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A Model for Western State Drought Response and Planning

Prepared by the Staff of the
Western States Water Council

A MODEL FOR

WESTERN STATE DROUGHT RESPONSE AND PLANNING

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WESTERN STATE DROUGHT RESPONSE AND PLANNING

INTRODUCTION

The Western States Water Council

For over twenty years, the Western States Water Council has served western governors in developing a regional concensus on westwide water policy and planning initiatives. During the 1976-77 drought, the Western States Water Council was actively involved in state drought management and mitigation. Western governors designated the Council as the "lead" agency for regional drought policy and program development activities. The Council served as a clearinghouse for information about drought conditions, state drought-related mitigation and water conservation efforts, and federal assistance programs. The Council also published a periodic drought newsletter.

Further, the Council provided the core staff for the Western Regional Drought Action Task Force, which eventually included twenty-one states. The Drought Action Task Force was chaired by Governor Richard Lamm of Colorado, with Lieutenant Governor George Nye of Oklahoma as the alternate chair. Each of the twenty-one states named state drought coordinators, and a Task

Force representative, Dr. A. Barry Crawford, was assigned to Washington, D.C. There he worked closely with a White House drought coordinator. The Council staff was expanded to include a drought coordinator, and the offices in Salt Lake also housed other state and federal representatives, on temporary assignment.

The first staff level meeting of the Western Regional Drought Action Task Force was held in Salt Lake City on March 24, 1977. Further meetings of the Task Force and special workshops were held to assess drought-related impacts and address related problems. The Task Force also supported enactment of legislation providing federal drought assistance, published a Directory of Federal Drought Assistance,[1] and helped facilitate distribution of such assistance.

Unfortunately, while western states responded well to the drought crisis, potential mitigation measures often could not be implemented in a timely manner, and much of the state and federal government's response might better be categorized as relief activities. Preventive action can be far more effective in mitigating the impacts of a drought, or a series of dry years, than remedial emergency measures. A timely, effective, state government response can reduce the effects of drought by encouraging private initiative and facilitating local cooperative

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[1]Western Governors Policy Office (WESTPO), Directory of Federal Assistance, 1977

action. Western states learned about the importance of contingency planning from the 1976-77 experience, and one result was a recommendation that states "pre-package" drought response plans.[2]

Existing Western State Programs and Authority

Given the continuing threat of drought and its importance on a state and regional basis, the Western States Water Council compiled a report summarizing existing western state drought-related programs and response authority as an aid toward defining appropriate alternative state actions in managing future droughts. The report, Western State Drought Management (October 1986), found that there are many ongoing state programs for water development, management and conservation which address long-term needs and which can be particularly useful during drought (see Appendix II).

For example, nearly every western state supports some type of water development and/or water conservation program.[3] A

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[2]Western Governors Policy Office (WESTPO) Managing Resource Scarcity: Lessons from the Mid-Seventies Drought, Institute for Policy Research, August 1978, p.4.

[3]Western States Water Council, State/Federal Financing and Western Water Resource Development, 1984 Update, and Water Conservation and Western Water Resource Management, December 1983.

federal/state study of weather modification in Utah highlighted its use during drought as a feasible option for augmenting water supplies.[4] The Idaho Water Resources Board operates a water bank program which encourages exchanges by helping market stored waters.[5] Montana can reserve water for specific future uses.[6] State-sponsored academic institutions and state agencies also support drought-related research and education programs which may help moderate adverse impacts.

While an emergency drought management plan will generally focus on short-term responses, long-range programs and planning are very important. Drought should be considered as part of an overall state water management program which promotes and supports water conservation, along with necessary water development, to effectively address future problems and avoid or mitigate adverse social, economic and environmental impacts.

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[4]Utah Department of Natural Resources, Development of Contingency Plans and Scientific Background Studies for Applying Weather Modification During Drought Periods in Utah, Division of Water Resources, December 1982.

[5]Idaho Code Sections 42-1761 through 42-1766.

[6]Chapter No. 573, Montana Session Laws 1985, House Bill No. 680.

The Appropriation Doctrine

The Appropriation Doctrine itself is a dynamic state institutional mechanism for the efficient and equitable allocation of scarce water resources (see Appendix I). First, any right to water use is generally defined by actually putting it to "beneficial use." Beneficial use is often defined by listing allowable uses, and it is usually circumscribed by traditional norms as to what is viewed as reasonable use. Western states have also explicitly prohibited the waste of water. Second, a water right is only a right to use a quantity of water, where water is available, and it can be lost if not put to beneficial use. This fundamental concept is known as the "use it or lose it" principle. The waters of western states, whether in streams, rivers, lakes, or underground aquifers, are public property (with a few exceptions). The state is responsible for their allocation and distribution for use in accordance with constitutional and statutory requirements. Third, water use is administered under the queing principle of "first in time, first in right." Simply put, the earlier or senior appropriator, generally determined by the date of filing for use with the state or actually diverting and putting water to beneficial use, has priority over water use by later or junior appropriators.

With respect to water conservation and drought, the active enforcement of the above principles can effectively promote efficient water use. However, the interaction of these principles may also result in complex management problems. Conservation measures must be evaluated in terms of equity, given existing water rights, as well as efficiency. While some changes in state statutes could expedite water use changes during drought, in general existing codes are sufficiently flexible under ordinary circumstances to meet most needs.

For example, every western state's water code provides for the transfer of water rights (often from lower to higher economic uses). The states can take various steps to encourage water marketing, particularly during drought. Most states also allow temporary transfers and/or appropriations for some water uses. California and Washington have specifically allowed temporary water use to meet drought-related emergencies. Clearly defining existing water rights helps facilitate transfers and new appropriations, and some states have active adjudication programs. Lastly, every state's water code prohibits "waste." During drought, enforcement activities would likely be increased as complaints arise due to public awareness of the emergency.

State Emergency Powers

Every state has general emergency planning and response authority. A disaster or emergency response agency provides the governor's office support and is generally responsible for planning and implementing emergency response activities. Occasionally, the governor's office or another state agency may assume primary authority for drought response, but as a general rule, the state disaster or emergency services agency is the central agency for coordinating state agency action, local activities, and federal assistance. In Colorado, Oregon and South Dakota, drought management plans explicitly supplement broader emergency or disaster planning documents. The primary purpose of state emergency management activities is to supplement, when necessary, private and local resources and abilities. Of note, California, Oregon, and Texas have authority (under certain circumstances) to require local conservation and contingency plans.

Each state provides the governor with emergency management powers. To protect the public welfare, a governor may issue a disaster or emergency declaration under which he has authority to issue executive orders which have the force of law. Further, he may also suspend procedural requirements under state law that are an impediment to effective emergency response. Conceivably, a governor might therefore suspend usual notice and hearing

requirements to expedite and facilitate essential water right transfers. He could not suspend substantive constitutional or statutory protections for individual rights. However, in a crisis, the governor also has authority to take private property for public use, subject to just and reasonable compensation. Arguably, as private property, he could "take" water rights. To date, no state has found such extreme action necessary in response to a drought. Each governor also has access to some, though limited, general emergency funds, and a few states have provided specific disaster-related loans and grants.

State Drought Response Planning

Obviously, drought planning and response must be considered as part of broader state water and emergency management and planning efforts. State water management programs generally encourage the development of new water supplies to meet the demands of a growing population and an ever increasing number of uses. The states' drought response will generally involve managing demands given temporarily restricted water supplies. However, it also involves much more than water management, as the potential impacts of drought affect a broad range of interests covering energy supplies, recreation, tourism, wildfire, and other concerns. An extreme drought incidence may require

extraordinary state measures. However, only Colorado, Montana, North Dakota, Oregon and South Dakota have definitive drought response plans or documents.

In order to help western states effectively respond to future drought problems, the Western States Water Council prepared the following model state drought response plan. As part of this effort, the Council sponsored a workshop on State Drought Management and Response in Salt Lake City on March 26-27, 1987. Forty federal, state and local representatives from thirteen western states attended. Participants included the U.S. Department of Agriculture, the U.S. Bureau of Reclamation and various state agencies with responsibility for water resources, emergency services, economic development, land, forestry and fish and wildlife. Further, some water user groups participated. Meeting in small groups and as a whole, those in attendance discussed drought prediction, data collection and monitoring, intergovernmental cooperation, public information, and various potential impacts and possible mitigation measures. The model state drought response plan to be presented is based on past western state experiences, the Western States Water Council report on state programs, input derived through the workshop, and other comments from interested groups and individuals.

MODEL STATE PLAN OUTLINE

It should again be stressed that primary responsibility for drought response must remain with the individual, followed by local cooperative action, and then state and federal assistance. Hopefully, this model drought response plan will help provide an orderly system for activating the state response, when necessary and appropriate, as well as coordinating regional and federal efforts. Rather than a "turn-key" type plan, it is a model that each state will have to adapt to its own specific needs and institutional structure.

To preview the more detailed discussion which follows, a comprehensive state drought management plan should ideally include certain key provisions. As drought is a gradually developing phenomenon, a phased approach is perhaps most useful and appropriate. Drought must be defined and some measure identified which triggers specific state action. Generally, this should involve some accepted quantitative measure, such as the Palmer Drought Severity Index, as opposed to a more subjective determination. There should be some type of early warning or monitoring system, as well as a means of identifying and assessing potential drought impacts. This should include a formal process to gather and disseminate information and educate the public. Sound decisions require accurate and timely

information. State policies and precedures and intergovernmental assessment and response responsibilities should be defined. There should be a central response center that involves key state agency officials. Further, intergovernmental and private efforts must be coordinated. It is important to involve community and local officials, various private interest groups and organizations, and federal resource and relief agencies. Other important activities under any plan involve identifying areas most vulnerable to drought impacts, taking inventory of state resources, defining state priorities, and developing potential alternative actions in advance of an emergency.

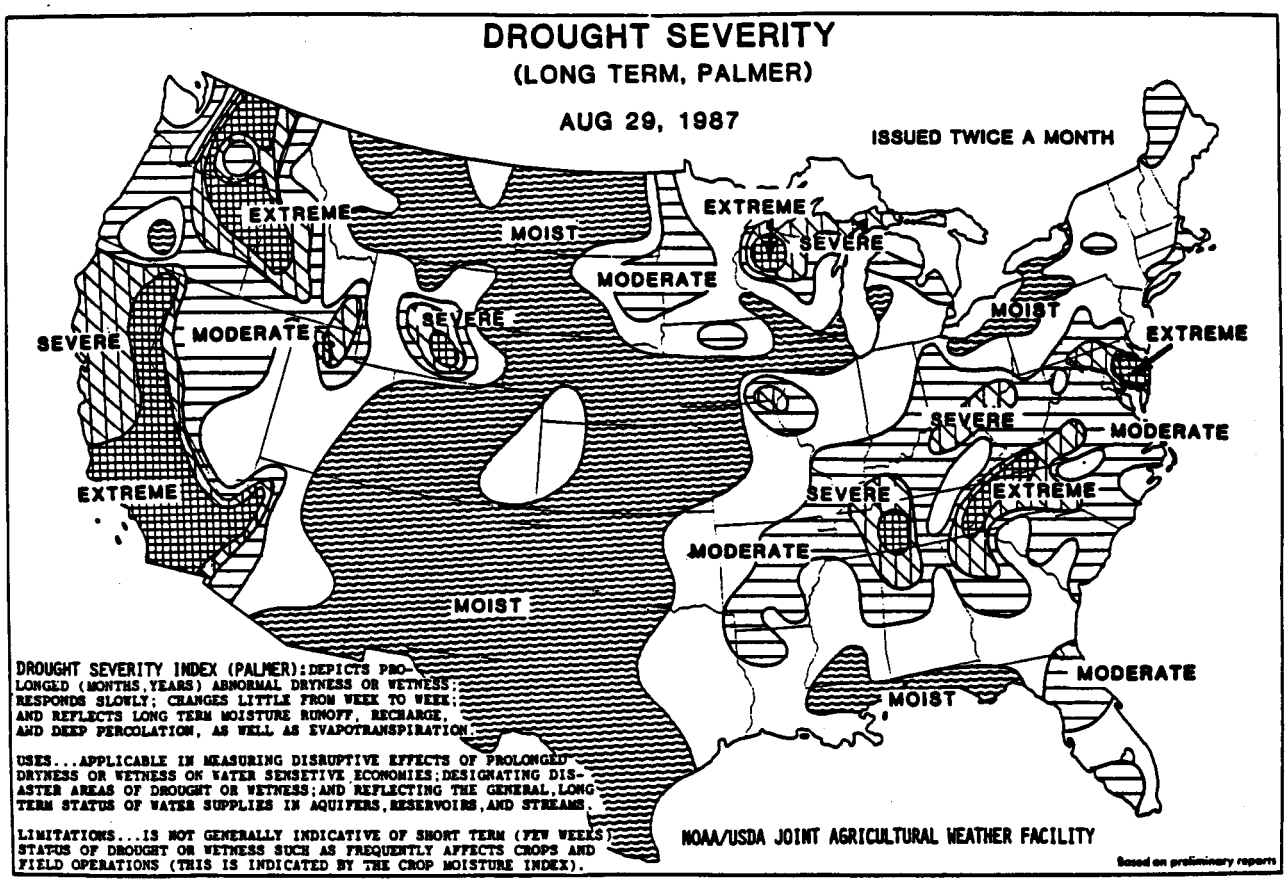
Defining Drought

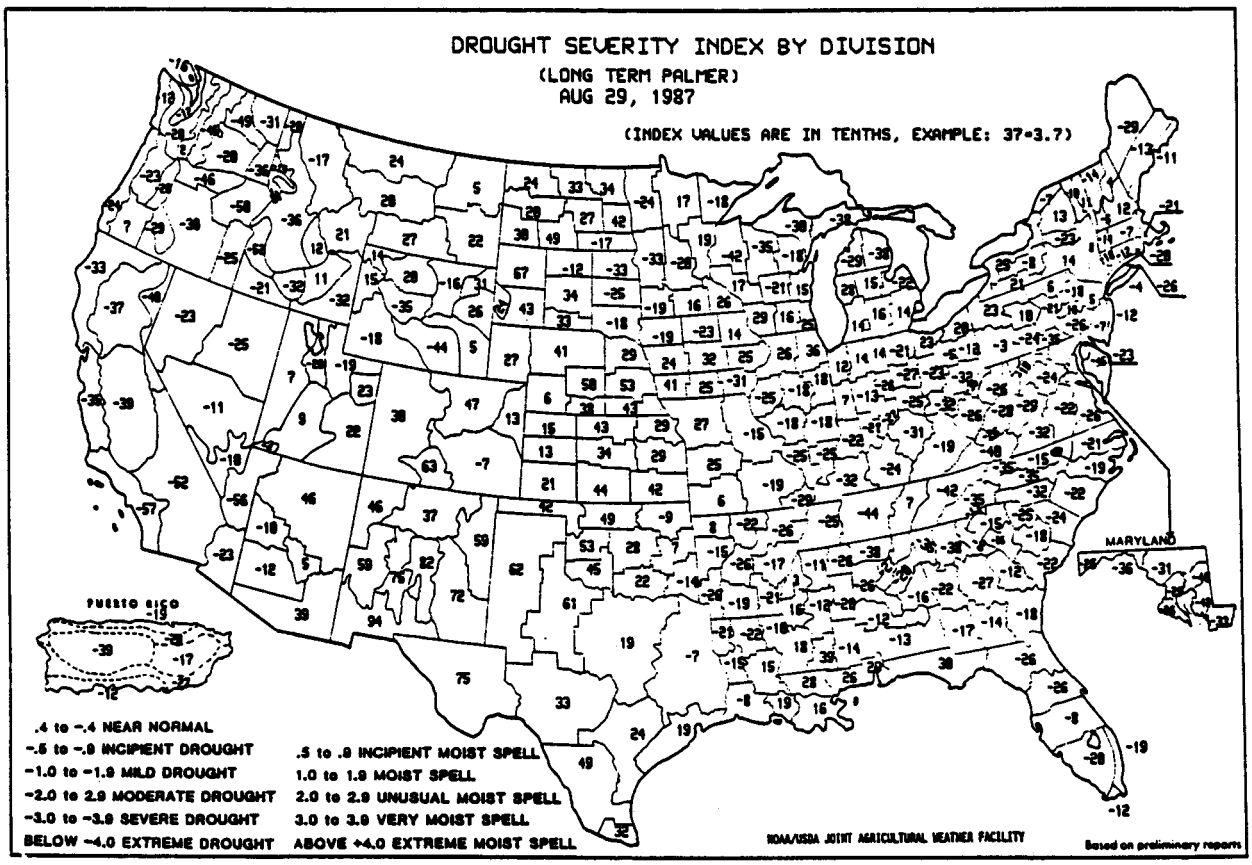
First, a comprehensive state plan must define drought. However, this is "easier said than done." There is no universally acceptable definition. Further, drought creates unusual management problems due to the uncertainty surrounding its occurrence, duration, magnitude and severity. The climatological and hydrological parameters of drought have been outlined in terms of precipitation, soil moisture, snowpack, runoff, recharge, evapotranspiration, and average temperature. There are several indices which employ such indicators to define and measure the intensity or severity of drought.

With respect to water resource management, drought must obviously be considered within the context of supply and demand. For example, a light winter snowfall in Alaska's southcentral lowlands caused the cancellation of the 1986 World Championship dogsled race during the Anchorage Fur Rendezvous for the first time in forty years. Still, the snowpack was ample to supply sufficient water supplies for all uses through the summer. Further, to some extent, drought is of lesser concern in the States of Arizona and New Mexico, where the use of surface streamflow is overshadowed by their dependence on groundwater resources -- which are affected much less by short-term variations in cyclical precipitation patterns. In general, drought may be viewed as a temporary state of disequilibrium, between water supplies and the demand for various uses, brought about by unusually dry climatic conditions.

However, for purposes of a state response plan, drought must be defined in terms of some comprehensive quantitative measure that may be used as an objective trigger for specific state action. The most widely used measure is the Palmer Drought Severity Index, which takes into account a number of hydrologic and climatic indicators. The Palmer Index uses a numerical scale generally ranging from +4 or "extremely" wet, to -4 or "extremely" dry. Its values are used in this model plan to trigger state action. Information on Palmer Index values are usually readily available from different federal agencies.

Therefore, it is also a convenient measure for communicating to the federal government how severe drought conditions may be in any single western state, or area of a state.





However, the Palmer Index may or may not be the best tool, and a state may wish to modify the Index to meet its needs. Other indices and specific hydrologic and climatic data, as well as field observations, should be used as corroborating information. Further, historic data must be considered. For example, a Palmer Index value of below -2.0 indicates a "moderate" drought. However, in many areas of the West this might be considered "normal," and no special state action would be required.

Drought Monitoring and Assessment

Once drought is defined, the next step in our model state plan is to monitor its potential development. Despite the availability of a number of theories, which interpret different data bases, the prediction of drought is generally considered to be in its experimental stages. A state cannot rely upon long-range predictions, but it must anticipate and prepare for drought in order to minimize losses and maximize mitigation opportunities. Therefore, an appropriate state plan must include a system which continually monitors what information is available. This process is designed to identify deteriorating water supply conditions very early, and begin to build governmental and public awareness of threatening conditions and potential future problems. The primary purpose of this continuous monitoring process is to provide enough lead time for state and local decisionmakers, as well as individuals, to take appropriate actions. Once a stream, a reservoir, or a well goes dry, it is too late to do much. State action should come long before the rains stop, water supplies disappear, crops fail, and farmers go bankrupt.

Preliminary monitoring should be undertaken by the State Disaster and Emergency Services Agency (DESA) (see page 22). The Agency should monitor information available through a number of federal agencies, including the National Weather Service, Soil

Conservation Service, U.S. Geological Survey, National Oceanic and Atmospheric Administration, Bureau of Reclamation, and Corps of Engineers. Information is also available from each State Climatologist and state water resource agencies (see pages 28-30). Under normal conditions, with positive Palmer Index values, DESA reviews available information for deteriorating conditions. Once a drought appears to emerge, at a Palmer value of 0 to -1.0, DESA discusses any trends with appropriate state and federal agency officials.

Under Phase I of the Assessment System (see p. 22), when the Palmer Index drops to between -1.0 and -2.0, or once the potential for a drought is apparent, DESA activates and chairs the **Water Supply Availability Committee** (SAC). Comprised of appropriate federal, state, and local agencies, some of which have already been mentioned above, this Committee continues to monitor trends, and serves as a reservoir of technical information for state and local decisionmakers, as well as an initial source of information for the public and the media.

Under Phase II, once the Palmer Index drops below -2.0 in any river basin--again assuming this is an abnormal condition--the SAC prepares for the Governor's signature a "Memorandum of Potential Drought Emergency." Once signed by the Governor, it activates the **Drought Review and Reporting Committee** (DRRC), chaired by the **State Drought Coordinator**, named by the Governor.

Other DRRC members include the chair of each of a number of State Drought Impact Task Forces, which the memorandum also activates to assess actual and potential impacts on the state's economy, the environment, and natural resources. Specific Impact Task Forces will be designated by each individual state plan, but should cover the following needs: (1) agriculture; (2) wildfire; (3) fish and wildlife; (4) recreation and tourism; (5) public water supplies; (6) energy; (7) economics; (8) water quality; (9) interstate commerce and navigation; and (10) others.

A **Lead State Agency** (LSA) is selected to chair each Impact Task Force. Meetings of each Task Force will be at the call of the chair, and the LSA representatives are authorized to respond to questions from the media or issue news releases concerning their specific areas of responsibility. The appropriate participating state agencies name an **agency drought coordinator**, and begin to assess various drought-related impacts and undertake whatever response is appropriate within available agency resources under their normal programs. Each Impact Task Force will: (a) identify potential and existing drought-related problems; (b) evaluate the severity of these problems and estimate related costs and potential losses; (c) assess state and local resources and capacity for response; and (d) determine residual unmet needs. The Impact Task Forces report their findings to DRRC, the designated Lead State Agencies, and with respect to data on economic losses, to the Economics Task Force.

Again, local governments and other public and private interest groups should be involved, in an advisory role, in each Task Force's activities.

The Drought Review and Reporting Committee (DRRC) will monitor progress of the Impact Task Forces, and evaluate the adequacy of task force reports and procedures. Further, DRRC will aggregate information from the individual Task Forces in order to develop its own assessments, projections and trends. DRRC will also oversee task force and intergovernmental coordination, including federal agency actions, and make timely reports on the status of the drought and response activities to the Governor, other state leaders, the media, and the public.

Drought Response System

Under Phase III, when the Palmer Drought Index falls below -3.0 (indicating a "severe" drought), or when the Drought Review and Reporting Committee (DRRC) determines that there are significant unmet needs which cannot be met within existing state resources, DRRC prepares for the Governor a "Drought Emergency Proclamation." Once signed, it activates the **State Drought Response Center** or Committee (DRC), which consists of senior managers in the Lead Response Agencies, and is chaired by the State Drought Coordinator. Other representatives may be designated as required. DRC assumes the "response"

responsibilites of the DRRC, including interagency and intergovernmental coordination and media relations. The same Lead State Agencies and other interests will generally be represented, so continuity of response efforts should be maintained. Decisionmaking will be at a higher level, with DRRC continuing assessment activities and providing advice and support. However, the Drought Response Center should have its own office space and staff, requiring the hiring of some additional administrative, clerical and public relations help.

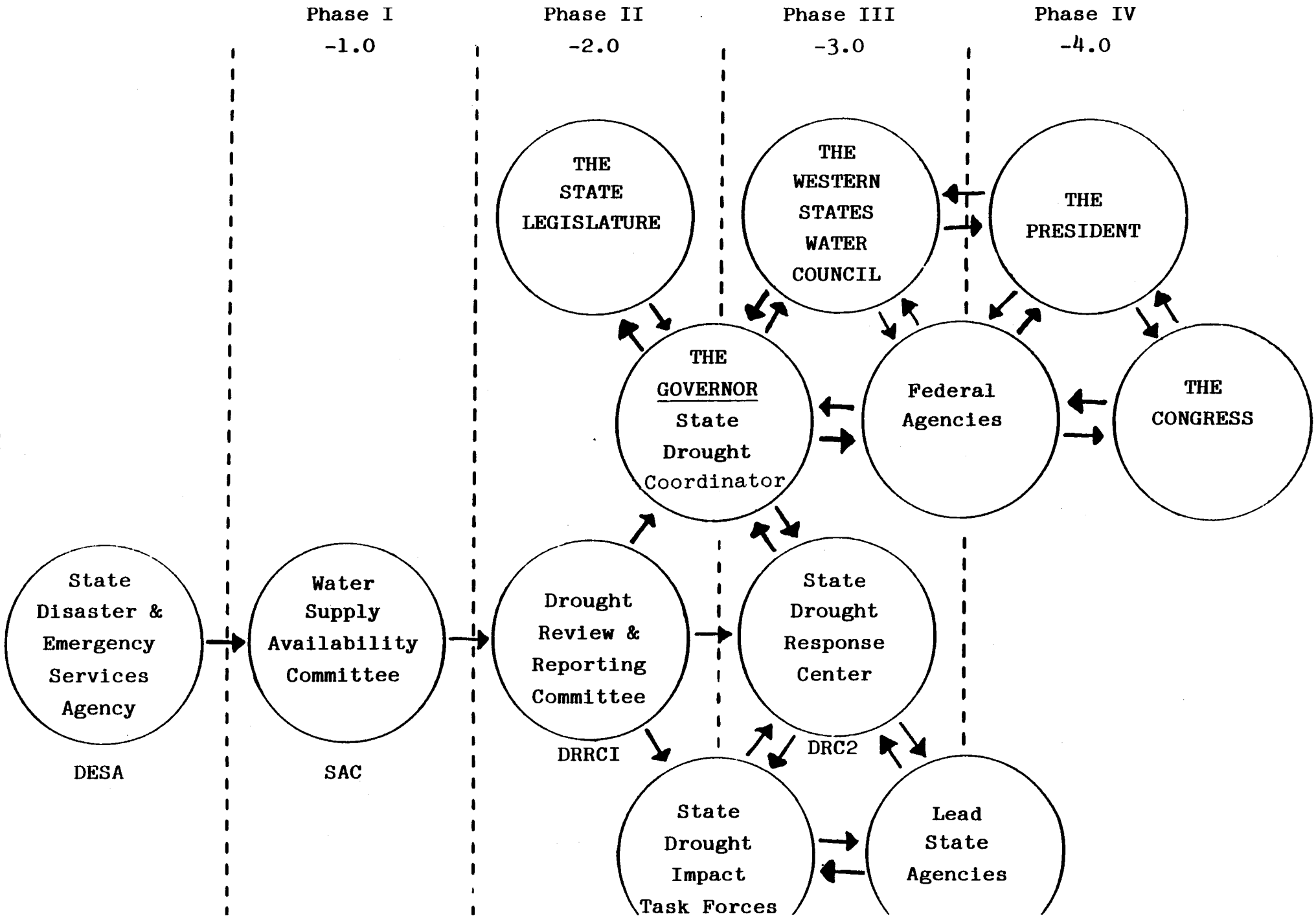
The Drought Response Center reviews DRRC statements of unmet needs, addresses potential solutions which may involve inter-departmental actions requiring the reallocation of state resources and coordinates private support. DRC provides general policy direction, and as appropriate makes policy recommendations to the Governor for his disposition, such as suggested legislative action and funding requests. The Center may also advise the Governor on the use of his emergency powers (see page 7). DRC also assembles the necessary data to support the Governor's request, if necessary, for a federal presidential disaster declaration. For purposes of federal assistance, the State Drought Coordinator would serve as the required contact with the Federal Emergency Management Agency and generally other federal agencies.

In summary, at this point in the plan, the Water Supply Availability Committee (SAC) is providing information on drought conditions to the Drought Review and Reporting Committee (DRRC) and the various State Drought Impact Task Forces. Each task force, in turn, provides impact assessment reports to DRRC and the Lead State Agencies, and also shares information with the other individual drought impact task forces. The State Drought Response Center or Committee (DRC) has been activated, and under its leadership, the DRRC continues to receive and compile information on unmet needs from the Impact Task Forces and individual Lead State Agencies. DRC makes interagency policy and resource allocation decisions and refers problems beyond the scope of its capabilities (with its recommendations) to the Governor. The Governor provides DRC with policy direction, and DRC in turn directs the Impact Task Forces and Lead State Agencies. The Governor deals with the State Legislature, where new authority and funding is necessary. Further, if needs exceed the resources of the State, the Governor may request federal disaster assistance (Phase IV).

Should the extent of the drought require a regional effort, the Western States Water Council would provide a forum for the exchange of information on drought conditions and mitigation strategies in western states and serve to coordinate regional efforts to secure federal assistance, including support for legislation to create new programs and/or expand funding.

As the drought subsides and the emergency passes, if continuing assistance requirements can be met within normal state administrative channels, the Drought Response Center prepares for the Governor's signature an "End to the Drought Emergency Proclamation." Then, prior to disbanding, the Center will prepare and issue a final report on its activities. The Drought Review and Reporting Committee again assumes primary responsibility for "response" activities and for interagency and intergovernmental coordination. Once the Palmer Drought Index reaches -1.0, or DRRC determines the emergency has passed, it issues a final report and disbands. The Water Supply Availability Committee will continue to function until the Palmer Index rises above -0.6, when the state plan returns to its monitoring status, under the State Disaster and Emergency Services Agency.

The flow chart on the next page graphically represents the interaction, during different phases of the model state drought response plan, of the various groups previously described. The next section outlines suggested operating procedures for each group within the plan.


Phase I
-1.0
Phase II
-2.0
Phase III
-3.0
Phase IV
-4.0
THE STATE LEGISLATURE
THE WESTERN STATES WATER COUNCIL
THE PRESIDENT
THE GOVERNOR State Drought Coordinator
Federal Agencies
THE CONGRESS
State Disaster & Emergency Services Agency
DESA
Water Supply Availability Committee
SAC
Drought Review & Reporting Committee
DRRCI
State Drought Response Center
DRC2
State Drought Impact Task Forces
Lead State Agencies

OPERATING PROCEDURES

The procedures outlined in this plan are designed to overcome, to the extent possible, potential obstacles to an effective state response by providing: (1) a timely assessment of information upon which to base decisions; (2) defined state policies and procedures for addressing drought situations; (3) specific mechanisms to coordinate intergovernmental and private response efforts; and (4) a specific means to trigger state actions to supplement private and local resources. The plan represents a process for addressing drought-related needs and facilitating mitigation, relief and recovery efforts. It is designed to effectively apply limited state resources as a drought develops. Given its duration and intensity, the drought may exceed the limitations on state resources, funding and emergency response capabilities. Therefore, the plan also addresses coordination of any necessary and appropriate federal response.

Once activated, each committee or task force and the Drought Response Center, as previously described, will meet at the call of the designated chairperson. The initial step will be to review the plan and suggested operating procedures and make any necessary revisions such as the frequency of meetings and/or reports, the format of reports, appropriate group membership and

advisory support, etc. Each appropriate state agency will name a drought coordinator. Further, special working teams may be formed to undertake specific tasks in a timely manner, which may tap the talents of any state agency, and as appropriate, private and local groups or federal agencies. Records will be kept of drought-related activities, and prior to deactivation, a final report will be written by each group. It will include an analysis of any obstacles to an effective state response which were encountered and suggested solutions to these problems.

No special compensation will be provided members of any team, committee, task force or the Drought Response Center. General administrative support, including personnel and materials, will be provided and the cost borne by the member agencies as appropriate. However, the Drought Response Center will require additional support, including its own staff, and emergency funds should be budgeted accordingly. Otherwise, requests for special funding will be reported to the Drought Review and Reporting Committee, which will make preliminary recommendations to the Drought Response Center. DRC in turn will either approve the request, or if it calls for the reallocation of state resources or new supplemental funding which is beyond the scope of its authority, DRC will forward the request to the Governor.

WATER SUPPLY AVAILABILITY COMMITTEE

TRIGGER: A Water Supply Availability Committee (SAC) will be activated by the Director of the State Disaster and Emergency Services Agency (DESA) when the Palmer Drought Index values drop below -1.0.

PURPOSE: The Water Supply Availability Committee will collect, evaluate and assess water availability data. Further, it will project trends, identify key areas of water shortage, and report its findings to the DESA Director, and once activated, the Drought Review and Reporting Committee (DRRC) and the various State Drought Impact Task Forces.

ORGANIZATION: The Committee will be comprised of representatives of the following state and federal agencies (which may be expanded to include new resource agencies as appropriate):

Disaster and Emergency Services Agency, Chair
Division of Water Resources and/or State Engineer
State Climatologist
Bureau of Land Management
National Weather Service
Soil Conservation Service
U. S. Geological Survey

Each of the above agencies will continue to publish and disseminate its normal reports, which are described on pages 28-30. The Committee will meet at the call of the Chair and first address any necessary changes in these operating procedures or the following action plan.

ACTION PLAN:

- Utilizing the various information sources of its members, the Committee will assess the following hydrologic and climatic parameters and project future conditions on a drainage basin and/or geographical/political subdivision basis:

  Precipitation

  Reservoir levels

  Snowpack

  Soil moisture

  Stream flow

  Temperatures

- Provide projections and assessments to the DRRC and Impact Task Forces using a specific, uniform format selected or developed by the Committee. These routine reports will be issued at least monthly.

- Provide supplemental and special reports as required in response to Impact Task Force requests or significant weather events.

- Coordinate data requirements of the DRRC, Impact Task Forces and Lead Response Agencies.

- Identify and seek to resolve information gaps and other impediments to accurate and timely reports.

Water Availability Information

(Given Present and/or Potential Agency Capabilities and Reports)

Division of Water Resources and/or State Engineer

- Data on current water uses including diversions, decreed rights, and reservoir storage levels.

- Streamflow field observations and reservoir capacity projections.

- Ground water use data and projections.

- Development of water rights inventories using infrared aerial photography.

State Climatologist

- Monthly climate reports covering precipitation and temperature, compared to historic norms.

- Capacity to develop probability projections based on historical records.

Bureau of Land Management

- Historic climatic data for planning districts within the state.

- Site-specific data maintained at the district level.

U. S. Bureau of Reclamation

- Reservoir storage and release information and projections.

National Weather Service

- Daily 3-5 day forecasts received around 2:15 p.m. MST.

- Extended 6-10 day temperature/precipitation outlook received around 10:00 a.m. MST on Monday, Wednesday and Friday.

- The following weekly reports:

  a. Crop Moisture Index, received around 10:00 a.m. MST on Tuesday.
  b. Drought severity chart, received around 4:50 p.m. MST on Tuesday.

c. Summary of daily temperature (heating degree day summary) and forecast received via teletype around 8:00 a.m. MST on Wednesday.

- Semi-monthly reports on the average monthly precipitation and temperature outlook for the next 30 days, received shortly after the 1st and 15th of the month; and streamflow outlooks.

- Monthly water supply outlooks, received around the 3rd to the 5th of the month; and 90-day temperature outlooks, received during the last week of the month.

U. S. Geological Survey (USGS)

- Statewide well measurements made on an annual basis and on a monthly basis for some areas.

- Stream guage data, based on reporting stations, with some telemetering.

- Streamflow, reservoir and ground water use modeling for some river basins.

- Joint federal/state programs and special projects.

DROUGHT REVIEW AND REPORTING COMMITTEE

TRIGGER: The Drought Review and Reporting Committee (DRRC) is activated by the Governor, in signing a "Memorandum of Potential Drought Emergency," as recommended by the Water Supply Availability Committee when the Palmer Index values drop below -2.0 and deteriorating conditions suggest a "moderate" drought is beginning to develop.

PURPOSE: DRRC will review projections of overall water supply conditions received from the Water Supply Availability Committee and aggregate and evaluate assessments of water demands and other needs prepared by the State Drought Impact Task Forces. DRRC will coordinate state drought response activities which can be undertaken within existing state program authority and funding. DRRC will make timely reports to the Governor, and recommend activation of the State Drought Response Center.

ORGANIZATION: The State Drought Coordinator chairs the Drought Review and Reporting Committee, with the Director of the Disaster and Emergency Services Agency as the vice-chair. Other DRRC members include the chair from each of the Lead State Agencies representing the various Drought Impact Task Forces, also created by the Governor's memorandum. Individual state agency drought

coordinators, as well as federal agencies and local government or private groups, may be invited to attend as observers. DRRC will meet at the call of the chair, or on a weekly basis.

ACTION PLAN:

- Review SAC assessments and projections.

- Review written assessments and projections of need prepared by the various State Drought Impact Task Forces.

- Aggregate these assessments and provide situation reports for the Governor, on a weekly basis, or as needed.

- Provide information to the public and the media.

- Coordinate initial interagency, local and private response within existing programs and resources.

- Prepare and recommend for the Governor's signature a "Drought Emergency Proclamation," once the Palmer Drought Index value drops to or below -3.0, or DRRC determines that growing needs require a state response beyond existing programs and funding.

- Provide weekly situation reports and other advice and support to the Drought Response Center, including recommendations regarding funding response activities.

- Prepare a final report of activities before disbanding.

DROUGHT RESPONSE CENTER

TRIGGER: The Drought Response Center (DRC) is activated by the Governor's "Drought Emergency Proclamation" as the Palmer Index value drops below -3.0, or it becomes obvious existing state resources, programs, funding and organizations are insufficient to deal with growing problems and needs.

PURPOSE: The Drought Response Center coordinates all relief activities, provides policy direction, and as appropriate recommends to the Governor, for his disposition, alternative state actions to address unmet needs.

ORGANIZATION: The Drought Response Center will be chaired by the State Drought Coordinator, representing the Governor, and will be composed of senior (cabinet level) officials of the Lead State Agencies (LSA's) representing the State Drought Impact Task Forces. Generally, it will be these senior officials, or their close subordinates, which chair the Task Forces and also sit as members of the Drought Review and Reporting Committee (DRRC). Other participants may be designated by the chair, as required, in an advisory capacity, including such federal agencies as the U. S. Department of Agriculture, Bureau of Reclamation, and Federal Emergency Management Agency. Other appropriate advisors may include local and private groups or individuals with specific

expertise or interests, such as major water utilities, academicians, environmentalists, and water user groups or other associations affected by the drought. Participation by such interests will be at the invitation of the chair, and may necessarily be limited so as to not overly inhibit decisive action by the Drought Response Center.

ACTION PLAN:

- Review periodic statements of unmet needs from the DRRC and Impact Task Forces, to be submitted in a uniform format.

- Request special reports from Impact Task Forces, as well as Lead State Drought Response Agencies and other sources.

- Identify alternative response actions, within the authority of the DRC membership, with respect to executive branch actions.

- Provide a weekly report, or as needed, to the Governor on unmet needs, reviewing DRC activities and recommending further executive action.

- Recommend to the Governor legislative action for new programs and/or increased funding.

- Provide general state policy direction.

- Coordinate outside support, public and private.

- Coordinate federal assistance, and prepare data to support, if necessary, the Governor's request for a Presidential disaster declaration.

- Coordinate public/press/media releases.

- Prepare for the Governor's signature an "End to the Drought Emergency" proclamation, as the drought subsides and continuing needs can be met within normal state administrative channels.

- Prepare a final report on its activities prior to disbanding.

STATE DROUGHT IMPACT TASK FORCES

With respect to the State Drought Impact Task Forces, minimum duties and activities are to include:

- Revise and update as necessary Task Force guidelines and procedures.

- Establish procedures for coordination with other task forces, federal agencies, local government, and/or other public and private groups.

- Identify key contacts in state, federal and private support groups.

- Develop a method and procedures for periodic contact with critical areas and/or groups.

- Create and utilize special working teams, as appropriate.

- Review existing reporting and analyzing capabilities.

- Identify information gaps.

- Assess the current and potential severity of impacts.

- Identify and inventory existing sources of assistance and available resources for response.

- Using this information, project impacts given various scenarios.

- Recommend response levels and activities.

- Estimate related costs.

- Analyze any barriers to response or special needs.

- Establish the format and process for making timely reports.

- Report to the DRRC and DRC in general on a monthly basis in a "moderate" drought, and on a weekly basis in a "severe" drought.

- Issue special reports as conditions warrant or upon request.

- Maintain supporting data and records of activities.

- Prepare a final report on activities.

Individual state agencies and advisory groups which make up each State Drought Impact Task Force should name an agency drought coordinator and by their own initiative take appropriate measures in response to drought-related problems. The timely implementation of effective measures by individual agencies should not be hindered by a strict review and approval process. Rather, the Impact Task Forces are to coordinate and facilitate individual agency actions and oversee cooperative efforts. In this regard, task force representatives must be able to speak for their agency and have authority to make reasonable commitments toward effective cooperation and coordination.

AGRICULTURE

TRIGGER: The Task Force is activated by the Governor.

PURPOSE: To promptly notify farmers and ranchers of potential drought conditions, assess and project likely impacts, identify alternative responses and sources of assistance and report data and recommendations to the Drought Review and Reporting Task Force or Drought Response Center.

LEAD STATE AGENCY: Department of Agriculture

ORGANIZATION: The Agriculture Task Force is chaired by the Department of Agriculture and should include the following state, federal and advisory groups:

Department of Agriculture
Cooperative Agricultural Extension Service
Division of Water Resources and/or State Engineer
Division of State Lands and Forestry
USDA State and County Emergency Boards
Bureau of Land Management
Bureau of Reclamation
Farm Bureau
State Grange

Soil Conservation District Association

Livestock, Feeders and Growers Associations

The Task Force will meet at the call of the chair and will coordinate individual agency or industry programs, augmenting such programs as necessary and appropriate. However, such programs do not require formal task force review and approval prior to implementation.

ACTION PLAN:

- Review available data sources.

- Review existing drought reports and analyze potential threats.

- Provide timely data to ranchers and farmers, state agencies and industry.

- Inventory available resources.

- Describe potential response activities and take appropriate actions.

- Assist in emergency livestock feeding and water hauling operations.

- Survey and monitor animal health and care.

- Operate and maintain hay-locater service.

- Coordinate ecomonic outlook reporting.

- Survey, evaluate and coordinate reponse to insect and pest problems.

- Oversee and coordinate intergovernmental and industry activities.

- Identify any gaps in these various programs and recommend action on unmet needs.

- Makes requests and recommendations with respect to emergency funding.

- Prepare a final task force report upon termination of activities.

WILDFIRE

TRIGGER: Activated by the Governor.

PURPOSE: To assess and address drought-related impacts due to the threat of wildfire.

LEAD STATE AGENCY: State Forester and/or Division of Lands.

ORGANIZATION: The Task Force will be chaired by the State Forester and/or Director of the State Lands Division and shall include representatives of the following agencies:

State Forester and/or Division of Lands
State Parks and Recreation Department
Division of Fish and Wildlife
State Disaster and Emergency Services Agency
National Guard
National Weather Service (Fire Weather Forecaster)
U.S. Forest Service
Bureau of Land Management
National Park Service
Bureau of Indian Affairs

The Task Force will meet at the call of the chair, which may designate other agency representatives. The Task Force will coordinate and augment existing wildfire protection activities. However, the Task Force will not require approval of corroborating agency actions, nor actually undertake fire suppression operations, with the exception of public information and education activities.

ACTION PLAN:

- Identify key personnel and contacts, as well as various agency policies, priorities and authority.

- Outline formal and/or informal information exchange systems.

- Collect and exchange data among agency representatives.

- Assess and project the extend and potential impact of wildfire threats.

- Review existing wildfire protection capabilities.

- Identify potential priorities for the allocation of scarce resources.

- Project the need for additional resources.

- Evaluate barriers to effective cooperation in wildfire protection.

- Provide technical planning and preparedness assistance.

- Devise a wildfire danger warning system for coordinated public education/information.

- Coordinate federal, state and local fire restrictions.

FISH AND WILDLIFE

TRIGGER: Activated by the Governor.

PURPOSE: To collect and evaluate data on fish and wildlife related impacts, project the potential severity of such impacts, and identify alternative mitigation measures and sources of assistance.

LEAD STATE AGENCY: Fish and Wildlife Division.

ORGANIZATION: Chaired by the Fish and Wildlife Division, the Task Force should also include representatives of the following agencies:

Department of Parks and Recreation
Bureau of Land Management
U.S. Fish and Wildlife Service
U.S. Forest Service

ACTION PLAN:

- Assess and project impacts on the State's fish and wildlife resources, including game and non-game species, as well as endangered species.

- Estimate potential short-term wildlife losses and make long-term projections, particularly with respect to state controlled land and waters.

- Recommend mitigation measures such as reservoir conservation pools, instream flows, construction of watering ponds, etc.

- Estimate funding and manpower requirements by project and species.

- Coordinate state and federal agency assistance as well as individual reservoir and ditch company cooperation.

- Review state held water rights for fish and wildlife, and the potential impact of reservoir releases on domestic and other needs.

- Coordinate public information releases.

RECREATION AND TOURISM

TRIGGER: Activated by the Governor.

PURPOSE: To assess the impact of drought on recreation and the State's tourism industry, and coordinate public and private efforts to avoid or mitigate economic losses.

LEAD STATE AGENCY: Division of Commerce and/or Tourism.

ORGANIZATION: The Task Force will be chaired by the Tourism Division with the following agencies represented:

Division of Parks and Recreation
Bureau of Land Management
Bureau of Reclamation
Corps of Engineers
National Park Service
U. S. Forest Service
Ski Industry
Hotel/Motel Association
County Governments
Federal Home Loan Administration

ACTION PLAN:

- Provide accurate and timely information on drought conditions and related recreation impacts to appropriate state agencies and especially the public.

- Develop and disseminate tourist information to the media and public on the existence, or lack thereof, of restrictions on visitation to specific areas.

- Develop and distribute information to offset tourism losses.

- Assist cities, counties and businesses with public relations initiatives.

- Compile and project visitation data, sales tax revenue, lodging receipts and employment impacts.

- Identify major commercial and industry specific problems and recommend solutions.

- Identify and expedite state and federal loan or loan guarantee programs to assist affected businesses.

PUBLIC WATER SUPPLY TASK FORCE

TRIGGER: Activated by the Governor.

PURPOSE: To ensure adequate supplies of potable water for essential domestic uses, as well as other municipal and industrial needs.

LEAD STATE AGENCY: Division of Public Water Supplies.

ORGANIZATION: Chaired by the Division of Public Water Supplies, the Task Force should include the following agencies and others by invitation:

Division of Public Water Supplies
Division of Water Resources and/or State Engineer
Division of Disaster and Emergency Services (DESA)
Department of Health
Public Service Commission
Municipal League and County Associations
County Extension Agents
Water District Associations
Fire Chief's Associations
USDA - Farmers Home Administration
Economic Development Administration
Army Corps of Engineers/Bureau of Reclamation

ACTION PLAN:

- Assess needs by reviewing available data.

- Develop a current list of problem areas.

- Provide water conservation program information.

- Provide technical assistance for operational changes, repair lines, etc.

- Facilitate, as necessary, approval of rate and operation changes.

- Provide emergency state grants and loans.

- Provide or coordinate water hauling services by the National Guard or private volunteers.

- Coordinate FmHA emergency assistance and other federal actions.

ENERGY

TRIGGER: Activated by the Governor.

PURPOSE: To assess the extent and impact of energy losses, due to reduced hydropower generation, and coordinate appropriate mitigation measures.

LEAD RESPONSE AGENCY: State Department of Energy

ORGANIZATION: Chaired by the Director of the State Department of Energy, the Energy Task Force should also include:

Public Service Commission
Division of Water Resources and/or State Engineer
Bonneville Power Administration or Western Power Administration, etc.
Federal Energy Regulatory Commission
Bureau of Reclamation
Corps of Engineers
Major utilities, cooperatives and related associations

ACTION PLAN:

- Assess and project energy related impacts due to reduced hydropower production, specifically identifying vulnerable areas or utilities.

- Monitor federal agency activities with respect to "power wheeling" and other activities.

- Address state utility rate increase requests as appropriate.

- Promote energy conservation.

- Project economic and environmental impacts of increased reliance on fossil-fueled power generation.

SITUATION: The generation and distribution of power is often an interstate activity undertaken by different federal agencies and power marketing administrations and regulated by the Federal Energy Regulatory Commission. The state role in addressing energy losses related to drought may be limited. However, it would be important to oversee federal activities, and the state might take an active role in promoting energy conservation. The

affect of the loss of hydropower generation capacity will vary from state to state, and is most significant in the Northwest and Coastal States of Idaho, Washington, Oregon, and California.

The Western Systems Coordinating Council (WSCC) is a public/private organization representing an interconnected network of utilities covering all or part of 14 western states. During the 1976-77 drought, the total generating capacity was 89,844 megawatts, with 40.4% in 937 conventional hydro units. Given interstate and international utility interconnections, transmission capability exists to meet foreseeable needs. Generating capacity and energy production is the main concern. Any hydro energy deficit would likely be absorbed by increased use of fossil-fuel generation, curtailment of interruptable loads, and conservation. Such changes in the energy mix would have some economic and environmental impacts as increased reliance on fossil-fueled generation could increase air pollution, raise rates, and affect jobs (as might curtailment of interruptable supplies). Energy conservation is another important alternative. Utility programs are most effective, and should be supported by the state.

ECONOMICS

TRIGGER: Activated by the Governor.

PURPOSE: To establish procedures and an organization to assess drought-related economic impacts and recommend and undertake specific responses.

LEAD STATE AGENCY: Office of Planning and Budget.

ORGANIZATION: The Task Force will be chaired by the Office of Planning and Budget and include representatives of the following agencies:

Department of Revenue
Department of Labor and Employment
Department of Agriculture
Department of Social Services
Division of Commerce
State Treasurer
Municipal League
Banking Industry

ACTION PLAN:

- Compile data and prepare assessment reports using resources of the member agencies.

- Evaluate and synthesize this data.

- Identify actual and potential economic impacts of drought by area of the state.

- Identify information gaps.

- Develop and employ an economic simulation model to project drought impacts.

- Identify specific counties or areas which have or will experience significant additional resource requirements, such as Social Services expenses.

- Identify actual or potential revenue losses by state and local governments.

- Recommend mitigation measures.

- Identify state and federal sources of financial assistance.

- Identify priority areas for additional state funding, and possible sources of funding.

- Monitor the costs incurred by state agencies responding to the drought.

- Coordinate public information releases concerning economic impacts.

APPENDIX I

THE APPROPRIATION DOCTRINE

The Appropriation Doctrine itself is a dynamic state institutional mechanism for the efficient and equitable allocation of scarce water resources. State-by-state variations of the basic doctrine address past and present needs, including drought. In essence, the appropriations doctrine consists of a few simple principles and concepts.

First, a right to water use generally is obtained by diverting water from its natural course, or withdrawing it from an underground aquifer, and putting it to "beneficial use." The diversion requirement has been modified by many states, and specific appropriations procedures have been outlined. Reasonable and beneficial use is the basis, measure, and limit of an appropriator's right. Generally, beneficial use has been defined by listing allowable uses.

Efficiency criteria are not usually expressly defined, rather traditional norms affect what is viewed as reasonable. However, allowable withdrawals may be set -- usually in cubic feet per second (cfs) or acre-feet (af) per acre. Excessive

water use or waste is implicitly prohibited under the Appropriation Doctrine. Further, many western states have also explicitly prohibited the waste of water.

Second, a water right is only a right to use a specific quantity of water, where water is available, and it can be lost if not put to beneficial use. This fundamental aspect is known as the "use it or lose it" principle. A water right acquired pursuant to the Appropriation Doctrine is both a real property right and a usufructuary right. In other words, it is generally an exclusive, valuable right which can be defined, sold, transferred, mortgaged and bequeathed. However, there is no ownership of the resource (vested water right) until it is actually diverted and continuously applied to a beneficial purpose over some period of time. The waters of the state, whether in streams, rivers, lakes, or underground aquifers, are public property (with a few exceptions). The state is responsible for their allocation and distribution for use in accordance with constitutional and statutory requirements. Further, any waters returning to the hydrologic system, such as irrigators' return flows and cities effluent flows, are usually the property of the state (not the user) and are again available for allocation. An appropriator only has a right to withdraw a decreed amount of water, which must be put to beneficial use.

Third, water use is administered under the queing principle of "first in time, first in right." Simply put, the earlier or senior appropriator, generally determined by the date of filing for use with the state or actually diverting and putting water to beneficial use, has priority over water use by later of junior appropriators. This traditional principle developed as an equitable basis for resolving conflicts among water users.

With respect to water conservation and drought, the interaction of these principles may result in complex management problems. Western states' water law is an important consideration in evaluating the potential desirability of any water conservation effort. Conservation measures must be evaluated in terms of equity, as well as efficiency. For example, specific water conservation measures may negatively impact other users. More important than the amount of water withdrawn for use is the amount actually consumed and therefore irrecoverable for further use. An upstream irrigator might install a sprinkling system to improve efficiency. However, if he increases his consumptive use and the water supply on which a downstream appropriator depends is reduced, causing injury, then the downstream appropriator may be able to seek a legal remedy to protect his right. Maximizing water conservation opportunities, while adequately protecting others water rights, is a complex and difficult state management problem.

Again, water right is one of use, and the states are ultimately responsible for protecting the "public interest." The state implicitly determines what constitutes the public interest in defining beneficial use and granting new appropriation applications. In practice, traditional methods of use are usually held to be reasonable. However, beneficial use may be reevaluated and redefined by the states in view of technological advances. This flexibility allows the law to address changing needs over time. As necessary demands grow, and public values change, western states have authority to strictly require more efficient use in the public interest. The Appropriation Doctrine provides the necessary authority for states to mandate conservation measures. How this authority is exercised largely depends on social and political standards. New standards can rather easily be applied in considering new appropriation applications. A much more difficult issue is the application of new efficiency criteria to existing uses represented by valid vested water rights.

Public interest considerations and criteria are imbedded in western state constitutions and water laws, which often explicitly establish public interest criteria which must be met in order to acquire a water right. Protecting and enhancing the public interest implicitly forms the basis for allocating water use, as well as maintaining some form of regulation, such as the "use it or lose it" principle. However, the Appropriation Doctrine is not a static institutional standard, but rather a

dynamic and complex body of law, based on simple principles which reflect social and political values, as well as legal rights. Many states are necessarily recognizing changing public values in water resource allocation and management. California, Idaho and other states are more carefully defining public interest considerations in the use of their waters.

In general, protection of the public interest has involved a prospective application of constitutional and statutory criteria established by the legislature and administered by the executive branch of state government. Vested water rights have not been taken by a state for public use, except through specific eminent domain proceedings, which mandate reasonable compensation for the owner. Still, western states have exercised their police powers to enforce prohibitions on waste and other reasonable water use restrictions, which affect how vested water rights may be exercised.

However, briefly, a developing legal theory called, the Public Trust Doctrine, based on common law and inherent sovereign power, dictates a state cannot alienate its fiduciary responsibility to protect the public interest in its water resources by granting any fee or property right interest to private parties which the state cannot revoke. Therefore, private water users cannot obtain vested water rights which the state cannot revoke, if necessary (and perhaps without compensation), to promote the public interest.

The doctrine is predominantly a judicial creation, though as described the public interest is protected by state constitutions, statutes and rules. Views on the issue range from the public trust as a legal fiction, created through an inappropriate exercise of legislative authority by the judiciary, to that of the public trust as a basic tenet of state water law and policy which provides an opportunity for reevaluating current water uses. The Public Trust Doctrine is an evolving precept which may affect future water use.

In National Audubon Society v. Superior Court of Alpine County, the California Supreme Court held that the Public Trust Doctrine and the State's appropriative water rights system are parts of an integrated system of California water law. The court noted, "Once the state has approved an appropriation, the public trust imposes a duty of continuing supervision over the taking and use of the appropriated water. In exercising its sovereign power to allocate water resources in the public interest, the state is not confined by past allocation decisions which may be incorrect in light of current knowledge or inconsistent with current needs."[7]

The potential implications with respect to water conservation and more efficient use are obvious. However, outside California the relationship between the Public Trust Doctrine and water use has yet to be defined. Using the doctrine

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[7]National Audubon Society v. Superior Court of Alpine County, 33 Cal. 3d 4190, modified at 33 Cal. 3rd 726a (1983).

to require change in traditional uses and methods of use would raise serious questions of equity and problems with political acceptability. Its utility in drought response will be limited.

Every state's water code provides for the transfer of water rights (often from lower to higher economic uses), and states can take various steps to encourage water marketing, particularly during drought. While water rights transfers almost always require public notice and often hearings, under certain circumstances approval can be formally or informally expedited. During drought, the length of transfer proceedings could be kept to the absolute statutory minimum. Most transfers could be approved within three to four weeks, assuming third party rights and/or the public interest are not adversely affected. Absent evidence of either of the latter, the State of Utah allows construction to begin (at the risk of the applicant) during the notice period. While some legal restrictions may impede transfers during drought, they are usually necessary to protect individual or public rights and cannot be suspended, though they might be modified to accommodate special needs.

Clearly defining existing water rights helps facilitate transfers. Some states have active adjudication programs. While some rights are based on specific statutory water use duties, most are quantified on a case-by-case basis using "beneficial use" as a measure of the right. Every state water code prohibits "waste," but defining and enforcing such provisions can be

difficult. Enforcement usually takes place on a site-specific basis in response to a complaint. During drought, enforcement activities would likely be increased as complaints increase due to public awareness of the emergency. Of note, during the 1976-77 drought, the California State Water Resources Control Board refused to allow the filling of a reservoir, developed in a residential area strictly for aesthetic purposes, finding it to be a wasteful and unreasonable use, given existing drought conditions.

Most states also allow temporary transfers and appropriations for specific water uses such as construction. The term of such temporary permits range from three months to three years. In the past, California and Washington have specifically allowed temporary water use to meet drought-related emergencies.

Where water demands are high, such as on fully appropriated streams, state water commissioners or watermasters have been named to strictly regulate diversions. When supplies are insufficient to meet demand, junior (in time) water rights may be suspended to meet senior needs. Some state statutes include preference provisions (generally for domestic, municipal or stock watering uses), which may supersede the usual allocation process based on "first in time, first in right." Further, small domestic users often are not required to obtain a state permit.

Every state allows municipalities to condemn and acquire water rights through eminent domain proceedings with "reasonable" or "just" compensation. However, during a short-term drought emergency, the length of the "due process" proceedings would likely limit the usefulness of this alternative. An unusual Texas statute allows municipal water users to be retroactively assigned a 1913 priority, and therefore the senior right, as against other subsequent appropriators for different uses.

While some changes in state statutes could expedite water use changes during drought, in general existing codes are sufficiently flexible under ordinary circumstances to meet most needs. Legislative changes can and have been made where physical necessity and public concern prompt political action.

APPENDIX II

WATER CONSERVATION PROGRAMS

Effective drought mitigation strategies require a long-term commitment to water conservation programs which will help avoid a crisis situation. The following suggestions relate to long-term programs and short-term opportunities for state and local action. Both "supply-side" and "demand-side" water conservation are discussed, as traditional water development, together with measures to reduce water use--often by increasing water use efficiency, must be part of comprehensive state and local water management plans and programs. The following suggestions are not an exhaustive list, but rather examples to stimulate imaginative problemsolving. It should be noted, water conservation opportunities can be difficult to quantify and implement given their complex nature.[8]

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[8] see Water Conservation and Western Water Resource Management, Western States Water Council, December 1983.

Supply-Side Water Conservation Programs

Supply-side water conservation may be defined as altering the natural physical and hydrologic environment to increase the availability of water for various uses.

Water Project Construction

Water resource development helped provide a foundation for settlement of the West, and cannot be overlooked as a necessary component of water supply management. During drought, reservoir storage is a critical resource upon which we all depend. In large measure, the effect of past, present and future droughts have been mitigated by the many federal, state, local and private projects. The construction of new water storage projects must be considered as a mitigation measure, although it is generally perceived as a means of satisfying growing demands, rather than as insurance against drought. Construction of a project must take into account the firm yield and anticipate sporadic shortages.

Weather Modification

Weather modification is a long-term alternative to help mitigate deteriorating drought conditions. It can have short-term benefits. Weather modification programs have proven to be

an effective means in many states of augmenting existing water supplies. Still, opportunities to enhance precipitation, through weather modification, decrease along with normal precipitation events during drought. Long-term studies are required in order to evaluate the usefulness of weather modification in specific areas. Further, it takes time to establish an effective program. It is not a matter of determining that, "in two weeks we would like to have 'x' amount of precipitation in 'y' drainage basin."

Using Water of Impaired Quality

Matching water uses with supplies of adequate quality is one alternative for greater efficiency. Promoting the use of sewage effluent to irrigate a golf course, or saline waters for powerplant cooling are examples, as is research, development and marketing of salt-tolerant crops. Water reuse is another possibility. Obviously, physical and institutional obstacles must be overcome and public acceptance encouraged. Both take time.

Vegetation Management

Managing watersheds to maximize yields is a long-term alternative which may produce a significant increase in the local water supply.

Vegetation management also includes demand-side water conservation measures. Water efficiency can be increased, and water demands reduced, by eliminating phreatophytes and hydrophytes to stop such irrecoverable water losses. However, the trade-off may be simultaneously reducing wildlife habitat and perhaps aesthetic benefits.

Demand-Side Water Conservation Programs

Demand-side water conservation may be defined as decreasing withdrawals and/or depletions by reducing demand, often through more efficient use of available water supplies.

Public Education

One of the most important aspects of any effective water conservation effort involves public education. Sound public information and education programs have generally proven to be highly successful in reducing water use (up to 30%) -- at least in the short-term. Every state supports public education, and most states have some type of water-related program. Some are very comprehensive and could be utilized to facilitate short-term public education activities in response to drought. For example, the State of Utah has a program to provide water-related information and educational aids to 8,000 teachers. Imagine what could be accomplished by these teachers during a drought on

behalf of the State. Actually, many of the present state water education programs were initiated in response to the 1976-77 drought. Support for such programs should be continued and perhaps expanded.

Water Pricing Policies and Metering

Municipal and utility, as well as agricultural, water rate structures can provide an effective pricing incentive for water conservation. However, rate structures cannot be set up overnight, and they often require prior approval (as by the Public Service Commission). Further, for pricing to be effective, the distribution system must be metered. Over the long-term, rates should generally reward lower consumption and declining block rates should be avoided.

During a drought, some purveyors may find themselves in the difficult circumstance of having to raise rates in order to meet fixed costs--given declining revenues as a result of lower water sales caused by short supplies and perhaps lower demand due to conservation measures. The consumer may actually end up paying more for less water.

Rationing

Rationing, such as alternate watering days, is an effective conservation measure. Both mandatory restrictions and calls for voluntary reductions in use can be effective. However, administrative difficulties and the high degree of voluntary compliance required usually make rationing practical only in emergencies. Municipal ordinances or other guidelines need to be in place to implement rationing fairly and smoothly.

Domestic Water Conservation Measures

Domestic water conservation measures are effective. In-home measures include the installation of retrofit devices such as toilet dams, shower flow controls, pressure regulators, faucet aerators, and water efficient appliances. The use of similar measures in new construction, sometimes required by building codes, can be even more effective. The capital costs of such measures can be a problem, but coupled with an appropriate public education and information program, domestic water use can be reduced significantly.

Dual Water Systems

Though not widely used, one potential conservation measure involves the use of dual water systems, which separate culinary water and water for outside use. Cistern and greywater systems, which collect rainwaters and household wastewater for application outside, are also an alternative to provide water for landscaping. However, the capital costs of installing special systems, along with potential health hazards, may make implementation impractical.

Landscaping

Landscaping accounts for a substantial portion of municipal or domestic water use in arid states, particularly during summer months. Various conservation measures have been employed to reduce outside water use. Studies have found that often much more water is applied to lawns than is necessary for optimal maintenance. Simply reducing lawn watering can be very effective. More efficient watering using sprinkler scheduling is also effective. Xeriscape or desert landscaping is another alternative, using relatively "unthirsty" native vegetation. There are important capital costs associated with improving water use in landscaping. Another major drawback relates to public

values and acceptance. Westerners enjoy a green yard, in an otherwise arid environment, and may be reluctant to reduce water usage if it will detract from the appearance of their homes.

Industrial Water Use

Industrial water use, including water for energy development, is another important aspect of western water conservation. Recirculation and reuse of cooling and process waters are effective. A detailed discussion of the many opportunities for industrial water conservation is beyond the scope of this report. However, one important alternative involves the use or reuse of water of impaired quality, including process water, treated wastewater and saline water. In addition to reducing water use or demands on potable supplies, this can result in waste treatment and/or disposal cost savings.

Agricultural Efficiency

Agriculture accounts for about 80% of the consumptive water use in the Nation, and it is thus often the focus of attention with respect to water conservation. However, much of the water "lost" by on-farm and off-farm distribution systems is ultimately recoverable for reuse and therefore conservation measures may not provide "new" water for additional uses. Still, various means of improving agricultural water use efficiency should be considered,

including: (1) lining, enclosing and consolidating canals, laterals and ditches to reduce or eliminate seepage and evaporation; (2) use of return flow and tailwater recovery systems to allow reuse of the water; and (3) increasing irrigation application efficiencies in order to provide a sufficient amount of water at the root zone to avoid plant stress, but no more. The latter may involve the installation of water control structures, sprinkler or drip irrigation systems, furrow dams, land leveling or contouring, soil moisture monitoring and irrigation scheduling, and improved tillage practices. Again, such actions require time to implement. They may require the purchase of new and specialized equipment, and training farmers to be comfortable with new ways.

Conjunctive Use

Conjunctive use of ground water and surface water supplies can be useful. Short-term variations in precipitation patterns affect ground water much less than surface streamflow. Therefore, ground water development can supplement surface supplies. There are other advantages to using aquifers as storage reservoirs. Again, conjunctive management of ground water and surface water resources must be arranged beforehand, and take into account all existing public and private rights.

Water Marketing, Transfers and Temporary Appropriations

Every western state provides for the transfer of water rights. Some states allow temporary transfers and appropriations. Others can expedite administrative notice and hearing procedures. Encouraging more efficient use of water through marketing, banking and transfer systems is one way to mitigate drought impacts. However, such actions and related negotiations take time before an agreement can be reached between the parties and approved by the state. Therefore, such agreements need to be in place well before a change in water needs is anticipated. Once an agreement has been reached, in the event of drought, a transaction could be undertaken immediately. Otherwise, their usefulness may be limited. The role of the state should be to help bring together willing buyers and sellers, and implement only necessary constraints on transactions to protect the public interest or trust. Some states, particularly California and Oregon, have made significant legal changes in order to facilitate and encourage conservation and water transfer agreements.

Of note, while every western state's water codes include a power of eminant domain, through which water rights can be condemned and transferred to higher uses, such authority has yet to be used during drought. The time required for such proceedings makes its use impractical during a crisis.