

CHAPTER 11. DROUGHT

11.1 GENERAL BACKGROUND

Rain and snowfall in the American River watershed eventually flow into Folsom Lake, a reservoir within the U.S. Central Valley Project. These flows and, to a more limited extent, surface water flows within the City of Roseville and neighboring jurisdictions, directly affect water availability for Roseville water users. The City of Roseville owns the Roseville water system and water treatment plant and has negotiated contracts with the U.S. Bureau of Reclamation, the Placer County Water Agency (PCWA), and the San Juan Water District (SJWD) to ensure that water needs are met for existing and future growth.

Roseville is largely urbanized with no agricultural interests remaining. Lack of sufficient water supply would affect residents and businesses that rely on water for their daily household, employee, and industrial needs. It also would affect the replenishment of rivers, creeks and groundwater to grow trees and grass/grain for livestock and to support healthy fish populations.

DEFINITIONS

Drought—The cumulative impacts of several dry years on water users. It can include deficiencies in surface and subsurface water supplies and generally impacts health, well being, and quality of life.

Hydrological Drought—Deficiencies in surface and subsurface water supplies.

Socioeconomic Drought—Drought impacts on health, well being and quality of life.

11.1.1 Water Supply Strategy

The water supply strategy for the City of Roseville uses a comprehensive approach to ensure water reliability for customers. The City has a diverse set of water supply options—including surface water contracts, recycled water, and groundwater wells—to ensure that even following a period of dry years, a combination of available water supplies and water conservation measures will meet the community's water needs. The City has contracts for surface water with three agencies (see Table 11-1).

- The primary water contract is with the U.S. Bureau of Reclamation (USBR) for 32,000 acre-feet per year of surface water from Folsom Lake. An acre-foot is the amount of water needed to serve one or two households for one year.
- Roseville's secondary supply of surface water is through PCWA. Roseville signed agreements to purchase 10,000 acre-feet of water, with two options for an additional 20,000 acre-feet. Based on the provisions of these contracts, the City is entitled to a total of 30,000 acre-feet of water from the Middle Fork of the American River. PCWA has several interconnections between its treated water system and the City of Roseville to supply this water and to enable water supply should an emergency occur. In addition, Roseville is pursuing long-term agreements that will allow delivery of PCWA water through USBR facilities at Folsom Lake. It is anticipated that this agreement will be completed in 2005, with use of temporary agreements until completion of the long-term agreement.
- The third source of surface water for the City of Roseville is the transfer to Roseville of underused PCWA water purchased by SJWD. SJWD is a water district in Sacramento and Placer Counties that draws water from Folsom Lake. SJWD also wholesales water to Citrus Heights Water District, Fair Oaks Water District and Orangevale Water Company in Sacramento County. The City of Roseville has entered into a reallocation agreement with SJWD for 4,000 acre-feet per year.

TABLE 11-1. CITY OF ROSEVILLE WATER SUPPLY CONTRACTS	
Source	Contract Amount (acre-feet per year)
U.S. Bureau of Reclamation	32,000
San Juan Water District	4,000
Placer County Water Agency	
Exercised	10,000
Two options	20,000
<i>Placer County Water Agency Total</i>	<i>30,000</i>
Total	66,000

11.1.2 Water Supply Infrastructure

The City of Roseville Water Treatment Plant is on Barton Road east of Roseville. Constructed in 1971, the plant treats water from Folsom Lake to Environmental Protection Agency (EPA) domestic drinking water standards. The City owns a water system network consisting of water mains ranging from 4 to 66 inches in diameter. The system is designed to deliver an adequate supply of water throughout the community at an acceptable pressure level for domestic and fire flow purposes. A booster pump station near East Roseville Parkway and North Sunrise Boulevard is designed to provide sufficient water pressure to the higher elevations of the city as well as fill and manage the reservoirs in the system. Some areas within the Roseville city limits are served by either the PCWA or the SJWD, where topography and facility locations make it beneficial to do so.

The City supplements its water supply with backup wells throughout city. These wells are planned to be used primarily to offset cutbacks required from Folsom Lake in times of drought or other emergencies. In addition, the City operates a recycled water utility to lessen the use of potable water for irrigating landscaped areas. The City is pioneering aquifer storage and recovery programs in which water is injected into the underground aquifers in wet years and recovered in dry years for public use.

11.1.3 The Water Forum

In the late 1990s, the Roseville mayor and environmental utilities director participated in the Water Forum, a meeting of regional stakeholders concerned with the protection of the Lower American River and reliable water supplies. The City entered into a “Purveyor Specific Agreement” that outlines how the City of Roseville will meet commitments resulting from the Water Forum. These commitments include a strategy for providing a safe and reliable water supply through 2030 and protecting resources associated with the Lower American River.

In the final Water Forum Agreement, Roseville agreed to limit takes of American River water in reduced amounts based on the supply available. The City projected a water demand of 54,900 acre-feet for the anticipated growth area at that time. Annexations to the city (Foothill Business Park, Doctor’s Ranch, and the West Roseville Specific Plan) occurred after completion of Water Forum negotiations and an additional 4,000 acre-feet was provided through an agreement with SJWD. Therefore, the total water supply allocated through the Water Forum process is 58,900 acre-feet. As water shortages occur, Roseville will reduce American River diversions to a minimum of 39,800 acre-feet. When combined with commitments made through the Water Forum by other agencies, the water supply will be sufficient to meet all water needs.

11.1.4 Local Water Contracts—Definition of Drought

Roseville’s drought levels are defined by the Water Forum Agreement adopted by the member agencies in 1999. The definition is based on the type of hydrologic year for inflow to Folsom Lake, as defined by 70 years of hydrologic data into the lake. The hydrological year types are as follows:

- **Baseline**—Baseline means the historical maximum amount of water that suppliers diverted from the American River in any one year through 1995 or in certain appropriate instances other amounts specified in a Purveyor Specific Agreement. For the City of Roseville, the baseline amount is 19,800 acre-feet per year.
- **Wet/Average Years**—Years when the projected March through November unimpaired flow to Folsom Lake is greater than 950,000 acre-feet are classified as wet or average years. The City of Roseville can divert up to 54,900 acre-feet per year plus an additional 4,000 acre-feet from the SJWD in this year type.
- **Dry or Drier Years**—Dry or drier years are when the projected March through November unimpaired flow to Folsom Lake is less than 950,000 acre-feet and greater than 400,000 acre-feet. During these years, the PCWA Middle Fork Project will provide replacement water to the river equivalent to Roseville’s diversions above the baseline (19,800 acre-feet). Replacement water is required to remain in the river to the confluence of the American and Sacramento Rivers, but can be sold to downstream users. The PCWA replacement water will be no more than 20,000 acre-feet so the total allocation available to Roseville will be 39,800 acre-feet (20,000 acre-feet of replacement water plus the baseline of 19,800 acre-feet). The Water Forum refers to this replacement water as “re-operation” or “re-op” water. SJWD water is not available in these conditions, as a condition of the transfer agreement.
- **Driest Years (Conference Years)**—Years when the projected March through November unimpaired flow to Folsom Lake is less than 400,000 acre-feet are defined as the driest years or “conference years.” Conference years require the City and other stakeholders to meet and confer on how best to meet current demands and how to protect the American River. For this year type, the City will decrease its diversions to 39,800 acre-feet and PCWA’s Middle Fork Project water will provide 20,000 acre-feet of replacement water to the river. Should the unimpaired inflow into Folsom Lake be insufficient to supply this quantity, Roseville will meet with other purveyors and stakeholders in the region to determine how the available water supply should be managed. The Water Forum Agreement includes a set of guiding principles for such a meeting.

Dry years over the 70-year hydrologic record are listed in Table 11-2. Table 11-3 provides a list of driest year flows of the American River in the Folsom Lake vicinity.

TABLE 11-2. DRY YEAR FLOWS INTO FOLSOM LAKE			
Year	Unimpaired Inflow to Folsom Lake (acre-feet)	Year	Unimpaired Inflow to Folsom Lake (acre-feet)
1931	571,000	1981	881,000
1934	690,000	1987	705,000
1939	873,000	1988	545,000
1959	872,000	1990	873,000
1961	854,000	1992	631,000
1976	518,000	1994	649,000

Dry Year	Unimpaired Inflow to Folsom Lake (1,000 acre-feet)
1924	379
1977	332

11.2 HAZARD PROFILE

Droughts originate from a deficiency of precipitation resulting from an unusual weather pattern. If the weather pattern lasts a short time (a few weeks or a couple months), the drought is considered short-term. If the weather pattern becomes entrenched and the precipitation deficits last for several months or years, the drought is considered to be a long-term drought. It is possible for a region to experience a long-term circulation pattern that produces drought, and to have short-term changes in this long-term pattern that result in short-term wet spells. Likewise, it is possible for a long-term wet circulation pattern to be interrupted by short-term weather spells that result in short-term drought.

Droughts typically occur after two or three consecutive years of below-average rainfall for the period from November to March, when about 75 percent of California’s average annual precipitation falls. December, January, and February are when approximately 50 percent of the rainfall occurs in California.

11.2.1 Past Events

State of California

The California Department of Water Resources has state hydrologic data back to the early 1900s (<http://watersupplyconditions.water.ca.gov>). The hydrologic data show multi-year droughts from 1912 to 1913, 1918 to 1920 and 1922 to 1924. Since then, three prolonged periods of drought occurred in California:

- **1929 to 1934 Drought**—The 1929 to 1934 drought established the criteria for designing the supply and yield of many large Northern California reservoirs. The Sacramento Valley runoff was 55 percent of average for the time period from 1901 to 1996, with only 9.8 million acre-feet received.
- **1975 to 1977 Drought**—California had one of its most severe droughts due to lack of rainfall during the winters of 1976 and 1977. 1977 was the driest period on record in California, with the previous winter recorded as the fourth driest in California’s hydrological history. The cumulative impact led to widespread water shortages and severe water conservation measures throughout the state. Only 37 percent of the average Sacramento Valley runoff was received, with just 6.6 million acre-feet recorded. Over \$2.6 billion in crop damage was recorded in 31 counties. A federal disaster declaration was declared in Placer County and surrounding counties.
- **1987-1992 Drought**—California received precipitation well below average levels for four consecutive years. While the Central Coast was most affected by the lack of rainfall and low runoff, the Sierra Nevadas in Northern California, as well as the Central Valley counties including Placer County, were also affected. During this drought, only 56 percent of average runoff for the Sacramento Valley was received, totaling just 10 million acre-feet. By February 1991, all 58 counties in California were suffering from drought conditions and urban areas as well as rural and agricultural areas were impacted.

Placer County

The 2010 Placer County Multi-Hazard Mitigation Plan identifies the following significant droughts that impacted Placer County:

- **1977**—A federal disaster declaration was made as a result of a drought affecting Placer and surrounding counties. The PCWA declared a water shortage and restricted water use for both irrigation and treated water users. The restrictions included a 50 percent reduction in water usage by customers and rate increases. This shortage lasted until January 1978 when the PCWA board terminated the water shortage restrictions.
- **1988**—Again the PCWA board declared a water emergency. All customers had their water use reduced by 25 percent and rates were again increased for excessive usage. The countywide emergency prohibited washing of sidewalks, driveways, parking lots and other hard surfaces, restricted the washing of vehicles, airplanes, and trailers to 3 gallons of water, prohibited fire hydrant flushing and drills, prohibited filling of pools, and prohibited new agricultural land irrigation.
- **1991**—The most recent drought emergency declared by the PCWA board was in February 1991. Raw water customers had their water usage reduced by 50 percent annually and by 25 percent seasonally. Treated water users were given most of the same restrictions and prohibitions as in 1988. Due to a very late storm season, the emergency was lifted by April 1991.
- **2008**—The Governor of California declared a drought on June 4, 2008. In July 2009, PCWA reported the implementation of normal ongoing conservation measures. As a result of these drought conditions, it is anticipated that Lake Tahoe's water level will drop to near its natural rim. The last time it dropped below its natural rim was in 2004.

Roseville Drought History

Roseville's drought history parallels the water shortages for the State of California and Placer County. The Roseville City Council has declared official drought alerts twice: from April 1991 to March 1993 when Stage 2 drought water restrictions were in effect and enforced through full-time water patrols; and in May 2008 when the City of Roseville's Environmental Utilities Department activated a Stage One drought alert. Stage One drought alert does the following:

- Increases water waste patrols to ensure that water is being used efficiently and leaks in residential and commercial properties are repaired per the Roseville Municipal Code
- Requests all city water users to reduce their water use by 10 percent
- Prohibits the washing of streets, parking lots, driveways, sidewalks or buildings, unless public health requires it; this does not apply to street sweepers
- Requests that restaurants not serve water except upon request.

11.2.2 Location

Many quantitative measures of drought have been developed in the United States. NOAA has developed several indices to measure drought impacts and severity and to map their extent and locations:

- The ***Palmer Crop Moisture Index*** measures short-term drought on a weekly scale and is used to quantify drought's impacts on agriculture during the growing season.
- The ***Palmer Z Index*** measures short-term drought on a monthly scale. Figure 11-1 shows this index for July 2010.

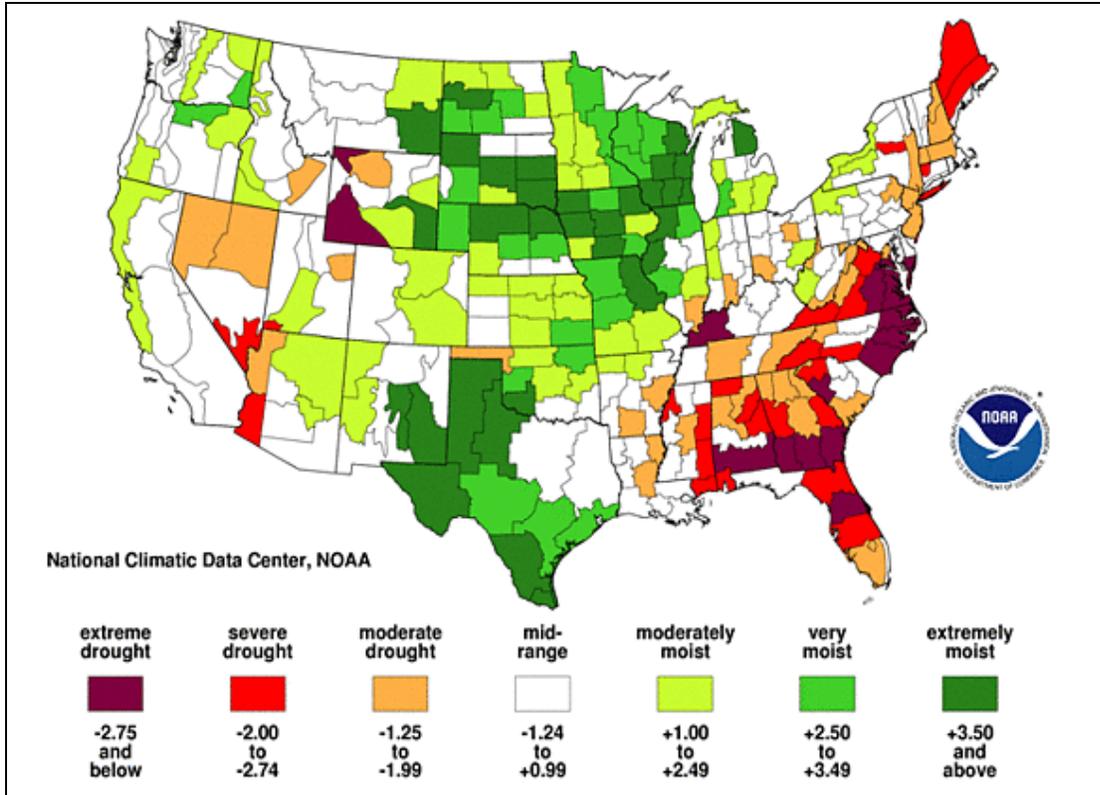


Figure 11-1. Palmer Z Index Short-Term Drought Conditions (July 2010)

- The **Palmer Drought Severity Index (PDSI)** measures the duration and intensity of long-term drought-inducing circulation patterns. Long-term drought is cumulative, so the intensity of drought during a given month is dependent on the current weather patterns plus the cumulative patterns of previous months. Weather patterns can change quickly from a long-term drought pattern to a long-term wet pattern, and the PDSI can respond fairly rapidly. Figure 11-2 shows this index for July 2010.
- The hydrological impacts of drought (e.g., reservoir levels, groundwater levels, etc.) take longer to develop and it takes longer to recover from them. The **Palmer Hydrological Drought Index (PHDI)**, another long-term index, was developed to quantify hydrological effects. The PHDI responds more slowly to changing conditions than the PDSI. Figure 11-3 shows this index for July 2010.
- While the Palmer indices are water balance indices that consider water supply (precipitation), demand (evapotranspiration) and loss (runoff), the **Standardized Precipitation Index (SPI)** is a probability index that considers only precipitation. The SPI standardizes the probabilities of various amounts of precipitation. An index of zero indicates the median precipitation amount; the index is negative for drought and positive for wet conditions. As the dry or wet conditions become more severe, the index becomes more negative or positive. To capture the various scales of short-term and long-term drought, the SPI is computed for time scales ranging from one month to 24 months. Figure 11-4 shows the 24-month standard precipitation index map for August 2008 through July 2010.

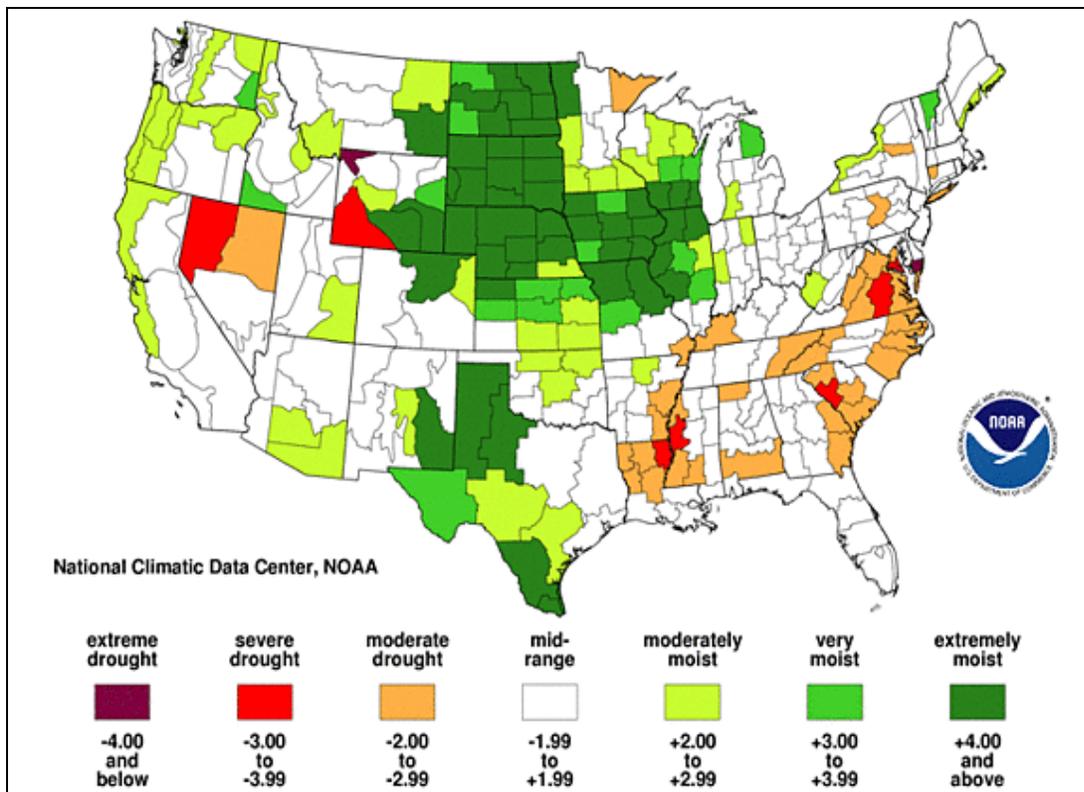


Figure 11-2. Palmer Drought Severity Index Long-Term Drought Conditions (July 2010)

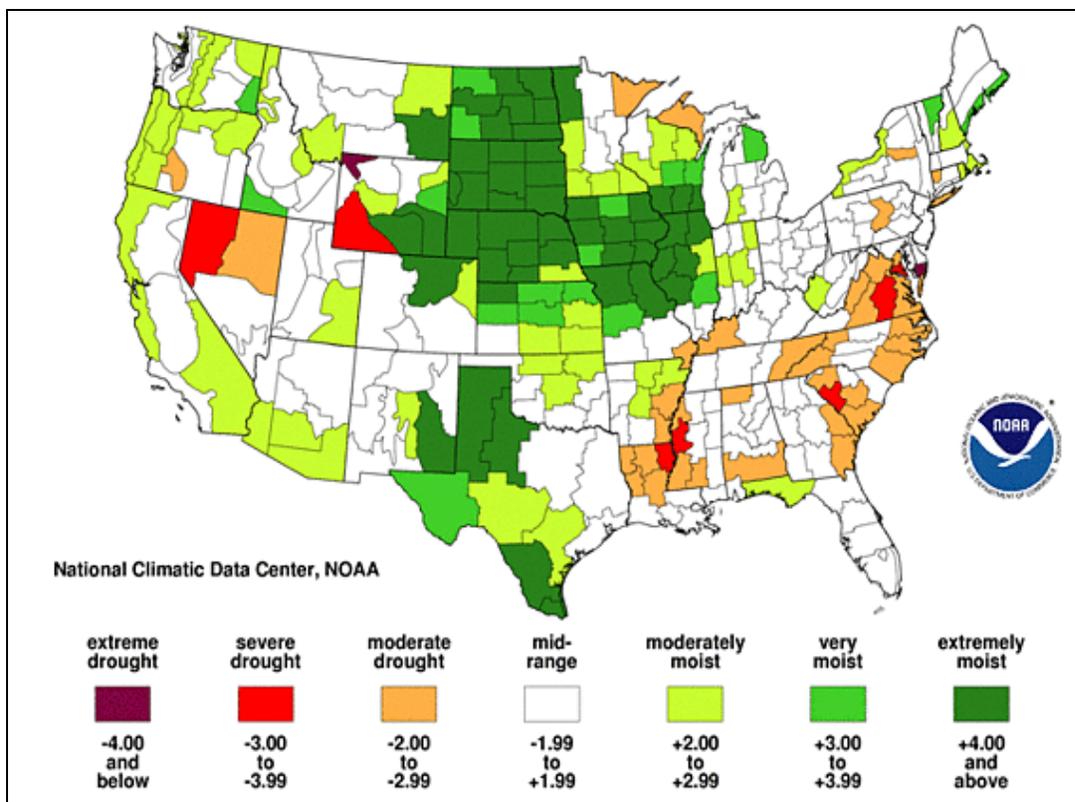


Figure 11-3. Palmer Hydrological Drought Index Long-Term Hydrologic Conditions (July 2010)

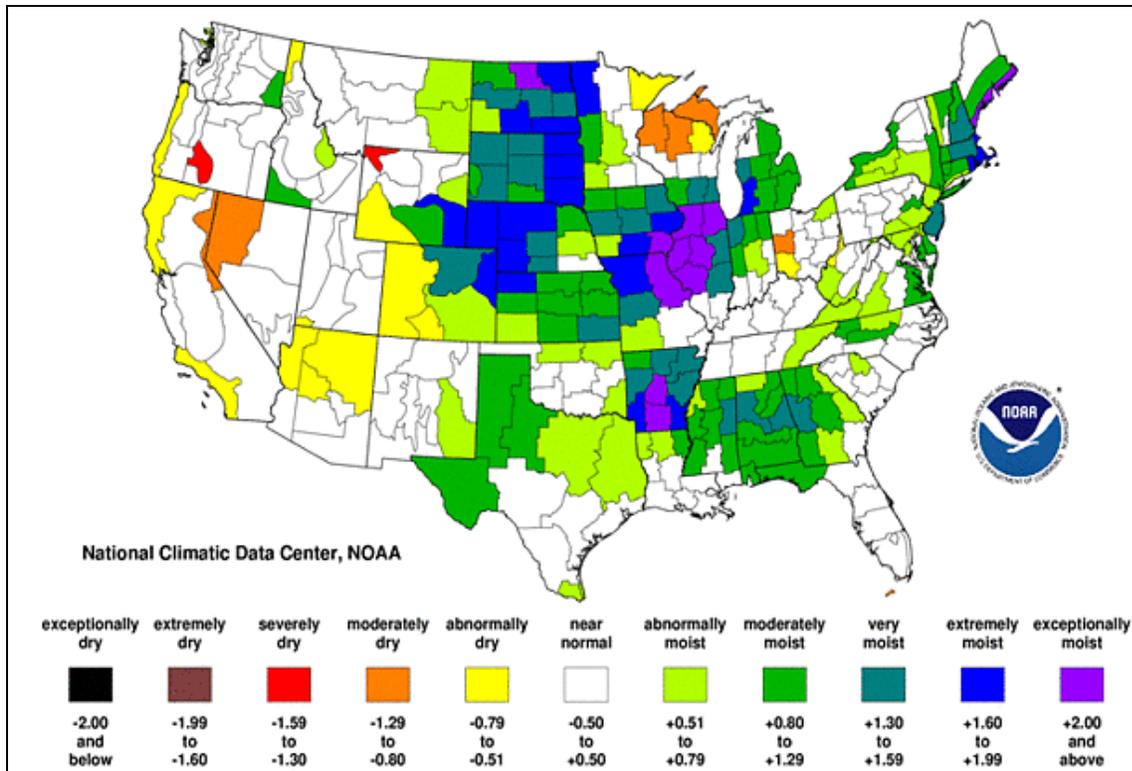


Figure 11-4. 24-Month Standardized Precipitation Index (August 2008 – July 2010)

11.2.3 Frequency

Historical drought data for the Placer County region indicate there have been four significant droughts in the last 79 years. This equates to a drought every 19.8 years on average or a 5.1 percent chance of a drought in any given year.

11.2.4 Severity

The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts. Droughts are not usually associated with direct impacts on people or property, but they can have significant impacts on agriculture, which can impact people indirectly. When measuring the severity of droughts, analysts typically look at economic impacts on a planning area.

11.2.5 Warning Time

Droughts are climatic patterns that occur over long periods of time. Only generalized warning can take place due to the numerous variables that scientists have not pieced together well enough to make accurate and precise predictions.

11.3 SECONDARY HAZARDS

The secondary hazard most commonly associated with drought is wildfire. A prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends. Environmental losses are the result of damage to plants, animals, wildlife habitat, and air and water quality; forest and range fires; degradation of landscape quality; loss of biodiversity; and soil erosion.

Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation. However, many species will eventually recover from this temporary aberration.

The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity. Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects.

11.4 CLIMATE CHANGE IMPACTS

The long-term effects of climate change on regional water resources are unknown, but global water resources are already stressed without climate change. Current stresses on water resources include:

- Growing populations
- Increased competition for available water
- Poor water quality
- Environmental claims
- Uncertain reserved water rights
- Groundwater overdraft
- Aging urban water infrastructure

With a warmer climate, droughts could become more frequent, more severe, and longer-lasting. The drought of the late 1980s showed what the impacts might be if climate change leads to a change in the frequency and intensity of droughts across the United States. From 1987 to 1989, losses from drought in the United States totaled \$39 billion (OTA, 1993). More frequent extreme events such as droughts and floods could end up being more cause for concern than the long-term change in temperature and precipitation averages.

The best advice to water resource managers regarding climate change is to start addressing current stresses on water supplies and build flexibility and robustness into any system. Flexibility helps to ensure a quick response to changing conditions, and robustness helps people prepare for and survive the worst conditions. With this approach to planning, water system managers will be better able to adapt to the impacts of climate change.

11.5 EXPOSURE

All people, property and environments within the City of Roseville would be exposed to some degree to the impacts of moderate to extreme drought conditions.

11.6 VULNERABILITY

Based on hydrologic data for the American River, there is a probability that rainfall will be insufficient once every 17 years to supply Folsom Lake and guarantee the City of Roseville its existing contract amounts. In these years, the City by agreement is required to find alternate sources of supply.

Having the flexibility to use both the USBR and PCWA contractual supplies during a drier or driest year enables the City to provide a 73-percent reliable surface water supply for municipal and industrial uses. By incorporating groundwater into the water supply strategy, the City's reliability increases to 90 percent.

The remaining 10 percent will be compensated for by water use reductions through conservation (implementation of drought stages as outlined in the Roseville Municipal Code).

In extreme conditions or successive dry years, it is possible that Roseville’s diversion could drop below 39,800 acre-feet per year. The City’s Urban Water Management Plan Update of 2005 outlines the water supply reliability at build-out for a three-year drought. Water would be supplied by the American River through Folsom Lake and groundwater only in the second year of a drought. Roseville’s recycled water utility is expected to provide a constant annual supply of 4,526 acre-feet per year. A summary of the water supply reliability at build-out for multiple dry water years is provided in Table 11-4.

TABLE 11-4. WATER SUPPLY RELIABILITY AT BUILDOUT					
	Normal Water Year	Single Dry Water Year	Multiple Dry Water Years		
			Year 1	Year 2	Year 3
Water Supply					
Surface Water (acre-feet)	58,900 ^a	54,900 ^b	54,900 ^b	47,350 ^c	39,800 ^d
Groundwater (acre-feet)	0	0	0	2,739	8,822
Recycled Water (acre-feet)	4,526	4,526	4,526	4,526	4,526
Projected Demand (acre-feet)	58,662	58,662 ^e	56,081 ^f	54,615 ^f	53,148 ^f
Surplus or (Deficit) (acre-feet)	4,764	764	3,345	0	0
<p>a. Although additional water is under contract, surface water supplies are available based on Water Forum Agreement diversion commitments.</p> <p>b. Although contracts are in place for normal water year supplies of 62,000 acre-feet, the supply shown is consistent with Water Forum Agreement diversion limits and water is not available from San Juan Water District. Volume is dependent on unimpaired inflow to the American River.</p> <p>c. Surface supply is estimated at 50% ramp down, consistent with Water Forum supply agreement (drier years)</p> <p>d. Surface supply reduction is consistent with Water Forum supply agreement anticipating worst case shortage (driest years)</p> <p>e. Conservation measures would be implemented in event of supply cutback. Savings are not projected for these programs for reliability in a single dry year.</p> <p>f. Conservation savings in times of shortage is estimated at 5% for the pre-annexation city area in the first year of multiple dry years. Prolonged shortage savings is estimated at 7.5% and 10% in pre-annexation areas and 2.5% and 5% for annexation areas in later years through continued conservation messages.</p> <p>Source: City of Roseville 2005 Urban Water Management Plan Update</p>					

11.6.1 Population

The City of Roseville, regional water purveyors, members of the Water Forum, and the USBR have spent considerable time and effort to protect life, safety and health should several consecutive dry years occur. Provisions and measures have been taken to analyze and account for anticipated water shortages. The City has the ability to minimize any impacts on residents and water consumers in Roseville. No significant life or health impacts are anticipated as a result of drought in Roseville.

11.6.2 Property

No structures will be directly affected by drought conditions in Roseville, though some structures may become vulnerable to wildfires, which are more likely following years of drought.

11.6.3 Critical Facilities

Critical facilities as defined for this plan will continue to be operational during a drought. Critical facility elements such as landscaping may not be maintained due to limited resources, but the risk to the city's critical facilities inventory will be largely aesthetic. For example, when water conservation measures are in place, landscaped areas will not be watered and may die. These aesthetic impacts are not considered significant.

11.6.4 Environment

Environmental losses from drought are associated with damage to plants, animals, wildlife habitat, and air and water quality; forest and range fires; degradation of landscape quality; loss of biodiversity; and soil erosion. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes and vegetation. However, many species will eventually recover from this temporary aberration. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity. Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects.

11.6.5 Economic Impact

Economic impact will be largely associated with industries that use water or depend on water for their business. For example, landscaping businesses were affected in the droughts of the past as the demand for service significantly declined because landscaping was not watered. The City's Environmental Utilities Department, through the water conservation programs, works to ensure that businesses that rely on water receive allotments to continue operating.

11.7 FUTURE TRENDS IN DEVELOPMENT

Table 11-5 illustrates past, current, and projected water use from 1990 to 2020. Water use is estimated by review of existing meter data as well as proportioning un-metered water based on flat rate sales within the service area.

11.8 REVIEW OF EXISTING ORDINANCES, PROGRAMS AND PLANS

Since California's 1975 to 1977 drought, Roseville has had a policy of no water waste supported by City ordinances. The City adopted a "No Waste" ordinance in 1989 and updated the Water Conservation Ordinance (Roseville Municipal Code Chapter 14.09—Water Conservation) to include drought mitigation measures in April 1991. The ordinance provides conservation measures for shortages in water supply due to drought. Drought mitigation is achieved through a tiered approach that is based on the surface water available to Roseville. As water supplies decrease, additional restrictions are imposed. Conservation measures (water use restrictions) have been established to address conditions from adequate water supplies to conditions in which surface water supplies are capable of meeting only 50 percent of Roseville's water needs.

**TABLE 11-5.
CITY OF ROSEVILLE PAST, CURRENT, AND PROJECTED WATER USE**

	Water Use (acre-feet/year)						
	1990	1995	2000	2005	2010	2015	2020
Single family residential	7,534	9,966	13,566	21,327	23,486	26,164	28,089
Multi-Family residential	589	780	1,061	1,668	1,837	2,047	2,197
Commercial	713	943	1,284	2,019	2,223	2,477	2,659
Industrial	1,507	1,993	2,713	4,265	4,697	5,233	5,618
Institutional and Governmental	717	948	1,290	2,028	2,234	2,489	2,672
Landscape	2,897	3,832	6,216	8,199	9,029	10,059	10,799
Sales to other agencies	0	0	0	0	0	0	0
Groundwater recharge	NA	NA	NA	NA	NA	NA	NA
Conjunctive use ^a	0	0	0	0	0	0	0
Agriculture ^b	0	0	0	0	0	0	0
Unaccounted system loss ^c	285	377	513	806	888	989	1,062
Total	14,242	18,839	26,644	40,314	44,395	43,457	53,095

- a. Conjunctive use programs are currently being developed and will be included in future city studies.
- b. No agricultural water use is required in the Roseville service area.
- c. Unaccounted system losses are estimated at 2% of total water production, which is not considered unreasonable for well-run and new systems. Actual loss will be evaluated once full system metering is completed.

NA = Not applicable

Source: City of Roseville 2003 Urban Water Management Plan Update

A significant portion of Roseville’s water is used for landscape irrigation. Landscape irrigation also accounts for a large portion of water wasted in Roseville. Conservation patrols are used to enforce City ordinances restricting water waste. These patrols generally consist of existing service workers that identify and document water waste during daily travels or when responding to complaints. Evening calls are made in response to resident complaints.

In times of reduced water availability, higher drought stages are implemented. In summer 1991, Roseville hired temporary employees to serve as the first dedicated water patrol. This patrol supplemented existing service crew coverage and provided 24-hour-per-day capability. These patrols led to the issuance of over 500 water waste citations that greatly decreased water wasted through malfunctioning irrigation systems and/or excessive watering.

Roseville has a number of programs and policies that are implemented as early as possible to reduce water use in the event of a prolonged water shortage. As a USBR contractor, Roseville is required to develop and maintain a water conservation plan consistent with the requirements of the Central Valley Project Improvement Act of 1992. In addition, Roseville is a member and signatory to the American River Water Forum, which also includes requirements for water conservation programs.

To proactively promote water conservation and to be prepared in the event of a water shortage, the City implements demand management (conservation) measures, is developing supplemental water supplies,

and has a water shortage contingency plan. These are summarized in the City of Roseville 2005 Urban Water Management Plan Update and detailed in the work programs for the Environmental Utilities Department Water Division.

11.9 SCENARIO

An extreme multiyear drought more intense than the 1977 drought could impact the region with little warning. Combinations of low precipitation and unusually high temperatures could occur over several consecutive years. Intensified by such conditions, extreme wildfires could break out throughout Placer County, increasing the need for water. Surrounding communities, also in drought conditions, could increase their demand for water supplies relied upon in the City of Roseville, causing social and political conflicts. If such conditions persisted for several years, the economy of Placer County and Roseville could experience setbacks, especially in water dependent industries.

11.10 ISSUES

The planning team has identified the following drought-related issues:

- Identification and development of alternative water supplies
- Utilization of groundwater recharge techniques to stabilize the groundwater supply
- The probability of increased drought frequencies and durations due to climate change
- The promotion of active water conservation even during non-drought periods.

