial. Northwestern and southeastern Arizona, which currently have no snow data collection stations, are priority regions for improved snow data collection.
3. Soil moisture data are lacking throughout Arizona. Although some drought indices can possibly serve as a proxy for soil moisture, there are no substitute measured soil moisture observations.

KEY DEFINITIONS:

Short-term Drought

Measured by the departure of precipitation or another drought indicator from average conditions on a time-scale from one to several seasons. Typically related to soil moisture deficit and vegetation stress.

Long-term Drought

When sustained precipitation deficits over time periods of one to several years affect surface and subsurface water supplies.

Triggering Mechanisms and Alert Levels

To implement an objective process for triggering drought mitigation and response actions, the Monitoring Technical Committee developed a science-based approach that uses the correspondence between historical drought impacts and the statistical properties of historical hydrologic and climate data (Steinemann, 2003). This method was initially developed for the Georgia Drought Management Plan (2003). The method has been adapted to a two-drought category system, short- and long-term, to trigger drought mitigation and response actions appropriate to the timescales of drought impacts (see Appendices I and II). This process will allow

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the Monitoring Technical Committee to closely monitor a relatively small group of drought indicators for the purpose of triggering regional drought mitigation and response actions, while monitoring a vast array of locally-relevant indicators less intensively, in order to corroborate the drought status suggested by the drought trigger models. This approach to determining the optimal operational combination of drought indicators to produce effective drought response triggers has also been adapted to account for Arizona's varied topography and to take into account the considerable contribution of snow to Arizona's hydrology.

Analytic Procedures to Calculate Triggers (Adapted from Georgia Drought Plan)

Drought indicator data measure a variety of phenomena and are often measured on scales (e.g., degrees Fahrenheit, inches of precipitation, cubic feet per second of stream flow, feet below the surface of groundwater) that do not readily correspond to each other for comparative analysis. To provide ease of comparative interpretation, statistical comparability, and temporal and spatial consistency, the indicator data were transformed to percentiles relative to each month. To understand the percentile approach, assume 100 years worth of January temperature data, each value measuring the monthly average January temperature for a particular year. The highest value (hottest temperature) would be in the 1st percentile, whereas the lowest value (coolest temperature) would be in the 100th percentile, and so on for the other 98 values, which would fall between the highest and lowest percentiles. The data were then converted to the corresponding drought trigger levels (see Table 1). For precipitation, standardized precipitation index (SPI) values were calculated. SPI was used, because these data show precipitation in a manner consistent with Monitoring Technical Committee needs for ease of interpretation and statistical comparability. Monthly streamflow data were also converted to percentiles, consistent with the aforementioned approach. Reservoir data, which are influenced by management decisions, will be used only as one of several drought indicators for the Phoenix metropolitan area, combined subjectively (due to artificial, and historically inconsistent, limits imposed on the data by management decisions); reservoir data will also be used for Climate Division 1, on an experimental basis.

For each climate division, the drought indicator data have been divided into groups of short- and long-term indicators. Short-term drought indicators include the 3-, 6-, and 12-month SPI. Long-term drought indicators include 24-, 36-, and 48-month SPI, as well as streamflow at selected gages in each climate division (except Climate Division 5, which has no perennial streams, except the Colorado River, and which is subject to federally-mandated response options based on the status of the Colorado River). Drought status is

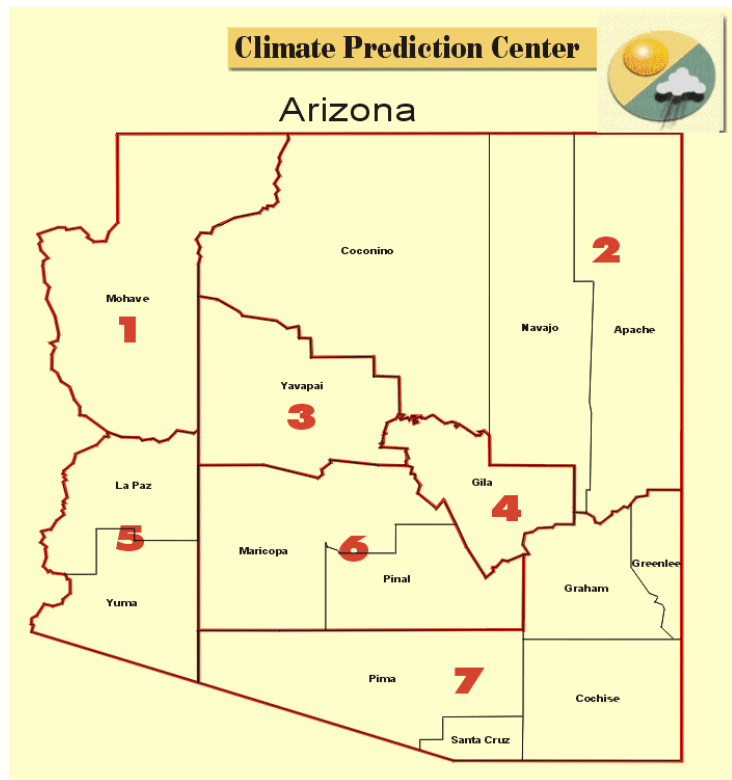


Figure 2: Arizona climate divisions and counties.

Source: NOAA Climate Prediction Center.

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measured separately for the situation of moving to a higher drought status (“drought in”) and for the situation of moving to a lower drought status (“drought out”). In order to ensure smooth transitions between monthly drought status levels, and to bolster the drought plan philosophy of proactive drought planning, indicators for *drought in* must be at a certain or higher level for 2 consecutive months. Drought out indicators must be at a certain or lower level for 4 consecutive months. The indicator trigger levels are then averaged (and rounded up to the nearest whole number) separately for short- and long-term drought status, and for drought in and drought out status. The maximum of drought in or drought out status for each drought category (short- and long-term) is then used to declare the final short- and long-term status. The indicators are illustrated for each climate division in [Appendix VI](#).

As significant changes in the status of reservoirs and groundwater occur more slowly than at a monthly time scale, the Monitoring Technical Committee will release an *annual* report on the drought status of the two major metropolitan areas, based on reservoir levels, annual groundwater index well data, and short-term precipitation data, as they pertain to each metro area. For each climate division, annual groundwater index well data, and seasonally-available snow water equivalent and SWSI data, as well as a host of other drought impact data will be consulted before finalizing drought trigger status.

Combinations of the indicator data described above have been evaluated for their faithful representation of past drought conditions. The evaluations use actual data, to generate the triggering sequences that would have occurred historically. These sequences were then compared to retrospective assessments of drought according to Arizona resource managers and decision makers. Sets of triggers were selected for the short- and long-term drought categories. The Monitoring Technical Committee will evaluate the performance of the drought trigger system at least annually, in order to assure that the indicator data and combinations of indicators used to trigger drought status are consistent with observed drought impacts. (Note: post-drought triggers might need to be reassessed in the future.)

Drought Trigger and Declaration Process

The Monitoring Technical Committee will routinely monitor and evaluate the drought indicators that are supplied by its constituent agencies. These indicators reflect the state of the hydrologic system. The indicators for each of Arizona’s seven climate divisions are described in Appendix III. In keeping with the philosophy outlined earlier in this plan, the Governor’s Drought Task Force advocates proactive responses to potential drought. Therefore, as mentioned above, drought triggers going into drought are relatively more sensitive to impending drought (but avoiding drought false alarms), and triggers going out of drought are relatively conservative (but avoiding excessive restrictions), to assure that mitigation in response actions are not withdrawn prematurely.

Operational drought triggers are defined in terms of combinations of various observed hydrologic and climatic measurements (e.g., precipitation, stream flow), and the threshold levels associated with those variables (Table 4). This procedure produces an objective measure for triggering specific drought mitigation and response actions. At the same time, the Arizona Drought Preparedness Plan must retain flexibility to address situations where strict adherence to or reliance on a specific threshold would be inappropriate. The Arizona Drought Preparedness Plan must also ensure that this discretionary latitude does not weaken the proactive approach by forestalling timely responses. The Monitoring Technical Committee will use a two-step approach to evaluating and recommending a change in status of the drought conditions, as follows: a

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preliminary trigger, based on the availability of high-quality, continuous, monthly-resolution, long-term data, will be used as the first indicator of drought for a specified climate division; an intensive evaluation of additional drought indicator data for sub-regions within that climate division will be used to confirm the trigger and thus trigger a notification of a change in the drought status.

Table 4: Overview of Arizona Drought Categories, Impacts, and Trigger Percentiles

Category	Description	Possible Impacts	Indicator Percentiles
0	Normal Conditions		>40.00
1	Abnormally Dry	Measurable reduction in precipitation, stress to seasonal grasses, stock pond storage somewhat reduced	25.01-40.00
2	Moderate Drought	Noticeable reduction in precipitation, some vegetation stress, stock pond storage reduced, reduced streamflows, lower than average reservoir levels	15.01–25.00
3	Severe Drought	Long-term reduction in precipitation, low snowpack, reduction in reservoir levels, vegetation stress affecting trees and shrubs, habitat and pasture degradation	5.01-15.00
4	Extreme Drought	Multi-year precipitation deficits (including snowpack), significant reduction in reservoir levels, measurable reduction in groundwater levels, near-record low streamflows, substantial stress on trees and significant rangeland degradation, diminished wildlife populations	<5.00

Preliminary trigger:

Going into drought. For each of the drought categories (short- and long-term), the individual indicators in a climate division must reach or pass a certain prescribed threshold for two consecutive months. The average of short-term indicators (rounded up to the nearest whole number) is then taken each month; similarly the rounded-up whole number average of long-term indicators is then taken each month.

Coming out of drought. For each of the drought categories (short- and long-term), the individual indicators in a climate division must reach or be lower than a certain prescribed threshold for four consecutive months. The average of short-term indicators (rounded up to the nearest whole number) is then taken each month; similarly the rounded-up whole number average of long-term indicators is then taken each month.

Drought status. The maximum of drought in and drought out values for short-term drought is used as the final preliminary trigger for short-term drought status, and the maximum of drought in and drought out values for long-term drought is used as the final preliminary trigger for long-term drought status.

Evaluation: Once a drought status trigger has been "tripped," the Monitoring Technical Committee, will report to the Interagency Coordinating Group, the Local Area Impact Assessment Groups, and the Governor's Office and Cabinet. The Monitoring Technical Committee, in conjunction with the aforementioned groups, will convene and use additional drought indicators and local-scale and high spatial resolution data in order to determine the geographic extent of drought alert within the particular climate division. As different communities across the state have implemented various mitigation measures (e.g., development of drought supply reserves), this corroboration at the local level is essential in identifying the appropriate drought status for a particular area or sector and corresponding drought response. This additional evaluation will ensure that the public is appropriately informed as to the status of drought in their community and will help avoid unnecessary and potentially costly actions. The Monitoring Technical Committee will also incorporate subjective monitoring measures, such as quarterly ranching conservation district status reports provided by US Department of Agriculture – Natural Resources Conservation Service, into evaluating the extent of drought and the need for drought declaration.

The Monitoring Technical Committee will continue to monitor the drought indicators for indication of changing conditions, and will act in response to those changing conditions. The Monitoring Technical Committee will consult with the Local Area Impact Assessment Groups as necessary and will keep the Interagency Coordinating Group, the Local Area Impact Assessment Groups and the Governor's Office and Cabinet apprised of changes in climate conditions.

As explained above, the Monitoring Technical Committee will evaluate the performance of the drought trigger system at least annually, in order to assure that the indicator data and combinations of indicators used to trigger drought status, and ancillary data used to corroborate drought status, are consistent with observed and impending drought impacts.

PLAN IMPLEMENTATION

The Arizona Department of Water Resources will have the lead role in the implementation of the Arizona Drought Preparedness Plan. The components of the Plan will be ongoing, in the case of the Monitoring Technical Committee, however, once a trigger has been reached, as described above, certain actions must be initiated to provide Arizonans with as much information and warning to help reduce the impacts that have historically been experienced. The table below identifies each trigger level [note the trigger levels used below have not been identified but are used as a means to set up the implementation plan], the associated responsibilities for each Committee/Group, and Agency responsibilities.

If the preliminary evaluation by the Monitoring Technical Committee indicates the possible need for a drought stage declaration for a specific climate division and all or part of the relative hydrologic regions (watershed/groundwater basin) in and adjacent to that climate division, the Director of the Arizona Department of Water Resources (ADWR Director) will consult with members of the Interagency Coordinating Group and the Local Area Impact Assessment Group(s) to determine the potential severity of the drought condition(s), and the expected impacts. The Local Area Impact Assessment Group, in consultation with the Interagency Coordinating Group, will make a determination of the appropriate level of response, if any, to be made. Response guidance for each level of drought severity is provided by this plan, but particular drought conditions may require greater or lesser responses than those contained herein. The Arizona

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Department of Water Resources and members of the Interagency Coordinating Group will assist, as needed, local governments and water supply providers as to the appropriate action to be taken. In cooperation with the Local Area Impact Assessment Group, press releases will be prepared explaining the situation and any local response requirements.

The tables in Appendix IV outline the specific tasks of each entity responsible for implementing the Arizona Drought Preparedness Plan under each stage of drought.

PLAN REVIEW AND REVISIONS

As identified above, the Interagency Coordinating Group will provide an annual report to the Governor. In years following a drought, the Interagency Coordinating Group will receive input from the Monitoring Technical Committee and the Local Area Impact Assessment Group(s) on the implementation of conservation measures or emergency response activities enacted in that area. Each year, by October 1st, the information obtained from the Local Area Impact Assessment Groups and the Monitoring Technical Committee will be used to determine if modifications are necessary to improve implementation of the Plan. The Interagency Coordinating Group will make recommendations for modifying the Plan and submit these recommendations in writing to the Governor by November 1st of each year.

ASSESSMENT OF FUTURE NEEDS

The development of the Arizona Drought Preparedness Plan focused primarily on initiating a statewide monitoring system to facilitate early detection and warning of impending droughts. Additionally, impacts due to droughts were identified by various water users in each of the sectors as well as mitigation and response options that have been employed in the past either within the State of Arizona or in other Western States. As this was the first cut at developing a statewide drought plan for the State of Arizona, many additional issues identified through the public process need to be addressed. This section outlines these issues in addition to identifying action items for improving the implementation and structure proposed in this Plan. Furthermore, these issues and action items have been separated into short-term, meaning within the first two years of implementation of this plan and long-term, within the next three to five years.

Short-Term Actions

Identification of Financial Requirements – The Arizona Drought Preparedness Plan and the Arizona Statewide Water Conservation Strategy include recommendations for adding a Drought Coordinator and staff, initiating an Office of Water Conservation, maintaining a monitoring database and assessment program, and development of interactive public websites.

Identification of a timetables for a scoping phase, a design phase, and an implementation phase needs to be developed immediately as each phase will require specific funding. The Arizona Department of Water Resources will develop this timetable before November 1, 2004 and the total funding needs for these components before December 1, 2004.

State to Facilitate Town Hall Meetings on Water - One of the shortcomings of the yearlong process to develop the state's first drought plan was that stakeholders (outside of the Phoenix and Tucson metro area) were not engaged throughout the entire process. Although efforts were made

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to encourage input from the rural areas, the short timeframe prevented extensive efforts in facilitating this input. As the series of workshops around the state has shown, these stakeholders provided valuable insights, they expressed concerns not shared by drought planners, and they emphasized needs for fairness, trust, and the use of existing resources in dealing with water conservation issues. In order to facilitate better buy-in to the state's drought plan, and to insure constructive and positive dialogue, the State should facilitate and fund town hall meetings on drought and the state-wide water-supply topics throughout the state with the Governor's Office before the end of calendar year 2004. Key facilitators for these face-to-face meetings should include Cooperative Extension and USDA-NRCS conservation district agents, whose histories with our rural communities will help engender trust, confidence, and fairness during the process.

Initiate and Facilitate Local Area Impact Assessment Groups - The GDTF statewide workshops brought home the need for and utility of the proposed Local Area Impact Assessment Groups. These groups will be a great aid to the Drought Monitoring Committee and the Interagency Coordinating Group, as they will provide sub-regional level input on impending and/or current drought conditions; they will serve as ground-truthing and quality control for the drought monitoring process. Moreover, the Local Area Impact Assessment Groups provide an essential link between the communities and the state and federal agencies. It is through these groups that the drought plan and its associated committees will gain much needed credibility. As recommended, by the Task Force, the state needs to initiate the development and identification of these groups immediately. The assumption is that the State is still in a drought situation and rather than waiting for more costly impacts these groups will help identify the local area needs. To do this, the state will need to devote resources to these groups, and to the monitoring committee for coordination with and outreach to the Local Area Impact Assessment Groups. ADWR staff, including the proposed Drought Coordinator and the Rural Watershed group will need to immediately (October 2004) begin discussions with the County Emergency Managers and the Cooperative Extension, who have been identified to assist in this effort. Although, these groups will be the face of the drought plan in Arizona's communities and will provide the mechanism to improving outreach, education, mitigation and response to reduce the economic, social and environmental costs associated with drought, there still needs to be an identification of how to enforce the measures agreed upon by these groups, if necessary. There currently is no enforceability or authority that reaches all water users in the state; thus, these local groups are only acting on a voluntary nature. This will need to be explored by the Local Area Impact Assessment Groups and the Interagency Coordinating Group.

Continue and Facilitate the Monitoring Technical Committee – The Monitoring Technical Committee is the lynchpin to the education and outreach of the Arizona Drought Preparedness Plan. This is the committee that is responsible for assessing the indicators of drought and identifying the associated drought triggers. Because this effort has raised the consciousness of the citizens of this state to drought and its impacts, the state will continue to facilitate the continuation of this Committee, indefinitely. This will provide a seamless transition to the implementation of the Arizona Drought Preparedness Plan and continue to provide the citizens, policy-makers and land managers throughout the state with essential information related to the current climatic conditions and future implications associated with these conditions

1. **Identify Key Areas for Additional Monitoring** – The Monitoring Committee in cooperation with the Drought Coordinator will identify key locations within the State where drought monitoring is insufficient and develop a prioritized list of those locations to be addressed in the next 5 years. ADWR in cooperation with other agencies will seek funding to provide the tools necessary to eliminate these data gaps.
2. **Continued Assessment of the Trigger Levels** – The Monitoring Technical Committee will

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continue to assess the proposed trigger levels against historic drought data throughout the next year. This process will continue well beyond that, however, the Plan will need to be modified before June 30, 2005 to conform to these "ground-truthed" trigger levels to be ready to make determinations across the State and to prepare for the summer when most impacts are highly visible. This will also allow for the Local Area Impact Assessment Groups to identify their existing resources and needs to respond to those levels.

3. **Incorporate Colorado River shortage sharing provisions** – One area that has not been incorporated into the Drought Plan is how shortages will be shared among the Lower Basin Colorado River entitlement holders. The reason for this is that discussions are underway to identify shortage sharing in the Lower Colorado River Basin amongst the Basin states. Once the political leaders at the State and Federal level have made these decisions, this information needs to be incorporated into the plan. It is expected that this process will be completed by the end of 2004.

Develop State Website – To provide up to date and accurate information to all water users in the state, the Arizona Department of Water Resources in cooperation with the Monitoring Technical Committee will develop a Website, modeled after the Arizona Flood Warning System. The Website will differ in its accessibility to the public and providing information on community water use, drought status, and general information on response/mitigation using easy to understand terminology and graphics. Another feature of this website is a place to report water wasting which can be forwarded to the appropriate utility or in many cases report wasting/leaks by the utilities themselves (also would need to provide a 1-800 #).

Statewide Assessment of Water Deliveries and Supplies - One of the first lines of action that can help water users better understand the nature and extent of their water use and the degree to which conservation can help offset the impacts of drought is the metering of all water systems and water users. The data provided by metering can bolster the understanding of the benefits of conservation programs during times of drought. The State should continue with its efforts to inventory all water systems in the state and identify the existence and ability to meter its customers (including annual follow-up to improve the information). Once this has been completed, an assessment should be made of the potential for water conservation based on each system's characteristics, water use, and existing measures.

Identification of Agency Responsibilities (Reporting, Monitoring, Mitigation & Response) - One of the insights coming from a recent paper in *Natural Hazards Review*, by Michael J. Hayes of the National Drought Mitigation Center, is that drought plans assigning specific tasks and responsibilities to specific agencies have a stronger record of success; such plans had greater ease of implementation and public acceptance than drought plans lacking these features. Although, the present Arizona Drought Preparedness Plan makes some attempts to assign specific tasks to specific agencies; for example, the responsibility for coordinating Local Area Impact Assessment Groups is assigned to a combination of the Arizona Department of Water Resources, County Emergency Management and the University of Arizona Cooperative extension, there is still a need to assign specific actions to specific agencies. Because of the short timeframe for developing this plan, this was one area that will be addressed and is essential for implementation of this plan. Before the end of calendar year 2004, ADWR will complete discussions with each of the recommended agencies to identify agency responsibilities, availability of the resources necessary, and a commitment that they will make it a high priority.

Long-Term Actions

Cost-Benefit Assessment - A sentiment expressed both at the Governor's Drought Task Force public meetings throughout the state, as well as by drought planning officials in other states, is that was a fundamental lack of information about the impacts of drought. Especially lacking is information about the economic impacts of drought. Fundamental studies regarding the costs of various conservation measures, mitigation measures, and alternative response options to drought are lacking. For example: What is the cost of a town-wide xeriscaping mandate, versus the cost of drilling a new well? What are the benefits over 5-, 20-, 50-year time frames? The kinds of analyses that would yield information of use to decision-makers probably require multiple years of study. Nevertheless, without such information decision makers may find themselves stymied in terms of choosing a particular course of action, and may resort to inaction. The state needs to invest in the research arms of its state agencies and universities by creating a specific mandate to conduct research on the economic impacts of drought; topics of special interest include the costs and benefits of drought mitigation and response options, logistical challenges and expertise needed to implement such options, and the timelines associated with implementing and reaping benefits from such options. In addition, it is recommended that the state invest in and develop drought impacts and drought mitigation cost-benefit databases. To facilitate this effort, the Governor should make it a priority for state agencies to systematically record drought impact and mitigation/response cost-benefit information and deposit this information in the proposed state database along with getting participation from Federal and Tribal entities to participate. This should be on the agenda for the Interagency Coordinating Group to discuss and decide on a course of action.

Water Supply Availability - What the drought planning and public meeting processes have revealed to Arizona drought planners is that our major drought related water supply issues may not be resolved without changes to water law and without consensus from the citizens of the state on priority water uses. However, because Arizona water law is a complex system that has been developed over the last 100 years, the reality is not as simple. Focusing on a sustainable future for the citizens of this state with assured water supply and water quality for expanding populations, and water supplies for agriculture, mining, industry, and natural amenities, such as wildlife, riparian areas, and healthy forests, requires an all-inclusive statewide dialogue and consensus. The need for dialogue and active engagement in reviewing current water policy is underscored by drought in the Colorado River Basin, and the potential political ramifications of allowing events to drive policy, rather than taking a proactive approach.

RECOMMENDATIONS

Each of the Impact Assessment Workgroups as well as the Monitoring Committee was ask to provide specific recommendations to ensure a sustainable drought planning process and to address the impacts and vulnerabilities within the water use sectors. The Governor's Drought Task Force supports and proposes the following recommendations:

General Recommendations

- Seek funding for a Drought Coordinator and two half time staff persons to be located at the Arizona Department of Water Resources, in addition to adequate funding for the a partner at one of the State Universities, who will share responsibilities to improve the state's preparedness for drought through implementation, assessment and improvements to the Arizona Drought Preparedness Plan, including database development, monitoring enhancements, and meeting coordination and to ensure that the drought planning process is maintained.
- ADWR should continue to facilitate, through the Rural Watershed Program and the Local Area Impact Assessment Groups, coordinated water planning (including drought and conservation planning) between counties, cities, and water providers.
- Recognizing the need for adequate water planning in the event of drought for potable water systems (both private and public), the Governor's Drought Task Force recommends the Governor seek legislative authority for the Arizona Department of Water Resources to require all potable water systems develop a Drought Contingency Plan that must be submitted to the Arizona Department of Water Resources by January 1, 2006. Staff will review these plans and provide feedback to the water provider on the Plan's consistency with the State Drought Plan and the mitigation and response options. The Drought Plan must include both mitigation strategies, including a water conservation plan to reduce vulnerability to drought, and response actions. The Municipal and Industrial Impact Assessment Workgroup has developed a guidance document on how to prepare a drought plan contained in Appendix VII of this document and the State Drought Coordinator and Office of Water Conservation will also provide further assistance to communities to meet this requirement. To meet this requirement and to build upon the curtailment plan tariffs that the Arizona Corporation Commission already requires of private systems, the Drought Coordinator will work with the Arizona Corporation Commission to incorporate the mitigation measures embodied in this report.
- Seek legislative authorization for the Arizona Department of Water Resources to require all water systems to provide consistent and coordinated water supply information to the Arizona Department of Water Resources. This information can be used at the State and local level to identify the water uses within the system, determine conservation potential, and ensure reductions during times of critical need.
- Assess the merits of an Assured Water Supply program in parts of Arizona outside of the Active Management Areas by initiating an economic analysis of the implementation of such a program. There is also a need to include public involvement in this process.
- Due to the current drought conditions, the Governor's Drought Task Force recommends that the Arizona Department of Water Resources immediately initiate the Local Area Impact Assessment Groups to identify a structure and contacts and to facilitate the implementation of the Arizona Drought Preparedness Plan.

Monitoring Committee

The Monitoring Committee makes the following recommendations that will provide improved forecasting for multiple regions and sectors at a higher degree of resolution, an improved drought and hydroclimate disaster early warning system, access to historic data and trend

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analysis for decision-makers and experts, input to shortage sharing plans, improved stakeholder and citizen awareness and response capabilities.

- In order to reduce the necessary investment in the drought monitoring system, and to take advantage of systems already in place, we recommend that drought-monitoring activities be connected to and integrated with the Arizona flood monitoring and response system.
- We recommend that the state fund a website dedicated to drought and drought monitoring. We recommend that, in addition to drought status and monitoring, information on drought planning, mitigation/adaptation/vulnerability, and water conservation be included. We recommend that the state fund staff whose responsibilities are to keep the information current and complete, and to improve access to monitoring data, state and municipal drought plans, drought plan implementation, and drought vulnerability assessment for all regions and sectors. In order to maximize use of this information as soon as possible, this needs to be completed within the first year after this Plan is adopted.
- The backbone of any data analysis effort, such as drought monitoring, is a standardized system for archiving, storing, retrieving data over time. We recommend that the state invest in the hardware, software, and human resources necessary to establish and maintain a drought monitoring database, including the aforementioned drought impacts data. A key area for data archiving is to transfer paper records (especially groundwater) to digital format, and to quality control those data. In order to maximize use of this information as soon as possible, this needs to be completed within the first year after this Plan is adopted.
- In order to monitor drought in a timely and accurately fashion, an adequate drought monitoring observation network is necessary. We recommend that the state invest in the monitoring hardware and human resources that are needed to develop an improved network to monitor drought and to improve early warning for hydroclimatic hazards. In order to maximize use of this information as soon as possible, this needs to be completed within the first year after this Plan is adopted.
 - Prioritized monitoring needs are:
 - A soil moisture monitoring system in critical areas of the state;
 - Mountain precipitation (rain and snow) in data-sparse areas;
 - Real-time groundwater levels, coordinated with soil moisture observations, in strategic locations relative to demand centers that are considered vulnerable to drought;
 - Weather stations in data sparse areas;
 - Funding for the State Climatology Office to coordinate Arizona drought monitoring and the monitoring technical committee
 - Replacement of surface water gages that have been shut down
- Currently, drought impacts data are scarce, not collected systematically, and not subject to any standards or protocols. We recommend that Arizona develop a state drought impacts database and standardized system to collect regional and sectoral qualitative and quantitative impacts, especially economic impact data. In order to maximize use of this information as soon as possible, this needs to be completed within the three years after this Plan is adopted.

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- In order to ensure that drought monitoring and planning materials are useful to Arizonans, we recommend that the state invest in a drought science communication officer. The drought science communication officer's responsibility would be to interpret drought monitoring data, reports, outreach materials, and the state drought website materials for a non-expert audience, including residents, stakeholders, and decision makers. This recommendation is commensurate with the goals of the National Integrated Drought Information System.
- The benefits to Arizona of these investments will include greater ability and flexibility to plan for, mitigate the effects of, and respond to drought through:
 - An improved drought and hydroclimatic hazard forecasting and early warning system, including greater preparedness for disasters, and improved ability to reduce disaster economic losses
 - Improved capability to anticipate drought-related economic impacts, and to place Arizona in a comparative economic advantage over neighboring states and competing regions
 - Improved analyses of hydroclimatic trends for planning, and better anticipation of growth and development opportunities
 - Input to water shortage sharing plans
 - A better informed public and more prepared decision makers
 - Improved access to historic hydroclimatic data, drought impacts data (including economic, wildlife, agriculture and rangelands)

Environmental Health, Watershed Management, Livestock, and Wildlife Workgroup

The workgroup found that several agencies conduct systematic analysis of resource conditions relative to drought. However, the data that is collected is not coordinated between the multiple agencies. The workgroup makes the following recommendations:

- Better integration of current monitoring efforts regarding impacts of drought is needed.
- The workgroup found that additional monitoring is needed in the following areas:
 - Identification of representative, standardized ranches for the collection of forage loss data and stock pond monitoring – coordinated by Arizona Agricultural Statistics, Arizona State Land Department, and the Natural Resources Conservation Service;
 - More comprehensive assessment of local conditions after regional drought indicators have been triggered;
- Expand the spatial coverage of precipitation and forage condition sites – develop a network of volunteers to provide data.

Irrigated Agriculture Work Group

From the Summary and Full Work Group Reports, and the August 25, 2004 GDTF PowerPoint presentation

1. *From Summary Report, Page 5*

As it relates to Arizona's irrigated agricultural sector, the goal of drought preparedness and management should be to sustain the long-term economic viability of the State's irrigated agriculture in the event of protracted drought.

2. *From Summary Report, Page 18*

Long-term drought preparedness can most productively focus on the more important and tractable water supply vulnerabilities. The latter include vulnerability to a single water supply source, lack of or inadequate storage, lack of drought planning and preparedness, sudden changes in available supplies, low supply reliability, and uncertain or low priority power supplies. Diversity across irrigation districts must be recognized when addressing these vulnerabilities.

3. *From Summary Report, Pages 25-26*

Voluntary, willing, term-limited, and market-driven water transfers offer one means of preparing for or responding to several of Arizona's chief drought vulnerabilities, such as reliance on single supplies, inadequate storage, severe shortages, or sudden supply changes. Voluntary water transfers further offer an approach to relieving such drought impacts as supply depletion, drawdown, and income loss to farmers and irrigation districts. When structured so that all involved parties benefit, a term-limited and voluntary market approach may offer great promise to Arizona as a drought preparedness tool.

4. *From Summary Report, Pages 26-27*

Attention to agricultural water conservation as a demand reduction and drought preparedness tool must recognize the enormous statewide conservation investments that have already been made by Arizona's irrigated agriculture. Several promising approaches are already popular with, and in use by, Arizona growers. These include:

- ✓ Existing incentive programs directed at physical and structural conservation improvements, targeting growers who may still benefit from voluntary participation in such programs. Currently, in Arizona, these programs are constrained by available funding.
- ✓ Private or publicly supported agronomic and water management outreach programs, again directed at growers who volunteer to participate. Currently, in Arizona, these programs tend to be constrained by available manpower.
- ✓ Continued use of tax credits, low-interest loans, crop insurance, and like programs targeted at drought preparedness, which might benefit if public awareness of existing programs were raised.

5. *From Summary Report, Page 27*

The present drought-induced reversion to groundwater as a primary irrigated agriculture supply source cannot be an effective or even workable drought management strategy over a longer-term. It may be one of few options available over the short-term.

6. *From Summary Report, Page 26*

Programs can be used to address impacts or for longer-term drought preparedness. Specific program ideas include property tax credits and low-interest loans for drought-stricken farmers to lessen income and financial impacts, as well as investment programs to address shortage, flexibility, storage, or supply vulnerabilities. Programs could be used to improve on-farm or

GOVERNOR'S DROUGHT TASK FORCE

district distribution systems, to increase well command areas, to promote system inter-connectivity, or to add small regulatory storages. Analogous programs are presently in use in some Federal and State incentive conservation programs.

**APPENDIX I
MITIGATION GOALS**

COMMERCE, RECREATION & TOURISM WORKGROUP

9/27/04

MITIGATION GOALS

<u>Recommendation</u>	Lead/Partner Agencies	Year
Goal: Improve Information Dissemination		
Enhance public outreach and education	ADWR/AOT/ADOC	On-going
Develop timely, accurate & consistent recreation and tourism messages that stress alternative recreational opportunities	ADWR/AOT	On-going
Goal: Promote Drought Planning		
Develop local community mitigation and response plans to assist with economic diversification and preparedness	ADWR/ADOC	2005
Identify mitigation and adaptation measures specifically for water quality related constraints, due to contamination of recreation sites and/or low flow volumes	ADWR/ADEQ/ADOP	2005
To the extent possible, coordinate river releases	ADWR/BOR	On-going
Evaluate campfire restrictions in areas with: –on site water supplies –full time site management –cleared vegetation in the vicinity of fire rings or grills	ADWR/USFS/ADOP	On-going
Evaluate ways to limit impacts of fire closures	ADWR/USFS	On-going
Goal: Support Drought Conservation Measures		
Enhance short-term local drought related water conservation programs	ADWR (Office of Water Conservation)	On-going

**ENVIRONMENTAL HEALTH, WATERSHED MANAGEMENT, LIVESTOCK & WILDLIFE
WORKGROUP 8/24/04**

MITIGATION GOALS

Recommendation	LEAD/Partner Agencies	Year
Goal: Improve Water Availability Monitoring		
Secure Funding for improved monitoring of key indicators	ADWR	2005
Secure funding for stream gage improvements	USGS	2005
Augment real-time monitoring of groundwater data with additional wells statewide	ADWR	
Improve wildlife and habitat monitoring and develop an accessible and standardized database for reporting habitat conditions, populations, and human-wildlife contact incidents	Az Game & Fish	2006
Develop an "Arizona Drought Status" strategy that communicates current drought conditions to the public and decision-makers	ADWR	On-going
Investigate most appropriate mechanism to communicate information, e.g. newspaper, direct mail, radio, website etc.	ADWR	2005
Secure funding for improved monitoring	ADWR	2006
Educate water users on how to use climate information to plan for mitigation and response	ADWR	On-going
Goal: Increase Public Awareness and Education		
Develop an internet site for Arizona Drought Preparedness Plan	ADWR	2004
Provide public general information on drought and wildfire issues	State Forester	On-going
Provide ranchers with workshops on coping with drought	NRCS/Extension	On-going
Provide public with information on wildlife issues – especially how to deal with increased interactions	Az Game & Fish	2004 (probably already done)
Provide public with information on impacts from recreation on areas that are vulnerable to drought and how to reduce those impacts	USFS/BLM/National Parks/State Parks	On-Going
Prepare and update an "About Drought" informational brochure	ADWR	2004
Goal: Augment Water Supplies		
Develop program for instream flow water leasing to protect native fish and sports fisheries	Az Game & Fish/ADWR	2006
Initiate partnerships with local water users and regulatory agencies to develop emergency alternative water supplies to habitat for critical species	Az Game & Fish/ADWR	2005
Explore feasible water transfers	ADWR	2005
Goal: Facilitate watershed and local planning		
Implement Coordinated Resources Management of watersheds on public lands	NRCS	2004 – on-going

GOVERNOR'S DROUGHT TASK FORCE

Develop risk-based vulnerability assessment for each basin /watershed	ADWR/State Lands/USFS/US BLM/NRCS	2006
Develop a water budget for each watershed/basin – integrating inflows and outflows to meet all needs including quantification of carrying capacity	ADWR/NRCS	2006
Incorporate fire management into watershed planning	State Forester	On-going
Investigate opportunities for regional drought planning to facilitate drought response and assist cooperators in developing regional programs	ADWR/ADEQ/ACC	On-going
Explore Coordinated Management of Wildlife and Livestock	AZ G&F/Extension	2005
Conduct workshops on developing local or regional drought plans	ADWR	2004 – 2005
Direct state resource managers to develop drought plans for State Lands and State Parks	Governor's Office	2004
Goal: Reduce Water Demand / encourage conservation		
Support local development of water conservation programs	ADWR (Office of Water Conservation)	On-going
Goal: Impact Reduction		
Conduct workshops on livestock management during drought	NRCS/Extension	On-going
Address evolving water use conflicts	ADWR	On-going
Include wildlife corridors in new housing developments	Local Communities	On-Going
Coordinate removal of non-native vegetative species in combination with proper management and replacement of native vegetation		
Provide climate and economic forecasts of other areas in competition with local livestock operations		On-going

IRRIGATED AGRICULTURE WORKGROUP

9/29/04

MITIGATION GOALS

Recommendation	Lead/Partner Agencies	Year
Goal: Reduce Impacts		
Study effectiveness of water conservation measures.	ADWR	On-going
Participate in Preventative Planning (crop) Insurance Program (planning not to crop due to assumed "problems")	ADWR	
Evaluate historic climate/pest impacts	ADWR/Monitoring Committee	2006
Increase awareness of irrigation efficiencies/conservation options to growers	ADWR	2004
Evaluate power-related drought mitigation option		
Goal: Promote Drought Planning		
Develop a State Water Plan - early warning system.	ADWR	2005
ADWR and Arizona Department of Ag assist Irrigation suppliers to develop a drought contingency plan.	ADWR/ADEQ/ACC	2005
Goal: Improve Information Dissemination		
Provide climate and economic forecasts of other areas in competition with local operators	AZ Department of Ag	
Provide education on drought related issues	ADWR/NRCS/NRCDs	On-going
Goal: Improve Monitoring		
Identify areas where improved monitoring is needed for agricultural water users	ADWR/USGS	On-going
State and federal agencies improve accuracy of seasonal runoff and water supply forecasts.		
Secure funding for improved monitoring	ADWR	2005/ On-Going
Goal: Review Institutional and Legal Impediments for augmenting water supplies		
Explore short-term, voluntary, market-driven water transfers	ADWR	2006
Investment program: increase flexibility of water supply sources.		
Evaluate institutional mechanism for temporary and voluntary drought related water transfers	ADWR	2006

MUNICIPAL & INDUSTRIAL WORKGROUP

9/27/04

MITIGATION GOALS

Recommendation	Lead/Partner Agencies	Year
Goal: Improve Information Dissemination		
Determine precise needs of water providers; what types of information are most relevant. This may vary by region and system.	ADWR	On-going
Investigate most appropriate mechanism to communicate information, e.g. newspaper, direct mail, radio, website etc.	ADWR	
Provide water systems and the public with relevant information on drought status and issues	ADWR/Monitoring Committee	On-going
Educate water providers on how to use climate information to plan for mitigation and response	ADWR	On-going
Develop an "Arizona Drought Status" strategy that communicates current drought conditions to the public and to decision-makers	ADWR	2005
Goal: Promote Drought Planning/Require long and Short-term Drought Plans for all Potable Systems		
Secure funding for financial and technical assistance for water system	ADWR	2005
Develop drought plan guidelines. Work with ADEQ and ACC to integrate their emergency response plans into a long-term drought plan requirement for water systems	ADWR/ADEQ/ACC	2005
Assist providers to develop drought plans and develop a reporting and review program	ADWR	On-going
Investigate feasibility of mandatory metering for potable water providers as a mechanism to improve planning and development of appropriate mitigation and response measures	ADWR	2005
Goal: Promote Regional Drought Planning		
Investigate opportunities for regional drought planning to facilitate drought response and assist cooperators in developing regional programs	ADWR/ADEQ/ACC	On-going
Goal: Improve Monitoring		
Identify areas where improved monitoring is needed for municipal and industrial sector purposes, e.g. snowpack, targeted water level monitoring. This effort must be coordinated with other drought monitoring activities	ADWR/USGS	On-going
Secure funding for improved monitoring	ADWR	2005

GOVERNOR'S DROUGHT TASK FORCE

Goal: Assist M&I Providers to implement Drought Conservation Measures		
Secure funding for implementation of drought conservation measures and for improved water measurement to identify conservation potential.	ADWR (Office of Water Conservation)	On-going
Support local development of water conservation programs.	ADWR (Office of Water Conservation)	On-going

**APPENDIX II
IMPACTS & RESPONSE OPTION**

COMMERCE, RECREATION & TOURISM WORKGROUP

9/27/04

Impact	Response
Threat of catastrophic Fire	May require closures of National Forest, State parks, and other public lands. May require fire restrictions or prohibitions of fire on public lands. May require restrictions of hunting and fishing on State and Federal lands.
Wildfires	Enhance public outreach and education especially as it relates to loss of public lands and habitat, and loss of rural commerce
Reduced snow pack	Establish alternative recreational opportunities as a result of cancellation or abbreviated ski season and reduction in the number of skiers
Low surface water flows and reservoir levels	Reduction in water-based recreation requires coordination of releases from dams, and the establishment alternative recreational opportunities
Potable water supply limitations	Local service industry, retailers, resident populations and visitors to rural Arizona may be adversely affected, potentially requiring water system improvements or water hauling.

**ENVIRONMENTAL HEALTH, WATERSHED MANAGEMENT, LIVESTOCK & WILDLIFE
WORKGROUP**

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Impact		Response
Watersheds		
Ecosystem Damage	<ul style="list-style-type: none"> • Reduced health of vegetation • Loss of vegetation • Change in vegetative species composition • Increase of non-native vegetation • Reduced soil moisture • Reduced water quality • Increased insect infestations • Post-drought erosion due to decreased vegetative cover 	<ul style="list-style-type: none"> • Emergency culling of livestock populations to reduce disease transmission and starvation • Emergency culling of wildlife populations to reduce disease transmission and starvation • Federal and State land management agencies impose restrictions on recreational activities • Closure of public lands to public access • Implement increasing public awareness campaign on watershed conditions • Implement emergency erosion control
Increased Wildfire Potential	<ul style="list-style-type: none"> • Decreased moisture in vegetation (timber) • Decreased moisture in detritus • Increased insect infestations leading to increase tree mortality 	<ul style="list-style-type: none"> • Local communities, counties, and state and federal land management agencies impose restrictions on or cancellation of burning permits • Reduce volume of dead or dying trees due to insect damage • Increase public awareness on fire dangers
Economic	<ul style="list-style-type: none"> • Loss of timber production • Decreased recreational opportunities • Decreased tourism 	<ul style="list-style-type: none"> • Media and tourism campaign on local alternatives to decrease in tourism
Impact		Response
Wildlife		
Animal Health	<ul style="list-style-type: none"> • Increased susceptibility to disease • Increased spread of diseases to other animals and humans • Reduction in reproduction • Increased animal 	<ul style="list-style-type: none"> • Increase public awareness on wildlife diseases and handling of impaired wildlife • Emergency culling of wildlife species • Increased predator control in critical habitat • Adjust fishing and hunting regulations and conduct public education programs to protect impaired fish and wildlife resources

GOVERNOR'S DROUGHT TASK FORCE

	<p>mortality</p> <ul style="list-style-type: none"> • Increased stress to endangered species • Increased predation or a reduction in available prey 	
Habitat Degradation	<ul style="list-style-type: none"> • Reduced availability of forage • Loss of forage • Reduction of stream flows/reservoir and lake levels • Reduction in available water supplies for drinking • Loss of aquatic habitat due to reduced flows and standing water • Reduced water quality • Disturbance to ecosystem populations and species composition • Increased human/animal interaction 	<ul style="list-style-type: none"> • Consider careful reduction of big game and livestock populations from areas where concerns of forage resource damage arise • Supplemental feeding in critical areas • Water hauling and/or development in critical areas • Curtailment of fish stocking programs • Reclamation States Emergency Drought Relief Act of 1991
Economic	<ul style="list-style-type: none"> • Reduction of hunting permits • Reduction of fishing licenses • Reduction of income for private fish and wildlife-based enterprises • Reduction of recreational opportunities (birding, etc.) 	<ul style="list-style-type: none"> • Relocate inventory of hatchery fish to alternative recreational fishing sites • Media and tourism campaign on local alternatives to decrease in hunting and fishing opportunities • Promote availability of recreational opportunities in other areas
Impact		Response
Livestock		
Animal Health	<ul style="list-style-type: none"> • Increased susceptibility to disease • Increased spread of 	<ul style="list-style-type: none"> • Allow for increased predator control • Cull livestock herds • Move livestock to areas with greater forage

GOVERNOR'S DROUGHT TASK FORCE

	<p>diseases to other animals</p> <ul style="list-style-type: none"> • Reduction in reproduction • Increased animal mortality • Increased predation • Reduced weaning weights resulting in less healthy calves/lambs, etc. 	<p>availability</p>
Rangeland Availability	<ul style="list-style-type: none"> • Reduced health of forage • Loss of forage • Reduced availability of water supplies (stockponds, access to rivers/streams) • Increased competition with wildlife populations 	<ul style="list-style-type: none"> • Consider careful reduction of big game and livestock populations from areas where concerns of forage resource damage arise • Implement more intensive herd management programs • Supplemental Feeding • Water Hauling • Utilize Conservation Reserve Program – Emergency Haying or Grazing • Controlled restocking rates to aid forage recovery •
Economic	<ul style="list-style-type: none"> • Reduction in market weights of livestock • Increased supplemental feeding • Increased need for hauling water • Reduction of herd sizes or elimination of herd • Reduction of animals going to market • Reduced market prices • Increased post-drought market prices 	<ul style="list-style-type: none"> • Assist communities and ranchers to develop supplemental natural resource employment opportunities to supplement income losses due to grazing restrictions • Emergency loans

IRRIGATED AGRICULTURE WORKGROUP

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	Impact	Response
Supply Depletion, Other Environmental Concerns	<ul style="list-style-type: none"> • GW depletion, water table declines • Reservoir and lake drawdown 	<ul style="list-style-type: none"> • Target reliance on single supply sources, inadequate storage, low supply reliability • Options include wheeling, increased connectivity, or voluntary market-based trading and water transfers • Other options include small regulatory storages, recharge projects, recapture, and reuse; related investment programs to increase the flexibility of water supply sources • Conservation options include voluntary incentive programs directed at physical and structural improvements and agronomic and water management outreach programs
Financial Viability, Income Loss, and Land Prices	<ul style="list-style-type: none"> • Income loss for farmers and districts • Financial viability of districts 	<ul style="list-style-type: none"> • Target severe supply shortages, low supply reliabilities, and uncertain or low priority power supplies • Options include voluntary and willing market-based trading and water transfers • Other options include property tax credits or low-interest loans for drought-stricken farmers
Agronomic Impacts	<ul style="list-style-type: none"> • Fewer planted acres in irrigation districts • Damage to crop quality • Reduced cropland productivity 	<ul style="list-style-type: none"> • Facilitate diversification of water supply sources • Increase supply reliability
Other Impacts	<ul style="list-style-type: none"> • Increased energy demand and reduced supply • Cost of additional water resource development 	<ul style="list-style-type: none"> • Help rural power districts tie down long-term power supplies • Reverse the current trend toward increasing reliance on power-intensive groundwater pumping • Investment programs to increase the flexibility of water supply sources

MUNICIPAL & INDUSTRIAL WORKGROUP

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Impact	Response
Increased water demand	<ul style="list-style-type: none"> • Improve aging and inadequate storage facilities, pumps and wells (WIFA funding, State and County economic assistance programs) • Implement water demand reduction programs (e.g. low-water use landscaping) • Develop cooperative water conservation programs (e.g. with energy companies, other water providers, NRCDS, BOR) • Implement leak detection and repair program • State or locally imposed short-term emergency restrictions during drought emergency • State and local government water use restrictions on public facilities • Industrial user conservation programs and partnerships • Water use Ordinances that prohibit certain water uses (misters) and/or set allotment standards for use (golf courses)
Increased peak demand	<ul style="list-style-type: none"> • Improve aging and inadequate storage facilities, pumps and wells (WIFA funding, State and County economic assistance programs) • Implement water demand reduction programs (e.g. time of day/day of week water restrictions)
Reduced water supply availability	<ul style="list-style-type: none"> • Cooperative water hauling program • State/Federal funds for emergency well drilling • Emergency inter-basin groundwater transfers • Emergency interconnects between water suppliers • Emergency water rights transfers for potable systems • Implement temporary pumping arrangements • Alternative water supply development • Secure emergency funds from federal agencies (USACE, USDA, USBR) • Information, funding and incentives for grey water use and rainwater harvesting • Expand water banking program outside of AMAs to develop back-up supplies that can be recovered during drought
Groundwater level declines and associated energy pumping costs and poorer water quality	<ul style="list-style-type: none"> • Funding for well deepening, enhanced water treatment • Rate structure adjustment to recover increased energy costs

GOVERNOR'S DROUGHT TASK FORCE

Reduction in water company revenue due to demand reduction	<ul style="list-style-type: none">• Rate structure adjustments to recover costs of implementing conservation programs and associated lost revenue
Economic impact of alternative supply development (well drilling, increased wastewater use , etc.)	<ul style="list-style-type: none">• Funding sources for utilities to invest in long term water supply development
Demand reduction impacts on sewage quality and disposal	<ul style="list-style-type: none">• Additional sewage treatment• Funding for treatment plant improvements

GOVERNOR'S DROUGHT TASK FORCE

APPENDIX III FEDERAL EMERGENCY ASSISTANCE PROGRAMS

GOVERNOR'S DROUGHT TASK FORCE

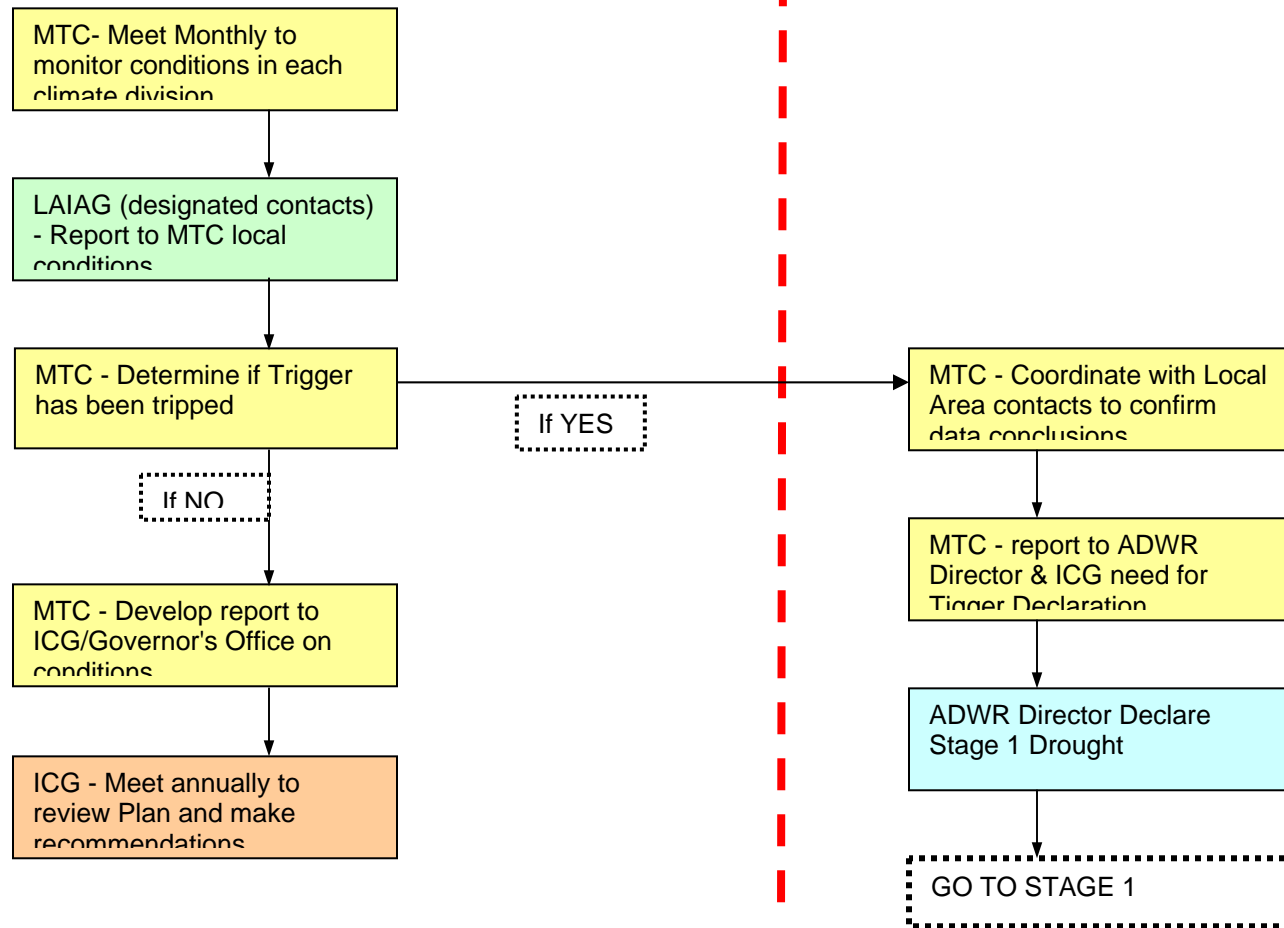
Program	Description	Agency
Conservation Reserve Program	During periods of severe drought, FSA may permit farmers with Conservation Reserve Program contracts to hay or graze land enrolled in CRP. Producers must have eligible CRP acreage or may lease the haying and grazing privilege on eligible CRP acreage in approved counties.	Farm Service Agency, USDA
Wetlands Reserve Program	Technical and financial assistance through the purchase of easements or cost-share agreements. Assistance in reducing flood damage, preventing soil erosion, recharging groundwater, improving water quality, and wildlife habitat improvement.	Natural Resources Conservation Service, USDA
Emergency Conservation Program	Provide financial assistance (cost-sharing) for cost of restoring farmland damaged by wind erosion, floods, hurricanes, or other natural disaster, or for emergency water conservation measures during severe droughts. Practices include providing water for livestock, restoring structures, and water conservation measures.	Farm Services Agency, USDA
Livestock Assistance Program	Provides payments to eligible producers who have suffered grazing losses due to a natural disaster.	Farm Services Agency, USDA
Livestock Compensation Program	Assistance provided to eligible owners and cash lessees for damages and losses due to drought.	Farm Services Agency, USDA
Livestock Indemnity Program	Provides partial reimbursement of livestock losses to eligible producers.	Farm Services Agency, USDA
American Indian Livestock Feed Program	Provides emergency financial feed assistance to livestock owners on tribal governed lands affected by a natural disaster.	
Environmental Quality Incentives Program	Necessary technical, educational, and financial assistance to assist owners and operators and to comply with Federal, State, and Tribal environmental laws on a voluntary basis to encourage environmental enhancements. This program is not a drought assistance program, however, practices could be used to address particular drought impacts on the land.	Natural Resources Conservation Service, USDA
Emergency Loans	Emergency loans to family farmers, ranchers, or aquaculturists for physical damage or severe production losses.	Farm Services Agency, USDA
Farm Operating Loans	Funds can be used to pay annual farm operating expenses, to purchase livestock and farm equipment, and pay costs associated with land and water development.	Farm Services Agency, USDA
Watershed Planning River Basin Surveys and Investigations	Assist Federal, State, and local agencies plan and develop coordinated water and related land resources programs. USDA cooperates in the preparation and updating of State water resources plans and other water, land, and related studies. Assistance is provided in the following areas: engineering, economics, social sciences, agronomy, range management, forestry, biology, hydrology, archaeology, landscape architecture, waste management, etc.	Natural Resources Conservation Service, USDA

GOVERNOR'S DROUGHT TASK FORCE

National Streamgaging Program	Assistance in the form of information including monitoring of streamflow, groundwater levels, and reservoir contents. Comparison with previous droughts, drought studies, and service on drought-emergency committees. The data available from the USGS are used in responding to drought emergencies, characterizing a drought, finding alternative water supplies, and allocating water resources.	U.S. Geological Survey, USDOI
Emergency Watershed Protection Program	Technical and financial assistance to local organizations for planning and implementing watershed projects in relieving an imminent threat to life and property as a result of sudden impairment of a watershed caused by a natural occurrence including drought.	Natural Resources Conservation Service, USDA
Reclamation States Emergency Drought Relief Act of 1991	Assistance in the form of loans and grant for the purchase of water for resale or for fish and wildlife purposes; use of project facilities to store and convey water. Non-financial assistance also available to willing buyers and sellers. Programs and authorities are only applicable during times of drought.	U.S. Bureau of Reclamation, USDOI
Wildlife Habitat Incentives Program	WHIP is a voluntary program that offers private landowners cost-sharing to install practices to improve wildlife habitat. Native species and habitat will be emphasized Types of practices include: disking, prescribed burning, mowing, planting habitat, converting fescue to warm season grasses, establishing riparian buffers, creating habitat for waterfowl and installing filter strips, field borders and hedgerows.	Natural Resources Conservation Service, USDA
Economic Injury Disaster Loan	Low-interest working capital loans to small non-farm businesses and small agricultural cooperatives to help meet financial obligations arising from natural disasters. Assistance is available to small businesses dependent on agricultural production including livestock operations. Such businesses might include suppliers to farmers and ranchers, packers, shippers, food processors, and others directly dependent on trade with the agricultural enterprises.	U.S. Small Business Administration

APPENDIX IV PLAN IMPLEMENTATION

NORMAL

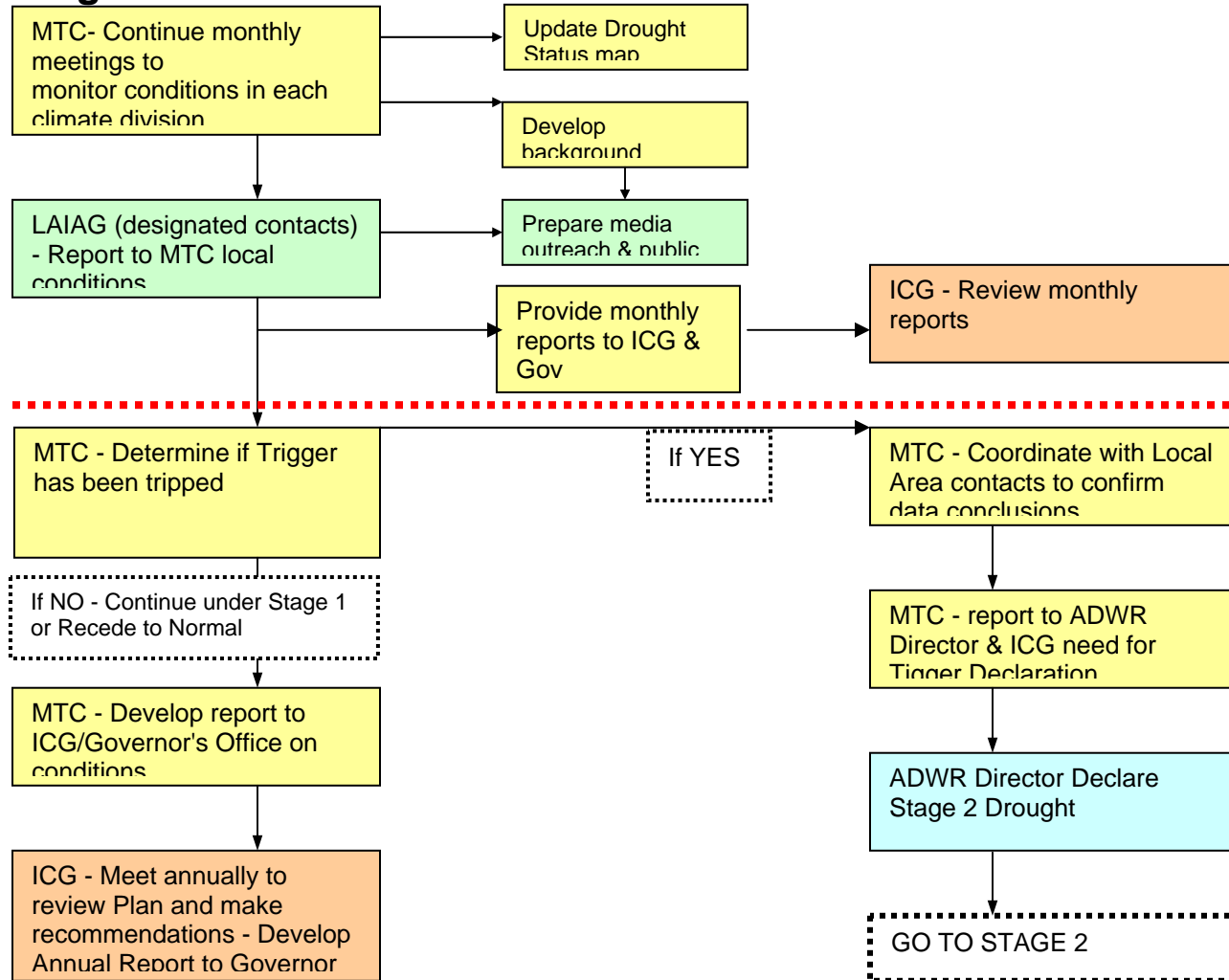


GOVERNOR'S DROUGHT TASK FORCE

NORMAL CONDITIONS

Monitoring Committee	Local Area Impact Assessment Group	Interagency Coordinating Group
<ul style="list-style-type: none"> - Meet monthly between November and April to discuss statewide conditions and monitor triggers (coordinated by Co-Chairs). - Maintain data base for compilation of data for MTC (ADWR). - Develop and provide monthly reports to the Governors office and ICG members on statewide conditions (Co-Chairs). - Coordinate with ICG on annual report to Governor (Co-Chairs). - Review local conditions and impacts in areas where preliminary trigger has been tripped before notifying ADWR Director of change in conditions (Committee). - Notify ICG if conditions warrant a trigger to Stage 1 drought status (ADWR Director). - Identify data needs for impacted areas entering Stage 1 Drought (Committee) 	<ul style="list-style-type: none"> - Designated contacts, located within each County, provide monthly reports on local conditions by phone or email to monitoring committee members, as needed (MTC Co-Chairs). - Implement mitigation measures as defined locally - recommendations from Conservation Committee/Conservation Plan may serve as a guideline (Local communities with ADWR technical assistance) 	<ul style="list-style-type: none"> - Develop annual report in October for the Governor on statewide conditions in coordination with the Monitoring Committee (Co-Chairs & MTC Co-Chairs).

Stage 1 - ABNORMALLY DRY

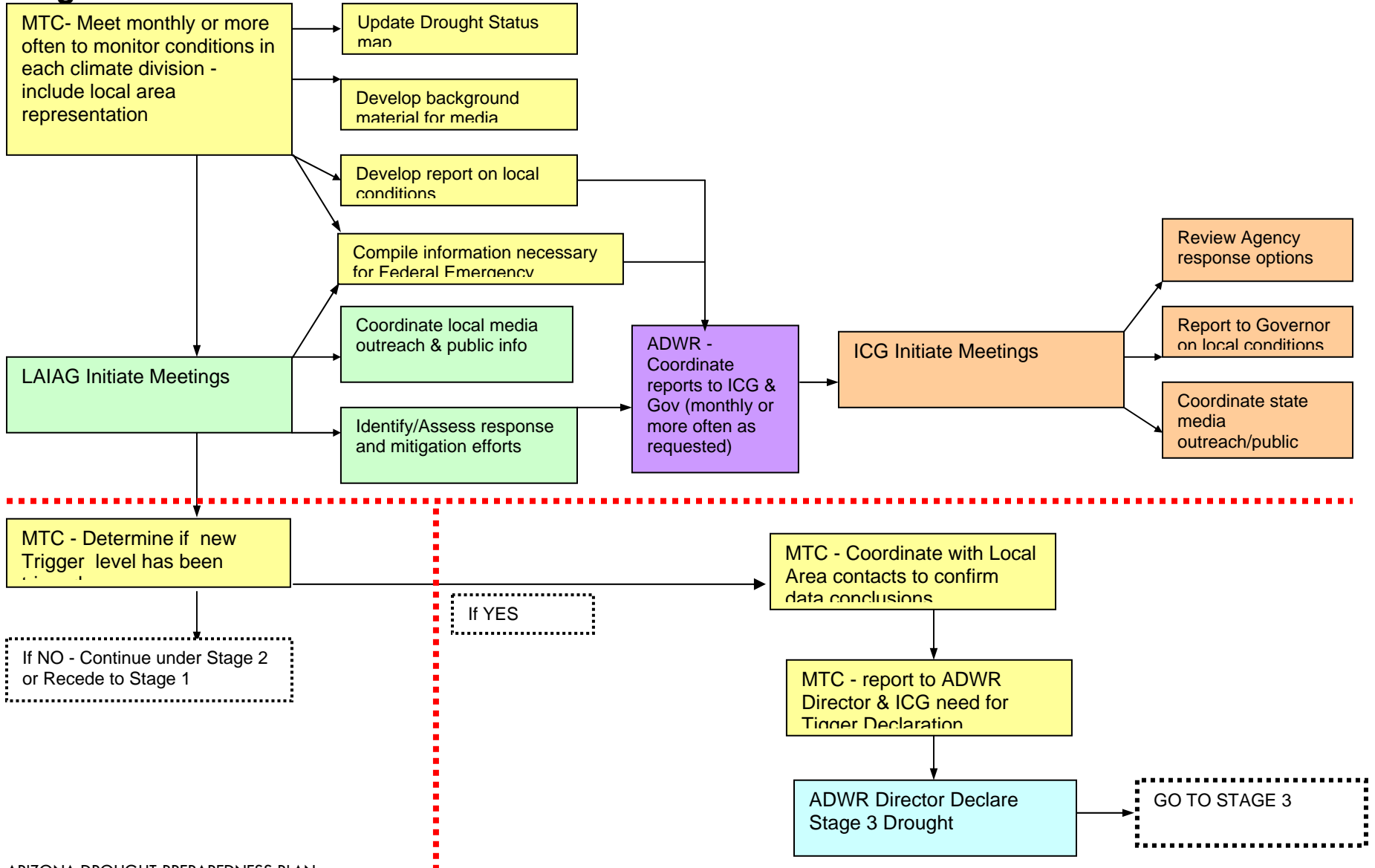


GOVERNOR'S DROUGHT TASK FORCE

STAGE 1 - ABNORMALLY DRY

Monitoring Committee	Local Area Impact Assessment Group	Interagency Coordinating Group
<ul style="list-style-type: none"> - Update State Drought Status Map for area entering Stage 1 status on public website (Co-Chairs/ADWR Webmaster) - Continue to provide monthly reports developed by the Committee to ICG and Governors Office on statewide conditions (Co-Chairs). - Meet (monthly or more often as necessary) to monitor and to provide more specific information on conditions in areas that have been identified to ICG and Governors Office (Co-Chairs). - Collect information gathered from designated contacts at the local levels, include this information in monthly reports to the Governors Office (Co-Chairs) - Develop/Facilitate correspondence between MTC and Governor's office (ADWR) - Develop background material on local conditions for Governors Office (ADWR). - Review local conditions and impacts in areas where preliminary trigger has been tripped before notifying ADWR Director of change in conditions (Committee). - Notify Governor and ICG if conditions warrant a trigger to Stage 2 drought status (ADWR Director). - Identify data needs for impacted areas entering Stage 2 Drought (Committee) - Continue to coordinate with ICG on annual report to Governor (Co-Chairs). 	<ul style="list-style-type: none"> - Designated contacts located within each County from LAIAG provide monthly reports to MTC on local conditions by phone or email to monitoring committee (MTC Co-Chairs). - Implement mitigation measures as defined locally or in State Drought Plan - recommendations from Conservation Committee/Conservation Plan may also serve as a guideline for on-going program (Local communities with ADWR technical assistance) - Begin preparing, in cooperation with MTC, local media outreach and public awareness information. 	<ul style="list-style-type: none"> - <i>[drought standby mode – receiving information on local conditions]</i> - Develop an annual report in October for the Governor on statewide conditions in coordination with the Monitoring Committee(Co-Chairs & MTC Co-Chairs). - Review Conservation Committee media outreach and public awareness campaign recommendations. Develop implementation plan (Co-Chairs). - Review Drought Plan response options and specify agency response (Co-Chairs)

Stage 2 - MODERATE DROUGHT

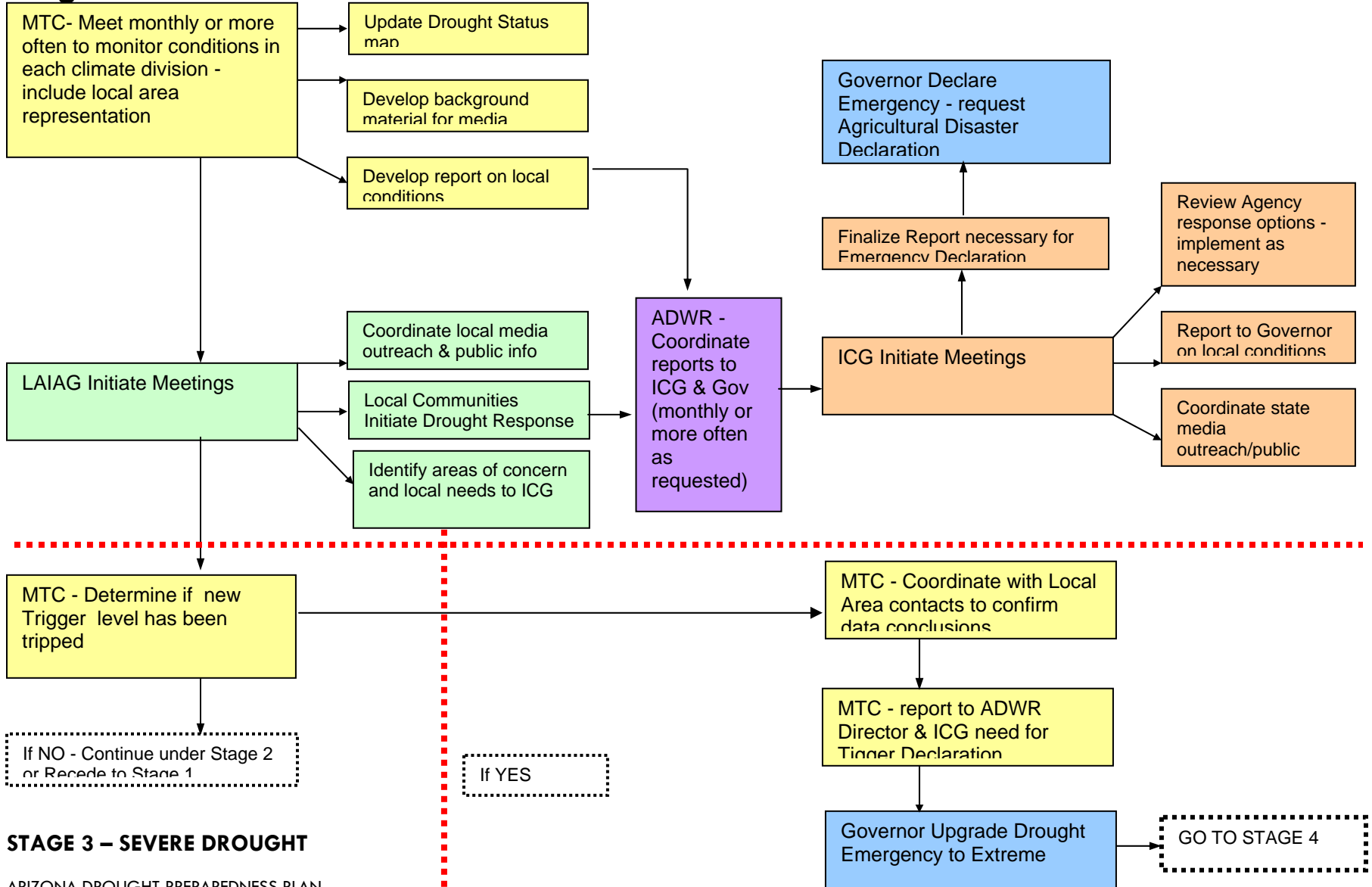


GOVERNOR'S DROUGHT TASK FORCE

STAGE 2 – MODERATE DROUGHT

Monitoring Committee	Local Area Impact Assessment Group	Interagency Coordinating Group
<ul style="list-style-type: none"> - Update State Drought Status Map for area entering Stage 2 status on public website (Co-Chairs/ADWR Webmaster) - Meet monthly, or more often, as necessary to monitor statewide conditions with special emphasis on areas identified with drought conditions (Co-Chairs). Expand MTC to include representation from LAIAG in identified area(s) - Continue to provide monthly reports developed by the Committee to ICG and Governors Office on statewide conditions (Co-Chairs). - Develop/Coordinate correspondence between MTC and Governor's office (ADWR) - Coordinate reporting to Governor with ICG on local conditions and prepare information necessary for Agricultural Disaster Declaration (ADWR). - In coordination with the ICG, compile information necessary for Governor's request for Presidential Emergency or Agricultural Disaster Declaration by U.S. Agriculture Secretary (Committee/ADWR). - Notify Governor and ICG if conditions warrant a trigger to Stage 3 drought status (ADWR Director) - Identify data needs for impacted areas entering Stage 3 Drought (Committee) - Continue to coordinate with ICG on annual report to Governor (Co-Chairs). 	<ul style="list-style-type: none"> - LAIAG meets in response to triggering of Stage 2 drought status to facilitate public outreach/awareness and availability of local response efforts – continue to meet as necessary (Co-Chairs). - LAIAG provides report, developed by LAIAG, on local impacts (by sectors as necessary), implementation of local response efforts, and identifies unmet needs to ICG at least monthly (Co-Chairs/ADWR) - Coordinate intensified media outreach and public awareness campaign with media, communities, land management agencies, educational groups, etc. on local drought conditions (Local communities/Co-Chairs/ADWR). - Identify and assess response and mitigation efforts implemented by local areas – report to ICG (ADWR Coordinator). 	<ul style="list-style-type: none"> - Upon receipt of Stage 2 drought status, co-chairs will call a meeting of the ICG to review conditions, response actions, and unmet needs at the local level (ADWR). - Meets again as necessary based on information from monitoring committee and LAIAG (Co-Chairs). - Synthesize information received from MTC and LAIAG for review by ICG (ADWR). - Review Drought Plan response options and specify agency response (Co-Chairs) - Provide reports to Governors Office on local conditions and response efforts and identifies potential needs for local areas (Co-Chairs) - Coordinate State media outreach and public awareness campaign on local drought conditions for Governors Office (Co-Chairs). - Develop an annual report in October for the Governor on statewide conditions in coordination with the Monitoring Committee (Co-Chairs).

Stage 3 - SEVERE DROUGHT

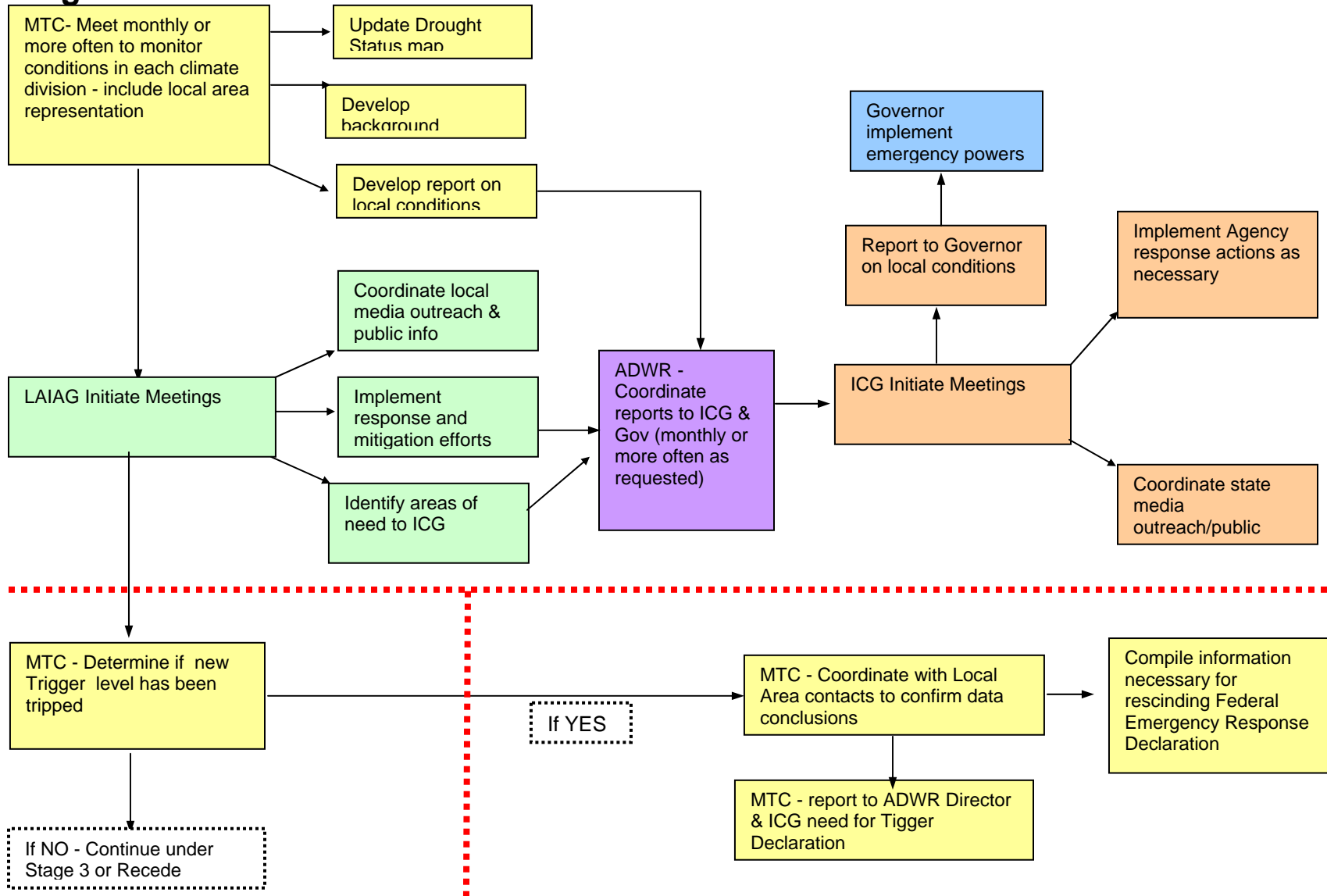


STAGE 3 – SEVERE DROUGHT

GOVERNOR'S DROUGHT TASK FORCE

Monitoring Committee	Local Area Impact Assessment Group	Interagency Coordinating Group
<ul style="list-style-type: none"> - Update State Drought Status Map for area(s) entering Stage 3 status on public website (Co-Chairs/ADWR Webmaster) - Finalize report for ICG to request agricultural emergency or disaster declaration status from federal government (ADWR) - Continues to monitor statewide conditions with special emphasis on areas identified with drought conditions (Co-Chairs) - Expand MTC to include representation from LAIAG in identified area(s) - Continue to provide monthly reports developed by the Committee to ICG and Governors Office on statewide conditions (Co-Chairs). - Coordinate data sharing with LAIAG(s) that has/have been initiated, coordinate reporting to Governor with ICG on local conditions (Co-Chairs). - Provide support to LAIAG to assist with media outreach and public awareness campaign (ADWR PIO). Develop media outreach material on local conditions for ICG and Governor's office (ADWR). - Review local conditions and impacts in areas where preliminary trigger has been tripped before notifying ADWR Director of change in conditions (Committee). - Issue notice to Governor and ICG if conditions indicate conditions are improving (ADWR Director). - Continue to coordinate with ICG on annual report to Governor (Co-Chairs). 	<ul style="list-style-type: none"> - LAIAG meets as necessary to facilitate public outreach/awareness and local response efforts - LAIAG, with assistance from monitoring committee, provides reports on local conditions (by sectors as necessary) and implementation of local response efforts and identifies unmet needs to monitoring committee and ICG at least monthly). - Requests implementation of response from ICG, as necessary. - Coordinate intensified media outreach and public awareness campaign on local conditions and emergency response options and local/state restrictions (Local communities/Co-Chairs). - Identify and assess response and mitigation efforts implemented by local areas – report to ICG (ADWR Coordinator). 	<ul style="list-style-type: none"> - Upon receipt of Stage 3 drought status, co-chairs will call a meeting of the ICG to review conditions, response actions, and unmet needs at the local level and make a recommendation that Governor requests agricultural emergency or disaster declaration status from federal government. - Based on information developed by MTC make recommendation for Governor to request Presidential Emergency or Agricultural Disaster Declaration by U.S. Agriculture Secretary (Co-Chairs with MTC Co-Chairs). - ICG assumes intergovernmental coordination of state drought response activities and meets on a monthly basis (or more often if necessary) to review conditions, response actions, and unmet needs or requests for action requested at the local level(s). - Identifies state restrictions to alleviate drought impacts. - Ensures implementation of response as necessary within agency capabilities. - Provides information, press releases and climate/impact information for media outreach and public awareness campaign. - Report drought and impacts status to Governor and Cabinet on a weekly basis, or as necessary. - Governor may implement Emergency Powers

Stage 4 - EXTREME DROUGHT



GOVERNOR'S DROUGHT TASK FORCE

STAGE 4 – EXTREME DROUGHT

Monitoring Committee	Local Area Impact Assessment Group	Interagency Coordinating Group
<ul style="list-style-type: none"> - Update State Drought Status Map for area(s) entering Stage 4 status on public website (Co-Chairs/ADWR Webmaster) - Finalize report for ICG to request agricultural emergency or disaster declaration status from federal government (ADWR) - Continues to monitor statewide conditions with special emphasis on areas identified with drought conditions (Co-Chairs). Expand MTC to include representation from LAIAG in identified area(s) - Continue to provide monthly reports developed by the Committee to ICG and Governors Office on statewide conditions (Co-Chairs). - Coordinate data sharing with LAIAG(s) that has/have been initiated, coordinate reporting to Governor with ICG on local conditions (Co-Chairs). - Provide support to LAIAG to assist with media outreach and public awareness campaign (ADWR PIO). Develop media outreach material on local conditions for ICG and Governor's office (ADWR). - Review local conditions and impacts in areas where preliminary trigger has been tripped before notifying ADWR Director of change in conditions (Committee). - Issue notice to Governor and ICG if conditions indicate conditions are improving (ADWR Director). - Continue to coordinate with ICG on annual report to Governor (Co-Chairs). 	<ul style="list-style-type: none"> - LAIAG meets as necessary to facilitate public outreach/awareness and local response efforts - LAIAG, with assistance from monitoring committee, provides reports on local conditions (by sectors as necessary) and implementation of local response efforts and identifies unmet needs to monitoring committee and ICG at least monthly). - Requests implementation of response from ICG, as necessary. - Coordinate intensified media outreach and public awareness campaign on local conditions and emergency response options and local/state restrictions (Local communities/Co-Chairs). - Identify and assess response and mitigation efforts implemented by local areas – report to ICG (ADWR Coordinator). 	<ul style="list-style-type: none"> - Upon receipt of Stage 4 drought status, co-chairs will call a meeting of the ICG to review conditions, response actions, and unmet needs at the local level and make a recommendation that Governor requests agricultural emergency or disaster declaration status from federal government. - ICG assumes intergovernmental coordination of state drought response activities and meets on a monthly basis (or more often if necessary) to review conditions, response actions, and unmet needs or requests for action requested at the local level(s). - Identifies state restrictions to alleviate drought impacts. - Ensures implementation of response as necessary within agency capabilities. - Provides information, press releases and climate/impact information for media outreach and public awareness campaign. - Report drought and impacts status to Governor and Cabinet on a weekly basis, or as necessary. - Governor implement Emergency Powers

GOVERNOR'S DROUGHT TASK FORCE

RECEDING FROM DROUGHT EMERGENCY

Monitoring Committee	Local Area Impact Assessment Group	Interagency Coordinating Group
<ul style="list-style-type: none"> - Update State Drought Status Map for area(s) receding from a Stage 3 status on public website (Co-Chairs/ADWR Webmaster) - Continues to monitor statewide conditions with special emphasis on areas identified with drought conditions (Co-Chair) - Meet monthly, or more often, as necessary to continue monitoring conditions in local areas (Co-Chairs) - Continue to provide monthly reports developed by the Committee to ICG and Governors Office on statewide conditions (Co-Chairs). - Continue to provide monthly reports developed by the Committee to ICG and Governors Office on statewide conditions (Co-Chairs). - Continue data sharing with LAIAG(s) that has/have been initiated, coordinate reporting to Governor with ICG on local conditions (Co-Chairs). - Review local conditions and impacts in areas where preliminary trigger has been tripped before notifying ADWR Director of change in conditions (Committee). - Issue notice to Governor and ICG if conditions warrant a trigger to change in drought status. - Continue to coordinate with ICG on annual report to Governor (Co-Chairs). 	<ul style="list-style-type: none"> - LAIAG continues to meet as necessary to facilitate public outreach/awareness and local response efforts - LAIAG, with assistance from monitoring committee, provides reports on local conditions (by sectors as necessary) and implementation of local response efforts and identifies unmet needs to monitoring committee and ICG at least monthly. - Assess local response efforts before, during and after drought event - develop recommendations to mitigate local impacts to drought, submit to ICG (LAIAG/ADWR) 	<ul style="list-style-type: none"> - Meet as necessary to review conditions, response actions, and unmet needs at the local level(s). - Meet in September /October to discuss annual report, in cooperation with MTC and LAIAG and identify pros and cons of response efforts during the year. - Develop annual report in October on statewide conditions in coordination with the Monitoring Committee, in addition to an assessment of local, state, and federal response efforts during the year. Identify areas of need for upcoming year.

GOVERNOR'S DROUGHT TASK FORCE

RECEDING FROM MODERATE DROUGHT

Monitoring Committee	Local Area Impact Assessment Group	Interagency Coordinating Group
<ul style="list-style-type: none"> - Update State Drought Status Map for area(s) receding from State 2 status on public website (Co-Chairs/ADWR Webmaster) - Continues to monitor statewide conditions with special emphasis on areas identified with drought conditions - Meet monthly, or more often, as necessary to continue monitoring conditions in local areas - Issue notice to Governor and ICG if conditions warrant a trigger to change in drought status ADWR Director. - Continue to coordinate with ICG on annual report to Governor (Co-Chairs). 	<ul style="list-style-type: none"> - LAIAG continues to meet as necessary to facilitate public outreach/awareness and local response efforts - LAIAG, with assistance from monitoring committee, provides reports on local conditions (by sectors as necessary) and implementation of local response efforts and identifies unmet needs to monitoring committee and ICG (monthly, weekly?) - Assess local response efforts before, during and after drought event. - Develop recommendations to mitigate local impacts to drought, submit to ICG 	<ul style="list-style-type: none"> - Meet as necessary to review conditions, response actions, and unmet needs at the local level(s). - Meet in September /October to discuss annual report, in cooperation with MC and LAIAG and identify pros and cons of response efforts during the year. - Develop annual report in October on statewide conditions in coordination with the Monitoring Committee, in addition to an assessment of local, state, and federal response efforts during the year. Identify areas of need for upcoming year.

RECEDING TO NORMAL

Monitoring Committee	Local Area Impact Assessment Group	Interagency Coordinating Group
<ul style="list-style-type: none"> - Update State Drought Status Map for area(s) receding from Stage 1 status on public website (Co-Chairs/ADWR Webmaster) - Meet monthly between November and April to discuss statewide conditions and continue to monitor triggers. - Meet in September /October to develop information for final report to ICG to identify conditions as well recommend needs for additional monitoring, if necessary, based on ability to identify drought conditions before, during and after drought. 	<ul style="list-style-type: none"> - Assess local response efforts (by sector as necessary) before, during and after drought event. - Develop recommendations to mitigate local impacts to drought, submit to ICG 	<ul style="list-style-type: none"> - Meet in September /October to discuss annual report and identify pros and cons of response efforts during drought. - Develop an annual report, in cooperation with MC and LAIAG in October for the Governor and media on statewide conditions in addition to an assessment of local, state, and federal response efforts during drought event. Identify areas of need for future droughts, assess implementation of State Drought Plan and recommend any modifications as necessary for improvement.

APPENDIX V KEY MONITORING DATA AND SOURCE

GOVERNOR'S DROUGHT TASK FORCE

Indices/Monitors	Summary of Data	Source
Precipitation		
Climate Division Precipitation Data	A prepared dataset from the National Climatic Data Center (NCDC) has been compiled and aggregated based on monthly averages created from data for individual stations falling within climatically homogeneous regions (Climate Divisions) within each of the 48 contiguous states of the U.S for the period 1895-present. The data are updated from station data within the first 1-2 weeks of each month and they include a statewide average monthly value created from the data for each climate division within the state, weighted by the area of each division.	National Climatic Data Center (http://www.cdc.noaa.gov/Timeseries/)
Arizona Station Precipitation Data	A database of precipitation values from individual stations throughout Arizona, from 1996 to the present was created from a combination of National Weather Service (NWS) First Order and NWS Cooperative Observer Stations. There are 81 Arizona stations included in the NWS database. Provides information about the difference between recent precipitation and the long-term average precipitation at each individual station. The database will be updated each month around the 15th. For example, February data will appear in the current year's column around March 15th. Stations not reporting by the 15th will be updated as the data becomes available. Future region-specific monitoring will use the most complete long-term NWS station data records available. Use of these records requires data quality control beyond the scope of the current drought plan development timetable.	National Weather Service – Phoenix http://www.wrh.noaa.gov/cgi-bin/Phoenix/DroughtPage.pl?data=ALLDATA .
Temperature	The climate division database of NCDC includes average monthly temperature for each of the 7 climatic regions within the state of Arizona. The data are quality assured and published on the same schedule as the precipitation data. Used only as a loose indicator of water demand in the form open-water evaporation and potential evapotranspiration from land surfaces, and consequently, municipal demand, average air temperature is represented in the same way as precipitation. Data for each climate division and a statewide average are placed into a historical context in the form of a frequency distribution for 1- , 3- , 6- , and 12-month periods. As with precipitation, average air temperature can be monitored rather easily and updated within the first 1-2 weeks of each month.	National Climatic Data Center (http://www.cdc.noaa.gov/Timeseries/)
Standard Precipitation Index	The SPI is a relatively new drought index based only on precipitation and can be used to monitor conditions on a variety of time scales. This temporal flexibility allows the SPI to be useful in both short-term and long-term drought applications. As monthly precipitation data are updated, the data are ranked and the ranking is divided by the period length in order to place the current month into perspective. The data are also ranked for the most recent 3- , 6- , 12- , and 24-month periods, based on precipitation totals for each of those time periods. The SPI is calculated for each climate division, and for the entire state, on a monthly basis and for the aforementioned periods. SPI is expressed as positive or negative values. Positive SPI values indicate greater than median precipitation, and negative values indicate less than median precipitation.	

GOVERNOR'S DROUGHT TASK FORCE

Indices/Monitors	Summary of Data	Source
Soil Moisture	The Office of the State Climatologist for Arizona uses a water budget model for calculating soil moisture surplus/deficit from monthly climate division values of temperature on precipitation.	
Palmer Drought Severity Index (PDSI)	Another product of the NCDC climate division database is the calculation of a drought index from monthly precipitation and average monthly air temperature. The PDSI was developed as a method for quantifying drought conditions. The PDSI actually uses a supply and demand model for the amount of moisture in the soil, where supply = the amount of moisture in the soil plus the amount that is absorbed into the soil from rainfall, and where demand = the potential for water loss from the soil to the atmosphere and is largely dependent upon air temperature. The PDSI reflects how existing soil moisture compares with normal conditions. A given PDSI value is usually a combination of the current conditions and the previous PDSI value, so the PDSI also reflects the progression of trends, whether it is a drought or a wet spell. PDSI categories range from "mild" to "moderate" to "severe" to "extreme". The normal PDSI values range from -0.5 to +0.5. Any PDSI values above +4.0 or below -4.0 fall into the "extreme" category of a wet spell or drought. The National Drought Mitigation Center advises that PDSI is best used as a retrospective measure of drought history, rather than an operational monitoring tool. We include it in the GDTF MTC drought monitoring indicators, as it is a well-known and frequently used measure of historical drought.	
Reservoir Levels	The USDA-NRCS National Water and Climate Center provides monthly state basin outlook reports that contain usable reservoir storage, snowpack, and stream flow forecast data for all Arizona and Colorado River basins. The U.S. Bureau of Reclamation (USBR) provides daily reports of all reservoirs on the Upper Colorado River Basin (UCRB), as well as the mainstream Colorado River reservoirs. In addition, USBR provides monthly estimated most probable water supply for a two-year projection on major UCRB reservoirs, including Lake Powell. The Salt River Project provides daily reservoir and runoff data for its Salt and Verde River watershed reservoirs and basin totals.	Salt River Project http://www.srpwater.com/dwr/ U.S. Bureau of Reclamation http://www.usbr.gov/uc/water/index.html USDA-NRCS National Water and Climate Center http://www.wcc.nrcs.usda.gov/cgi-bin/bor.pl
Surface Water Supply Index (SWSI)	In 2004, the NRCS began calculating an experimental Surface Water Supply Index (SWSI) for Arizona river basins. The SWSI complements drought indices that require only climatological inputs, such as the PDSI and SPI, because it incorporates hydrological and climatological inputs into a single index. The SWSI calculation is based on the following four input variables: historic snowpack, mountain precipitation, stream flow, and reservoir storage data collected from individual watersheds. The SWSI is an indicator of surface water conditions in regions where mountain snowpack is a major component; in Arizona, such regions include the high elevations of northern Arizona, along the Mogollon Rim, and throughout the sky island mountain ranges of southeastern Arizona. The SWSI is useful in anticipating water availability for irrigated agriculture, fisheries, and other uses of runoff water. The SWSI can be used to anticipate post-winter water supplies since the water content of snowpack is stored until runoff. Like the PDSI, the SWSI is centered on zero and ranges from +4.2 to - 4.2	

GOVERNOR'S DROUGHT TASK FORCE

Indices/Monitors	Summary of Data	Source
Groundwater Levels	The groundwater data being used has been derived from the ADWR GWSI database. This database consists of about 1500 index wells located across the state that have water levels measured yearly or bi-yearly. The record for these wells varies in length from a few years to over 50 years. Of the 1500 index wells there are approximately 80 wells that are equipped with water level recorders or transducers. These wells have daily and in some cases every four-hour water level readings. Wells with recorders or transducers will be given priority for use in data analysis.	
Stream flow	<p>The U.S. Geological Survey (USGS) operates 196 streamflow-gaging stations in Arizona. The stations are operated to collect stream-discharge data that are used for many purposes, such as flood warning and flood control, the evaluation of climatic extremes (drought and flood), and monitoring stream flow for compacts and decrees. To evaluate drought conditions, 120 stations were initially selected throughout the State. Stations with minimal effect from reservoir regulation and groundwater withdrawals were selected. A few exceptions were included, but for the most part only stations on non-regulated streams were selected. The network of stations will be further refined by comparing the data collected at the stations to data collected at precipitation and temperature stations to identify the stations that best represent drought conditions, thus identifying a network of index stations. Continuous discharge computed from streamflow-gaging station data will be used to determine monthly mean discharges at each site in the network. Monthly mean discharges, which are considered provisional pending an annual review of data, will be made available to the Drought Task Force Monitoring Committee.</p> <p>The National Weather Service (NWS) Colorado Basin River Forecast Center (CBRFC) produces stream flow data and river forecasts for most streams in the Colorado River Basin, including Arizona streams. These data correspond to the USGS data used for drought monitoring (see above).</p> <p>The USDA-NRCS National Water and Climate Center provides monthly state basin outlook reports that contain stream flow forecast data for all Arizona and Colorado River basins. Forecast data are produced jointly by the NWS-CBRFC and USDA-NRCS. Stream flow forecasts are a useful indicator of future reservoir conditions and possible long-term drought.</p>	<p>USGS http://waterdata.usgs.gov/az/nwis/rt NWS-CBRFC http://www.cbrfc.noaa.gov USDA-NRCS http://www.wcc.nrcs.usda.gov/</p>
Fire and fuel moisture indicators	Secondary drought monitoring indicators, such as fire danger ratings and fuel moisture assessments are intimately associated with multi-season to multi-year variations in precipitation and temperature. Fire danger and fuel moisture assessment data are provided by a variety of state and federal agencies, including the Arizona State Land Department, the Southwest Coordination Center (SWCC: multi-agency), the US Bureau of Land Management, the USDA-Forest Service, the National Park Service, as well as through the program for Climate, Ecosystems and Fire Applications (CEFA: Desert Research Institute).	<p>SWCC http://www.fs.fed.us/r3/fire/ CEFA http://www.cefa.dri.edu/</p>

GOVERNOR'S DROUGHT TASK FORCE

Indices/Monitors	Summary of Data	Source
Agriculture, rangeland, wildlife habitat indicators	Subjective monitoring indicators such as reports on the conditions of topsoil, vegetation and forage, stock ponds, and wildlife habitat are a good source of information at the local level. USDA-NRCS has agreed to provide the MTC with quarterly reports from its ranching conservation districts. The MTC will seek corresponding input from the Arizona Game & Fish, the University of Arizona Cooperative Extension, and cooperating tribes. Subjective indicators corroborate quantitative indicator information, provide information from parts of the state for which there are no meteorological or hydrological data stations, incorporate indicators that integrate hydroclimatic parameters (for example, topsoil and vegetation conditions integrate temperature, precipitation, sunshine, etc.).	

APPENDIX VI CLIMATE DIVISION INDICATORS

GOVERNOR'S DROUGHT TASK FORCE

CLIMATE DIVISION	County	Irrigation District	NRCS - Resource Areas	Tribe	Short-term Indicators	Long-term Indicators
1	Mohave	<ul style="list-style-type: none"> • Lake Havasu IDD • Mohave WCD • Mohave Valley IDD 	<ul style="list-style-type: none"> • Upper Mojave Desert • Middle Mojave desert • Lower Mojave Desert • Upper Sonoran Desert • Middle Sonoran Desert • Colorado Plateau Sagebrush-Grasslands • Colorado Plateau Cold Desert Grassland • Grand Canyon Corridor • Colorado Plateau Pinyon-Juniper Sagebrush 	<ul style="list-style-type: none"> • Ft Mohave • Kaibab-Paiute • Hualapai 	<ul style="list-style-type: none"> • 3-month SPI • 6-month SPI • 12-month SPI 	<ul style="list-style-type: none"> • 24-month SPI • 36-month SPI • 48-month SPI • Lake Mead level • Big Sandy at Wikieup flow
2	Apache Coconino Navajo		<ul style="list-style-type: none"> • Colorado Plateau Grasslands and Pinyon-Juniper Savannahs • Colorado Plateau Cold Desert Shrubs – Grasslands • Colorado Plateau Sagebrush-Grasslands • Grand Canyon Corridor • Colorado Plateau Pinyon-Juniper Sagebrush • Colorado Plateau Pinyon-Juniper Sagebrush • Colorado Plateau Ponderosa Pine Forests • Colorado Plateau Mixed Conifer Forests • Mogollon Plateau Ponderosa and mixed Conifer Forests 	<ul style="list-style-type: none"> • Ft Apache • Havasupai • Hopi • Hualapai • Kaibab-Paiute • Navajo • Zuni Pueblo 	<ul style="list-style-type: none"> • 3-month SPI • 6-month SPI • 12-month SPI 	<ul style="list-style-type: none"> • 24-month SPI • 36-month SPI • 48-month SPI • Chinle Creek near Mexican Water flow • Paria River at Lees Ferry flow • Little Colorado River above Lyman Lake near St. Johns flow • Little Colorado River at Woodruff flow • Show Low Creek near Lakeside flow • East Fork White River near Fort Apache flow

GOVERNOR'S DROUGHT TASK FORCE

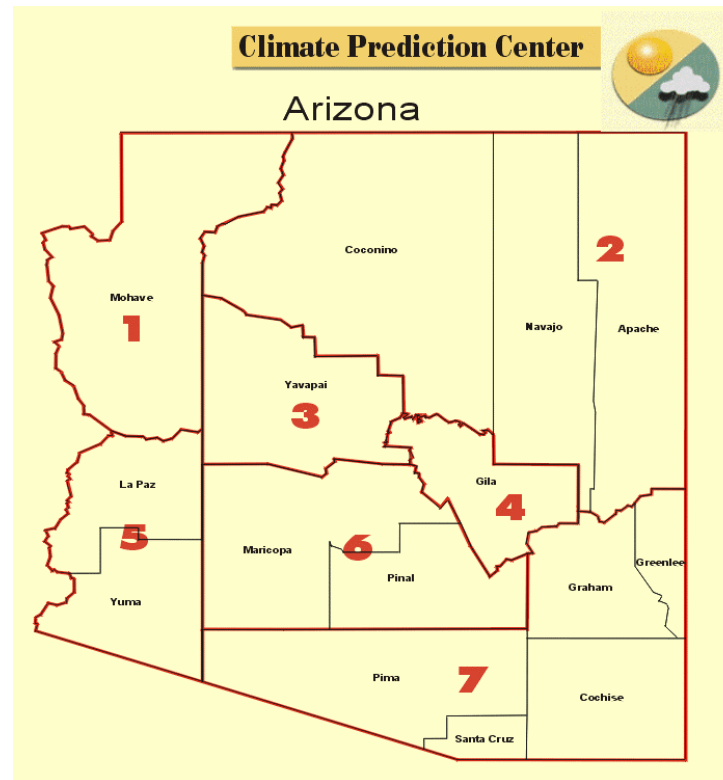
CLIMATE DIVISION	County	Irrigation District	NRCS - Resource Areas	Tribe	Short-term Indicators	Long-term Indicators
3	Yavapai	<ul style="list-style-type: none"> • Chino Valley ID 	<ul style="list-style-type: none"> • Upper Sonoran Desert • Colorado Plateau Pinyon-Juniper Sagebrush • Mogollon Transition Chaparral Grasslands • Mogollon Transition Pinyon-Juniper-Chaparral • Mogollon Transition Oak Pine Forests • Mogollon Plateau Ponderosa and mixed Conifer Forests 	<ul style="list-style-type: none"> • Camp Verde • Yavapai-Prescott 	<ul style="list-style-type: none"> • 3-month SPI • 6-month SPI • 12-month SPI 	<ul style="list-style-type: none"> • 24-month SPI • 36-month SPI • 48-month SPI • Verde River near Paulden flow • Verde River near Clarkdale flow • West Clear Creek near Camp Verde flow • Agua Fria River near Mayer flow • Verde River below Tangle Creek above Horseshoe Dam flow • Wet Bottom Creek near Childs flow
4	Gila		<ul style="list-style-type: none"> • Mogollon Transition Chaparral Grasslands • Mogollon Transition Pinyon-Juniper-Chaparral • Mogollon Transition Oak Pine Forests • Mogollon Plateau Ponderosa and mixed Conifer Forests • Mexican Oak-Pine Forest and Oak Savannah • 	<ul style="list-style-type: none"> • Ft Apache • San Carlos • Tonto Apache 	<ul style="list-style-type: none"> • 3-month SPI • 6-month SPI • 12-month SPI 	<ul style="list-style-type: none"> • 24-month SPI • 36-month SPI • 48-month SPI • Salt River near Roosevelt flow • Tonto Creek above Gun Creek near Roosevelt flow
5	La Paz Yuma	<ul style="list-style-type: none"> • Aguila ID • Cibola Valley IDD • Highlander C IDD • McMullen Valley • North Gila Valley IDD • Yuma County Water Users • Yuma ID • Yuma-Mesa IDD • Unit B IDD • Wellton-Mohawk IDD 	<ul style="list-style-type: none"> • Middle Sonoran Desert • Lower Sonoran Desert 	<ul style="list-style-type: none"> • Cocopah • Colorado River Indian Tribes • Fort Yuma 	<ul style="list-style-type: none"> • 3-month SPI • 6-month SPI • 12-month SPI 	<ul style="list-style-type: none"> • 24-month SPI • 36-month SPI • 48-month SPI

GOVERNOR'S DROUGHT TASK FORCE

CLIMATE DIVISION	County	Irrigation District	NRCS - Resource Areas	Tribe	Short-term Indicators	Long-term Indicators
6	Maricopa Pinal	<ul style="list-style-type: none"> • Aguila ID • Arlington ID • Adaman IWDD • Buckeye WCDD • Chandler Heights IDD • Clearwater Farms I • Clearwater farms II • Harquahala Valley IDD • Maricopa Water District • New Magma IDD • Peninsula Ditch ID • Queen Creek ID • Roosevelt WCD • Roosevelt ID • Salt River Project • St Johns ID • San Tan ID • Sun Valley Farms (II, IV, VII) • Tonopah ID • Central Arizona IDD • Hohokam IDD • Maricopa-Stanfield IDD • Papago Butte WD • San Carlos IDD 	<ul style="list-style-type: none"> • Upper Sonoran Desert • Middle Sonoran Desert • Lower Sonoran Desert • Mogollon Transition Chaparral Grasslands • Mogollon Transition Pinyon-Juniper-Chaparral • Mexican Oak-Pine Forest and Oak Savannah • Chihuahuan-Sonoran Semi-Desert Grasslands 	<ul style="list-style-type: none"> • Ak-Chin • Ft McDowell • Gila Bend • Gila River • Salt River Pima-Maricopa • San Carlos • Tohono O'odham 	<ul style="list-style-type: none"> • 3-month SPI • 6-month SPI • 12-month SPI 	<ul style="list-style-type: none"> • 24-month SPI • 36-month SPI • 48-month SPI • Aravaipa Creek near Mammoth flow • Santa Cruz River near Laveen flow • Sycamore Creek near Fort McDowell flow

GOVERNOR’S DROUGHT TASK FORCE

CLIMATE DIVISION	County	Irrigation District	NRCS - Resource Areas	Tribe	Short-term Indicators	Long-term Indicators
7	Cochise Graham Greenlee Pima Santa Cruz	<ul style="list-style-type: none"> • Avra Valley ID • Cotaro-Marana ID • Farmer’s Investment Co. • Franklin ID • Duncan – Virden Valley Consolidated Canal Co. • Pomerene WUA 	<ul style="list-style-type: none"> • Upper Sonoran Desert • Middle Sonoran Desert • Lower Sonoran Desert • Mogollon Transition Chaparral Grasslands • Mogollon Transition Pinyon-Juniper-Chaparral • Mogollon Transition Oak Pine Forests • Mogollon Plateau Ponderosa and mixed Conifer Forests • Mexican Oak-Pine Forest and Oak Savannah • Chihuahuan-Sonoran Desert Shrubs • Chihuahuan-Sonoran Semi-Desert Grasslands 	<ul style="list-style-type: none"> • Pasqua-Yaqui • San Carlos • San Xavier • Tohono O’odham 	<ul style="list-style-type: none"> • 3-month SPI • 6-month SPI • 12-month SPI 	<ul style="list-style-type: none"> • 24-month SPI • 36-month SPI • 48-month SPI • Blue River near Clifton flow • San Francisco River at Clifton flow • Gila River at head of valley near Solomon • San Pedro River at Palominas • San Pedro River at Charleston • Aravaipa Creek near Mammoth • Santa Cruz River near Lochiel • Leslie Creek near McNeal



GOVERNOR'S DROUGHT TASK FORCE

**APPENDIX VII
DEVELOPING AND IMPLEMENTING
A WATER PROVIDER DROUGHT PLAN**

GOVERNOR'S DROUGHT TASK FORCE

Developing and Implementing a Municipal Water Provider Drought Plan

INTRODUCTION

Having a drought response plan has become increasingly important for municipal water providers throughout the state of Arizona. This section provides a brief overview of the components of a drought plan, and identifies the steps necessary for developing and implementing (if necessary) a drought response plan for their water service area.

Utilities are increasingly discovering the need to develop drought response plans in preparation for the unusually dry conditions that we are currently experiencing in Arizona. Every drought response plan has certain key elements that are universal.

A drought response plan typically defines increasingly severe levels of drought based upon the amount of water demand reduction required to meet available supplies. These levels of drought are triggered by various reductions in available supplies. The triggers can vary depending upon the type and reliability of available water supplies. The State has proposed its own trigger levels for each Climate Division of the State. These can be used as guidelines for local communities.

A drought response plan should also contain descriptions of the measures proposed to reduce water demand at each drought level. These measures typically move from less stringent to more stringent and from voluntary to mandatory. The plan should also describe the mechanisms that will be used to enforce compliance with the mandatory water use reduction measures.

SYSTEM AND SUPPLY INVENTORY

In order to determine the impact that a drought will have on a municipal water system, a utility first needs to inventory the water supplies available, and the infrastructure to deliver them to customers. Water supplies should be reviewed from a “worst case” scenario. For surface water supplies, the history of flows should be examined, paying particular attention to those years when the lowest deliveries were reported. This is a good place to start for planning. However, this may not cover all bases, as extraordinarily dry conditions may lead to unforeseen delivery reductions, as happened in 2003 when Salt River Project reduced its water deliveries by one-third to its shareholders in the metro Phoenix area.

When looking at the “worst case” well supply, consider a couple of things. First of all, consider what would happen and what could be done if all groundwater wells became unreliable due to declining water levels. Then consider what would happen if only a portion of the well supply was lost. The amount of system storage available must also be considered when planning for supply shortage conditions. An emergency response plan may be a valuable tool in assessing the vulnerability of water providers.

As the availability of water supplies is assessed, the water provider should also look at unique local conditions that may affect the ability to obtain reliable quantities of water. The Endangered Species Act (ESA) is increasingly affecting surface streams throughout the state. As endangered species become more prevalent in a stream stretch, their needs often compete with the needs of the human water users utilizing the same supply. In a time of shortage, it may be possible that a court could decide that the endangered species’ needs take precedence, requiring a water provider to leave water in a stream that could otherwise be used for meeting system demands.

Another limitation on supply availability in Arizona is the ban on transferring groundwater supplies between groundwater basins except in certain limited cases. This ban is an outgrowth of Phoenix area cities purchase of “water farms” in the 1980s, and was designed to ensure that groundwater supplies were left with the land. If a water provider is on the edge of a basin boundary, they may not be able to simply construct a new well in another basin and transport the additional water to their system. Groundwater basin maps are available at the Arizona Department of Water Resources office in Phoenix.

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The next step in developing a drought plan is to compare available “worst case” supplies to expected demands. This will help approximate how much water demand would need to be reduced in the event of drought. In addition to looking at average day demand, be sure to look at peak day and peak hour demand. It may be that a provider can supply average demand even without all of its wells if they have sufficient system storage, but that peak day and peak hour demands may drain storage tanks faster than their wells can refill them.

DROUGHT TRIGGERS

As the drought plan is developed, it will need to define trigger points to implement various levels of drought mitigation measures. These triggers will be very specific to the water supply system. Factors influencing drought triggers typically include: types of supplies, amount and location of water storage, distribution system capacities, and interconnections with other systems.

Very specific criteria exist for private water companies who apply for a Curtailment Tariff from the Arizona Corporation Commission (ACC). The ACC defines specific triggers and specific measures associated with each trigger. Their triggers are based upon the levels of storage capacity and/or amount of well capacity available. As storage capacity or well capacity decreases, the measures become more severe.

If a system relies on heavily on surface supplies, there are several factors to consider when developing trigger points. The first is rainfall. If rainfall levels are low, it is reasonable to expect that surface supplies will be lower at some point in the future. Rainfall is more of a factor if there is no reservoir storage available for the system's surface water supply.

The amount of streamflow is also an important factor to consider. This is again more important if a utility does not have reservoir storage available to carry itself over during short-term decreases in stream flow. The final factor to consider is the amount of reservoir storage remaining in surface supply reservoirs. Triggers based upon reservoir storage are typically set by the entity operating the reservoir, and are based both upon existing levels of reservoir storage and future expected runoff.

Groundwater supply triggers are much harder to define, because they are affected by much more than surface water drought. When looking at developing a drought trigger for groundwater supply usage, a utility will want to consider water level declines and well capacity reductions. At some point, as water levels decline, a utility will most likely determine that it is no longer economically feasible to deepen a well to follow the water, and therefore, it could run into a supply shortage. However, this may be due to many factors other than drought.

After considering all the above factors, the utility is ready to develop its “worst case” scenario. This is defined as the absolutely worst possible thing that a drought could do to the utility's water supply. It becomes the most severe stage or level of drought, with the most severe and mandatory demand reduction measures. Drought plans typically contain four stages, so once the worst case is defined, the other, less severe levels can be defined, until a normal, non-drought level is attained. These levels define the points at which the various drought response measures will be implemented.

DEMAND REDUCTION MEASURES

Once water use reductions to meet available supplies have been determined, a utility will need to define appropriate ways to reduce those water demands. Measures will differ from service area to service area, depending on the types of water use that are most common.

Some of the more common examples of water demand reduction measures are included in Attachment 1, which summarizes the components of a drought plan. Typical actions taken include reducing the amount of landscape irrigation by both residential and non-residential users, and offering water use audits to customers.

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Drought-related conservation measures must be easily enforceable. They should be things that a utility can keep track of without too much trouble. For example, if a utility limits or prohibits landscape watering, it should be done on days of the week when there are employees available to inspect for compliance. Don't prohibit watering on the weekends, when a utility may have to pay overtime.

Water utilities should also set a good example. Make sure the utility's water delivery system is in good repair before asking customers to cut water use. The system should be inspected for leaks and those found should be promptly repaired. Also, the utilities' own landscaping should be watered efficiently such that there is no perception of waste. Make sure all water department buildings are landscaped with low water use plants, and office plumbing fixtures utilize low flow devices. This will go a long way toward making any drought-related conservation measures more palatable to customers.

DROUGHT PLAN ENFORCEMENT

One of the greatest challenges of developing a drought plan is deciding upon how best to enforce it without stepping on too many toes. This component of the drought plan needs plenty of public comment during the plan development process.

If the utility is also a municipality, drought plan measures cannot be enforced without an ordinance. This ordinance gives the Council or City Manager or other designee the ability to declare drought, and the ability to enforce the drought plan. The ordinance will also describe the enforcement mechanisms. Typical mechanisms used for enforcement include citations, fines, water flow curtailment, or even cut off of water service for the most egregious offenders. The ordinance should, however, allow exceptions to the water use reduction measures for health and safety reasons, upon approval by the City Manager or other authority.

Levels of drought enforcement should gradually increase depending upon the severity of the offense, and the number of times that it has been repeated. For example, the first time a customer waters on a non-authorized day, they might get a warning. The second time, they might get a ticket and pay a fine. The third time, they might pay a bigger fine and have their water use curtailed. The fourth time, they might have their water turned off.

A private water company is required to apply to the ACC for a Curtailment Tariff and file a Curtailment Plan to enforce drought-related demand reduction measures. The ACC requires very specific measures at the different drought stages, gradually increasing in severity as drought worsens.

Deciding which personnel will enforce the drought ordinance or curtailment plan is difficult, especially in these financially strapped times, when everyone is doing more with less. It is usually recommended to utilize code enforcement or law enforcement personnel, as they have the specific training in documentation of violations, which may be required in the case of a repeat offender who is going to court. Should other types of personnel be utilized, it is important that they have training in documenting cases and dealing with the public.

The final thing to consider when developing an enforcement strategy for a drought plan is the cost of enforcement. (e.g., How will the utility pay for the "lawn watering police"?) Many utilities implement a drought surcharge or curtailment tariff to offset the costs of regular inspections and enforcement proceedings. As a drought plan is developed, the utility will need to work closely with the agencies and others who will be enforcing it to keep a handle on both costs and staff requirements. This will ensure that if it becomes necessary to implement such a plan, unexpected surprises are minimized.

PUBLIC INVOLVEMENT

Public information and education programs are one of the most important components of the plan development process. The utility should identify the groups of people that will be affected by the drought plan and develop a strategy for communicating with and involving each of them. One good way to get started with this is to designate one person within your organization as the “drought liaison” – the person that everyone goes to for drought information. This could be a public information officer or a water conservation person or could simply be someone from the utility’s office staff.

The group that will be most directly affected by the utility’s drought plan is their customers. Implementing the drought plan will affect both their homes and businesses, so they need to be involved in plan development from a very early stage. Keep them informed and enlist their help in developing plans to save water and respond to drought. Often they will come up with ideas that the utility staff may not have considered.

The utility’s board of directors or City Council must also be kept up to date. They may not be interested in the details as the plan is being developed, but will certainly want to have input into the finished product. They also will want to be aware of what is being proposed so as to address potential political ramifications.

It may be helpful to convene a small working group of concerned citizens and community members to help with plan development. They can serve as a sounding board, and as a resource for new programs and concepts. If they buy into the plan as it is being developed, they can also serve as strong advocates for the need for the plan within the community once the plan is completed.

Once a draft of the plan is completed, public meetings and workshops should be held to explain the plan within the community. Take advantage of opportunities to speak to community groups and enlist their support. Talking to school groups has also proved to be effective in getting the message across. As you receive and incorporate public input, the utility’s governing board should be kept up to date.

As the impacts of the plan on the community are communicated, the need for the plan, and what will happen if a drought plan is not put in place should be explained. This helps customers understand that this is not something the utility is doing to complicate their lives.

In order for the drought plan to be effectively implemented, it should be publicly adopted by the utility’s governing board. Ample public notice of the meeting should be provided in order to give customers ample opportunity to comment and participate, though ideally all concerns should have been addressed before presenting the plan to them for approval. Official approval and public notification will make the plan more easily enforceable, as it will have the weight of official action.

IMPLEMENTING A DROUGHT PLAN

Implementing a drought plan is something any water provider hopes that they never have to do. In order for the plan to be effective in reducing water use, there are several things to keep in mind.

1. Have a communications plan.

When a utility’s drought plan is being prepared, it is hoped that either it will never need to be deployed or that the utility is in the middle of a drought the plan needs to be quickly implemented. Either way, the utility will need a communications strategy when the drought plan is implemented.

The communications strategy looks a lot like the strategy the utility used when it developed the plan in the first place. First, the utility should name a “drought liaison” to serve as the point of contact for drought related questions from your customers or from other employees.

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There are several audiences that the utility will want to reach with information about the drought plan and what exactly is underway. The utility's employees need to have a clear understanding of what's in the plan, and what their role is in enforcing it. For example, are they expected to write tickets? The best mechanism for this is to hold an employee meeting just before the drought plan is formally implemented. Introduce the drought liaison (if people don't know him/her already), and refer future questions to that person. Your governing body should also be briefed in a similar fashion.

As the drought plan is implemented, the most important audience to reach is the utility's water customers. There are many ways to publicize that a drought has been declared. Customers also must be told what they are expected to do. Experience has been that most people are willing to conserve if they perceive there is a real need to do so.

Make sure notice of the drought is adequately published, and that the name and contact information for the drought liaison appears prominently in any news release or media advisory. Use the print, radio, and television media if they are available and within the utility's budget. Media are always willing to carry an important story like upcoming drought restrictions.

Prepare fact sheets and talking points to use in communications with the media and with customers. Choose two or three points to consistently make, such as "we're ready" and fill in fact sheets around them. Talk about specific actions the utility is taking to prepare for the drought, impacts that the drought could have on the community if the drought plan isn't followed, and actions the customers are expected to take. Include these fact sheets as inserts in utility bills, if there is room. This is one way to be sure that every customer receives one.

Finally, a speaker's bureau of employees can be very useful in getting the word out. Make them available to speak at civic groups and service clubs. Depending on the audience, using line employees can be very effective in building relationships with the community, because they are perceived as "average Joes" and thus can have higher credibility.

2. Give your customers help & enforce the plan evenhandedly.

Implementing a drought plan will likely mean asking customers to take certain actions to conserve water. Give them as much help as possible. Provide staff assistance and water use audits if at all possible. Oftentimes, customers will want to save water, but will not know which actions to take. Provide conservation information and literature at the utility's business offices. Additional resources are also available via the internet. The "Water Use It Wisely" website (www.wateruseitwisely.com) has many conservation tips, and links to other conservation sites.

Consistent enforcement is critical as the mandatory stages of the drought plan are implemented. All provisions of the drought plan must be consistently equally enforced among customers; there can be no special treatment. Each application for a variance from the plan requirements must be scrutinized carefully, and consistent criteria must be used to evaluate each one. Obtain and complete documentation of the reasons for granting or denying the request in the event the decision is later challenged.

There are two ways to enforce the requirements of a drought management. One is proactive; the other is reactive. Proactive enforcement involves enforcement by water provider staff (such as meter readers) and/or local law enforcement personnel. This can be costly, in time spent getting staff properly trained, and in time spent away from other duties. However, it has the benefit of being much more likely to be perceived as evenhanded and fair.

Reactive enforcement relies upon citizens and customers to report violations, with follow up by the water provider. This has the benefit of being less costly than the alternative of using in house staff, but does have the potential for uneven and unfair enforcement, as neighbors may use the excuse of drought

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management to settle old grudges. Therefore, choose to use reactive enforcement only if you have no other alternatives.

CONCLUSIONS

A water supply drought is something no municipal water provider wants to implement. Utilities don't want to admit they might not be able to deliver water or maintain water pressure. However, if a utility plans their drought response in advance and keeps the public informed about what's going on, the negative impacts of declaring a drought should be minimal.

REFERENCES

American Water Works Association www.awwa.org

- Handbook: Drought Management Planning
- Small systems forum
- www.waterwiser.com

Arizona Water Pollution Control Association (www.awpca.org) - Circuit riders program conservation information.

Water Use It Wisely (www.wateruseitwisely.com)

APPENDIX VIII

ARIZONA DROUGHT PREPAREDNESS PLAN AGENCY RESPONSIBILITIES

[NOTE: THIS NEEDS TO BE FLESHED OUT MORE SUCCINCTLY WITH THE AGENCIES AND WILL BE BASED ON THE RESPONSE TO THE PROPOSED STRUCTURE THAT IS INCLUDED IN THIS PLAN – PENDING]

GOVERNOR'S DROUGHT TASK FORCE

AGENCY RESPONSIBILITIES – Arizona Drought Preparedness Plan

STATE AGENCY	SPECIALIZATION			
Governor's Office				
Department of Agriculture				
Department of Commerce				
Department of Commerce				
Corporation Commission				
Department of Economic Security				
Department of Education				
Division of Emergency Management				
Department of Environmental Quality				
Game and Fish Department				
Department of Health Services				
Commission on Indian Affairs				
State Land Department				
State Parks				
Office of Tourism				
Department of Transportation				
Water Banking Authority				
Water Infrastructure Finance Authority				
Department of Water Resources				

ADDITIONAL ASSISTANCE				
OTHER AGENCY/ORGANIZATIONS				
US Bureau of Land Management				
US Bureau of Reclamation				
Central Arizona Project				
UofA Cooperative Extension				
US Fish & Wildlife Service				
US Forest Service				
US Bureau on Indian Affairs				
US Geological Survey				
National Park Service				
National Weather Service				
State Climatologist				
State Universities				