Photo provided by the Northern Colorado Water Conservancy District

Sample of a Municipal Drought Management Plan

City of Shallow Creek

Fiction County

June 2011

Prepared for:

Colorado Water Conservation Board
1313 Sherman St., Room 721
Denver, CO 80203

Prepared by:

AMEC Earth & Environmental
1002 Walnut Street, Suite 200
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PURPOSE AND SCOPE OF THIS DOCUMENT

This Sample Municipal Drought Management Plan (Sample Plan) is a complementary resource to the Municipal Drought Management Plan Guidance Document (Guidance Document), both developed by the Colorado Water Conservation Board (CWCB). These documents, in conjunction with the Drought Toolbox and other drought related information on CWCB's website, serve as reference tools that water providers and local governments throughout the state may use to develop local drought management plans.

The Guidance Document provides a comprehensive background on municipal drought management planning and recommends drought mitigation and response planning steps and components useful in developing a local plan. This Sample Plan provides an example of how the Guidance Document may be used to develop a municipal drought management plan. The Sample Plan closely corresponds with the guidelines and template provided in the Guidance Document.

This Sample Plan was developed for a fictitious municipality called Shallow Creek. Shallow Creek is representative of a "typical" municipal water provider in Colorado, exhibiting the following traits:

- Shallow Creek is of "medium size," serving water to a residential service area population of approximately 30,000 people in addition to commercial and municipal end users.
- The location of Shallow Creek is described under neutral pretenses; in other words, it is not located within a specific basin or region of the State.
- Shallow Creek's water supply system is representative of the water supply systems existing in municipalities throughout the State (i.e. snowmelt-driven surface water hydrology, direct flow and storage rights, surface water storage, groundwater wells and augmentation supplies, etc.)
- Challenges faced by Shallow Creek are similar to the typical challenges many municipalities in the State are confronted with (i.e. anticipated growth, limited funds, uncertainties related to drought cycles and climate change, etc.).
- Shallow Creek uses planning tools of moderate sophistication for forecasting the availability of its water supplies on an annual basis as well as for estimating the firm yield of its water supply system.

ACKNOWLEDGEMENTS

The development of the Sample Plan was a collaborative effort led by the CWCB. The Steering Committee included municipalities, conservancy and conservation districts, and experts from the National Drought Mitigation Center. All played an integral role in the development of the Sample Plan. The stakeholder process included a workshop focusing on the overall utility and main components of the Sample Plan. This workshop was followed by a review period where the Steering Committee had the opportunity to provide additional comments.

The CWCB and project team would like to thank the following stakeholders for their time and input on this document:

- Aurora Water
- Breckenridge Water Department
- City of Boulder Public Works Department
- Clifton Water District
- Colorado River Water Conservation District
- Denver Water
- Mount Werner Water and Sanitation District
- National Drought Mitigation Center
- Northern Colorado Water Conservancy District
- Pagosa Area Water and Sanitation District
- Town of Erie

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Executive Summary

Profile

The City of Shallow Creek (Shallow Creek) is located at the base of the Rocky Mountains in north Fiction County, Colorado. Shallow Creek provides treated water and wastewater services to a 25 square mile service area with approximately 30,000 people. The current population is expected to grow as Shallow Creek's popularity as a tourist destination and regional business hub increases.

Shallow Creek typically relies on a combination of direct flow water rights and storage water rights. The City typically diverts water directly from Shallow Creek during spring runoff and releases water stored in Castle and Crown Reservoir in the mid-summer through the winter season. Shallow Creek also has four alluvial wells that are used to irrigate nearby parks and open spaces with raw water via a substitute water supply plan.

Plan Objectives

An interactive, collaborative stakeholder process consisting of senior City staff members, City Council members and representatives from the public was instrumental in developing a robust and comprehensive plan. The following Drought Management Plan (Plan) objectives were developed through the stakeholder process:

- Preserve essential public services during any level of drought severity from mild to critical emergency conditions.
- Minimize the adverse drought-related impacts on public health and safety, economic activity, environmental resources, and individual lifestyles during a drought event.
- Provide a comprehensive yet flexible framework to guide City staff on the drought mitigation and monitoring efforts, as well as on procedures to follow for declaring a drought and implementing the drought response.
- Effective communication of drought awareness and response information to water customers.
- Provide an efficient means to monitor and improve the effectiveness of the Plan over time.
- Closely coordinate the drought mitigation and response with Shallow Creek's water supply reliability planning efforts described in Section 3.1 as well as with other City and regional level policies and planning efforts. This includes City, County, and State policy as well as Shallow Creek's Conservation Plan and Fiction County's multi-hazard mitigation and emergency operations plans.
- Provide sufficient contextual information in the Plan to convey the importance of drought preparedness and management to the public and how the actions set forth in this Plan are relevant to reducing future drought-related impacts.

Historical Drought and Impacts

Historically, Shallow Creek was a small town and had not experienced water shortages and prior to the 2002 drought. As such, Shallow Creek did not have a formal drought plan or designated drought mitigation measures. However, during the 2002 drought, dramatic reductions in reservoir storage justified the necessity for a drought response. The drought response measures included: watering restrictions starting in June 2002 and continuing through September 2002; a public drought campaign to educate the public about drought; and some low-cost adjustments to the water treatment in attempt address the taste and odor issues. An increasing block rate structure was also adopted in 2003 in which a portion of the additional revenue generated by the top two tiers of water users is set aside in a drought reserve account for future droughts. Per capita water demands in the years following the drought were noticeably lower, with an average five-year per capita water usage of 168 gpcd (2005-2009).

The Shallow Creek Utilities Department (Utilities) experienced a variety of drought-related impacts during the 2002 drought. These impacts were generally moderate to minor in nature and did not extend beyond the 2002 drought, although such impacts could have been worse if the drought had extended into 2003. The Shallow Creek community also experienced a variety of impacts. The lack of rainfall stressed the surrounding environment resulting in increased risk of wildfire, lowered streamflows and reservoir levels, stressed wildlife, and resulted in an overall reduction in the aesthetics of the area. This significantly impacted recreational activities, such as tubing and fishing, and impacted the local tourist industry (hotels, restaurants, shops) in the City. The nearby agricultural community was also impacted. Farmers with junior water rights had very limited water to grow crops and several landscaping companies relying on summer as their busy season were forced out of business.

Drought Vulnerability

Water supply reliability planning is an important component of ensuring sufficient supplies during times of drought and to some extent overlaps with drought management planning. Shallow Creek's water supply reliability planning efforts focus on the ability of the City's water supply system to meet the needs of its customers during times of stress. This reliability depends on a multitude of factors including the City's water source(s), seniority of water rights, storage capacities, and rate of customer demand growth. Utilities is currently leading an effort to update the outdated 1998 Raw Water Master Plan which is scheduled for completion by 2012. This Plan will enable Shallow Creek to meet its future growing demands while also improving water supply reliability during drought periods.

Utilities could experience a variety of future drought-related impacts of significant to minor severity. Potential significant future impacts include reduction in storage reserves, disruption of water supplies, degraded water quality, sediment and debris loading to reservoir following wildfire, and increased costs to acquire additional supplies. The community could also experience a variety of future drought-related impacts. While some of the community impacts are beyond the immediate control of Shallow Creek Utilities, drought mitigation activities and daily operational adjustments could be made to alleviate some of these impacts. One of the main objectives of this Plan is to minimize drought impacts on Utilities and the Shallow Creek community.

Drought Mitigation

Drought mitigation refers to actions taken in advance of a drought that reduce potential drought-related impacts when the event occurs. Shallow Creek's current and planned drought mitigation measures include the following:

- *Drought mitigation planning* – The major components of this Plan provide an effective means for Shallow Creek to prepare for drought. When done in advance of a drought, planning is considered drought mitigation. These components include the objectives and operating principles; assessment of historical and potential drought impacts; drought-related monitoring; drought stages, trigger points and response targets; declaration of a drought; development of drought-related ordinances; and the public drought education campaign. This planning effort in advance of a drought is considered mitigation.

- *Ongoing monitoring of drought indicators* – Shallow Creek's monitoring plan is outlined in Section 7.2.

- *Development of new water supplies* – Shallow Creek is planning to develop additional water supplies for drought protection and meet the growing water demands through the update of the Raw Water Master Plan to be completed by 2012. A portion of these new supplies will be designated for new growth while the remainder will be reserved for use during periods of drought.

- *Develop cooperative sharing agreement opportunities with neighboring communities during periods of drought* - Shallow Creek's water supply yields may be increased by making some adjustments to how water rights are traditionally managed and through other synergies developed via cooperative agreements with other local water users. Where possible, these agreements will be established in advance of a drought as part of the mitigation effort and activated during drought periods. Agreements may include exchanges, agricultural leases, trades, temporary fallowing, etc. Appropriate Substitute Water Supply Plans and/or water court filings will occur to ensure that the agreement is viable under Colorado Water Law.

- *Existing operation and maintenance activities that improve water distribution efficiency* – Utilities currently conducts annual audits on their water distribution system, routinely repairs leaks on an as-needed basis, monitors and replaces inaccurate meters, and strategically operates its water supply system to avoid reservoir spills (releasing reservoir water when not necessary for water supply purposes).

- *New operation and maintenance activities that improve water distribution efficiency* – The addition of new water supplies to Shallow Creek's system will require modifications to current daily operations. Such operational changes are being evaluated through the Raw Water Master Plan Update process with the objective of optimizing operations to improve the efficiency and overall distribution of water supplies when the new water supplies are developed. Utilities also plans to update their water treatment plant to recycle wash water and reduce water waste by 2013.

- *Conservation measures specified in the Conservation Plan* – Many of Shallow Creek's conservation measures serve the dual purpose of conserving water while also providing drought protection. A portion of the water saved through these conservation measures is stored as drought reserves in each of Shallow Creek's reservoirs.

- *Standard practices of the Utilities Department and Shallow Creek City Staff* – Shallow Creek's management and operations reflect the City's values of sustainability and environmental stewardship. Many of Utilities' standard operations focus on water conservation, providing multi-year water savings, and drought mitigation during dry periods.

Drought Stages, Trigger Points and Response Targets

Table ES-1 presents Shallow Creek's drought stages which specify an appropriate level of response, according to drought severity. The four stages increase in intensity from watch, to warning, to critical, to emergency. The response target (targeted water savings) also increases with each stage, with a 10% water savings target under the watch drought stage and a 50% water savings target under the emergency drought stage.

Table ES-1 Drought Stages, Trigger Point Guidelines, and Response Targets

Drought Stage	Drought Trigger Point Guidelines			Response Targets[1]
	Measured Snowpack near the end of April	Projected Reservoir Storage on July 1		
		Storage Level	Approximate Supply[2]	
Watch	90% of normal	Storage less than 90% of full	2 years of unrestricted total demand	10% water savings
Warning	75% of normal	Storage less than 80% of full	1 year of unrestricted total demand	25% water savings
Critical	50% of normal	Storage less than 65% of full	1 year of total demand with mandatory outdoor restrictions	40% water savings
Emergency	30% of normal	Storage less than 50% of full	1 year of unrestricted indoor demand	50% water savings

[1]Percentage water savings is measured as annual total retail water sales divided by a 5 year running average of retail water sales.
[2]Based on 2020 projected demands. Unrestricted implies no drought response or water restrictions are enacted.

The drought trigger points are based on the measured snowpack near the end of April and Shallow Creek's projected percentage of storage on July 1. Utilities staff begins to develop these storage projections in early March taking into consideration snowpack measurements and other hydrologic data. It is important to note that the drought trigger points are only general guidelines. Multi-year droughts could require a significant modification to the drought triggers based on the duration and severity of the drought and the Utilities staff's historical experience managing Shallow Creek's water supply system. The declaration of a drought, timing of the declaration and corresponding drought stage will ultimately be a real-time decision based on a combination of the drought trigger guidelines in Table ES-1, staff experience, and other drought indicator data described in Section 5.2.

Staged Drought Response Program

Drought response planning specifies the actions that should be taken in response to drought-induced water supply shortages. Shallow Creek's staged drought response program is summarized in Table ES-2.

Table ES-2 Summary of the Staged Drought Response Program

	Watch	Warning	Critical	Emergency
	Reservoirs less than 90% full	**Reservoirs less than 80% full**	**Reservoirs less than 65% full**	**Reservoirs less than 50% full**
	10% savings	**25% savings**	**40% savings**	**50% savings**
Supply-Side Measures				
Technical and financial assistance	Seek technical and financial assistance opportunities.	Seek technical and financial assistance opportunities.	Seek technical and financial assistance opportunities.	Seek technical and financial assistance opportunities.
Water rights and cooperative agreements	Assess new water rights management and cooperative agreement opportunities.	Assess new water rights management and cooperative agreement opportunities.	Assess new water rights management and cooperative agreement opportunities.	Assess new water rights management and cooperative agreement opportunities.
Modify reservoir releases	n/a	Modify reservoir releases to enhance streamflows during critical recreational times of the day (12:00 pm to 3:00 pm for tubing July – August).	Modify reservoir releases to enhance streamflows during critical recreational times of the day (1:00 pm to 3:00 pm for tubing July – August).	n/a (too dry to implement)
	n/a	Adjust reservoir releases to maintain Castle Reservoir storage at 50% of capacity to avoid degradation of drinking water quality.	Adjust reservoir releases to maintain Castle Reservoir storage at 50% of capacity to avoid degradation of drinking water quality.	n/a (too dry to implement)
Demand-Side Measures Shallow Creek Utilities Department				
Drought surcharge	n/a	n/a	Design a drought surcharge to support water use restrictions and the targeted water savings. Surcharges will be applied to all customers.	Design a drought surcharge to support water use restrictions and the targeted water savings. Surcharges will be applied to all customers.
Outdoor irrigation	Standard irrigation practices on City-owned properties that promote efficient water use.	Standard irrigation practices on City-owned properties that promote efficient water use.	Restrict turf irrigation on City parks and open spaces. Sports fields, trees and shrubs, and preferred “green areas” specified via community outreach efforts may be irrigated on a pre-determined limited basis.	Eliminate all turf irrigation on City parks and open spaces until drought has ceased. Limited irrigation of trees with a hand-held hose or non-spray device is allowed to help ensure survival.

	Watch	Warning	Critical	Emergency
	Reservoirs less than 90% full	**Reservoirs less than 80% full**	**Reservoirs less than 65% full**	**Reservoirs less than 50% full**
	10% savings	**25% savings**	**40% savings**	**50% savings**
Outdoor irrigation	n/a	Turf irrigation on City-owned property from September 30 to May 1 is prohibited.	Turf irrigation on City-owned property from September 30 to May 1 is prohibited.	
Washing of City-owned vehicles	Washing of City-owned field vehicles is limited to once every two weeks and washing of all other vehicles is limited to once per a month.	Washing of City-owned field vehicles is limited to once every two weeks and washing of all other vehicles is limited to once per a month.	Washing of City-owned vehicles is prohibited.	Washing of City-owned vehicles is prohibited.
Hydrants	n/a	Reduce frequency of hydrant washing and flushing.	Reduce frequency of hydrant washing and flushing.	Hydrant washing and flushing is prohibited unless necessary for public safety reasons.
	n/a	n/a	Use of all water for fire training and of water from the hydrant is prohibited unless essential for public safety.	Use of all water for fire training and of water from the hydrant is prohibited unless essential for public safety.
Fountains	Ornamental fountains and drinking fountains in City-owned parks are turned off from 10:00 am to 4:00 pm.	Ornamental fountains and drinking fountains in City-owned parks are turned off.	All ornamental fountains and drinking fountains on City-owned property and City-owned buildings are to be turned off.	All ornamental fountains and drinking fountains on City-owned property and City-owned buildings are to be turned off.
Demand-Side Measures Residential				
Outdoor irrigation	Voluntary outdoor water restrictions.	Mandatory outdoor water restrictions (limits residents to watering two designated days per week).	Mandatory outdoor water restrictions (limits residents to watering one designated day per week using a hand-held hose or non-spray device. Hand-held hose may be used Monday and Thursday to sustain new plantings and trees)	All outdoor irrigation is prohibited with exception to watering of trees with a hand-held hose every first and third Wednesday of the month from June through December.
	n/a	Residents are encouraged to reduce turf irrigation from September 30 to May 1.	Residents are restricted from irrigating turf from September 30 to May 1.	n/a
	n/a	Residents are encouraged to forego the installation of new sod, seeding, and landscaping.	The installation of new sod, seeding, and landscaping is prohibited.	The installation of new sod, seeding, and landscaping is prohibited.

	Watch	Warning	Critical	Emergency
	Reservoirs less than 90% full	**Reservoirs less than 80% full**	**Reservoirs less than 65% full**	**Reservoirs less than 50% full**
	10% savings	**25% savings**	**40% savings**	**50% savings**
Washing (vehicles and impervious surfaces)	Power washing and spraying on impervious surfaces (driveways and sidewalks) should be minimized.	Power washing and spraying on impervious surfaces (driveways and sidewalks) is prohibited.	Power washing and spraying on impervious surfaces (driveways and sidewalks) is prohibited.	Power washing and spraying on impervious surfaces (driveways and sidewalks) is prohibited.
	Personal vehicles may only be washed using bucket and hand-held hose with shut-off nozzle.	Personal vehicles may only be washed using bucket and hand-held hose with shut-off nozzle.	All washing of personal vehicles is prohibited except at commercial car washes.	All washing of personal vehicles is prohibited except at commercial car washes.
Fountains	n/a	All non-recirculating outdoor fountains must be turned off.	All outdoor and indoor fountains must be turned off.	All outdoor and indoor fountains must be turned off.
Swimming pools and hot tubs	All private swimming pools and hot tubs should be covered when not in use and maintained to prevent leaks.	All private swimming pools and hot tubs should be covered when not in use and maintained to prevent leaks.	The filling of private swimming pools and hot tubs is discouraged.	The filling of private swimming pools and hot tubs is prohibited.
Air conditioning	Adjust room temperatures to reduce use of water-cooled air conditioning.	Adjust room temperatures to reduce use of water-cooled air conditioning.	Adjust room temperatures to reduce use of water-cooled air conditioning.	Adjust room temperatures to reduce use of water-cooled air conditioning.
Indoor restrictions	n/a	n/a	n/a	Residents are limited to 30 gallons per person per day.
Indoor water audits	n/a	n/a	n/a	Residents are encouraged to sign-up for free indoor water audits provided free-of-charge by Utilities.
Demand-Side Measures Commercial and Institutional				
Construction water	Conserve and prevent wasting of construction water.	Conserve and prevent wasting of construction water.	Conserve and prevent wasting of construction water.	Use of all construction water is prohibited unless necessary for air quality and construction reasons. This must be negotiated beforehand with Utilities.

	Watch	Warning	Critical	Emergency
	Reservoirs less than 90% full	**Reservoirs less than 80% full**	**Reservoirs less than 65% full**	**Reservoirs less than 50% full**
	10% savings	**25% savings**	**40% savings**	**50% savings**
Outdoor irrigation	Voluntary outdoor water restrictions.	Mandatory outdoor water restrictions (limits businesses to watering two designated days per week).	Mandatory outdoor water restrictions (limits businesses to watering one designated day per week using a hand-held hose or non-spray device. Hand-held hose may be used Monday and Thursday to sustain new plantings and trees).	All outdoor irrigation is prohibited with exception to the watering of trees with a hand-held hose every first and third Wednesday of the month from June through September.
	Free outdoor water audits. Sign up on Utilities website.	Free outdoor water audits are encouraged. Sign up on Utilities website.	Free outdoor water audits are required. Sign up on Utilities website.	n/a
	n/a	Businesses are encouraged to forego the installation of new sod, seeding, and landscaping.	Installation of new sod, seeding, and landscaping is prohibited.	Installation of new sod, seeding, and landscaping is prohibited.
Fountains	n/a	All non-recirculating outdoor fountains must be turned off.	All outdoor and indoor fountains must be turned off.	All outdoor and indoor fountains must be turned off.
Swimming pools and hot tubs	All commercial swimming pools and hot tubs should be covered when not in use and maintained to prevent leaks.	All commercial swimming pools and hot tubs should be covered when not in use and maintained to prevent leaks.	All commercial swimming pools and hot tubs should be covered when not in use and maintained to prevent leaks.	The filling of commercial swimming pools and hot tubs is prohibited.
Vehicle washing	Commercial car washes encouraged to reduce water use by 10% where technically feasible.	Commercial car washes required to reduce water use by 10% where technically feasible.	All commercial car washes are required to implement best management practices and limit water use to 40 gallons per vehicle.	All commercial car washes are required to implement best management practices and limit water use to 20 gallons per vehicle.
	Vehicles at car dealerships should be washed using bucket and hand-held hose with shut-off nozzle.	Vehicles at car dealerships should be washed using bucket and hand-held hose with shut-off nozzle.	All washing of vehicles on car dealership property is prohibited.	All washing of vehicles on car dealership property is prohibited.
Restaurant and lodging services	Restaurants encouraged to only serve water when requested by customer.	Restaurants encouraged to only serve water when requested by customer.	All restaurants are to not serve water unless customers specifically ask for it in addition reducing the number of service dishes (conserving water used for washing).	All restaurants are to not serve water unless customers specifically ask for it in addition reducing the number of service dishes (conserving water used for washing).

	Watch	Warning	Critical	Emergency
	Reservoirs less than 90% full	**Reservoirs less than 80% full**	**Reservoirs less than 65% full**	**Reservoirs less than 50% full**
	10% savings	**25% savings**	**40% savings**	**50% savings**
Restaurant and lodging services	Lodging establishments are encouraged to promote conservation and limit frequency of linen washings.	Lodging establishments are encouraged to promote conservation and limit frequency of linen washings.	All lodging establishments must place water conservation cards in every room promoting water conservation (i.e. short showers) as well as not changing linens and towels unless a customer specifically requests the service.	All lodging establishments must place water conservation cards in every room promoting water conservation (i.e. short showers) as well as not changing linens and towels unless a customer specifically requests the service.
Indoor	n/a	n/a	n/a	All businesses are encouraged to sign up for a free indoor water audit provided free-of-charge by Utilities. Businesses with over five active employees working at the same time are required to sign up for the audit.

Drought Public Information Campaign

The public drought education campaign is one of Shallow Creek's largest drought management efforts. The public drought campaign will be closely coordinated with Shallow Creek's current conservation education programs and other related programs providing information on sustainability, climate, climate change, etc. When reasonable, these programs may be integrated into a single program by the Public Affairs Department to integrate efforts and enhance efficiencies. These program(s) will promote the importance of conserving water and achieving water savings in both normal and drought years. During non-drought years the drought campaign component will simply provide a general overview on drought and the importance of drought preparedness. During a drought, the drought messages will increase in frequency and intensity and will be expanded to include information on the staged drought response program and the necessity to conserve supplies.

The objectives of the public drought campaign are:

- Provide concise and effective drought information to Shallow Creek customers and the media.
- Adjust the intensity of the public outreach effort in accordance to the severity of the drought (drought stage).
- Coordinate campaign efforts with nearby municipal entities and other conservation oriented entities to capitalize on synergistic opportunities and convey, where appropriate, a consistent drought message.

Implementation and Monitoring

Effective implementation and monitoring of this Plan is critical to ensuring Shallow Creek's preparedness and ability to respond to drought. These include the following:

- *Mitigation action plan* – Section 7.1 provides an action plan for Shallow Creek's drought mitigation measures with the majority of measures related to the development of new water supplies and operation/maintenance changes to occur in 2013 when the new supplies are anticipated to come online.
- *Drought monitoring* – Utilities has a comprehensive drought monitoring program. Monitoring data is collected throughout the year. These data are critical in characterizing Shallow Creek's water supplies under various hydrologic conditions and predicting drought in a timely manner. These data include reservoir levels, snowpack, precipitation, streamflows, call records, US Drought Monitor, etc.
- *Drought declaration protocol* – It is important for the City to officially declare a drought and adjust corresponding drought stage in a timely manner.[1] If a drought is declared too late or actions are not taken early enough to reduce water use, supplies can be severely depleted and

[1]Timeliness is also important if the City decides to pursue federal funding through the Federal Emergency Management Agency (FEMA) which requires information on the beginning and end of a hazard.

strict water restrictions may be required, leading to economic impacts that could have been avoided. Conversely, premature drought declarations can result in unnecessary mandatory water restrictions and associated impacts while customers can lose confidence in the declaration. This Plan lays out a specific protocol for drought declaration to ensure timely and accurate declaration. The City Mayor is ultimately responsible for making the official declaration.

- *Implementation of the Staged Drought Response Program* – This Plan lays out the specific roles and responsibilities that the Utilities, Parks, Public Affairs, and Finance Departments have in carrying out the Staged Drought Response Program. Effective collaboration and coordination is crucial to the success of this program.

- *Enforcement of the Staged Drought Response Program* – Shallow Creek's level of enforcement will be customized to the severity of the drought (drought stage) as well as to how responsive the public is to mandatory drought response measures. Enforcement will consist of a call in service where customers have an opportunity to report infractions, patrol of neighborhood and business districts to identify owners/residents that are in violation of mandatory restrictions/requirements, and issuing citations and appropriate penalties based on the drought stage and number of violations.

- *Revenue implications and a financial budgeting plan* – A reduction in customer water use during periods of drought reduces water sales and consequently could result in a revenue shortfall for Shallow Creek. Increased costs associated with the drought response could further intensify the shortfall. To alleviate this issue, funds for the implementation of Shallow Creek's staged drought response program are set aside in a reserve drought account on an annual basis. Additional emergency funds may be set aside for drought and drought surcharges for the critical and emergency drought stages and could also provide additional funds.

- *Monitoring of Plan Effectiveness* – Monitoring provides the information and data necessary to improve the effectiveness of updates to Shallow Creek's Plan. This process is key to improving Shallow Creek's ability to prepare and respond to drought. Monitoring is both an ongoing and post-drought evaluation process. Ongoing monitoring includes testing components of the drought management plan when a drought is not occurring as well as tracking and following through with the drought mitigation measures.

Formal Plan Approval and Updates

The Public Affairs Department facilitated a public review process educating and providing the public an opportunity to review and provide feedback prior to finalization of the Plan. This process was important to developing an effective Plan that was also reflective of the community's values and could mitigate potential conflict during a future drought event.

Shallow Creek's Drought Management Plan was approved by City Council at the June 1, 2011 City Council meeting. This included the adoption of several ordinances necessary to implement the Plan. The next update to the Plan is scheduled for June 2016.

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

TABLE OF FIGURES

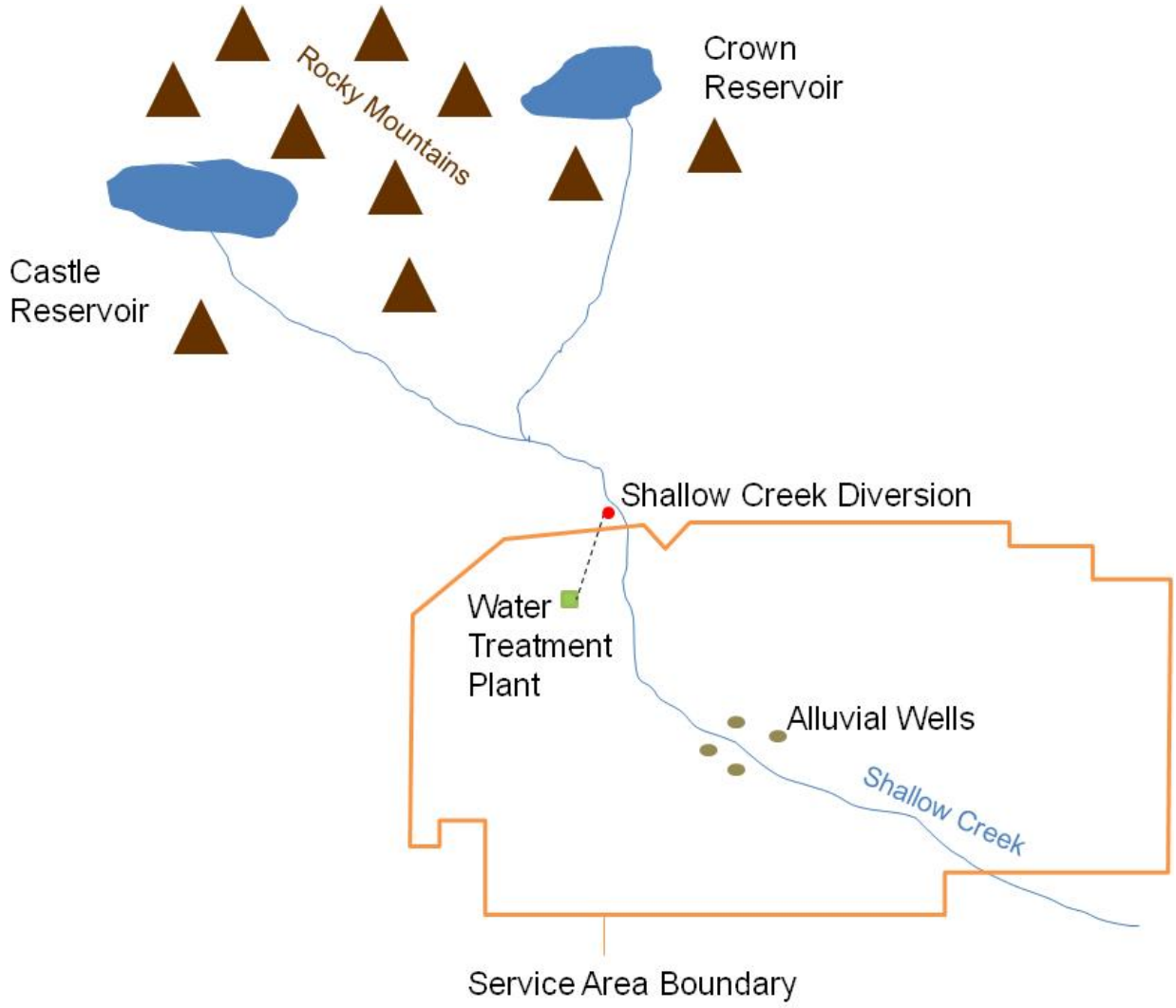
Introduction

Profile of Existing System

The City of Shallow Creek (Shallow Creek) is located at the base of the Rocky Mountains in north Fiction County, Colorado. Shallow Creek provides treated water and wastewater services to a 25 square mile service area with approximately 30,000 people. The current population is expected to grow as Shallow Creek's popularity as a tourist destination and regional business hub increases. Historically, Shallow Creek's economy was primarily based on the surrounding agricultural community. Although the general demographic is shifting to a stronger emphasis in tourism and business, agriculture will continue to have a prominent role in Shallow Creek's economy and community life.

The major components of Shallow Creek's water supply system are illustrated in Figure 1. Shallow Creek typically relies on a combination of direct flow water rights and storage water rights. The City typically diverts water directly from Shallow Creek during spring runoff and releases water stored in Castle and Crown Reservoirs in the mid-summer through the winter season. Shallow Creek also has four alluvial wells that are used to irrigate nearby parks and open spaces with raw water via a substitute water supply plan. The City has filed for an augmentation plan to augment these wells using some recently purchased agricultural water rights.

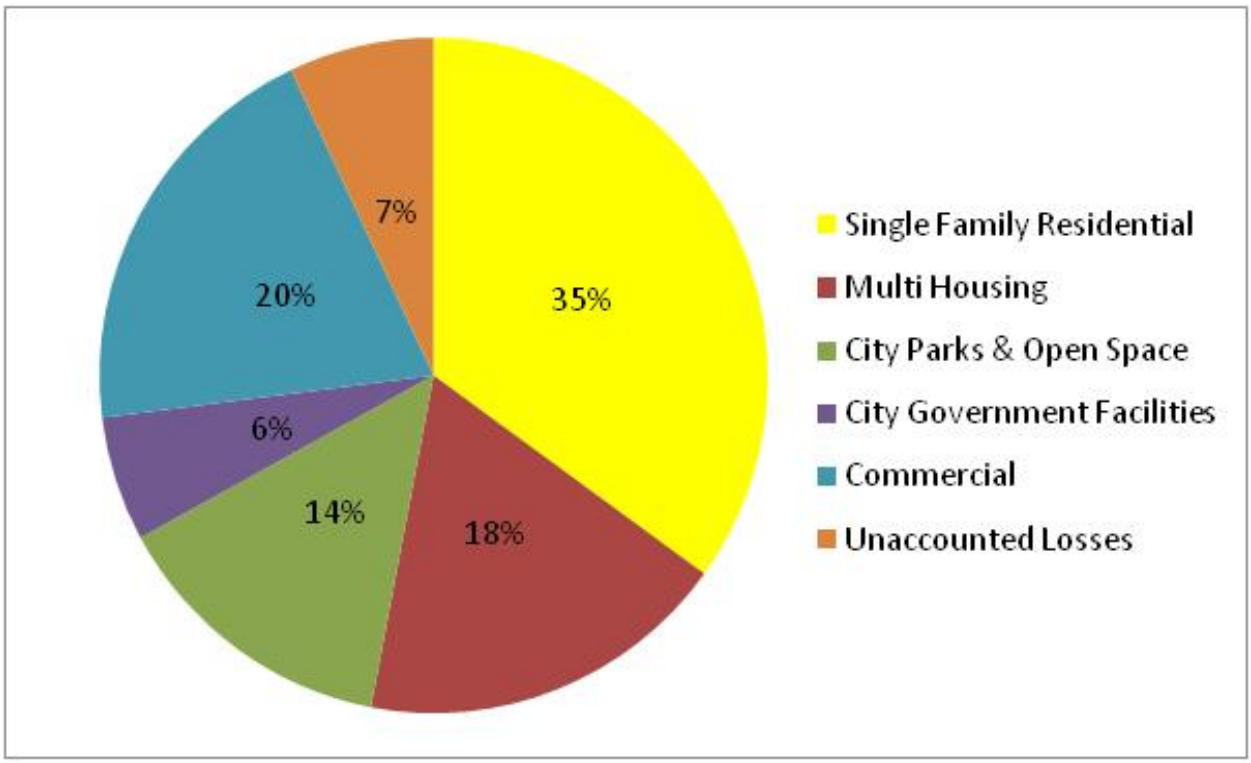
Figure 1 Shallow Creek Water Supply System[2]



Shallow Creek's average annual water deliveries for 2003-2009 were 5,690 acre feet (AF). As shown in Figure 2, single-family residential and multi-family housing comprise nearly half of Shallow Creek's customer base. Commercial is the largest non-residential use followed by City-owned parks and open space (including road medians). City government facilities are the smallest user. These uses include the washing of City vehicles, indoor use by City staff, outdoor landscaping on City-owned facility property, etc.) Unaccounted losses include system losses and meter error, and comprise an average of 7% annual water use.

[2]Some water providers may prefer to not disclose the location of water supply or conveyance facilities for public safety reasons. In those cases, this type of figure may be beneficial where the precise facility locations are not specified, yet a conceptual schematic of the water system is provided for discussion purposes.

Figure 2 2002-2009 Average Customer Water Use



Drought Mitigation and Response Planning

Drought may be defined as "a period of abnormally dry weather sufficiently long enough to cause a serious hydrological imbalance."[3] This occurs when precipitation is below average based on historical weather records and there are not sufficient supplies to satisfy a water provider's typical customer water demands, which results in a water shortage. A drought's impacts on society and the surrounding environment are a result of the natural event (less precipitation than normal), water demands, and drought preparedness.

Shallow Creek's water supply consists primarily of runoff from snowpack in the spring. Lack of winter snowfall resulting in droughts can stress Shallow Creek's water supply by reducing spring creek flows such that the period in which the City's direct flow rights may be diverted is shortened due to limited flow. This can result in greater reliance on storage, which can also be significantly reduced during droughts due to below average snowpack and runoff coupled with evaporation. Storage reserves may be stressed to a greater extent during multi-year droughts, which emphasizes the benefit of having sufficient storage to meet demands more multiple years. On the demand side, outdoor water demands can increase if the summer irrigation season is exceptionally dry. Effective drought management planning is necessary to ensure adequate water supplies for the community and reduce drought related impacts. This includes more severe water shortages that may occur as a result of multi-year droughts.

[3] Source: Glossary of Meteorology, 2nd edition. 2000. American Meteorological Society

The main purpose of drought mitigation and response planning is to preserve essential public services and minimize the adverse affects of drought on public health and safety, economic activity, environmental resources, and individual lifestyles during a drought event. Effective drought management plans remove the "crisis" from drought response efforts, reduce the hardship caused by water shortages, and raise public confidence in the actions taken to address the water supply shortage. Drought mitigation refers to actions taken in advance of a drought that reduce potential drought-related impacts when the event occurs. Whereas drought response planning refers to the conditions under which a drought-induced water supply shortage occurs and specifies the actions that should be taken in response. This Drought Management Plan (Plan) includes both drought mitigation and response planning; however, it does not address emergency water shortage events as a result of acute catastrophes such as an unexpected failure of a major raw water conveyance facility. It is also important to note that this Plan is effective in drought and non-drought years. Drought mitigation, monitoring of drought indicators, and drought public education are implemented on an annual basis regardless of whether it is a dry or wet year.

This Plan was developed in close coordination with Fiction County's multi-hazard mitigation and emergency operations plans in order to reduce redundancy and capitalize on joint efforts. Fiction County's multi-hazard mitigation and emergency operations plans address drought on a county-wide level. This Plan incorporates some of the county-level drought impact information presented in these plans, and coordinates with the County's drought-related response actions as well.

Historical Drought Planning Efforts

Shallow Creek developed a Drought Response Plan in 2003 following the 2002 drought. This response plan outlined a series of measures to be taken by the City based on four stages of potential drought severity (watch, warning, critical, emergency). Water restrictions were also a major component of the 2003 Drought Response Plan.

This Plan provides a more comprehensive review of potential drought mitigation and response strategies, provides a general framework for public outreach, specifies the roles and responsibilities for drought monitoring and Plan implementation, and includes a stakeholder feedback process during Plan development.

Drought Planning and Water Conservation

Water conservation and drought planning both involve a combination of strategies for reducing water demand. However, the main objective of a water conservation plan is to achieve continuing, long-term improvement in water use efficiency while reducing overall water demands. A drought management plan focuses on long-term drought mitigation in addition to response strategies that provide short-term responses to temporary drought-related water supply shortages. Nevertheless, conservation measures that result in an ongoing reduction in water demand can provide long-term drought mitigation benefits and can be considered as both conservation and drought mitigation measures.

Shallow Creek updated their state approved Water Conservation Plan in 2007 in accordance to the Colorado Water Conservation Board's Water Conservation Plan Guidelines. The Water Conservation Plan calls for a water savings of 575 AF (10% water savings when compared to the average annual water demand from 2002-2009) by 2020. Table 1 provides a list of Shallow Creek's water conservation measures.

Table 1 Conservation Measures

Conservation Measures
Outdoor watering limited to 6:00 pm to 9:00 am
Toilet rebate program
Washer rebate program
Dishwater rebate program
Loan program for installation of xeriscape
Historic water usage provided on water bills
Water wasting ordinance
Incentives for water efficient fixtures and/or appliances on house resale or remodeling
New landscape ordinances that promote wise water use
Xeriscape loans
Promote indoor water audits
Public education program promoting conservation
Provide acoustical meters to assist customers in identifying leaks
Provide instructional resources on developing a business/office specific conservation plan

These conservation measures also provide drought mitigation benefits by providing water savings that can extend into subsequent years. For example, savings achieved through the installation of water efficient toilets provide water savings for the service life of the toilet. These savings may reduce stress on Shallow Creek's system during drought years. A portion of the water saved through these conservation measures is stored as drought reserves in each of Shallow Creek's reservoirs.

1.0 STAKEHOLDERS, OBJECTIVES AND PRINCIPLES

1.1 Drought Planning Committee

Drought management plans that are developed by one or just a few individuals risk the potential of unforeseen community conflict and/or complications with the water supply system during times of drought. An interactive, collaborative process consisting of stakeholders throughout the City provides valuable insight and perspectives necessary for a more robust and comprehensive drought management plan.

During development of this Plan, a Drought Committee (see Table 2) was formed to review components of the draft Plan and provide feedback. Committee members were selected by the Shallow Creek Utilities Department (Utilities) based on their expertise and professional position.

The following members include senior staff of various departments impacted by drought, City Council members, and three members from the public:

Table 2 Drought Committee Members

Name	Position	Department	Role on Committee
Bob Fisher	City Manager	n/a	Provided general direction on Plan development.
Nancy Harper	Utilities Director	Utilities	Facilitated the Drought Committee meetings, led the coordination and gathering and dissemination of information, and delegated assignments to staff.
Jim Bell	Water Resources Engineer	Utilities	Provided input on water source availability, water rights yields, reservoir storage levels, and opportunities for use of non-potable water, operations, etc.
Henry Smith	Water Treatment and Operations Manager	Utilities	Provided information on water treatment operations and potential implications of a drought.
Melanie Thatcher	Conservation Specialist	Utilities	Served as a liaison between the Conservation Plan and development of the Drought Plan. Was primarily responsible for evaluating the drought response measures during the screening process.
Charles Goode	Accountant	Finance	Provided input on revenue implications associated with drought and costs necessary to implement the Plan.
Sandra Herring	Communications Director	Public Affairs	Provided input on public outreach, media relations, etc. Administered the public review period process discussed in Section 8.1.
Henry Boyd	Parks Manager	Parks Department	Provided feedback related to management of parks and open space.
Bob Kandid	City Lawyer	Legal Department	Provided legal advice.
Susan Richards	Elected Council Member	City Council	Served as a liaison between the City Council and staff.
Emily Woods	Business Woman	Public Resident	Provide input from public business and residential perspective.
Samantha Good	Shop Owner	Public Resident	Provided input from public business, commercial, and residential perspective.
George Wall	Teacher	Public Resident	Provided input from education and school facility perspective.
Trudy Scooter	President of the Tourist Board	Public Resident	Provide input from the tourist sector perspective.

Five meetings were held with the Drought Committee as the Plan was being developed. These meetings focused on the development of the Plan objectives and operating principles and facilitated a means to collect and review data and receive feedback on specific aspects of the Plan. The Drought Committee also had the opportunity to review and comment on the draft Plan in its entirety prior to finalization. The meetings focused on the following material:

- Meeting No. 1 – Introductions and development of water use priorities, objectives, and operating principles.

- Meeting No. 2 – Historical drought information, lessons learned from past droughts, identification of historical and potential future drought impacts, and development of preliminary mitigation and response strategies.
- Meeting No. 3 – Screening of mitigation and response measures as well as development of drought stages, trigger points, and response targets.
- Meeting No. 4 – Development of staged drought response plan.
- Meeting No. 5 – Development of implementation plan.

1.2 Objectives of the Drought Management Plan

The Plan objectives and operating principles are reflective of Shallow Creek's water use priorities and played an important role in guiding the development of the Plan. The Drought Committee allocated and prioritized Shallow Creek's water usage into the five categories shown in Table 3.

Table 3 Water Use Priorities

Priority	End Use	Description
1	Health and Safety	Single-family residential, multi housing, water treatment plant, hydrants (for emergency use), wastewater treatment plant, and hospital.
2	Business	Indoor use by the commercial and public sector including schools, stores, offices, hotels, restaurants, etc., and outdoor use on golf courses.
3	Public outdoor irrigation	Parks, sports fields, and open spaces.
4	Construction water	Water used for construction purposes.
5	Outdoor irrigation	Outdoor irrigation in the single- and multi-family residences, and public and commercial sectors.

Essential uses for the health and safety of the community were given the highest priority. Water uses for existing businesses were assigned a second priority, and construction and outdoor irrigation were assigned lower priorities.

The objectives of the Plan are as follows:

- Preserve essential public services during any level of drought severity from mild to critical emergency conditions.
- Minimize the adverse drought-related impacts on public health and safety, economic activity, environmental resources, and individual lifestyles during a drought event.
- Provide a comprehensive yet flexible framework to guide City staff on the drought mitigation and monitoring efforts, as well as on procedures to follow for declaring a drought and implementing the drought response.

- Effective communication of drought awareness and response information to the water customers.

- Provide an efficient means to monitor and improve the effectiveness of the Plan over time.

- Closely coordinate the drought mitigation and response with Shallow Creek's water supply reliability planning efforts described in Section 3.1 as well as with other City and regional level policies and planning efforts. This includes City, County, and State policy as well as Shallow Creek's Conservation Plan and Fiction County's multi-hazard and emergency operations plans.

- Provide sufficient contextual information in the Plan to convey the importance of drought preparedness and management to the public and how the actions set forth in this Plan are relevant to reducing future drought-related impacts.

The operating principles provide a set of guidance criteria that the Drought Committee used to develop the Plan. These criteria are also intended to provide guidance during implementation of the drought response during periods of drought. These operating principles are as follows:

- The screening and final implementation of mitigation and response measures should effectively address stressed water supplies during periods of drought by either improving the water supply system efficiency/reliability or promoting/enforcing water savings. They should also reflect the general values of the community and water use priorities in Table 3.

- The development and implementation of the Plan should not be conducted in a vacuum. Feedback from the Drought Committee, City staff, and the public is crucial to developing and implementing a well-rounded and effective Plan.

- Response measures that limit and/or restrict water use of certain end-users should be implemented in a manner to reflect the priorities listed above with the highest priority being the preservation of water for health and safety purposes during periods of a drought.

- When possible, efforts should be taken to preserve the environmental and recreational value of the surrounding lands which are important to the values and livelihood of City residents.

- Where possible, efforts should be made to allocate the costs associated with water use restrictions among all customers in an equitable manner.

- Effective coordination and collaboration among City staff is crucial to the success of the Plan. This Plan provides a comprehensive framework for implementation of the drought response based on the information available to date. Exceptions/adjustments to this framework may be necessary during a drought if proven to be of greater benefit. However, all changes should be clearly communicated and coordinated among relevant City staff.

2.0 HISTORIC DROUGHT AND IMPACT ASSESSMENT

2.1 Historical Assessment of Drought, Available Supplies and Demands

Droughts are a natural phenomenon of Colorado's climate. The 2002 drought was by far the worst drought year on record statewide in terms of streamflow. River administration was extremely tight with senior calls much earlier in the season than normal. Shallow Creek's direct flow rights were called out of priority in late May, when, under normal conditions, they traditionally extend into late June. While Shallow Creek's storage rights were of sufficient seniority to allow for the legal filling of both reservoirs, there was a shortage of physical supply. Snowpack above Castle and Crown Reservoirs was 50% of normal in late April and, as shown in Figure 3 and Figure 4, storage in Crown and Castle reservoirs was 56% and 57% of normal, respectively, by July 1, 2002.

Figure 3 Storage in Crown Reservoir

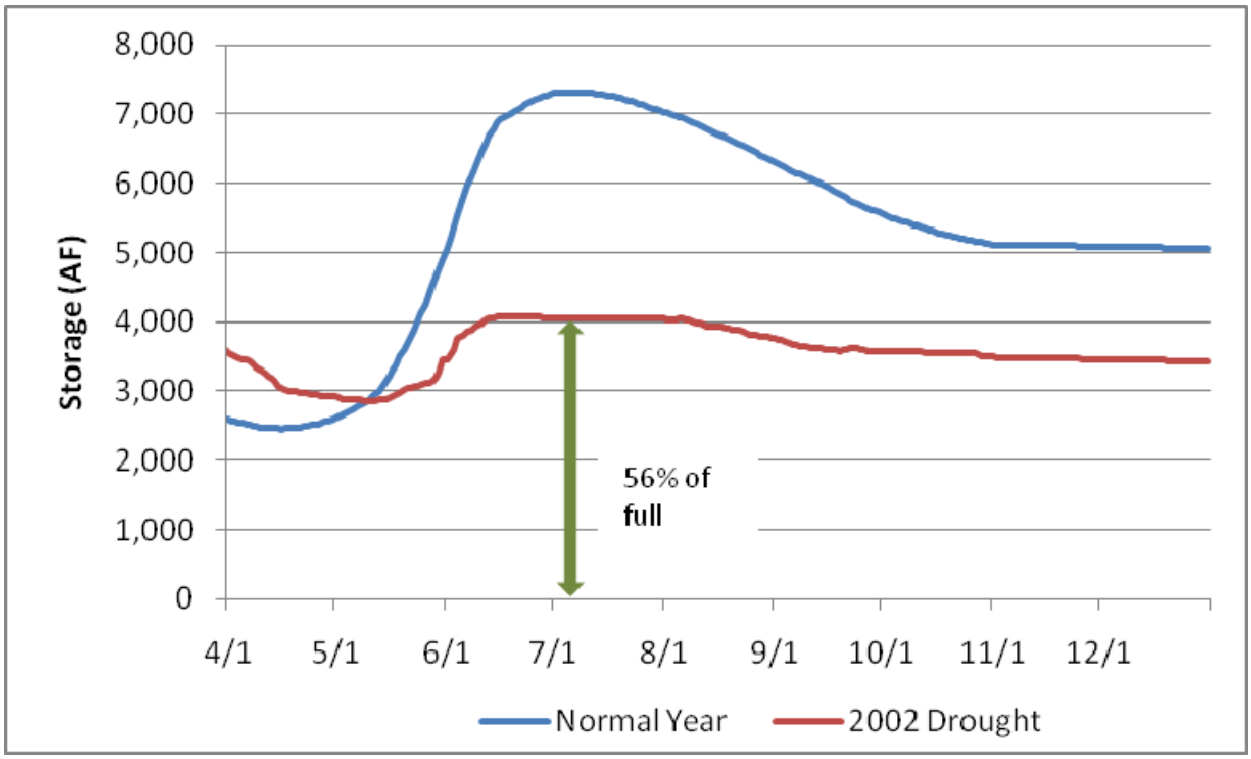
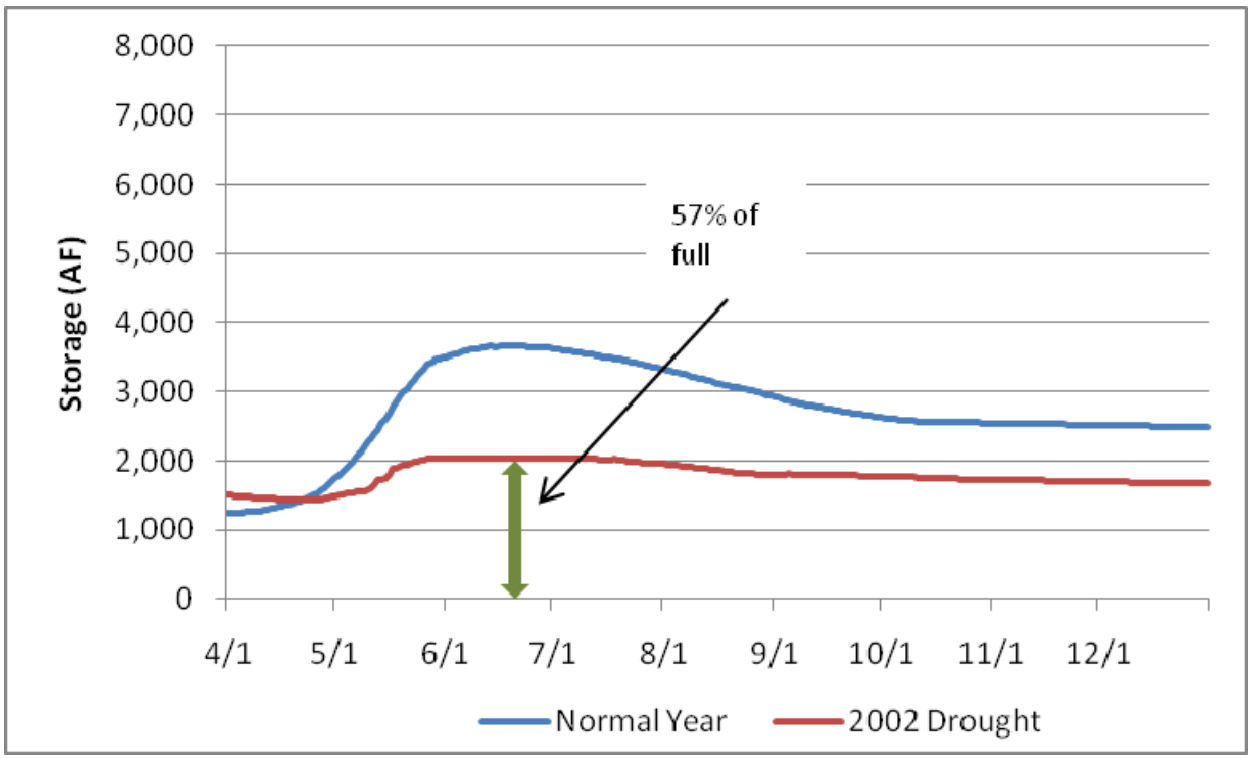


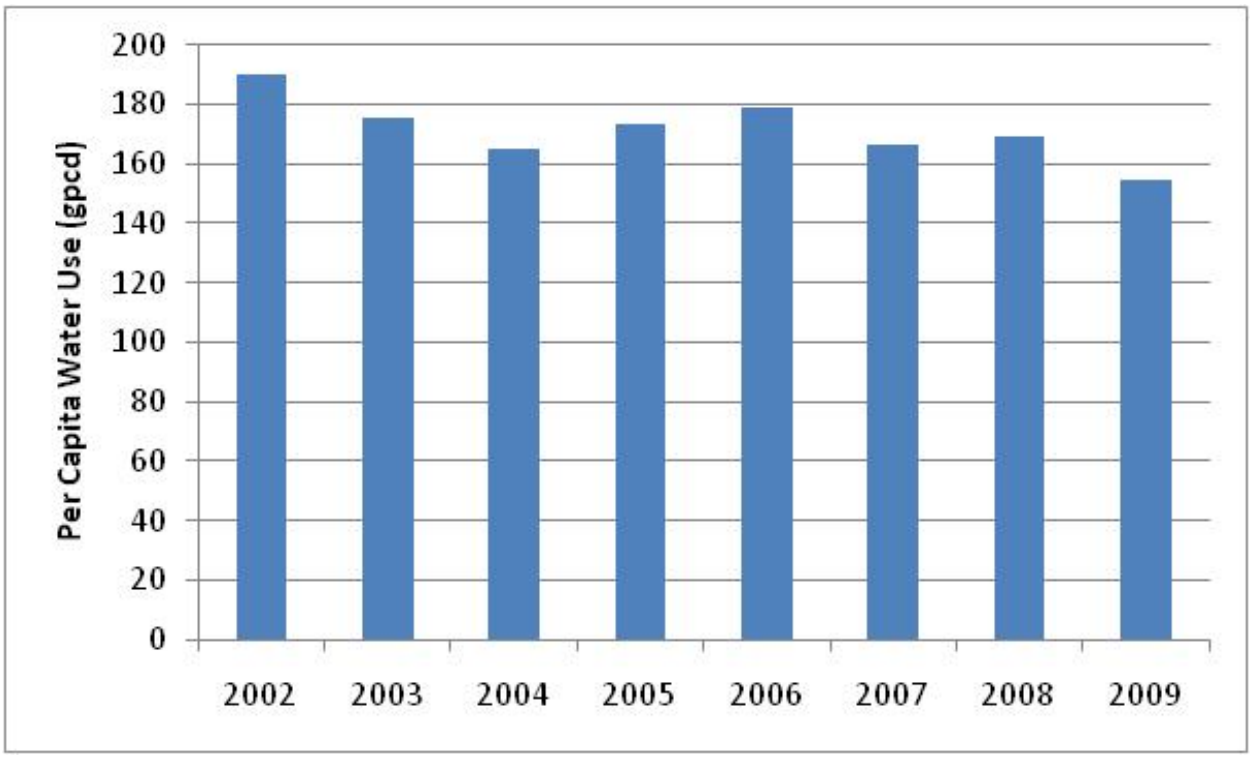
Figure 4 Storage in Castle Reservoir



While Shallow Creek had sufficient supplies to meet demands in 2002, water restrictions were enforced as a precautionary response in recognition that the drought could extend into the following year and drought response would be essential to meeting future 2003 demands. Figure 5 shows Shallow Creek's per capita water usage from 2002 to 2009. Per capita water demands in the years following the drought were noticeably lower with an average 5-year per capita water usage of 168 gpcd (2005-2009).[4] This post-drought reduction in per capita water usage is a common trend observed by many municipalities throughout the State and is likely attributed to behavioral changes in response to regional public drought campaigns promoting increased water conservation. A portion of Shallow Creek's reduction may also be attributed to new long-term water conservation measures initiated in 2003, as well as above average rainfall during the irrigation season.

[4] Shallow Creek typically uses five-year running average per capita water usage values for operational and annual planning purposes.

Figure 5 Shallow Creek Per Capita Water Demands



The 2002 drought emphasized the importance of effective water supply reliability and drought planning and provided the following lessons:

- In August of 2002, Utilities received customer complaints regarding taste and odor as a result of algae growth in Castle Reservoir. While this is a normal occurrence near the end of the summer, reservoir levels are such that this usually does not result in a water quality issue. However, in 2002, the abnormally low reservoir level resulted in less water to dilute the organic material, exacerbating the problem. In future droughts, management should make an effort to reserve supplies in the Crown Reservoir for use during the critical month of August, reducing the need to use the poor quality water in Castle Reservoir.

- Shallow Creek's efforts to educate the public on drought during the 2002 drought were generally well received and most customers were responsive to water restrictions. However, a sufficient number of water restriction infractions were found, suggesting that enforcement via utility staff neighborhood patrol and fines were necessary.

- Shallow Creek is projected to almost double in population over the next 40 years. While demand management is an important component of drought planning, the 2002 drought confirmed that additional supplies are needed to not only meet increasing demands, but to also provide additional insurance for the uncertainty of climate change and increased drought protection.

- Water rates were restructured in 2003 to compensate for the reduction in revenue from water sales and increased treatment costs during the drought. An increasing block rate structure was adopted where the water users at the highest two tiers of water usage are charged significantly higher water rates. A portion of the funds generated from these higher rates are put into a drought response reserve account to compensate for future drought related reductions in retail sales and costs associated with implementation of the drought response plan.

- In November of 2002, a variety of temporary leasing arrangements with downstream farmers were being discussed as a potential means to provide needed supplies to Shallow Creek if necessary in 2003. While the City did not need to utilize any of these arrangements, these discussions highlighted the benefit of working with the agricultural community and possibly neighboring municipalities in finding synergistic beneficial arrangements during a drought.

2.2 Historical Drought Impact, Mitigation and Response Assessment

Utilities experienced a variety of drought-related impacts during the 2002 drought. These impacts and level of severity are outlined in Table 4. These impacts were generally moderate to minor in nature and did not extend beyond the 2002 drought.

Table 4 Historical Impacts on the Utility Department

Historical Impact	Severity
Loss of revenue from reduction in water sales	Moderate
Reduction in storage reserves	Moderate
Degraded water quality	Moderate
Higher water treatment costs	Moderate
Increased costs and staff time to implement the drought response	Moderate
Increased data/information needs to monitor and implement drought response	Minor
Public favorable/unfavorable perception of provider regarding drought response	Minor

The Shallow Creek community also experienced a variety of impacts. The lack of rainfall stressed the surrounding environment resulting in increased risk of wildfire, lower streamflows and reservoir levels, stress to wildlife, and overall reduction in the aesthetics of the area. This significantly impacted recreational activities such as tubing and fishing and impacted the local tourist industry (hotels, restaurants, shops) in the City. The nearby agricultural community was also impacted. Farmers with junior water rights had very limited water to grow crops and several landscaping companies relying on summer as their busy season were forced out of business.

Historically, Shallow Creek was a small town and had not experienced water shortages, and prior to the 2002 drought Shallow Creek did not have a formal drought plan or designated drought mitigation measures. However, during the 2002 drought, such dramatic reductions in reservoir storage justified the necessity for a drought response. The drought response measures included: watering restrictions starting in June 2002 and continuing through September 2002; a public

drought campaign to educate the public about drought; and some low-cost adjustments to the water treatment in attempt address the taste and odor issues. While the water restrictions and public education program proved to be effective in lowering demands, the treatment adjustments were not very successful. An increasing block rate structure was also adopted in 2003 in which a portion of the additional revenue generated by the top two tiers of water users is set aside in a drought reserve account for future droughts.

3.0 DROUGHT VULNERABILITY ASSESSMENT

3.1 Water Supply Reliability and Drought Management Planning

Shallow Creek's water supply reliability planning efforts focus on the ability of the City's water supply system to meet the needs of its customers during times of stress. This reliability depends on a multitude of factors including the City's water source(s), seniority of water rights, storage capacities, and rate of customer demand growth. Water supply reliability planning is an important component of ensuring sufficient supplies during times of drought and, to some extent, overlaps with this drought management planning process. However, this Plan focuses on drought within the context of drought monitoring, mitigation actions, and drought response to lessen drought impacts. Consequently, this Plan does not take the place of water supply reliability planning but rather is closely coordinated with Shallow Creek's water supply reliability planning efforts.

Shallow Creek uses an in-house spreadsheet model, Shallow Creek Supply Model (SCSM), to project water supplies under various hydrologic scenarios. The SCSM model indicates that Shallow Creek currently has a firm yield of 8,000 AF assuming 1953-1956 drought conditions. In other words, Shallow Creek's current water supply system can provide up to 8,000 AF of water under drought conditions of the same magnitude experienced during the 1953-1956 drought.

A thorough assessment of Shallow Creek's water supplies was last conducted in 1998 when Shallow Creek updated their Raw Water Master Plan. Since 1998, Utilities has gained further insight as a result of the 2002 drought and has purchased additional water rights. Utilities is currently leading an effort to update the outdated 1998 Raw Water Master Plan which is scheduled for completion by 2012. This new Raw Water Master Plan will include the following:

- New water rights purchased and projected to be purchased since 1998.
- Updated water demand projections assuming build-out in 2050.

- Evaluation of whether Shallow Creek's current water supply planning approach using firm yield is adequate, or whether an alternative method such as a reliability criteria approach[5] is more applicable and compatible with the City's planning needs.

- Evaluation of new water supply options to meet future growing demands and to provide additional drought reserves. These options include:

  – New agricultural water rights.
  – Additional alluvial groundwater for non-potable irrigation of parks and open space.
  – Reclaimed water for non-potable irrigation of parks and open space.
  – Gravel lake storage just upstream of Shallow Creek's existing surface water diversion.
  – Lower reservoir intake structures to make use of dead storage in Crown and Castle Reservoirs.

- Assessment of how climate change may influence Shallow Creek's future demands and supplies.

- Evaluation of operational adjustments that could be made to address the taste and odor drinking water quality issue experienced during the 2002 drought. This may include adjustments to Crown and Castle Reservoir releases, blending of supplies to dilute the organic material in Castle Reservoir, and modifications to the water treatment plant to improve the removal of organics.

- Reconnaissance level evaluation characterizing the potential impacts to Shallow Creek's water supplies if a Colorado River Compact call occurred.

3.2 Drought Impact Assessment

Utilities could experience a variety of future drought-related impacts. These potential impacts and level of severity are outlined in Table 5. The potential severity of many of these impacts could be significant depending on the magnitude and duration of the drought as well as how effectively the drought mitigation and response efforts reduce the impact.

[5] Firm yield planning uses a modeling approach that assumes that a fixed average annual demand is met under all conditions until the active storage in the system is fully emptied (or drawn down to a minimum storage reserve), as modeled against a specified multi-year drought. Surface water-dependent municipal water supply systems do not operate in this manner. Utility managers impose watering restrictions or other demand-reducing measures long before storage in their raw water reservoirs is reduced to 10% or even 25% of active storage, as a precaution against the possibility that ensuing years will also be drought years. For this reason, the firm yield of a water supply system will overestimate the actual reliability of the system. In contrast, reliability-based planning incorporates recognition and response to drought into the modeling of the water supply system. Under this modeling approach, demand is reduced in specified amounts in response to varying levels of drought based upon quantified drought response triggers, such as snowpack and water in storage. This method of planning provides a more realistic assessment of water supply reliability and allows for systems to be designed in response to the community's reliability goals.

Table 5 Historical Impacts of the Utility

Potential Future Drought Impacts	Potential Severity
Loss of revenue from reduction in water sales	Moderate
Reduction in storage reserves	Significant
Disruption of water supplies	Significant
Degraded water quality	Significant
Higher water treatment costs	Moderate
Sediment and fire debris loading to reservoirs following a wildfire	Significant
Increased costs and staff time to implement drought plan	Minor
Increased data/information needs to monitor and implement drought mitigation plan	Minor
Increased costs of acquiring additional supplies during times of drought	Significant
Favorable/unfavorable public perception of provider regarding drought response	Moderate
Scarcity of equipment and other water related services (i.e. contractors to repair wells)	Moderate

The Shallow Creek community could also experience a variety of future drought-related impacts. Some of the more significant impacts include:

- Damage to public and private landscaping.
- Degraded drinking water quality similar to the taste and odor issues experienced during the 2002 drought.
- Unequal impacts of water restrictions and other drought response measures upon certain businesses/individuals. For example, landscaping companies and large golf courses that depend on irrigation may be more vulnerable. Furthermore, demand reductions achieved by reliance upon surcharges would be disproportionately borne by lower-income customers.
- Reduction in streamflows and reservoir levels could impact the tourist and commercial industry.
- Increased risk of wildfire that not only threatens the water supply but the safety and overall environment of the surrounding area.
- Loss of agricultural irrigation could reduce farm income and impact agricultural-related businesses in the City.
- Increased public awareness on drought response efforts, importance of water conservation and positive reduction in water usage.
- Loss of use of public and private swimming pools.

While some of these impacts are beyond the immediate control of Utilities, drought mitigation activities and daily operational adjustments during future droughts may be made to alleviate some of these impacts. This is discussed in further detail in Section 4.0.

4.0 DROUGHT MITIGATION AND RESPONSE STRATEGIES

As previously mentioned, drought mitigation refers to actions taken in advance of a drought that reduce potential drought-related impacts when the event occurs. Whereas drought response planning refers to the conditions under which a drought-induced water supply shortage occurs and specifies the actions that should be taken in response.

Mitigation and response strategies that focus on the management of the water supply system are generally referred to as supply-side actions; whereas demand-side mitigation and response strategies focus on actions that Utilities can take to promote or enforce reductions in customer water demands. This section presents the mitigation and response strategies selected following a screening process. The response strategies are further refined into a staged drought response program discussed in Section 6.0.

4.1 Drought Mitigation Measures

The drought mitigation measures were selected by developing a preliminary list of potential mitigation measures and conducting a screening process to select the measures most conducive for Shallow Creek. The preliminary list was developed using CWCB's Drought Management Guidance Document and accompanying worksheets, as well as incorporating Shallow Creek's water supply reliability and conservation planning efforts. Potential impacts identified in Section 3.2 were also used to generate new ideas for mitigation options. The preliminary mitigation list was screened and further refined using the following criteria:

- *Technical feasibility* – Is the selected mitigation or response strategy technically feasible and will it work as intended? Can implementation occur in a timely manner? Is there staff to implement the action?

- *Perceived benefits* – Will the selected mitigation or response strategy provide an adequate amount of water supplies and/or water savings?

- *Cost effectiveness* – How does the implementation cost compare with the benefits? This may simply be a qualitative assessment or quantitative comparison of ratios of implementation costs to the water savings cost benefit.

- *Public acceptance* – How favorably will the public react to the select mitigation/response strategy? A review process of alternative means to engage the public would be beneficial to assess general public acceptance.

- *Environmental sensitivity and other impacts* – What are the environmental benefits/costs to implementing the mitigation and/or response strategy? Is there an environmental issue or other impacts that should be further considered?

The final step of the screening process assessed the selected group of mitigation actions to ensure that the final combination collectively met the following criteria:

- Compatible with Shallow Creek's water supply system and is feasible from an implementation standpoint;
- Consistent with the operating principles and objectives of the drought management plan;
- Fairly represents the needs of affected individuals and groups; and
- Sufficiently addresses potential water shortages and future impacts.

The final mitigation measures are provided below.

Mitigation Measures:

- *Drought mitigation planning* – The major components of this Plan provide an effective means for Shallow Creek to prepare for drought. When done in advance of a drought, planning is considered drought mitigation. These components include the objectives and operating principles; assessment of historical and potential drought impacts; drought-related monitoring; drought stages, trigger points and response targets; declaration of a drought; development of drought-related ordinances; and the public drought education campaign. This planning effort in advance of a drought is considered mitigation.
- *Ongoing monitoring of drought indicators* – Shallow Creek's monitoring plan is outlined in Section 7.2.
- *Development of new water supplies* – Shallow Creek is planning to develop additional water supplies for drought protection and meet the growing water demands. New water supply options including alluvial groundwater wells, gravel lake storage, agricultural water right purchases/leasing arrangements, use of dead reservoir storage by lowering the reservoir intakes, and development of reclaimed water are being evaluated through the update of Shallow Creek's Raw Water Master Plan which is to be completed by 2012. A portion of these new supplies will be designated for new growth while the remainder will be reserved for use during periods of drought.
- *Develop cooperative sharing agreement opportunities with neighboring communities during periods of drought* – Shallow Creek's water supply yields may be increased by making some adjustments to how water rights are traditionally managed and through other synergies developed via cooperative agreements with other local water users. Where possible, these agreements will be established in advance of a drought as part of the mitigation effort and activated during drought periods.[6] Agreements may include exchanges, agricultural leases, trades, temporary fallowing, etc. Appropriate Substitute Water Supply Plans and/or water court filings will occur to ensure that the agreement(s) are viable under Colorado Water Law.

[6] Activation of these agreements and identification of additional temporary arrangements during drought periods would be a component of the drought response which is addressed in Sections 4.2 and 6.0.

- *Existing operation and maintenance activities that improve water distribution efficiency* – Utilities currently conducts annual audits on their water distribution system, routinely repairs leaks on an as-needed basis, monitors and replaces inaccurate meters, and strategically operates its water supply system to avoid reservoir spills (releasing reservoir water when not necessary for water supply purposes).

- *New operation and maintenance activities that improve water distribution efficiency* – The addition of new water supplies to Shallow Creek's system will require modifications to current daily operations. Such operational changes are being evaluated through the Raw Water Master Plan Update process with the objective of optimizing operations to improve the efficiency and overall distribution of water supplies when the new water supplies are developed. Utilities also plans to update their water treatment plant to recycle wash water and reduce water waste by 2013.

- *Conservation measures specified in the Conservation Plan* – The conservation measures shown in Table 1 serve the dual purpose of conserving water while also providing drought protection. A portion of the water saved through these conservation measures is stored as drought reserves in each of Shallow Creek's reservoirs.

- *Standard practices of the Utilities Department and Shallow Creek City Staff* – Shallow Creek's management and operations reflect the City's values of sustainability and environmental stewardship. Many of the Utility Department's standard operations focus on water conservation, providing multi-year water savings, and drought mitigation during dry periods. These include annual irrigation audits on City-owned parks and open spaces, routine education of City staff on how to save water, use of low volume irrigation (i.e. drip irrigation) instead of sprinklers and misters where appropriate, and the installation of water saving fixtures in all City-owned buildings. Since 2004, the City has replaced 80%of its toilets with water efficient toilets and is currently in the process of replacing dishwashers, shower heads, and urinals in all City-owned buildings.

4.2 Supply-Side Response Strategies

The same process and screening criteria used to develop the mitigation measures described in Section 4.1 were used to identify and select the final supply-side response strategies. The final supply-side response strategies in Table 6 consist of technical and financial assistance opportunities, water rights management and cooperative agreements, and improvements to water distribution efficiency. It was noted that some of the measures listed below would require approval of a substitute water supply plan by the Division Engineer and/or approval of a change decree by the Water Court. Each of these strategies is reflective of the operating principles disclosed in Section 1.2 and is refined into a staged drought management program in Section 6.0.

Table 6 Supply-Side Response Strategies

Category	Response Strategy
Seek technical and financial assistance opportunities	• Identify state, federal, county, and private entity assistance. This could include grants or loans for emergency drought related planning, drought relief, water use efficiency improvements, etc.
Execution of existing water rights management and cooperative agreements and development of new opportunities	• Purchase or lease water from other entities (i.e. neighboring cities, federal projects). • Arrangement and/or execution of exchanges. • Utilize emergency interconnections with other providers' systems. • Lease irrigation rights from farmers. • Negotiate purchases or "options". • Jointly develop water transfers with other entities. • Trade water supplies with other entities to increase yield. • Pay upstream water user to allow diversion of more water.
Improvements to water use efficiency	• Change pattern of water storage and release operations to reduce net evaporation, optimize efficiencies in Shallow Creek's water supply system, and reduce drought related impacts.

4.3 Demand-Side Response Strategies

The same process and screening criteria used to develop the mitigation measures described in Section 4.1 were used to identify and select the final demand-side response strategies. The final demand-side response strategies shown in Table 7 consist of actions taken by City staff to conserve water and place water use limitations on residential and commercial customers. These strategies are refined into specific drought response measures in Section 6.0. Each of these strategies is reflective of the operating principles disclosed in Section 1.2 and is refined into a staged drought management program in Section 6.0.

Table 7 Demand-Side Response Strategies

Category	Response Strategy*
City operations and maintenance activities (actions taken by City staff to conserve water)	• Implement drought surcharges. • Eliminate/reduce irrigation on City-owned parks and landscaping. • Educate City staff on how to save water. • Prohibit watering during fall, winter, and early spring. • Limit/prevent washing of City fleet vehicles. • Limit hydrant washing and flushing. • Limit use of water for fire training. • Eliminate all fire hydrant uses except those required for public safety. • Turn off ornamental fountains in City-owned buildings and parks. • Conduct indoor water audits.
Residential	• Enforce landscape watering restrictions. • Limit number of watering days per week and the duration of watering time. • Prohibit lawn watering during fall, winter, and early spring. • Limit watering to hand-held hose or no-volume non-spray device. • Limit/prohibit installation of new sod, seeding, and/or other landscaping. • Enforce restrictions on spraying of impervious surfaces. • Prohibit/limit vehicle washing. • Prohibit/limit non-recirculating fountains. • Prohibit/limit filling and use of swimming pools. • Enforce indoor water restrictions. • Promote/enforce reduction of water-cooled air conditioning.
Commercial	• Prohibit/limit use of construction water. • Enforce policy guidelines/limitations for installation of new sod and/or other landscaping. • Enforce outdoor landscape watering restrictions. • Promote/require indoor and outdoor water audits where applicable. • Turn off indoor and outdoor ornamental fountains. • Prohibit/limit filling and use of swimming pools. • Turn off public drinking fountains. • Prohibit/limit dealership washing of vehicles. • Enforce water use restrictions on commercial car washes • Promote/enforce service of water in restaurants only upon request. • Promote/enforce reduction in frequency of linen and towel washing in hotels.

*The response strategies listed in Table 7 are activities City staff can perform during drought periods to save water in addition to the standard practices and conservation measures specified in the Conservation Plan.

4.4 Drought Public Information Campaign

Shallow Creek's water demands were significantly reduced in 2002 as a result of the public's awareness and responsiveness to reduce water consumption. The public drought education campaign (public drought campaign) will be one of Shallow Creek's largest drought management efforts. Messages will be delivered in both Spanish and English to reach the majority of demographics within Shallow Creek's service area.

The public drought campaign will be closely coordinated with Shallow Creek's current conservation education programs and other related programs providing information on sustainability, weather, climate change, etc. When reasonable, these programs may be integrated into a single program by the Public Affairs Department to integrate efforts and enhance efficiencies. These program(s) will promote the importance of conserving water and achieving water savings in both normal and drought years. During non-drought years the drought

campaign component will simply provide a general overview on drought and the importance of drought preparedness. During a drought, the drought messages will increase in frequency and intensity and will be expanded to include information on the staged drought response program and the necessity to conserve supplies.

The objectives of the public drought campaign are:

- Provide concise effective drought information to Shallow Creek customers and the media.
- Adjust the intensity of the public outreach effort in accordance to the severity of the drought (drought stage).
- Coordinate campaign efforts with nearby municipal entities and other conservation oriented entities to capitalize on synergistic opportunities and convey, where appropriate, a consistent drought message.

The public drought campaign will provide the basic foundational drought information during non-drought periods outlined in Table 8. The Public Affairs Department will monitor the drought messages and information conveyed by other local providers to ensure that differences in drought-related messages may be explained, if necessary. Information from other providers may also serve as a means to generate new ideas of how Shallow Creek's public drought campaign and overall drought response could be improved.

Table 8 Public Drought Campaign Messages (Pre-Drought and Continuing During Drought Periods)

Drought Information	Coordination With Other Entities
Status of current drought conditions and corresponding drought stage	Be aware of messages conveyed by neighboring providers in order to explain, if necessary, why there are differences in the messages as well as in the overall drought response.
Long-term sustainability of water supply system	n/a
Location of where customers may access the Drought Management Plan	n/a
Factors that could influence water supply services and cost of services	n/a
Water provider's actions to save water and/or acquire new water	Be aware of other local providers' drought mitigation efforts. This may be helpful to generate new ideas to improve the City's public drought campaign and overall mitigation efforts.
Drought policies, requirements, and penalties	n/a

During drought periods, the intensity of both the conservation public education program and public drought campaign will increase. Particular messages as well as the means in which the information is conveyed to the public will be customized to the severity of the drought and public informational needs at that time. Information Shallow Creek intends to convey to the public during drought periods, as shown in Table 9, consists of educating customers of drought policies (i.e. water restrictions), enforcement, landscaping tips, and an expansion of the Water

Star Program established via the Conservation Plan. The Water Star Program advertises and promotes businesses that practice a strong water conservation ethic. This may encompass installing water efficient appliances/fixtures, xeriscape landscaping, water conservation education to staff, etc. During droughts, this program will be expanded to advertise and promote businesses that are going the extra mile to conserve water and adhere to voluntary drought response measures.

Coordination with other entities will be an important component of the public drought campaign during periods of drought. Efforts will be made to take advantage of synergies associated with consistent drought-related messages shared among neighboring providers and collectively contributing to a regional drought outreach effort. During this period it will also be important to be aware of neighboring providers' drought-related response activities, water use restrictions, and means of enforcement. This will enable Shallow Creek to explain any differences among their drought response efforts and maintain integrity with the public. Additionally, other entities may be able to provide assistance with the advertisement of drought related information. For example, several landscaping companies in Shallow Creek may be able to provide landscaping tips during a drought and what to do to revive landscape following droughts.

Table 9 Public Drought Campaign Response Information to Convey During a Drought

Drought Information	Coordination with other Entities
Measures and/or impacts that customers can expect if drought continues or intensifies	Be aware of the drought response measures implemented by other local providers. This will assist in addressing public concerns and questions.
Increase advertisement of water conservation promotion and incentives specified in the conservation and drought plans	Identify synergies/benefits of working with other entities on this advertisement campaign.
Landscaping tips during a drought (i.e. which plants to convert to drip, which to save, which to let die)	Research information that is currently available and identify whether there are other entities that can assist with this effort.
Post-drought landscape revival information	Research information that is currently available and identify whether there are other entities that can assist with this effort.
Encourage intense public discussion and media involvement concerning ways to reduce water use while minimizing impacts (i.e. landscaping impacts)	n/a
Explanation of rate increases/drought surcharge (this can apply to both drought and post-drought years)	Be aware of other provider's rates and drought surcharges and be prepared to explain why Shallow Creek's rates/drought surcharges are different.
Publicize efforts of individuals and businesses as examples of how to reduce water use Expand the Water Star Program developed through the Conservation Plan)	n/a

Utilities will coordinate efforts with the Public Affairs Department to ensure that accurate information is being conveyed to the media and to customers. The Public Affairs Department will be responsible for developing regular action plans detailing the specific drought-related messages delivered to the targeted audiences both prior to and during a drought. This will be an

evolving process that could change on a seasonal basis depending on weather and public concerns. The basic targeted audiences and communication tools intended to be used by the Public Affairs Department are shown in Table 10. Outreach will mainly consist of website communications, social networking media, and informational emails during non-drought periods. Communication tools will likely be expanded to newspaper articles, television ads, bill inserts, emails targeted to specific water users, booths at special events, and school programs during a drought.

Table 10 Public Drought Campaign Audiences and Communication Tools

Targeted Audience	Communication Tools	
	Long-term Mitigation	**Short-term Response Strategy**
Decision/policy makers, City departments (i.e. parks, finance, etc.)	• Email	• Email • Meetings
Media	• Website • Social networking media • Interviews	• Website • Newspaper articles • Social networking media • Interviews • Television ads
Water Customers (Single and multi-family, HOAs, commercial)	• Website • Broadly distributed emails • Social networking media	• Website • Broadly distributed emails • Social networking media • Public meetings • Bill inserts • Newspaper articles • Billboards • Booths at special events
Targeted business owner customers (recreation facilities, nurseries, health facilities, schools)	• Website • Social networking media	• Website • Emails targeted for business owners • Social networking media
Large water users (golf courses, water-intensive industrial customers)	• Website • Social networking media	• Website • Emails targeted for large water users • Social networking media • Meetings
Commercial business employees	• Website • Broadly distributed emails • Social networking media	• Website • Broadly distributed emails • Social networking media
School children	• Water educational curricula for teachers • Water educational programs for students • Water festivals	• School programs • Booths at special events for children

5.0 DROUGHT STAGES, TRIGGER POINTS AND RESPONSE TARGETS

5.1 Drought Stages, Trigger Points and Response Targets

Droughts can vary significantly in spatial extent, severity, and duration. The drought stages in Table 11 were developed to capture this variability and identify an appropriate level of response, according to drought severity. The four stages increase in intensity from watch, to warning, to critical, to emergency. The response target (targeted water savings) also increases with each stage, with a 10% water savings target under the watch drought stage and a 50% water savings target under the emergency drought stage.

Table 11 Drought Stages, Trigger Point Guidelines and Response Targets

Drought Stage	Drought Trigger Point Guidelines			Response Targets[1]
	Measured Snowpack near the end of April	Projected Reservoir Storage on July 1		
		Storage Level	Approximate Supply[2]	
Watch	90% of normal	Storage less than 90% of full	2 years of unrestricted total demand	10% water savings
Warning	75% of normal	Storage less than 80% of full	1 year of unrestricted total demand	25% water savings
Critical	50% of normal	Storage less than 65% of full	1 year of total demand with mandatory outdoor restrictions	40% water savings
Emergency	30% of normal	Storage less than 50% of full	1 year of unrestricted indoor demand	50% water savings

1 Percentage water savings is measured as annual total retail water sales divided by a five year running average of retail water sales.
2 Based on 2020 projected demands. Unrestricted implies no drought response or water restrictions are enacted.

The drought trigger points are based on the measured snowpack near the end of April and the projected percentage of storage on July 1. Utilities staff begins to develop these storage projections using Shallow Creek's SCSM water supply model in early March taking into consideration snowpack measurements and other hydrologic data. It is important to note that the SCSM modeling assumes a single-drought year scenario and consequently, while these trigger points provide a general means to gage drought, droughts are unpredictable and can significantly vary (as described in Section 5.2).

The drought triggers in Table 11 are simply general guidelines. Sustained multi-year droughts could require a significant modification to the drought triggers based on the duration and severity of the drought and the Utilities staff's historical experience managing Shallow Creek's water supply system. The declaration of a drought, timing of the declaration, and corresponding drought stage will ultimately be a real-time decision. The real-time decision will be based on a combination of the drought trigger guidelines in Table 11, historical staff experience, and other drought indicator data described in Section 5.2.

5.2 Drought Declaration and Predictability

Drought can appear quickly or slowly, last for a season or many years, and can occur locally, regionally, or statewide. Furthermore, a drought does not usually have a clearly defined

beginning or end and is difficult to predict. Following the 2002 drought, snowpack accumulation in early 2003 was again abnormally low and, if not for a large single snow storm event in late March 2003, many providers throughout Colorado, including Shallow Creek would have been seriously stressed and under significant water restrictions for the summer of 2003 and beyond.

In addition to reservoir storage, Utilities monitors other drought indicators throughout the year to develop a better understanding of the watershed hydrology and how to best manage the City's water supply system. These drought indicators include the following:

- *Snowpack* – Shallow Creek uses two SNOTEL gages upstream of Castle and Crown Reservoirs. The snowpack percent accumulation relative to normal conditions and moisture content are uploaded once a week October through mid-June. These data are critical to understanding the amount of runoff available to fill the reservoirs and the timing of when/if the drought triggers should be applied. For instance, if it had been a cold spring and the reservoirs had not started to fill by early June, drought would not be of a concern if the snowpack was 110 percent of normal. However, a warm spring with only 60 percent of normal snowpack would be strong indication of drought.

- *Precipitation records* – Shallow Creek monitors precipitation using three National Oceanic and Atmospheric Administration (NOAA) gages in the watershed upstream of Castle and Crown reservoirs. Precipitation is also monitored in the City service area using two gages in the northern and southern portions of the City. These data are measured on an hourly basis and are assessed/recorded on a weekly basis. Precipitation affects City water demands and streamflows. Dry springs and summers can significantly elevate outdoor demands. Shallow Creek also monitors winter and early spring season precipitation trends in the lower elevations of the major river basin in which it is situated, and where most of the basin's irrigated agricultural lands are located. Even when upstream snowpack is normal, below-normal precipitation in the lower elevations can result in extensive periods when downstream water rights are senior to Shallow Creek's water rights.

- *Streamflows* – Shallow Creek measures streamflows just upstream of its reservoir inflows, water treatment plant diversion, and wastewater discharge. These data are measured on an hourly basis and are assessed/recorded on a weekly basis. Streamflows play a significant role in river administration and the duration in which Shallow Creek can use its direct flow rights.

- *River calls* – Daily monitoring of river calls is necessary for operations as well as for discerning real-time water management decisions. The call data is reflective of downstream demands and the hydrology (i.e. wet vs. dry) of a given year. In dry years, the call is generally relatively senior early in the year and can limit Shallow Creek's direct flow diversions.

- *US Drought Monitor* – Provides current drought conditions as well as drought related forecasts on a regional basis, which are provided by the Climate Prediction Center at NOAA. The forecasts include regional one and three month climate outlooks (temperature and precipitation), drought outlooks, monthly updated streamflow forecasts for the first part of the year, Palmer Drought Severity Index, and soil moisture forecasts.

Monitoring and data assessment are most intensive from early February through the middle of July. In February, March, and April, Utilities monitors trends in snowpack, precipitation, and streamflows, and makes projections of expected July 1 storage. Utilities recognizes that drought responses should be formulated and announced as early in the irrigation season as possible in order to maximize their effectiveness. From May to early July, Utilities monitors the actual filling of its reservoirs. This is the crucial period in which a drought may be declared depending on reservoir storage and snowpack, although data from the other drought indicators also come into play. By late June/early July, Utilities assesses when reservoir releases should be initiated.

Utilities may also rely on other data in addition to the drought monitoring data listed above to predict and declare a drought. This may include regional weather/hydrologic data, drought indices such as the Palmer Drought Severity Index when appropriate, information from other nearby water users, long-term weather forecasts, etc.

It is important to ensure that the official drought declaration and corresponding drought stage designation occurs in a timely manner. If a drought is declared too late or actions are not taken early enough to reduce water use, supplies can be severely depleted and strict water restrictions and economic impacts may be required that could have been avoided. Conversely, premature drought declarations can result in unnecessary mandatory water restrictions and associated impacts, while customers can lose confidence in the declaration.

As discussed in Section 5.1, drought declarations are further complicated by the unpredictability of drought and storm events. Droughts may extend over multiple years which could result in response targets greater than what are provided in Table 11. The declaration of a drought and corresponding drought stage will be a real-time decision using the drought trigger guidelines in Table 11, historical experience, and other drought indicators described in detail in Section 5.1.

The drought stage may also be de-escalated (i.e. changed from the critical to the warning stage) and/or the drought declaration may be terminated if storm events or other hydrologic conditions sufficiently reduce stress to Shallow Creek's water supplies. This decision will be based on drought monitoring data and the Utilities staff's historical experience and professional judgment in managing Shallow Creek's supplies.

6.0 STAGED DROUGHT RESPONSE PROGRAM

The staged drought response program defines the specific response measures to be taken according to drought stage. This section outlines the mitigation, supply and demand-side measures and associated enforcement levels by drought stage.[7] It is important to note that crucial components of this program include the implementation, enforcement and monitoring which are discussed in Sections 7.4, 7.5, and 7.6, respectively.

[7]Some water providers may find it more conducive to put this detailed description of the staged drought response program into a separate accompanying document such as an appendix.

6.1 Watch Drought Stage

Drought Trigger Points: Storage less than 90% of full on July 1 and measured snowpack 90% of normal by the end of April.

Drought Stage and Trigger Summary: The Watch drought stage is triggered when the actual or forecasted storage on July 1 is less than 90% of full. The drought response is to primarily focus on voluntary measures with the objective of reaching a water use reduction target of 10% during the irrigation season.

Supply-Side Response Measures

The following two supply-side measures may be implemented regardless of the drought severity and stage. The specifics on how each measure would be implemented and timing would be identified at the onset of the drought.

- Seek technical and financial assistance opportunities – This may include assistance from the public sector at the federal, state, or county level or include assistance from private entities such as non-profit organizations promoting water conservation and drought awareness. Assistance may include grants, loans, technical assistance (i.e. water use efficiency improvement), education, etc. Shallow Creek plans to be aware of the technical and financial opportunities before a drought enabling the City to take advantage of the opportunities quickly and efficiently when a drought occurs.

- Water rights management and cooperative agreements – Shallow Creek's water supply yields may be increased by making some adjustments to how water rights are traditionally managed and through other synergies developed via cooperative agreements with other local water users. Where possible, these agreements will be established in advance of a drought as part of the mitigation effort and activated during drought periods. However, the activation of these agreements and identification of new arrangements during drought periods will be a component of the drought response. Appropriate Substitute Water Supply Plans will be filed to ensure that the agreement/arrangement(s) are viable under Colorado Water Law. These agreement/arrangement(s) may include the following:

  – Acquire water from other entities – Shallow Creek's water supply system is situated in such a manner that it could divert and utilize water from other entities via exchange. Purchase, lease, trade, temporary fallowing, and water transfer arrangements with downstream agricultural users and nearby water providers will be explored as an option during drought periods.
  – Pay upstream water users to divert less water – This would include Snow Mountain Ski Resort who can significantly reduce stream flows in November and December during snow making periods.

Demand-Side Response Measures

Utilities Department

- Irrigation of City-owned property (parks and open spaces) – enforce standard practices which includes water audits at the beginning of the irrigation season and efficient water use.
- Washing of City-owned vehicles – Washing of City-owned field vehicles is limited to once every two weeks and washing of all other vehicles is limited to once per a month.
- Fountains – Ornamental fountains and drinking fountains in City-owned parks are turned off from 10:00 am to 4:00 pm.

Residential Voluntary Restrictions

- Outdoor water restrictions – residents are encouraged to follow the voluntary outdoor water restrictions according to the following schedule:

Type of Property	Watering Days (three days per week)
Single family residential with even number address	Saturday and Wednesday
Single family residential with odd number address	Sunday and Thursday
All other residential properties (multifamily, HOAs, etc.)	Monday and Friday

- Impervious surfaces (driveways, sidewalks, patios, etc.) – recommend minimizing power washing and spraying on impervious surfaces. A broom or mop may be used as a replacement.
- Personal vehicles – should only be washed using a bucket and hand-held hose with an automatic shut-off nozzle.
- Private swimming pools and hot tubs – all swimming pools and hot tubs should be covered when not being used to reduce evaporation. Regular maintenance should minimize leaks and reuse the water for irrigation when emptying the pool/hot tub.
- Water cooled air conditioning, swamp coolers, and humidifiers – adjust room temperatures to reduce use of water-cooled air conditioning. Use room size humidifiers and swamp coolers in most utilized rooms as opposed to whole house units.

Commercial and Institutional

- Construction water – appropriate best management practices should be employed to conserve and prevent wasting of construction water.

- Outdoor water restrictions – commercial businesses are encouraged to follow the voluntary outdoor water restrictions according to the following schedule:

Type of Property	Watering Days (two days per week)
Businesses with even number address	Saturday and Wednesday
Businesses with odd number address	Sunday and Thursday
Large irrigators (i.e. golf courses, schools/athletic fields)	Monday and Friday

- Outdoor water audits – Shallow Creek has partnered with a natural resources conservation non-profit organization that promotes efficient water use. This non-profit organization provides free water audits for an unlimited number of customers during drought periods. Commercial businesses are encouraged to sign-up for a free outdoor water audit through the Utilities website.

- Commercial swimming pools and hot tubs – all swimming pools and hot tubs should be covered when not being used to reduce evaporation. Regular maintenance should minimize leaks and reuse the water for irrigation when emptying the pool/hot tub.

- Commercial car washes – all commercial car washes are encouraged to implement best management practices to reduce water use by 10% where technically feasible.

- Car dealership vehicles – should only be washed using a bucket and hand-held hose with an automatic shut-off nozzle.

- Restaurants – all restaurants are encouraged to not serve water unless customers specifically ask for it.

- Lodging – all lodging establishments are encouraged to place water conservation cards in every room promoting water conservation (i.e. short showers) as well as not changing linens and towels unless a customer specifically requests the service.

Public Campaign

Outlined in Section 4.4. Details of the public drought campaign are to be developed at the onset of a drought.

Enforcement Procedures

Provided in Section 7.5.

6.2 Warning Drought Stage

Drought Trigger Points: Storage less than 80% of full on July 1 and measured snowpack 75% of normal by the end of April.

Drought Stage and Trigger Summary: The Warning drought stage is triggered when the actual or forecasted storage on July 1 is less than 80% of full capacity. The drought response is to primarily focus on mandatory measures with the objective of reaching a water use reduction target of 25% during the irrigation season.

Supply-Side Response Measures

The following two supply-side measures may be implemented regardless of the drought severity and stage. The specifics on how each measure would be implemented and timing would be identified at the onset of the drought.

- Seek technical and financial assistance opportunities – This may include assistance from the public sector at the federal, state, or county level or include assistance from private entities such as non-profit organizations promoting water conservation and drought awareness. Assistance may include grants, loans, technical assistance (i.e. water use efficiency improvement), education, etc. Shallow Creek plans to be aware of the technical and financial opportunities before a drought enabling the City to take advantage of the opportunities quickly and efficiently when a drought occurs.

- Water rights management and cooperative agreements – Shallow Creek's water supply yields may be increased by making some adjustments to how water rights are traditionally managed and though other synergies developed via cooperative agreements with other local water users. Where possible, these agreements will be established in advance of a drought as part of the mitigation effort and activated during drought periods. However, the activation of these agreements and identification of new arrangements during drought periods will be a component of the drought response. Appropriate Substitute Water Supply Plans will be filed to ensure that the agreement/arrangement(s) are viable under Colorado Water Law. These agreement/arrangement(s) may include the following:

  - Acquire water from other entities – Shallow Creek's water supply system is situated in such a manner that it could divert and utilize water from other entities via exchange. Purchase, lease, trade, temporary fallowing, and water transfer arrangements with downstream agricultural users and nearby water providers will be explored as an option during drought periods.
  - Pay upstream water users to divert less water – This would include Snow Mountain Ski Resort who can significantly reduce stream flows in November and December during snow making periods.

- Modify reservoir releases to enhance streamflows during critical recreational times of the day during the tourist season. Highest releases are to occur from 12:00 pm to 3:00 pm for tubing July through August.

- Adjust reservoir releases to maintain Castle Reservoir storage at 50% of capacity to avoid degradation of drinking water quality.

Demand-Side Response Measures

Utilities Department

- Irrigation of City-owned property (parks and open spaces) – enforce standard practices which includes water audits at the beginning of the irrigation season and efficient water use.
- Fall, winter, and spring turf irrigation – all turf irrigation on City-owned property from September 30 to May 1 is prohibited.
- Washing of City-owned vehicles – washing of City-owned field vehicles (i.e. parks vehicles) is limited to once every two weeks and washing of all other City vehicles is limited to once per a month.
- Hydrants – Reduce frequency of hydrant washing and flushing.
- Ornamental fountains and drinking fountains – All ornamental and drinking fountains in City-owned parks are turned off.

Residential

- Outdoor water restrictions – residents must follow the mandatory outdoor water restrictions according to the following schedule:

Type of Property	Watering Days (two days per week)
Single family residential with even number address	Saturday and Wednesday
Single family residential with odd number address	Sunday and Thursday
All other residential properties (multifamily, HOAs, etc.)	Monday and Friday

- Fall, winter, and spring turf irrigation – residents are encouraged to reduce turf irrigation from September 30 to May 1.
- Installation of new sod, seeding, and other landscaping – residents are encouraged to forego the installation of new sod, seeding, and landscaping until the drought has ceased.
- Impervious surfaces (driveways, sidewalks, patios, etc.) – power washing and spraying on impervious surfaces are prohibited. A broom or mop may be used as a replacement.
- Personal vehicles – should only be washed using a bucket and hand-held hose with an automatic shut-off nozzle.
- Non-recirculating fountains – all non-recirculating outdoor fountains must be turned off.

- Private swimming pools and hot tubs – all swimming pools and hot tubs should be covered when not being used to reduce evaporation. Regular maintenance should minimize leaks and reuse the water for irrigation when emptying the pool/hot tub.

- Water cooled air conditioning, swamp coolers and humidifiers – adjust room temperatures to reduce use of water-cooled air conditioning. Use room size humidifiers and swamp coolers in most utilized rooms as opposed to whole house units.

Commercial and Institutional

- Construction water – appropriate best management practices should be employed to conserve and prevent wasting of construction water.

- Outdoor water restrictions – commercial businesses must follow the mandatory outdoor water restrictions according to the following schedule:

Type of Property	Watering Days (two days per week)
Businesses with even number address	Saturday and Wednesday
Businesses with odd number address	Sunday and Thursday
Large irrigators (i.e. golf courses, schools/athletic fields)	Monday and Friday

- Outdoor water audits – Shallow Creek has partnered with a natural resources conservation non-profit organization that promotes efficient water use. This non-profit organization provides free water audits for an unlimited number of customers during drought periods. Commercial businesses are encouraged to sign-up for a free outdoor water audit through Utilities' website.

- Installation of new sod, seeding, and other landscaping – businesses are encouraged to forego the installation of new sod, seeding, and landscaping until the drought has ceased.

- Non-recirculating fountains – all non-recirculating outdoor fountains must be turned off.

- Commercial swimming pools and hot tubs – all swimming pools and hot tubs should be covered when not being used to reduce evaporation. Regular maintenance should minimize leaks and reuse the water for irrigation when emptying the pool/hot tub.

- Commercial car washes – all commercial car washes are encouraged to implement best management practices to reduce water use by 10% where technically feasible.

- Car dealership vehicles – should only be washed using a bucket and hand-held hose with an automatic shut-off nozzle.

- Restaurants – all restaurants are encouraged to not serve water unless customers specifically ask for it in addition reducing the number of service dishes (conserving water used for washing).

- Lodging – all lodging establishments are encouraged to place water conservation cards in every room promoting water conservation (i.e. short showers) as well as not changing linens and towels unless a customer specifically requests the service.

Public Campaign

Outlined in Section 4.4. Details of the public drought campaign are to be developed at the onset of a drought.

Enforcement Procedures

Provided in Section 7.5.

6.3 Critical Drought Stage

Drought Trigger Points: Storage less than 65% of full on July 1 and measured snowpack 50% of normal by the end of April.

Drought Stage and Trigger Summary: The Critical drought stage is triggered when the actual or forecasted storage on July 1 is less than 65% of full capacity. The drought response is to primarily focus on mandatory measures with the objective of reaching a water use reduction target of 40% during the irrigation season.

Supply-Side Response Measures:

The following two supply-side measures may be implemented regardless of the drought severity and stage. The specifics on how each measure would be implemented and timing would be identified at the onset of the drought.

- Seek technical and financial assistance opportunities – This may include assistance from the public sector at the federal, state, or county level or include assistance from private entities such as non-profit organizations promoting water conservation and drought awareness. Assistance may include grants, loans, technical assistance (i.e. water use efficiency improvement), education, etc. Shallow Creek plans to be aware of the technical and financial opportunities before a drought enabling the City to take advantage of the opportunities quickly and efficiently when a drought occurs.

- Water rights management and cooperative agreements – Shallow Creek's water supply yields may be increased by making some adjustments to how water rights are traditionally managed and though other synergies developed via cooperative agreements with other local water users. Where possible, these agreements will be established in advance of a drought as part of the mitigation effort and activated during drought periods. However, the activation of these agreements and identification of new arrangements during drought periods will be a component of the drought response. Appropriate Substitute Water Supply Plans will be filed to ensure that the agreement/arrangement(s) are viable under Colorado Water Law. These agreement/arrangement(s) may include the following:

  - Acquire water from other entities – Shallow Creek's water supply system is situated in such a manner that it could divert and utilize water from other entities via exchange. Purchase, lease, trade, temporary fallowing, and water transfer arrangements with downstream agricultural users and nearby water providers will be explored as an option during drought periods.
  - Pay upstream water users to divert less water – This would include Snow Mountain Ski Resort who can significantly reduce stream flows in November and December during snow making periods.

- Modify reservoir releases to enhance streamflows during critical recreational times of the day during the tourist season. The highest releases are to occur from 1:00 pm to 3:00 pm for tubing July through August.

- Adjust reservoir releases to maintain Castle Reservoir storage at 50% of capacity to avoid degradation of drinking water quality.

Demand-Side Response Measures:

Utilities Department

- Drought surcharge – assess and design a drought surcharge to support water use restrictions and the targeted water savings. Surcharges will be applied to all customers.

- Irrigation of City-owned property (parks and open spaces) – restrict turf irrigation on City parks and open spaces. Sports fields, trees, and shrubs may be irrigated on a pre-determined limited basis. Preferred "green spaces" specified through a public outreach survey may also be irrigated on a pre-determined limited basis. This public outreach survey will be conducted by the Public Affairs Department if there is sufficient time and budget for such a survey.

- Fall, winter, and spring turf irrigation – all turf irrigation on City-owned property from September 30 to May 1 is prohibited.

- Washing of City-owned vehicles – washing of City-owned vehicles is prohibited.

- Reduce frequency of hydrant washing and flushing

- Water for fire training and use of fire hydrant – use of all water for fire training and of water from the hydrant is prohibited unless essential for public safety.

- Ornamental fountains and drinking fountains – all ornamental fountains and drinking fountains on City-owned property and City-owned buildings are to be turned off.

Residential

- Outdoor water restrictions – irrigation is limited to the use of a hand-held hose or non-spray device (drip system) and must adhere to the following schedule:

Type of Property	Watering Days (one day per week)
Single family residential with even number address	Saturday
Single family residential with odd number address	Thursday
All other residential properties (multifamily, HOAs, etc.)	Monday

- Fall, winter, and spring turf irrigation – residents are restricted from irrigating turf from September 30 to May 1.
- Installation of new sod, seeding, and other landscaping – residents are to forego the installation of new sod, seeding, and landscaping until the drought has ceased.
- Impervious surfaces (driveways, sidewalks, patios, etc.) – power washing and spraying are prohibited. A broom or mop may be used as a replacement.
- Personal vehicles – all washing of personal vehicles is prohibited except at commercial car washes.
- Fountains – All outdoor and indoor fountains must be turned off.
- Private swimming pools and hot tubs – the filling of private swimming pools and hot tubs is prohibited.
- Water cooled air conditioning, swamp coolers, and humidifiers – adjust room temperatures to reduce use of water-cooled air conditioning. Use room size humidifiers and swamp coolers in most utilized rooms as opposed to whole house units.

<u>Commercial and Institutional</u>

- Construction water – appropriate best management practices should be employed to conserve and prevent wasting of construction water.
- Outdoor water restrictions – irrigation is limited to the use of a hand-held hose or non-spray device (drip system) and must adhere to the following schedule:

Type of Property	Watering Days (one day per week)
Businesses with even number address	Saturday
Businesses with odd number address	Thursday
Large irrigators (i.e. golf courses, schools/athletic fields)	Monday

- Outdoor water audits – Shallow Creek has partnered with a natural resources conservation non-profit organization that promotes efficient water use. This non-profit organization

provides free water audits for an unlimited number of customers during drought periods. Commercial businesses are required to sign-up for a free outdoor water audit through the Utilities' website.

- Installation of new sod, seeding, and other landscaping – businesses are to forego the installation of new sod, seeding, and landscaping until the drought has ceased.
- Fountains – all indoor and outdoor fountains must be turned off.
- Commercial swimming pools and hot tubs – the filling of swimming pools and hot tubs is discouraged.
- Commercial car washes – all commercial car washes are required to implement best management practices and limit water use to 40 gallons per vehicle.
- Vehicles at car dealerships – all washing of vehicles on car dealership property is prohibited.
- Restaurants – all restaurants are to not serve water unless customers specifically ask for it, in addition to reducing the number of service dishes (conserving water used for washing).
- Lodging – all lodging establishments must place water conservation cards in every room promoting water conservation (i.e. short showers) as well as not changing linens and towels unless a customer specifically requests the service.

Public Campaign

Outlined in Section 4.4. Details of the public drought campaign are to be developed at the onset of a drought.

Enforcement Procedures

Provided in Section 7.5.

6.4 Emergency Drought Stage

Drought Trigger Points: Storage less than 50% of full on July 1 and measured snowpack 30% of normal by the end of April.

Drought Stage and Trigger Summary: The Emergency drought stage is triggered when the actual or forecasted storage on July 1 is less than 50% of full capacity. The drought response is to focus on mandatory measures with the objective of reaching a water use reduction target of 50% during the irrigation season with additional savings during the non-irrigation season.

Supply-Side Response Measures:

The following two supply-side measures may be implemented regardless of the drought severity and stage. The specifics on how each measure would be implemented and timing would be identified at the onset of the drought.

- Seek technical and financial assistance opportunities – This may include assistance from the public sector at the federal, state, or county level or include assistance from private entities such as non-profit organizations promoting water conservation and drought awareness. Assistance may include grants, loans, technical assistance (i.e. water use efficiency improvement), education, etc. Shallow Creek plans to be aware of the technical and financial opportunities before a drought enabling the City to take advantage of the opportunities quickly and efficiently when a drought occurs.

- Water rights management and cooperative agreements – Shallow Creek's water supply yields may be increased by making some adjustments to how water rights are traditionally managed and though other synergies developed via cooperative agreements with other local water users. Where possible, these agreements will be established in advance of a drought as part of the mitigation effort and activated during drought periods. However, the activation of these agreements and identification of new arrangements during drought periods will be a component of the drought response. Appropriate Substitute Water Supply Plans will be filed to ensure that the agreement/arrangement(s) are viable under Colorado Water Law. These agreement/arrangement(s) may include the following:

  - Acquire water from other entities – Shallow Creek's water supply system is situated in such a manner that it could divert and utilize water from other entities via exchange. Purchase, lease, trade, temporary fallowing, and water transfer arrangements with downstream agricultural users and nearby water providers will be explored as an option during drought periods.
  - Pay upstream water users to divert less water – This would include Snow Mountain Ski Resort who can significantly reduce stream flows in November and December during snow making periods.

Demand-Side Response Measures:

Utilities Department

- Drought surcharge – assess and design a drought surcharge to support water use restrictions and the targeted water savings. Surcharges will be applied to all customers.

- Irrigation of City-owned property (parks and open spaces) – eliminate all turf irrigation on City parks and open spaces until drought has ceased. Limited irrigation of trees with a hand-held hose or non-spray device is allowed to help ensure survival.

- Washing of City-owned vehicles – washing of City-owned vehicles is prohibited.

- Hydrant washing and flushing – hydrant washing and flushing is prohibited unless necessary for public safety reasons.

- Water for fire training and use of fire hydrant – use of all water for fire training and of water from the hydrant is prohibited unless essential for public safety.

- Ornamental fountains and drinking fountains – all ornamental fountains and drinking fountains on City-owned property and City-owned buildings are to be turned off.

Residential

- Outdoor water restrictions – all outdoor irrigation is prohibited with exception to watering of trees with a hand-held hose every first and third Wednesday of the month from June through December.

- Installation of new sod, seeding, and other landscaping – residents are to forego the installation of new sod, seeding, and landscaping until the drought has ceased.

- Impervious surfaces (driveways, sidewalks, patios, etc.) – power washing and spraying are prohibited. A broom or mop may be used as a replacement.

- Personal vehicles – all washing of personal vehicles is prohibited except at commercial car washes.

- Fountains – All outdoor and indoor fountains must be turned off.

- Private swimming pools and hot tubs – the filling of private swimming pools and hot tubs is prohibited.

- Water cooled air conditioning, swamp coolers and humidifiers – adjust room temperatures to reduce use of water-cooled air conditioning. Use room size humidifiers and swamp coolers in most utilized rooms as opposed to whole house units.

- Indoor water restrictions – residents are limited to 30 gallons per person per day.

- Indoor water audits – residents are encouraged to sign-up for a free indoor water audit provided free-of-charge by Utilities.

Commercial and Institutional

- Construction water – use of all construction water is prohibited unless necessary for air quality and construction reasons. This must be negotiated beforehand with Utilities.

- Outdoor water restrictions – all outdoor irrigation is prohibited with exception to the watering of trees with a hand-held hose every first and third Wednesday of the month from June through September.

- Installation of new sod, seeding, and other landscaping – businesses are to forego the installation of new sod, seeding, and landscaping until the drought has ceased.

- Fountains – all indoor and outdoor fountains must be turned off.

- Commercial swimming pools and hot tubs – the filling of commercial swimming pools and hot tubs is prohibited.

- Commercial car washes – all commercial car washes are prohibited from using water for vehicle washing.
- Commercial car washes – all commercial car washes are required to implement best management practices and limit water use to 20 gallons per vehicle.
- Restaurants – all restaurants are to not serve water unless customers specifically ask for it and are required to reduce the number of service dishes (conserving water used for washing).
- Lodging – all lodging establishments must place water conservation cards in every room promoting water conservation (i.e. short showers) as well as not changing linens and towels unless a customer specifically requests the service.
- Indoor water audits – all businesses are encouraged to sign up for a free indoor water audit provided free-of-charge by Utilities. Businesses with over five active employees working at the same time are required to sign up for the audit.

Public Campaign

Outlined in Section 4.4. Details of the public drought campaign are to be developed at the onset of a drought.

Enforcement Procedures

Provided in Section 7.5.

7.0 IMPLEMENTATION AND MONITORING

7.1 Mitigation Action Plan

The Mitigation Action Plan for Shallow Creek's drought mitigation measures discussed in Section 4.1 is provided in Table 12. Many of the mitigation measures are either a component of this Drought Management Plan, are specified in Shallow Creek's Water Conservation Plan, or are standard practices conducted by City staff. These measures are generally conducted and/or tested on a routine annual basis. The majority of mitigation measures related to the development of new water supplies and operation/maintenance changes are to occur in 2013 when the new supplies are anticipated to come online.

Table 12 Mitigation Action Plan

Mitigation	Implementation Activities	Milestone Deadlines	Administration
Drought mitigation planning	Complete stakeholder process	April 2011	Utilities Department
	Complete public review process	May 2011	
	Plan approved by City Council	June 2011	
	Pass drought-related ordinances	June 2011	
Development of new water supplies	Complete Raw Water Master Plan	December 2012	Utilities Department
	Feasibility studies for new supplies	June 2012	
	Design of necessary facilities	March 2013	
	Construction of necessary facilities	April to September 2013	
Develop cooperative sharing agreement opportunities with neighboring communities during periods of drought	Speak to neighboring entities about opportunities to improve reliability of supplies during drought	June 2011	Utilities Department
	Develop formal agreements where possible	Summer/Fall 2011	
	Maintain cooperative relationships with neighboring entities	Ongoing	
Existing maintenance and operational activities that improve water distribution efficiency			
Audits of water distribution system	Conducted annually (1/4 of system audited per year)	Conducted in the spring	Utilities Department
Repairs of leaks	Conducted on as-needed basis	n/a	Utilities Department
Monitoring and replacement of inaccurate meters	Conducted annually (1/4 of meters checked per year)	n/a	Utilities Department
Operations to avoid reservoir spills	Ongoing management of water supply system	n/a	Utilities Department
New maintenance and operational activities that improve water distribution efficiency			
Operational changes that incorporate new water supplies	Complete operational study via the Raw Water Master Plan	December 2012	Utilities Department
	Make adjustments to operations once new supplies are online	April to September 2013	

Mitigation	Implementation Activities	Milestone Deadlines	Administration
Modification of water treatment plant to recycle wash water	Complete Raw Water Master Plan	December 2012	Utilities Department
	Allocate funds and hire design contractor	March 2013	Utilities Department
	Complete construction	December 2013	Utilities Department
Conservation measures specified in the Conservation Plan			
Conservation programs specified in Table 1	Implemented via Conservation Plan	Specified in Conservation Plan	Conservation staff in Utilities Department
Standard practices of the Utilities Department and Shallow Creek City Staff			
Annual irrigation audits on City-owned parks and open spaces	Hire contractor to perform audits every April	Audits are initiated every May and completed within several weeks	Parks Department
Staff education on water conservation	Luncheon meetings held twice a year	Meetings held April and October	Conservation Staff in Utilities Department
Use of low volume irrigation instead of sprinklers and misters	Irrigation devices and efficiency is assessed annually	Every May	Parks Department
Installation of water saving fixtures in all City-owned buildings	Replacement of toilets, dishwashers, showerheads and urinals with more water efficient appliances/fixtures	Toilets projected to be 100% replaced by 2012 Remaining fixtures/appliances to be completed by 2014	City maintenance staff

7.2 Monitoring of Drought Indicators

Utilities is responsible for recording and evaluating drought indicator data. Monitoring data are collected throughout the year. These data are critical in characterizing Shallow Creek's water supplies under various hydrologic conditions and predicting drought in a timely manner. Table 13 summarizes the main drought indicators used to monitor drought. Typically these data are recorded and assessed at the beginning of each week; however the frequency may increase during dry periods and in the spring when runoff and river administration conditions are crucial to the overall availability of Shallow Creek's supplies. These data are processed weekly and stored electronically on the City's server according to the City's standard electronic filing protocol. Downloaded raw data are saved independently of other processed files to maintain the integrity of the original monitoring data.

Table 13 Monitoring of Drought Indicators

Drought Indicators	Type of Data
Reservoirs	Elevation of water surface level and corresponding storage in Crown and Castle reservoirs
Snowpack	Percent accumulation relative to normal conditions Moisture content
Precipitation records	Inches of rainfall from five weather gages
Streamflows	Average daily flow rate (cfs) at the following four calibrated stream gages: 1) Just upstream of Castle Reservoir, 2) Just upstream of Crown Reservoir, 3) Just downstream of wastewater treatment plant discharge, 4) Just upstream of Shallow Creek's diversion.
River calls	CDSS data
Additional resources provided in CWCB toolbox	CWCB's drought toolbox provides a variety of drought monitoring information and data that is updated on a routine basis. This toolbox will be assessed on an annual basis to identify monitoring information/data useful for City drought monitoring purposes.

7.3 Drought Declarations

Utilities does not have a pre-defined method or approach for forecasting drought. The drought triggers shown in Table 11 serve as a general guideline for action. However, the additional drought monitoring data, in addition to the experience and skill of Utilities staff, also plays a large role in determining the severity and corresponding action or declaration of a drought.

As previously mentioned in Section 5.2, it is important for the City to officially declare a drought and adjust corresponding drought stage in a timely manner. If a drought is declared too late or actions are not taken early enough to reduce water use, supplies can be severely depleted and strict water restrictions may be required, leading to economic impacts that could have been avoided. Conversely, premature drought declarations can result in unnecessary mandatory water restrictions and associated impacts while customers can lose confidence in the declaration. The Water Utilities Director is ultimately responsible for providing final recommendations on the timing of drought declaration and corresponding stage of a drought to the decision-makers.

The following protocol will be followed to officially declare a drought:

- Utilities staff discusses the drought monitoring data with the Water Utilities Director providing recommendations on the timing of the drought declaration and the appropriate drought stage (severity).
- The Water Utilities Director provides recommendations to the City Council.
- City Council members have an opportunity to ask questions and comment on recommendations in an official public City Council meeting that is either regularly scheduled or scheduled as an emergency specifically to discuss drought conditions.
- The City Mayor decides whether to declare a drought (and corresponding drought stage) based on the Water Utilities Director recommendations and comments of City Council.

Greatest credence should be given to the Water Utilities Director's recommendations. This decision should be made within one day following the City Council meeting.

- If the City Mayor decides to declare a drought, direction is given to the Public Affairs Director to convey the drought declaration to City and County Emergency Management, CWCB, Colorado Department of Emergency Management, and to the public.

The same protocol is followed to change a drought stage (i.e. water shortages are increased from a warning to a critical drought stage or reduced from a critical to a warning level) and to call an end to the drought, returning to normal operating conditions. If, for emergency reasons, the declaration or adjustment of a drought stage is necessary within a shorter timeframe than allowed for above, Ordinance 34-12 gives the City Mayor the authority to officially declare a drought and corresponding stage. This is limited to circumstances when the safety and health of the community are at risk due to stressed drought-related water supply conditions. A thorough review of supply conditions and implementation of the drought response program shall be conducted by Utilities following such declaration.

7.4 Implementation of the Staged Drought Response Program

The staged drought response program requires actions to be taken by the Utilities, Parks, Public Affairs and Finance Departments. In addition, City staff are expected to follow water use restrictions imposed by the staged drought response program. The roles and responsibilities are provided below.

- *Utilities Department* – administer, implement, and enforce the staged drought response program. The Water Utilities Director is ultimately responsible for facilitating necessary communication and coordination with other departments.

- *Parks Department* – coordinate outdoor irrigation efforts on City-owned property closely with the Utilities Department.

- *Public Affairs Department* – communicate with appropriate state and federal agencies regarding drought conditions and response, convey the drought declaration and key messages to the public, and implement the public drought campaign.

- *Finance Department* – closely monitor revenue and coordinate with the Utilities Department to develop a drought surcharge if necessary.

- *All City Departments* – follow water use restrictions imposed by staged drought response program.

Weekly staff meetings will be initiated by the Water Utilities Director at the onset of a drought among key departments and City staff to ensure that the program is properly carried out. The initial staff meetings will focus on implementation of the staged drought response program and public drought campaign and will include:

- Review of City budget and funds available for implementation of the Plan.

- Actions necessary to initiate the designated staged drought response measures to achieve the appropriate response target.
- Specific drought messages to convey to the public and methods used for education using the framework provided in this Plan (See Section 4.4).
- Actions necessary for enforcement (See Section 7.5).
- Review of roles and responsibilities of each staff member.

7.5 Enforcement of the Staged Drought Response Program

The staged drought response program requires a means of enforcement beyond simply educating the public. Shallow Creek's level of enforcement will be customized to the severity of the drought (drought stage) as well as to how responsive the public is to mandatory drought response measures. During the Watch drought stage, no enforcement will be necessary given that the majority of drought response is voluntary. However, for the remaining drought stages, enforcement will consist of a call-in service where customers have an opportunity to report infractions, patrol of neighborhood and business districts to identify owners/residents that are in violation of mandatory restrictions/requirements, and issuing citations and appropriate penalties based on the drought stage and number of violations. It is anticipated that at least one Utility staff member will be needed part-time for patrol; however, this could increase depending on the severity of drought stage and public response. Each staff member responsible for patrol will be trained to ensure that a consistent drought message is conveyed that conflicts are handled and conducted in a responsible orderly fashion.

Table 14 provides the pre-defined penalties associated with each drought stage and number of infractions per resident/business owner per calendar year. This will be posted on Utilities' website and conveyed to the public through the public drought campaign. All citations and monetary fines will be issued through the mail and/or email. If inclined, residents/occupants will have an opportunity to appeal citations. Written appeals may be mailed/emailed to Utilities providing justification for why the citation should be appealed. Reasons for appeal may include:

- The citation mistakenly included the wrong address.
- Irrigation is necessary for extraordinary circumstances.
- A new resident has moved into a house that had received multiple previous citations through no fault of the new resident.

Utilities will review each citation and determine whether sufficient justification has been provided to forfeit the citation and penalty. Isolated exemptions to water restrictions may also be made in certain cases upon review and approval of City staff.

Table 14 Enforcement of the Staged Drought Response Program

	Watch Reservoirs less than 90% full 10% savings	Warning Reservoirs less than 80% full 25% savings	Critical Reservoirs less than 65% full 40% savings	Emergency Reservoirs less than 50% full 50% savings
First Violation	n/a	Warning citation stating that next violation will result in monetary fine. Educational information on drought will be provided.	Warning citation stating that next violation will result in monetary fine. Educational information on drought will be provided.	Warning citation stating that next violation will result in monetary fine. Educational information on drought will be provided.
Second Violation	n/a	$100 fine added to water bill	$300 fine added to water bill	$500 fine added to water bill. Phone call to violator to educate the violator and inform him of the impending penalty if another infraction occurs.
Third Violation	n/a	$200 fine added to water bill. Phone call to violator to educate the violator and inform him of the impending penalty if another infraction occurs.	$500 fine added to water bill. Phone call to violator to educate the violator and inform him of the impending penalty if another infraction occurs.	$1,000 fine added to water bill and possible installation of a flow restrictor or temporary termination of water service until cause of violation is corrected and fines are paid.
Fourth Violation	n/a	$500 fine added to water bill and possible installation of a flow restrictor or temporary termination of water service until cause of violation is corrected and fines are paid.	$800 fine added to water bill and possible installation of a flow restrictor or temporary termination of water service until cause of violation is corrected and fines are paid.	Water service terminated indefinitely.

The Water Utilities Director and Utilities staff will be responsible for administering the enforcement of the staged drought response program and ensuring that appropriate messages concerning enforcement are conveyed to the public via the Public Affairs Department. This will require close coordination with the Financing and Public Affairs Departments. Roles and responsibilities of each department are as follows:

- *Utilities Department* – facilitation of call-in service for reports on infractions and follow up, patrol of service area, issuing written citations, facilitating the appeals process, and installing flow restrictors to cut off service until violation is corrected.

- *Finance Department* – issuing fines on water bills and recording and tracking number of citations and associated fines.

- *Public Affairs Department* – conveying accurate, consistent information on enforcement to the public through the public drought campaign.

7.6 Revenue Implications and a Financial Budgeting Plan

A reduction in customer water use during periods of drought reduces water sales and consequently could result in a revenue shortfall for Shallow Creek. Increased costs associated with implementation of the staged drought response program, public drought campaign, and enforcement could further intensify the shortfall. During the 2002 drought, several neighboring water providers had to increase customer water rates in order to compensate for such a shortfall. These increases were not anticipated and the general public's perception was that they were penalized for conserving water during the drought.

Funds for the implementation of Shallow Creek's staged drought response program are set aside in a reserve drought account at the beginning of the fiscal year in January. These funds may be used to implement the public drought campaign and staged drought response program at a level necessary for the declaration of a drought watch stage. Additional emergency funds may be set aside for drought if Utilities can justify the potential need for additional upcoming drought-related funds.

In addition to this drought reserve account, Shallow Creek plans to seek financial drought-related assistance (i.e. public drought-related loans, grants, etc.) if available. The staged drought response program for the critical and emergency drought stages also calls for a temporary drought surcharge. The main objective of this surcharge is to provide additional financial incentive to conserve water; however, as a secondary benefit, the drought surcharge could also be used to help compensate for reduced water sales and increased drought response costs. If drought conditions and corresponding water sale reductions are severe enough to warrant the increase of water rates, an intensive public outreach campaign would be implemented to convey the reasoning behind why the water rates are being raised and the status of the City's financial condition.

7.7 Monitoring of Plan Effectiveness

Monitoring provides the information and data necessary to improve the effectiveness of updates to Shallow Creek's Plan. This process is key to improving Shallow Creek's ability to prepare and respond to drought. Monitoring is both an ongoing and post-drought evaluation process. Ongoing monitoring includes testing components of the drought management plan when a drought is not occurring as well as tracking and following through with the drought mitigation measures.

Each March, Utilities will organize an annual drought monitoring meeting inviting all City staff members who are responsible for carrying out the drought mitigation and response actions specified in this Plan. The meeting will entail the latest status of potential drought conditions in the upcoming irrigation year based on current drought monitoring data, the status of the drought mitigation measures specified in this Plan, an overview of the public drought campaign efforts, and a review of individual staff member's roles and responsibilities if a drought does occur. The meeting will also provide a forum for educating new staff members on their drought-related responsibilities as well as "testing" the implementation of the Plan by enabling staff members to question and discuss potential challenges and solutions that could arise via implementation of the Plan.

Utilities staff will also present the results from monitoring data collected to assess the effectiveness of the drought mitigation, response measures and enforcement (if applicable), and the public drought campaign. The following monitoring data will be collected and presented by Utilities staff on an annual basis (some of these data may not be applicable if a drought has not occurred):

- *Demands* – Comparison of the demands during historical droughts relative to the current year's annual demands. These demand data includes monthly water usage by high water users, customer types, total per capita water usage, residential per capita water usage, and the Parks Department's monthly irrigation per acre on City parks and open space. Also, records on new development that influences water demands (i.e. new housing developments, parks, commercial buildings, etc.) will be maintained on an annual basis. If a drought occurred, information will also be presented on how effectively the water savings target response was achieved.

- *Lessons learned* – Key issues, challenges, and concerns that arose during implementation of the staged drought response program (if applicable), drought monitoring, mitigation activities, and public drought campaign. Utilities staff will interview City staff members from other departments also involved with the Plan implementation to get a full inter-departmental spectrum of lessons learned.

- *Conditions of the water supply system* – This will include the drought indicator data such as reservoir levels, water treatment plant production, call data, water obtained from direct flow rights, storage rights, etc.

- *Drought mitigation measures* – Status of the mitigation related activities to date and other relevant factors (i.e. budget).

- *Public perceptions and response to the drought* – This will include documenting comments provided at public meetings or city council/board meetings and electronic emails/letters sent to Shallow Creek regarding the drought response. Formal public surveys may also be used to gather public input depending on the magnitude of the drought and City budget available for the survey. These surveys will be developed in advance of a drought to ensure so that there is sufficient time to develop a well thought out survey.

- *Administrative staged drought response program data* – This will include the number of citations delivered to customers, number of incentives distributed, number of hotline calls received, etc. Records will also be maintained on the level of effort the staff put into facilitating the staged drought response measures and public education campaign.

These monitoring data provides a means to assess the effectiveness of the Plan, provides a means to make adjustments to mitigation and response measures if necessary, and develop recommendations for updating and improving the plan.

8.0 FORMAL PLAN APPROVAL AND UPDATES

8.1 Public Review Process

Prior to finalization of the Plan, the Public Affairs Department facilitated a public review process educating and providing the public an opportunity to review and provide feedback on the Plan. This process was important in developing an effective Plan that was reflective of the community's values and could mitigate potential conflict during a future drought event.

A 30-day public review process is stipulated for all City planning documents by City Ordinance 30-267. The public was informed of this review process and of two public open houses on the Plan via the City's website, general mass email distribution, Facebook, a newspaper ad, and through a water bill insert distributed a month in advance of the public review process. The two open houses were held on April 3, 2011 and April 14, 2011 to present the main components of the Plan and provide a question and answer feedback forum. During the 30-day period from April 1 to April 30, the draft Plan was posted on the City's website and was available in hard copy at City Hall. Members of the public could provide comments via email, verbally at the open houses, or deliver hard copies of their comments to the main receptionist at City Hall. The Public Affairs Department was responsible for consolidating all comments and providing these to Utilities for review and consideration for incorporation into the Plan.

The majority of public comments generally focused on the following:

- Some residents expressed concern regarding the survival of their turf grass and landscaping when mandatory water restrictions were implemented. A landscape expert at the open houses explained that the mandatory watering restriction's allowance of watering once or twice a week was generally sufficient for survival of most landscaping. The only time landscaping survival would be threatened on a broad scale would be in the most extreme emergency drought conditions when all turf and shrub irrigation would be prohibited out of necessity for preserving sufficient water for indoor water use.

- Many community members expressed concern over the survival of the large trees during severe drought. In response to this concern, the staged drought response program was revised to allow limited watering of trees twice a month during the summer even in emergency drought conditions.

- Several small shop owners and snack stands along the river walkway emphasized the importance of maintaining flows in the Shallow Creek for summer tubing. They indicated that this popular local and tourist activity was essential to the survivability of their businesses. In response the supply-side response measures were modified to include a means to operate reservoir releases in such a manner to ensure sufficient tubing flows during key times of the tubing season through a critical drought stage.

8.2 Adoption of Ordinances and Official Agreements

The following drought-related policies were adopted as a means to implement the Plan:

- *Ordinance 34-09, Drought Declaration* – Outlines the process in which a drought declaration is to be officially declared. This is described in Section 7.3 and authorizes the Mayor to officially declare a drought and corresponding stage.

- *Ordinance 34-10, Authorization for Implementation and Enforcement of the Staged Drought Response Plan* – Gives the Utilities Director the authority to conduct the actions laid out in the enforcement policy in order to enforce the measures specified in the staged drought response program and the flexibility to make changes if necessary to address specific problems and/or improve overall effectiveness of the staged drought response program.

- *Ordinance 34-11, Enforcement Policy* – Specifies the infraction, penalty, and fee structure outlined in Table 14.

- *Ordinance 34-12, Emergency Drought Declaration* – Gives the Mayor the authority to officially declare a drought and corresponding stage when there is not sufficient time to follow the process outlined in Ordinance 34-09. This is limited to circumstances when the safety and health of the community are at risk due to stressed drought-related water supply conditions. A thorough review of supply conditions and implementation of the drought response program shall be conducted by Utilities following such declaration.

Shallow Creek currently does not have any official agreements with other entities related to drought. However, these agreements may be an important component of drought mitigation and/or response in the future.

8.3 Drought Management Plan Approval

Shallow Creek's Drought Management Plan was approved by City Council at the June 1, 2011 City Council meeting. Each member had the opportunity to review the Plan and comment prior to finalization of the Plan and formal approval.

8.4 Periodic Review and Update

Drought management planning is most effective when viewed as an ongoing process rather than a discrete process that results in a shelved document only reviewed at the onset of a drought. Shallow Creek's Plan will be updated every five years. The next update is scheduled for June 2016. The Utilities Director will be responsible for initiating the update with Utilities staff responsible for the majority of facilitation. The update will consist of a similar stakeholder process outlined in Section 1.0 and the stakeholder group will be responsible for reviewing the Plan objectives and operating principles in light of the Plan monitoring data and conclusions presented in the annual monitoring reports. This group will be charged with providing recommended changes to the goals and operating principles as well as identifying key changes necessary to improve the overall effectiveness of the revised Plan.

Appendix A

Template for a Drought Management Plan

City of
Shallow Creek

Fiction County

Drought Management Plan Template

The following template was taken directly from CWCB's Drought Management Plan Guidance Document, which is intended to be used as a framework by municipalities to organize their drought management plans. The checked template items designate which of the template items are included in this Sample Shallow Creek Drought Management Plan. All of the essential items and majority of beneficial items are included. The essential items designate information necessary for effective drought mitigation and response planning and must be included in the drought management plans approved by the State. The beneficial information, while not essential, provides an added value to the effectiveness of drought planning. The majority of template items designated as public were also included in the Sample Plan. These items are intended to enhance the overall readability and usability of the document for public educational purposes. This includes background information, concepts, and terminology that is important for the layperson to understand.

Essential	Beneficial	Public	Document	
				Sample Municipal Drought Management Plan - Attachment A
				Introduction
				This section introduces the concept of drought management planning and provides a general background on service area and existing water supplies. Information on historical drought planning efforts and how they efforts differ from water conservation could also be addressed. While this information is not essential for planning, it provides useful background material.
				Profile of Existing System
				Objective: Provide an overview of the existing system and service area. This should be fairly general information and does not entail disclosure of "sensitive" information that could result in future public safety concerns.
	Δ	□		☒ Profile of service area – map or description of the service area and discussion of key water related infrastructure (e.g., water treatment plants, reservoirs, well fields, etc.)
	Δ	□		☒ Profile of existing supplies – general overview of the provider's water supplies, storage facilities, and other supply information applicable to drought planning.
	Δ	□	+	☒ Customer profile – average annual retail water delivered to customers (acre-feet), number of homes/customers within the service area, and profile of customer types (e.g., percentage of industrial, commercial, single residential, etc.)
				Drought Mitigation and Response Planning
				Objective: Provide a general description of drought mitigation and response planning. Background information on drought mitigation and response planning is provided in Sections 2.2 and 2.3 and also in the Drought Toolbox.
		□		☒ General description of a drought. See Section 2.1.
		□		☒ Explanation of how a drought affects the provider's water supplies.
		□		☒ Purpose and benefits of drought mitigation and response planning.
		□		☒ Introduce difference between drought mitigation and drought response planning.
	Δ			☒ Description of how the drought management plan is coordinated with the State Drought Plan and other local plans, including county or municipal level multi-hazard mitigation plans and emergency operation plans, to reduce redundancy and capitalize on joint efforts. County multi-hazard mitigation plans may be a source of information on drought history and vulnerability and often contain mitigation action strategies that may benefit or enhance local planning efforts.

Essential	Beneficial	Public	Document	
				Historical Drought Planning Efforts
				Objective: Describe historical drought planning efforts.
	Δ	□		☒ Overview of historical drought planning efforts.
	Δ	□		☒ Explanation of modifications made to the current drought planning effort and how this plan is an improvement to historical efforts.
				Drought Planning and Water Conservation
				Objective: Drought mitigation, response planning, and conservation planning are closely interrelated processes. Effective planning coordinates all three planning efforts. It is recommended that conservation measures included in a conservation plan, which also provide long-term drought mitigation benefits, also be incorporated as drought mitigation in the drought management plan. This section defines and explains the relationships between drought mitigation planning, drought response planning, and water conservation. Additional information on this may be found in Section 2.3.1.
		□		☒ Difference between drought and conservation planning. (Some providers may consider conservation as a means of drought mitigation. If this is the case, discuss how conservation is integral to drought mitigation.)
		□		☒ Brief summary of conservation efforts to date.
				1.0 Stakeholders, Objectives, and Principles
				This section introduces the stakeholder process and basic objectives of the drought management plan.
				1.1 Drought Planning Committee
				Objective: The members and size of the Drought Committee will vary among providers. Larger providers will likely have a more involved stakeholder process than smaller providers with limited drought planning resources and staff. This section provides an overview of the stakeholder process. See Section 4.1.1 for more information.
		□		☒ Importance of a stakeholder process.
♦			+	☒ Role of the Drought Committee in the development of the drought management plan.
		□		☒ Explanation of the Drought Committee selection process.
		□	+	☒ Drought Committee members including their job title and description of expertise.

Essential	Beneficial	Public	Document	
		□	+	☒ Summary of the Drought Committee planning meetings held during the drought management plan development process.
			+	☐ Appendix containing meeting materials (meeting agendas, minutes, presentations, etc.)

1.2 Objectives of the Drought Management Plan

Objective: Introduce the basic objectives and operating principles of the plan and describe how these objectives are integrated into the broader water management planning efforts. See Section 4.1.2 for more information.

♦			+	☒ List of the objectives and operating principles.
	Δ	□		☒ Discussion of how the objectives and operating principles reflect water use priorities during periods of a drought.
	Δ	□		☒ List of water use priorities (i.e., a) essential water needs, b) social or economic impacts, and c) nonessential uses such as outdoor irrigation).
		□		☒ Discussion of how the operating principles were incorporated into the plan development and how these principles will be considered during implementation (i.e., "The operating principles are reflective of the community's values and will be reviewed prior to implementing mandatory water use reductions.")

2.0 Historical Drought and Impact Assessment

This section provides an overview of historical droughts and corresponding changes to supplies and demands. Drought related impacts and lessons learned from previous droughts are also included. While the availability of historical data will vary among providers, the main objective of this section is to consolidate available data to provide insight for projecting and planning for future drought conditions.

2.1 Historical Assessment of Drought, Available Supplies, and Demands

Objective: Assess historical water supplies and demands from previous droughts. Provide as much beneficial detail as possible based on available historical data and institutional memory. See Section 4.2.1 for additional information.

♦				☒ Discussion of significant historical droughts and how they affected water supplies. This may include information on past reservoir levels, precipitation, streamflows, snowpack, groundwater levels, wholesale supplies, water quality issues, etc. Provide tables/figures that assist in describing historical conditions (i.e., hydrographs).

Essential	Beneficial	Public	Document	
		□		☒ Description of existing operational factors, concepts, and terms that are important when explaining drought planning to the public (e.g., drought reserves, firm yield/safe yield, water quality considerations, water rights, etc.)
	Δ			☒ Description of historical changes to water demands as a result of drought and/or drought response/mitigation measures. Provide applicable quantitative data if available. This may include total water demands, per capita water demands (gpcd), demands by customer type, indoor and outdoor usage, etc.
			+	☒ Lessons learned from previous drought(s) and recommendations for how implementation of drought mitigation/response measures should be altered to better respond to future drought.

2.2 Historical Drought Impact, Mitigation and Response Assessment

Objective: Review and discuss historical drought impacts and mitigation and response measures taken to reduce the impacts. Provide as much beneficial detail as possible based on available historical data and institutional memory. Section 4.2.2 for additional information.

♦				☒ Impacts experienced during historical droughts or current drought. ***Worksheet A*** provides a list of drought related impacts and a means to identify historical and current impacts.
	Δ			☐ Available drought-related economic loss data and any additional information useful for characterizing historical impacts. This may also be provided in a supplemental document as an appendix.
♦				☒ Mitigation measures historically implemented to minimize drought impacts. Demand- and supply-side historical mitigation measures may be identified using ***Worksheets B and C***, respectively.
♦				☒ Drought response measures implemented during previous drought(s) and overall effectiveness of these measures. Demand- and supply-side historical response measures may be identified using ***Worksheets B and C***, respectively.

3.0 Drought Vulnerability Assessment

This section provides an overview of water supply reliability and drought management planning and identifies potential future drought impacts. This information is useful for selecting the drought mitigation and response strategies described in Step 4.

3.1 Water Supply Reliability and Drought Management Planning

Objective: Present the approach used for the water supply reliability assessment. See Section 4.3.1 for additional information.

Essential	Beneficial	Public	Document	
	Δ	□	+	☒ Summary of water supply reliability planning efforts. For example, disclose raw water master planning studies, forecasting models, etc.
	Δ	□	+	☒ If not previously discussed, disclose key terminology used to define water supply reliability and how it is measured (e.g., firm yield, safe yield, etc.)
	Δ	□	+	☒ Description of how water supply reliability planning is related to drought planning (i.e., water supply reliability planning efforts target sufficient supplies to meet essential customer needs for a drought equivalent to the 2002 drought).
	Δ	□	+	☒ If applicable, address how climate change has been incorporated into water supply reliability planning.
	Δ	□	+	☒ Description of other factors that could influence either the quality or quantity of water supplies, or demands that are not directly incorporated into water supply reliability studies (e.g., water quality issues, severe cases of droughts in sequential years, Colorado River Compact call, etc.)

3.2 Drought Impact Assessment

Objective: Identify potential future drought impacts. See Section 4.3.2 for additional information.

♦				☒ Potential impacts that could occur during future droughts. ***Worksheet A*** may be used to identify potential impacts.
	Δ			☒ Discussion of the relative priorities assigned to the potential impacts. This information may be best represented as a table listing the potential impacts and corresponding priority with follow-up discussion. ***Worksheet A*** provides a means to record these priorities.

4.0 Drought Mitigation and Response Strategies

This section discusses the selected drought mitigation and response strategies.

4.1 Drought Mitigation Measures

Objective: Introduce existing and planned drought mitigation measures. These measures should be integrated into water supply management planning efforts and operations prior to a drought in order to reduce the severity of future droughts. See Section 4.3.1 for additional information.

♦				☒ List of drought mitigation measures.
	Δ			☒ ***Worksheets B and C*** list potential mitigation actions and provide a means to select and screen measures. ***Worksheet A*** facilitates the development of new mitigation actions that specifically address pre-identified potential impacts. These processes are described in greater detail in Section 4.2.2.

Essential	Beneficial	Public	Document	
	Δ			☒ Discussion of the criteria used to select the mitigation measures. Section 2.3.1 provides a list of suggested criteria.
♦				☒ If conservation is being considered as a component of drought mitigation, discussion of how the existing conservation measures provide drought mitigation. See Section for additional discussion.

4.2 Supply-Side Response Strategies

Objective: Provide an overview of the supply-side response strategies. See Section 4.4 for additional information.

♦				☒ List of the selected supply-side response strategies. Supply-side strategies listed in ***Worksheet B*** may be used as an initial reference source for generating strategy ideas. Specific details related to each strategy should be included. For example, if the "lower reservoir intake strategy" is selected, information should also be provided on the specific reservoir(s) in which the intake will be lowered.
	Δ	□		☒ Discussion of the criteria used to select the supply-side strategies. Section 4.4.2 provides a list of suggested criteria.
		□		☒ Discussion of how the selection process is reflective of the Step 1 objectives and operating principles.

4.3 Demand-Side Response Strategies

Objective: Provide an overview of the demand-side response strategies taken when drought is imminent or occurring. See Section 4.4 for additional information.

♦				☒ List of the selected demand-side response strategies. Demand-side strategies listed in ***Worksheet C*** may be used as an initial reference source for identifying strategies. This worksheet is also useful for identifying whether the strategy is to be implemented on a voluntary, incentive, or mandatory basis. For example, strategies may be voluntary for a Stage 1 drought and elevated to mandatory under more drought severe conditions. Coordination with other entities may also be beneficial and can be noted in ***Worksheet C***. Similar to the supply-side strategies, details related to the future implementation of each strategy should be included.
	Δ			☒ Discussion of the criteria used to select the demand-side strategies. Section 4.4.2 provides a list of suggested criteria.
		□		☒ Discussion of how the selection process is reflective of the Step 1 objectives and operating principles.

Essential	Beneficial	Public	Document	
				4.4 Drought Public Information Campaign
				Objective: Provide the drought public campaign framework. See Section 4.4.3 for additional information.
	Δ	□		☒ List of the public drought campaign goals.
	Δ	□		☒ Discussion of how the public drought campaign will be differentiated from the public conservation education program and how synergistic benefits can be developed between the two programs.
♦				☒ General components of the public drought campaign. This includes the types of audiences to be targeted, communication tools to be used to convey drought related information, specific key information to convey, and opportunities for future synergies. ***Worksheet D*** may be used as a means to develop this framework.
	Δ	□		☐ Prescripted messages targeted towards the public to be released through public information outlets during various drought stages. These could be detailed in an appendix.
				5.0 Drought Stages, Trigger Points, and Response Targets
				This section presents the drought stages, trigger points, and response targets and how they are incorporated into a drought declaration and response effort. Information is also provided on how these drought stages, trigger points, and response targets were developed and challenges related to the unpredictable nature of drought.
				5.1 Drought Stages, Trigger Points, and Response Targets
				Objective: Present the drought stages, response targets and, if applicable, corresponding drought trigger points. This should also include an explanation of how drought indicators and/or drought trigger points are used to determine and declare drought stages to the public. See Section 4.5 for additional information. Information on drought indicators is provided in the Drought Toolbox.
♦				☒ Presentation of the drought stages and, if applicable, corresponding drought trigger points and response targets. The tables included in ***Worksheet E*** may be used to present the drought stages, trigger points, and response targets.

Essential	Beneficial	Public	Document	
		□		☒ Explanation of how the drought stage depends upon the severity of the drought and that the amount of water that must be saved increases with the severity of the drought. For example, Stage 1 may involve voluntary saving measures while Stage 3 may require significant mandatory reduction of outdoor lawn watering).
	Δ			☒ If applicable, approach used to develop the drought trigger points and response targets.

5.2 Drought Declaration and Predictability

Objective: Provide a brief discussion of the challenges involved in early detection of a drought, how drought indicator data help characterize a drought, and other factors that influence drought declaration. See Section 4.5.2 for additional information.

		□		☐ Discussion of how weather patterns in Colorado can be unpredictable and the overall challenges in early detection of drought. Example(s) of past unpredicted weather events may be beneficial.
♦				☒ List of selected drought indicators and description of how these indicators are reflective of water supply conditions.
	Δ		+	☒ If applicable, significance of the selected drought trigger(s). In other words, why were these trigger(s) selected as opposed to other drought indicators.
♦				☒ Discussion of how the drought indicators, triggers, and other pertinent data are incorporated into the decision making process of declaring a drought.
♦				☒ Summary of how drought indicators will be monitored and general frequency of monitoring. Address critical times of year when monitoring is particularly important for identifying drought conditions (i.e., reservoir storage near the end of runoff).
	Δ	□		☒ Advantages and disadvantages of declaring a drought early versus delaying declaration of a drought stage until later in the season. Address the balance between prematurely declaring a drought and waiting too long to respond.
	Δ	□		☒ Discussion of how droughts can behave differently and the necessity for flexibility in declaring a drought stage (i.e., a multi-year drought could result in water shortages greater than anticipated requiring drought stages, trigger points, and response targets to be adjusted accordingly).

Essential	Beneficial	Public	Document	
				6.0 Staged Drought Response Program
				This section outlines the drought response measures corresponding to each of the drought stages developed in Step 5. See Section 6.0 for additional information.
♦				☒ Supply- and demand-side response measures by drought stage. ***Worksheet F*** may be used to divide the strategies into individual measures according to drought stage. ***Worksheet G*** provides a template for presenting the supply- and demand-side measures.
♦	□			☒ Provide a summary table that highlights the drought stages, trigger points, response targets and a summary of drought response measures. ***Worksheet H*** provides a template that may be used to summarize the staged drought response program (for insert into an executive summary, fact sheet for public distribution, etc.)
	Δ			☐ Provide detailed staged public drought campaign plan if the provider chooses to include a detailed public drought campaign plan as a component of the staged drought response program. If appropriate, this may be an appendix or supplemental document. See Section 4.6.2 for additional information.
				7.0 Implementation and Monitoring
				This section addresses the coordination necessary to fully implement the drought management plan. This includes mitigation plan, drought indicator monitoring, drought declaration protocol, implementation and enforcement of the staged drought response program, revenue planning, and monitoring of the drought response effort and making appropriate changes when necessary.
				7.1 Mitigation Action Plan
				Objective: Present the schedule and procedures necessary to implement the drought mitigation. See Section 4.7.1 for additional information.
			+	☒ ***Worksheet I*** provides a means to summarize the majority of information listed below in a table.
♦				☒ List of the drought mitigation actions.
♦				☒ Steps necessary to implement each mitigation action.
♦				☒ Milestone deadlines.
♦				☒ Entities/staff responsible for administrating the mitigation action.
	Δ			☐ List of funding sources.

Essential	Beneficial	Public	Document	
				7.2 Monitoring of Drought Indicators
				Objective: Discuss the approach used to monitor drought indicators, including the schedule, monitoring methodology, and roles and responsibilities of the entities/staff responsible for monitoring the drought indicators. See Section 4.7.2 for additional information.
♦				☒ Drought data monitored on an annual and seasonal basis.
♦				☒ Frequency monitoring and general schedule. Address how intensity of monitoring effort may increase during drought periods.
	Δ			☒ If applicable, approach and/or resources used to forecast drought.
♦				☒ Entities/staff responsible for drought monitoring.
	Δ			☒ Protocol for recording and archiving monitoring data.
				7.3 Drought Declarations
				Objective: Describe the decision-making process necessary to publicly declare a drought and the corresponding drought stage and how this information is conveyed to the public. See Section 4.7.3 for additional information.
♦				☒ Summary of guidelines (e.g., trigger points and/or drought indicator data) used by staff to evaluate drought conditions.
♦				☒ Decision maker(s) responsible for declaring a drought and corresponding drought stages.
	Δ			☒ If applicable, protocol for conveying drought information and recommendations from staff to decision makers.
♦				☒ Discussion of importance in identifying and declaring drought in a timely manner. Address timing of when decision-makers are informed and, subsequently, when the public is informed of a drought declaration.
♦				☒ Staff or entity responsible for announcing drought declaration to the public.
				7.4 Implementation of the Staged Drought Response Program
				Objective: Describe the roles and responsibilities of implementing the staged drought response program. See Section 4.7.4 for additional information.
♦				☒ Entities/staff responsible for administering the staged drought response program.
	Δ			☐ If applicable, discuss additional staff that would need to be hired.
♦				☒ Staff responsible for administering the drought public campaign.

Essential	Beneficial	Public	Document	
♦				☒ Communication and coordination protocol among entities/staff.

7.5 Enforcement of the Staged Drought Response Program

Objective: Describe the policy, roles and responsibilities, and activities necessary to enforce the drought response plan. See Section 4.7.5 for additional information.

♦				☒ Enforcement policies appropriate for each drought stage. ***Worksheets G*** and ***H*** provide options of how the specific enforcement policies and/or activities may be presented.
	Δ			☒ Identify the level of monitoring/patrolling necessary for each drought stage. Who will be responsible for patrolling the service area and issuing citations? Will additional temporary staff need to be hired? What training will be necessary?
	Δ			☒ Identify how information on the enforcement will be conveyed to the public.
	Δ			☒ Develop an appeals process and possible exemptions to enforcement procedures under certain circumstances.
	Δ			☒ Identify who is responsible for administration of the enforcement effort and approving exceptions to the enforcement policy.

7.6 Revenue Implications and Financial Budgeting Plan

Objective: Discuss the potential for revenue loss when customers reduce water use in response to drought and how this will be addressed. Quantitative estimates of revenue implications, water rate adjustments, or other budgetary modifications can be an involved and highly technical process that may be beyond the scope and financial resources for this effort. If the provider chooses to not pursue a detailed financial revenue analysis as a component of this Plan, this section should, at minimum, outline the steps and resources necessary to address this issue if revenues should be significantly impacted from future drought response efforts. See Section 4.7.6 for additional information.

		□		☒ Introduction to how the reduction in water use can reduce revenue and financially stress providers.
	Δ			☒ Estimates and/or qualitative discussion of potential revenue reductions and how this would impact the average residential and business customer.
♦				☒ Financial resources necessary to implement the response programs, including the public drought campaign, stated drought response program, and any additional funds necessary to intensify drought monitoring efforts.
♦				☒ Describe the strategies for addressing revenue losses. Include the general timing of when these strategies would be implemented relative to the declaration of a drought.

Essential	Beneficial	Public	Document	
	Δ			☐ Detailed estimates of potential revenue loss and specific actions taken by the provider to mitigate these losses (i.e., create a special fund prior to the drought to offset revenue losses during the drought, drought surcharges or raise water rates). Provide the assumptions and details of the financial analysis in an appendix or supplemental document.
	Δ			☐ Discuss how the drought surcharges and/or water rate increases would be conveyed to the public.

7.7 Monitoring of Plan Effectiveness

Objective: Describe the data collection and assessment activities in place to monitor the overall effectiveness of the plan. See Section 4.7.7 for additional information.

	Δ			☒ Schedule an exercise to test the implementation of the Plan.
♦				☒ Data to be collected. This should include demand data, lessons learned, conditions of the water supply system during the drought (e.g., storage amounts), public perceptions and general response to the drought, and administrative staged drought response program data (e.g., number of citations delivered).
♦				☒ Staff/entities responsible for the data collection, evaluation, and recommendations on Plan improvements.

8.0 Formal Plan Approval and Updates

This section addresses the public review and formal adoption process for the necessary ordinance(s) and agreement(s) of the Plan. Information is also provided on the maintenance and anticipated update of the Plan.

8.1 Public Review Process

Objective: This section summarizes the public's role in development of the Plan. See Section 4.8.1 for additional information.

	Δ			☒ A public review process is necessary to ensure that the public has had an opportunity to review and comment on the Plan. Providers should follow the appropriate rules, codes, or ordinances to make the draft Plan available for public review and comment. If there are no rules, codes, or ordinances governing the entity's public planning process, each provider should publish a draft Plan, give public notice of the Plan, make such plan publicly available, and solicit comments from the public for a period of not less than sixty days after the date on which the draft Plan is made publicly available. Reference shall be made in the public notice to the elements of a Plan that have already been implemented.

Essential	Beneficial	Public	Document	
	Δ			☐ If members from the general public are on the Drought Committee, describe their involvement.
♦				☒ Description of the public review process and how the public may access the Plan.
			+	☒ Summary of public comments and meetings held during the Plan development process.
			+	☐ Appendix of the public meeting minutes and public comments and how those comments were addressed within the Plan.

8.2 Adoption of Ordinances and Official Agreements

Objective: Summarize the ordinances and official agreements adopted to implement the Plan. See Section 4.8.2 for additional information.

♦				☒ Summary of the ordinance(s) and policy necessary to implement the Plan. This may include policy changes to: facilitate the formal declaration of a drought; implement and enforce the staged drought response program and drought public campaign; and adopt revenue changes, etc.
♦				☒ Official agreement(s) needed with other entities for drought-related coordination purposes.
			+	☐ Official copies of the ordinance(s) and/or official agreement(s) may be included in an appendix.
			+	☐ Challenges encountered to develop and approve the ordinance(s) and/or official agreement(s).

8.3 Drought Management Plan Approval

Objective: Briefly summarize the formal process for Plan adoption. Note: For some water suppliers, formal approval of its Plan may not be desirable. See Section 4.8.3 for additional information.

♦				☒ Government body that either approved or officially adopted the Plan.
♦				☒ Date of approval/adoption.
	Δ			☐ Potential conflicts/issues with the approval/adoption.
			+	☐ Copy of the official approval/adoption document in appendix.

8.4 Periodic Review and Update

Objective: Summarize the anticipated timing of Plan updates and the processes that will occur to facilitate the update. See Section 4.8.4 for additional information.

♦				☒ Frequency of when the Plan will be updated. Recommend every five years.

Essential	Beneficial	Public	Document	
♦				☒ Anticipated date of the next update.
	Δ			☒ Staff responsible for taking the lead in initiating the Plan update and collecting appropriate data.
	Δ			☒ Process of how the recommendations for Plan improvements will be incorporated into updated plans.

9.0 Suggested Appendices

This section provides a list of appendices that may be applicable to include with the Plan.

			+	☐ Drought Committee meeting materials (e.g., meeting agendas, minutes, presentations, etc.)
			+	☐ Public drought campaign prescripted messages.
			+	☐ Supplemental technical information and data. This may include studies on demand reduction and revenue impacts, historical drought impact studies/reports, or supplemental data/information on the water supply vulnerability assessment, etc.
			+	☐ Public meeting minutes and comments.
			+	☐ Official copies of the adopted ordinance(s) and/or official agreement(s).
			+	☐ Copy of the Plan approval document.

Appendix B

Worksheets

City of
Shallow Creek

Fiction County

Purpose of the Worksheets

The following worksheets came directly from CWCB's Drought Management Plan Guidance Document. These worksheets were developed to assist providers with generating ideas, organizing information and formatting data for direct incorporation into the Plan. These worksheets were filled out according to the fictional City of Shallow Creek. Water providers developing drought management plans may refer to these worksheets as examples while filling out the CWCB worksheets for their own service area.

Historical Drought Impacts, Future Potential Impacts, and Mitigation

WORKSHEET A - HISTORICAL DROUGHT IMPACTS, FUTURE POTENTIAL IMPACTS, AND MITIGATION

Instructions:
[1] This column provides a list of drought related impacts. Add additional impacts identified during the planning process. The grouping of impacts (i.e., community, economic) may be modified.
[2] Enter an "X" for all impacts experienced during historical droughts.
[3] Enter an "X" for all impacts currently being experienced as a result of an existing drought. This column is not applicable if provider is currently not experiencing a drought.
[4] Enter "1" - significant impact, "2" - moderate impact, or "3" - minor impact
[5] List historical/existing mitigation and response strategies that were implemented to address specific impact.
[6] Enter "1" - effective, "2" - moderately effective, or "3" - not effective
[7] Add any additional comments worth noting for historical drought assessment.
[8] Enter an "X" for all potential future impacts.
[9] Enter "1" - high priority, "2" - medium priority, or "3" - low priority
[10] List mitigation actions that may be taken to address identified potential impacts.
[11] List response strategies that may be taken to address identified potential impacts.

	Step 2 - Historical Drought Assessment						Step 3 - Vulnerability Assessment		Step 4 - Drought Mitigation and Response Strategies	
Historical, Existing and Potential Drought Impacts [1]	**Historical Impact [2]**	**Existing Impact [3]**	**Ranking of Drought Impact Severity [4]**	**Historical/Existing Mitigation & Response Strategies [5]**	**Effectiveness of Historical/Existing Mitigation & Response Strategies [6]**	**Comments [7]**	**Potential Future Impact [8]**	**Potential Impact Priority [9]**	**Mitigation [10]**	**Response Strategies [11]**
Water Provider										
Loss of revenue from reduction in water sales	X		2	Raised rates in 2003	2	Effective but not popular	X	2		Drought surcharge that is spread over period
Reduction in municipal well production										
Reduction in storage reserves	X		2				X	1	Acquire addiitional storage/supplies	
Disruption of water supplies							X	1	Acquire addiitional storage/supplies	
Degraded water quality	X		2				X	1		Blend sources, change reservoir operations
Higher water treatment costs	X		2	Raised rates in 2003	2	Minor when compared to revenue loss	X	2		Drought surcharge that is spread over period
Sediment and fire debris loading to reservoirs following a wildfire							X	1	Develop Emergency Wildfire Plan	
Increased costs and staff time to implement drought plan	X		2				X	3		
Increased data/information needs to monitor and implement drought mitigation plan	X		3				X	3		
Costs to acquire/develop new water supplies/water rights transfers							X	2		
Costs to increase water use efficiency										
Public favorable/unfavorable perception of provider regarding drought response	X		3	Public Education	2	Mixed reviews from public	X	2		
Scarcity of equipment and other water related services (i.e., contractors to repair wells)							X	2		
List other provider related impacts										
Community and Societal										
Domestic landscaping stressed or killed							X	2		
Public landscaping stressed or killed							X	2		
Lower quality drinking water (i.e., poor taste and odor)	X		2	Increased treatment but still issue	3		X	2		Manage reservoir releases

Historical Drought Impacts, Future Potential Impacts, and Mitigation

Historical, Existing and Potential Drought Impacts [1]	Step 2 - Historical Drought Assessment						Step 3 - Vulnerability Assessment		Step 4 - Drought Mitigation and Response Strategies	
	Historical Impact [2]	Existing Impact [3]	Ranking of Drought Impact Severity [4]	Historical/Existing Mitigation & Response Strategies [5]	Effectiveness of Historical/Existing Mitigation & Response Strategies [6]	Comments [7]	Potential Future Impact [8]	Potential Impact Priority [9]	Mitigation [10]	Response Strategies [11]
Reduced firefighting capability										
Cross-connection contamination as a result of lower pressures										
Increased pollutant concentrations	X		3				X	3		
Reduced quality of life							X	3		
Loss of human life (i.e., heat stress)							X	3		
Public safety from wildfires							X	3		
Reduction in fire fighting capabilities							X	3		
Increased respiratory ailments							X	3		
Increased disease caused by wildlife concentrations							X	3		
Mental and physical stress							X	3		
Increased political conflict										
Reduction or modification of recreational activities	X		1				X	2		Time reservoir releases to enhance flows at key tubing times
Inequal distribution of drought response measure implementation							X	2		
Changes to population growth trends (more likely during a long-term drought)							X			
Heightened awareness about water conservation	X		3	Public Education			X	2		
Change in water use behavior to conserve water	X		3	Public Education			X	2		
Re-evalution of social values (priorities, needs, rights)							X	3		
List other community related impacts										
Economic										
Decreased land prices										
Land subsidence as a result of groundwater depletions										
Income loss to farmers that indirectly affects municipal businesses	X		3				X	2		
Loss to recreation and tourist industry	X		1				X	2		
Reduction of economic development										
Increase in food prices										
Restrictions/limitations on landscaping harms landscaping companies							X	2		Promote xeriscaping
Impacts to large scale commercial water users (i.e., golf courses)							X	2		Work with large water user to minimize impacts
Loss in hydropower energy										
List other economic related impacts										
Environmental and Recreational										
Increased risk of frequency and severity of wildfires	X		1				X	1		
Beetle kill										
Stress to surrounding natural environment	X		2				X	3		
Loss of wetlands										
Lower streamflows	X		2				X	2		
Lower lake/reservoir levels	X		2				X	2		
Increased susceptibility to plant disease	X		3				X	3		
Increased wind and water erosion										
Reduced flow from springs										
Air quality effects (i.e. dust and pollutants)										
Visual and landscape quality (i.e., dust, vegetative cover, etc.)	X		2				X	3		
Stress to fish and other wildlife	X		2				X	3		
Lower water quality in streams and/or lakes/reservoirs	X		3				X	3		
Campfire bans	X						X	1		
Land subsidence										
List other envrionmental and recreational related impacts										

Supply-Side Mitigation and Response Strategies

WORKSHEET B - SUPPLY-SIDE MITIGATION AND RESPONSE STRATEGIES

Instructions:
[1] This column provides a list of supply-side response strategies. List additional strategies identified using Worksheet A or alternative sources.
[2] This column identifies long-term mitigation actions.
[3] This column identifies short-term response strategies.
[4] Preliminary Selection: Identify the mitigation and response strategies that meet the following:
Enter "existing" for all mitigation and response strategies included in existing drought management plans that will continue to be used in the future.
Enter "new" for all mitigation and response strategies are to be considered for this drought management planning effort.
Enter "eliminated" for all existing mitigation and response strategies that will no longer be used in the future.
[5] Specify whether the selected "existing" and "new" mitigation and response strategies are to be implemented as mitigation or short-term response strategies by entering an "X" in the appropriate column.
[6] Screening: Specify how well the selected mitigation and response measures meet the criteria to the right of these instructions by entering the following ranking value:
Enter "1" for mitigation and response strategies that meet one of the five screening criteria.
Enter "2" for mitigation and response strategies that meet two of the five screening criteria.
Enter "3" for mitigation and response strategies that meet three of the five screening criteria.
Enter "4" for mitigation and response strategies that meet four of the five screening criteria.
Enter "5" for mitigation and response strategies that meet five of the five screening criteria.
[7] Enter an X for selected mitigation and response strategies following the screening process.
[8] If necessary provide additional explanation of why a mitigation or response strategy was retained or eliminated.

[6] Screening Criteria:
a) Technical feasibility
b) Perceived benefits
c) Cost effectiveness
d) Public acceptance
e) Environmental sensitivity and other extraneous impacts

Supply-Side Mitigation and Response Strategies [1]	Long-term Mitigation Actions [2]	Short-term Response Strategy [3]	Preliminary Selection of Mitigation and Response Strategies [4]	Selection of Planning Horizon [5]		Screening Ranking Value [6]	Post-Screening Selection of Mitigation and Response Strategies [7]	Comments [8]
				Long-term Mitigation Actions	Short-term Response Strategy			
Elements of a Drought Management Plan								
Establish drought response principles, objectives, and priorities	**X**		N	X		5	X	Component of good drought planning
Establish authority and process for declaring a drought emergency	**X**		N	X		5	X	Component of good drought planning
Develop drought stages, trigger points, and response targets	**X**		N	X		5	X	Component of good drought planning
Prepare ordinances on drought measures	**X**		N	X		5	X	Component of good drought planning
Evaluate historical drought impacts	**X**		N	X		5	X	Component of good drought planning
Monitor drought indicators (snowpack, streamflow, etc.)	**X**	**X**	E	X		5	X	Component of good drought planning
Monitor water quality	**X**	**X**	E	X		5	X	Component of good drought planning
Track public perception and effectiveness of drought measures	**X**	**X**	N	X		5	X	Component of good drought planning
Improve accuracy of runoff and water supply forecasts	**X**		N	X		5	X	Addressed through water supply reliability planning
List additional strategies identified using Worksheet A or alternative sources								
Emergency Response								
Declare a drought emergency		**X**	E		X	5	X	Component of good drought planning
Establish water hauling programs	**X**	**X**						
Restrict/prohibit new taps		**X**						
Identify state and federal assistance	**X**	**X**	N		X	5	X	Well accepted & could be beneficial
Provide emergency water to domestic well users		**X**						
Import water by truck/train		**X**						
List additional strategies identified using Worksheet A or alternative sources								
Public Education and Relations								
Establish a public advisory committee	**X**	**X**	N		X	3		Not time & cost effective
Develop Drought Public Education Campaign with long- and short-term strategies. (See Worksheet D)	**X**	**X**	E	X	X	5	X	Framework developed during this planning effort - mitigation. Detailed plan developed during drought - response strategy.
Extend boat ramps and docks for recreational use when reservoirs are low	**X**	**X**	N			3		Not cost effective
List additional strategies identified using Worksheet A or alternative sources								

Supply-Side Mitigation and Response Strategies

Supply-Side Mitigation and Response Strategies [1]	Long-term Mitigation Actions [2]	Short-term Response Strategy [3]	Preliminary Selection of Mitigation and Response Strategies [4]	Selection of Planning Horizon [5]		Screening Ranking Value [6]	Post-Screening Selection of Mitigation and Response Strategies [7]	Comments [8]
				Long-term Mitigation Actions	Short-term Response Strategy			
Water Supply Augmentation								
Establish drought reserves	X		N	X		5	X	Being evaluated under 2012 Raw Water Master Plan
Draw from drought reserves		X						
Increase groundwater pumping		X						
Deepen wells	X	X						
Develop supplemental groundwater/conjunctive use	X		N	X		3	potential option	Being evaluated under 2012 Raw Water Master Plan
Reactivate abandoned wells		X						
Flush existing wells to develop maximum flow rates	X	X						
Blend primary supply with water of lesser quality to increase supplies		X	N	X		3	potential option	Being evaluated under 2012 Raw Water Master Plan
Rehabilitate operating wells	X	X						
Employ desalination of brackish groundwater	X							
Increase use of recycled water	X	X	N	X		3	potential option	Being evaluated under 2012 Raw Water Master Plan
Utilize ditch water or treated effluent for irrigating landscaping/parks	X	X	N	X		3	potential option	Being evaluated under 2012 Raw Water Master Plan
Build new facilities to enhance diversion or divert new supplies	X		N	X		3	potential option	Being evaluated under 2012 Raw Water Master Plan
Lower reservoir intake structures	X	X	N	X		3	potential option	Being evaluated under 2012 Raw Water Master Plan
Use reservoir dead storage		X	N			3	potential option	Being evaluated under 2012 Raw Water Master Plan
Acquire additional storage	X		N	X		3	potential option	Being evaluated under 2012 Raw Water Master Plan
Build emergency dams	X	X						
Reactivate abandoned dams	X	X	N			2		Not technically feasible
Cloud seeding	X	X	N			2		Not cost effective for size of City
List additional strategies identified using Worksheet A or alternative sources								
Water Rights Management and Cooperative Agreements								
Call back water rights that others are allowed to use		X						
Pay senior water user to not place a "call" on the river		X	N		X	4	X	Potential option to be considered in future.
Pay upstream water user to allow diversion of more water		X	N		X	4	X	Potential option to be considered in future.
Purchase water from other entities (i.e., neigboring cities, federal projects)		X	N		X	4	X	Potential option to be considered in future.
Arrange for exchanges	X	X	N		X	4	X	Potential option to be considered in future.
Lease irrigation rights from farmers		X	N		X	4	X	Potential option to be considered in future.
Lease private wells		X						
Cancel municipal leases of water to farmers		X						
Use irrigation decrees		X						
Invoke drought reservations that allow reduction in bypass requirements		X						
Negotiate purchases or ‘options’	X	X	N		X	4	X	Potential option to be considered in future.
Renegotiate contractually controlled supplies	X	X						
Develop water transfers with other entities	X	X	N		X	4	X	Potential option to be considered in future.
Develop water bank to facilitate water transfers in times of drought	X							
Develop interconnects with other entities	X	X	N	X				Not cost effective
Trade water supplies with other entities to increase yield		X	N		X	4	X	Potential option to be considered in future.
List additional strategies identified using Worksheet A or alternative sources								

Supply-Side Mitigation and Response Strategies

Supply-Side Mitigation and Response Strategies [1]	Long-term Mitigation Actions [2]	Short-term Response Strategy [3]	Preliminary Selection of Mitigation and Response Strategies [4]	Selection of Planning Horizon [5]		Screening Ranking Value [6]	Post-Screening Selection of Mitigation and Response Strategies [7]	Comments [8]
				Long-term Mitigation Actions	Short-term Response Strategy			
Improve Water Distribution Efficiency								
Conduct distribution system water audit	X	X	E	X		5	X	Existing Practices
Repair leaks in distribution system	X	X	E	X		5	X	Existing Practices
Reduce distribution system pressure		X						
Replace inaccurate meters	X		E	X		5	X	Existing Practices
Calibrate all production, commercial, industrial, and zone meters	X							
Install meters at key distribution points to isolate areas of overuse and probable leakage	X							
Minimize reservoir spills	X	X	E	X		4	X	Standard operations
Change operations to optimize efficiency and distribution of supplies	X	X						
Change pattern of water storage and release operations to optimize efficiency	X	X	N		X	5	X	Low cost & beneficial
Reduce reservoir evaporation (i.e., reduce storage in reservoirs with high evaporation rates)	X	X						
Reduce reservoir seepage (i.e., reduce storage in reservoirs with high seepage rates)	X	X	N	X		2		Not technically feasible
Recirculate wash water	X		N	X		5	X	Benefits exceed cost over time
Enhance efficiency of water treatment facilities	X							
List additional strategies identified using Worksheet A or alternative sources								

Demand-Side Mitigation and Response Strategies

WORKSHEET C - DEMAND-SIDE MITIGATION AND RESPONSE STRATEGIES

Instructions:
[1] This column provides a list of demand-side response strategies. List additional strategies identified using Worksheet A or alternative sources.
[2] This column identifies the long-term mitigation actions.
[3] This column identifies the short-term response strategies.
[4] Conduct screening: Identify the mitigation and response strategies that meet the following on a promotion/voluntary, incentive, mandatory, coordination basis:
Enter "existing" for all mitigation and response strategies included in existing drought management plans that will continue to be used in the future.
Enter "new" for all mitigation and response strategies are to be considered for this drought management planning effort.
Enter "eliminated" for all existing mitigation and response strategies that will no longer be used in the future.
[5] Specify whether the selected "existing" and "new" mitigation and response strategies are to be implemented as mitigation or short-term response strategies by entering an "X" in the appropriate column.
[6] Screening: Specify how well the selected mitigation and response measures meet the criteria to the right of these instructions by entering the following ranking value:
Enter "1" for mitigation and response strategies that meet one of the five screening criteria.
Enter "2" for mitigation and response strategies that meet two of the five screening criteria.
Enter "3" for mitigation and response strategies that meet three of the five screening criteria.
Enter "4" for mitigation and response strategies that meet four of the five screening criteria.
Enter "5" for mitigation and response strategies that meet five of the five screening criteria.
[7] Enter an X for selected mitigation and response strategies following the screening process.
[8] If necessary provide additional explanation of why a mitigation or response strategy was retained or eliminated.

[6] Screening Criteria:
a) Technical feasibility
b) Perceived benefits
c) Cost effectiveness
d) Public acceptance
e) Environmental sensitivity and other extraneous impacts

Mitigation and Demand-Side Response Strategies [1]	Type of Strategy		Selection of Mitigation and Response Strategies [4]				Selection of Planning Horizon [5]		Screening Ranking Value [6]	Post-Screening Selection of Mitigation and Response Strategies [7]	Comments [8]
	Long-term Mitigation Actions [2]	Short-term Response Strategy [3]	Promote/ Voluntary	Incentive Based	Mandatory	Coordinate with Other Entities	Long-term Mitigation Actions	Short-term Response Strategy			
Provider/Municipality											
Develop drought public education campaign with long-term and short-term demand management strategies	X	X			E	N	X	X	5	X	Necessary for effective plan
Identify high water use customers and develop water saving targets	X	X			N		X		3		Data intensive
Implement conservation measures that also provide water saving benefits during drought periods (i.e., water fixture rebates)	X			E	E		X		5	X	To coordinate w/ conservation efforts
Restrict the issuance of new taps		X									Not publicly acceptable
Implement drought surcharges		X			N			X	4	X	To use only when necessary for revenue purposes
Implement a modified rate structure for drought periods	X	X			N			X	3		Not popular w/ public
Conduct irrigation audits on Provider/Municipal parks and open spaces	X	X			E		X		5	X	Standard practice
Educate provider/municipal staff on how to save water	X	X			E	E	X		5	X	Standard practice
Provide instructional resources to business on developing an office/business specific drought mitigation and response plan	X	X									Not time or cost effective
Eliminate/reduce irrigation on provider/muncipal owned parks and landscaping	X	X			E			X	5	X	Standard practice to irrigate efficiently. Considered conservation. Irrigation may be eliminated under extreme droughts.
Limit outdoor watering to specific times of the day	X	X			E						Standard practice. Considered conservation measure.
Limit number of watering days per week	X	X			E						Standard practice. Considered conservation measure.
Set time limit for watering	X	X			E						Standard practice. Considered conservation measure.
Prohibit watering during fall, winter, and early spring		X			N			X	4	X	Under more severe droughts & preserve trees
Convert sprinklers to low volume irrigation where appropriate	X				E		X		5	X	Standard practice
Restrict outdoor misting devices		X			E		X		5	X	Standard practice

Demand-Side Mitigation and Response Strategies

Mitigation and Demand-Side Response Strategies [1]	Type of Strategy		Selection of Mitigation and Response Strategies [4]				Selection of Planning Horizon [5]		Screening Ranking Value [6]	Post-Screening Selection of Mitigation and Response Strategies [7]	Comments [8]
	Long-term Mitigation Actions [2]	Short-term Response Strategy [3]	Promote/ Voluntary	Incentive Based	Mandatory	Coordinate with Other Entities	Long-term Mitigation Actions	Short-term Response Strategy			
Reduce street cleaning, sidewalk, and driveway washing		X			E						Standard practice. Considered conservation measure.
Limit/prevent washing of city fleet vehicles		X			N			X	5	X	
Limit hydrant washing and flushing		X			N			X	4	X	
Limit use of water for fire training		X			N			X	4	X	
Eliminate all fire hydrant uses except those required for public safety		X			N			X	4	X	
Turn off ornamental fountains in buildings and parks		X			N			X	5	X	
Install water saving fixtures, toilets, and/or appliances in provider/municipal-owned buildings	X				E		X		4	X	Standard practice
Conduct indoor water audits	X	X				N		X	4	X	

Demand-Side Mitigation and Response Strategies

Mitigation and Demand-Side Response Strategies [1]	Type of Strategy		Selection of Mitigation and Response Strategies [4]				Selection of Planning Horizon [5]		Screening Ranking Value [6]	Post-Screening Selection of Mitigation and Response Strategies [7]	Comments [8]
	Long-term Mitigation Actions [2]	Short-term Response Strategy [3]	Promote/ Voluntary	Incentive Based	Mandatory	Coordinate with Other Entities	Long-term Mitigation Actions	Short-term Response Strategy			
List additional strategies identified using Worksheet A or alternative sources											
Residential											
Enforce landscape watering restrictions	X	X			E	N		X	4	X	Necessary during drought
Limit outdoor watering to specific times of the day	X	X	E		E						In conservation plan
Limit number of watering days per week	X	X	E		E	N		X	4	X	
Set time limit for watering	X	X	E		E						In conservation plan
Prohibit lawn watering during fall, winter, and early spring		X	E		N	N		X	4	X	
Limit watering to hand-held hose or no-volume nonspray device		X	E		N			X	4	X	
Promote outdoor water audits	X	X	E			E	X		5	X	Current program - well received
Convert sprinklers to low volume irrigation where appropriate	X	X	N	N			X		5	X	
Limit/restrict outdoor misting devices	X	X	N	N			X		5	X	
Limit/prohibit installation of new sod, seeding, and/or other landscaping		X	N		N			X	4	X	
Enforce policy guidelines/limitations for installation of new sod and/or other landscaping	X	X									
Enforce restrictions on spraying of impervious surfaces		X	E		N			X	4	X	
Prohibit/limit vehicle washing		X	N		N			X	4	X	
Prohibit/limit nonrecirculating fountains		X	N		N			X	4	X	
Prohibit/limit filling and use of swimming pools		X	N		N			X	4	X	
Enforce indoor water restrictions		X	N		N			X	3		Difficult to enforce
Promote indoor water audits	X	X		N		N	X				In conservation plan
Promote/require installation of water efficient appliances (e.g., dishwaters, clothes washer)	X	X		N			X				In conservation plan
Promote/require graywater use	X	X									
Provide acoustical meters to assist customers in identifying leaks	X	X	E				X				In conservation plan
Require water efficient fixtures and/or appliances on house resale or remodeling	X		E	N			X		3		Too intensive from administration perspective
Provide historical monthly water usage on water bills	X	X			E						Current practice
Promote/enforce reduction of water-cooled air conditioning		X	N		N			X	4	X	
List additional strategies identified using Worksheet A or alternative sources											
Commercial											
Prohibit/limit use of construction water		X			N	N		X	3	X	Only under severe conditions
Enforce policy guidelines/limitations for installation of new sod and/or other landscaping	X	X			N			X	4	X	
Enforce outdoor landscape watering restrictions	X	X			E			X	4	X	
Promote/require indoor and outdoor water audits where applicable	X	X		N		N		X	5	X	Business star program
Turn off indoor and outdoor ornamental fountains		X	N		N			X	4	X	
Prohibit/limit filling and use of swimming pools		X	N		N			X	4	X	
Promote/enforce installation of water efficient fixtures and appliances (i.e., toilets, faucets, etc.)	X	X		N	N		X		5	X	Business star program
Turn off public drinking fountains		X		N	N			X	4	X	Business star program
Promote reduction of water-cooled air conditioning		X		N	N			X	4	X	Business star program
Promote/require buildings with water-cooled air conditioning to raise the temperature modestly		X		N	N			X	4	X	Business star program
Prohibit/limit dealership washing of vehicles		X		N	N			X	4	X	Business star program
Enforce water use restrictions on commercial car washes								X	3		Very unpopular
Promote commercial car washes to install water recycling technology and/or other BMPs	X	X		N			X		4	X	Business star program
Promote/enforce service of water in restaurants only upon request	X	X		N	N			X	4	X	Business star program
Promote/enforce reduction in frequency of linen and towel washing in hotels	X	X		N	N			X	4	X	Business star program
Provide instructional resources on developing a business/office specific conservation plan	X	X		N		N	X		4	X	Business star program
List additional strategies identified using Worksheet A or alternative sources											
Industrial											
Prohibit/limit use of construction water		X									n/a
Enforce policy guidelines/limitations for installation of new sod and/or other landscaping	X	X									n/a
Enforce outdoor landscape watering restrictions	X	X									n/a
Promote/require indoor and outdoor audits where applicable	X	X									n/a

Demand-Side Mitigation and Response Strategies

Mitigation and Demand-Side Response Strategies [1]	Type of Strategy		Selection of Mitigation and Response Strategies [4]				Selection of Planning Horizon [5]		Screening Ranking Value [6]	Post-Screening Selection of Mitigation and Response Strategies [7]	Comments [8]
	Long-term Mitigation Actions [2]	Short-term Response Strategy [3]	Promote/ Voluntary	Incentive Based	Mandatory	Coordinate with Other Entities	Long-term Mitigation Actions	Short-term Response Strategy			
Promote reduction of water-cooled air conditioning		X									n/a
Require buildings with water-cooled air conditioning to raise the temperature modestly		X									n/a
Promote/require conversion of cooling towers and other industrial water using processes	X										n/a
List additional strategies identified using Worksheet A or alternative sources											n/a
											n/a

Drought Public Information Campaign

WORKSHEET D - DROUGHT PUBLIC INFORMATION CAMPAIGN

Instructions:
[1] Select the drought information to convey to the public prior to a drought (long-term mitigation), in response to declaration of a drought (long-term response), or for both scenarios. Enter "yes," "maybe,"or "no" in each column.
[2] Select the targeted audience and corresponding communication tool(s) for each of the drought components selected in column [1] by entering the appropriate letter designation(s) for each of the applicable communication tools identified in the communications tools listed to the right.
[3] Enter additional ideas.
[4] Enter an "X" for all components where coordination with other entities is a likely possibility.

Communication Tools

a Website devoted to drought and water conservation tips
b Water bill (monthly water use targets and actual consumption)
c Establish drought hotline & train staff to operate hotline
d Newspaper articles
e Television
f Reach out to general media
g City & county websites
h Water bill inserts
i Distribution of brochures
j Seminars/special programs
k Broadly distributed emails
l School outreach/educational programs (field trips, speakers, curriculum)
m Mail fliers
n Public meetings
o Distribution of water conservation tools (rain meter, sink aerators, etc)
p Booths at special events
q Billboards
r Social networking media
s Email

t Meetings
u Phone
Insert other communication tools [3]

Note: This worksheet was used to intially generate thoughts on the Public Drought Campaign. Modifications to the Public Drought Campaign have subsequently been made and hence this worksheet does not match the Plan exactly.

Public Information Campaign Components	Screening [1]		Targeted Audience [2]																Coordinate with Other Entities [4]
	Long-term Mitigation Actions	Short-term Reponse Strategy	Decision makers/policy makers	Governmental bodies/city departments (i.e. parks, fire department)	Community recreational facilities	Media	Single-family residential	Multi-family residential	HOAs	Commercial business owners	Commercial business employees	School facility managers	School children	Industrial businesses	Specific targeted businesses (local nurseries, landscape architects, health facilities)	Large water users (golf courses)	*Insert other audience members [3]*	
Drought Information to Convey to the Public																			
Status of current drought conditions and drought stage	Yes	Yes	s,t	s,t	a, b, g, k, s, t, u	a, d, g,n, r, u	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, d, g, n, q, r	a, b, d, g, h, k, m, n, q, r		n/a	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r		X
Long-term sustainability of water supply system	Yes	Yes	s, t	s, t	d, g, n	d, g, n	d, g, n	d, g, n	d, g, n	d, g, n	d, g, n	d, g, n		n/a	d, g, n	d, g, n		
Where customers may access drought mitigation plan	Yes	Yes	s,t	s,t	a, g, k	a, g, k	a, g, k	a, g, k	a, g, k	a, g, k	a, g, k	a, g, k		n/a	a, g, k	a, g, k		
Measures and/or impacts that customers can expect if drought continues or intensifies		Yes	s,t	s,t	a, b, g, k, s, t, u	a, d, g,n, r, u	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, d, g, n, q, r	a, b, d, g, h, k, m, n, q, r		n/a	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r		X
Factors that could influence water supply services and cost of services	Yes		s, t	s, t	d, g, n	d, g, n	d, g, n	d, g, n	d, g, n	d, g, n	d, g, n	d, g, n		n/a	d, g, n	d, g, n		
Water provider's actions to save water and/or acquire new water	Yes		s, t	s, t	d, g, n	d, g, n	d, g, n	d, g, n	d, g, n	d, g, n	d, g, n	d, g, n		n/a	d, g, n	d, g, n		
Policy recommendations, requirements, and penalties	Yes	Yes	s, t	s, t	d, g, n	d, g, n	d, g, n	d, g, n	d, g, n	d, g, n	d, g, n	d, g, n		n/a	d, g, n	d, g, n		

Drought Public Information Campaign

Public Information Campaign Components	Screening [1]		Targeted Audience [2]															Coordinate with Other Entities [4]
	Long-term Mitigation Actions	Short-term Reponse Strategy	Decision makers/policy makers	Governmental bodies/city departments (i.e. parks, fire department)	Community recreational facilities	Media	Single-family residential	Multi-family residential	HOAs	Commercial business owners	Commercial business employees	School facility managers	School children	Industrial businesses	Specific targeted businesses (local nurseries, landscape architects, health facilities)	Large water users (golf courses)	*Insert other audience members [3]*	
Enforcement of drought policies		Yes	s,t	s,t	a, b, g, k, s, t, u	a, d, g,n, r, u	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, d, g, n, q, r	a, b, d, g, h, k, m, n, q, r		n/a	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r		
Explanation of rate increases/drought surcharge	Yes		s, t	s, t	d, g, n, r, h	d, g, n, r, h	d, g, n, r, h	d, g, n, r, h	d, g, n, r, h	d, g, n, r, h	d, g, n, r, h	d, g, n, r, h		n/a	d, g, n, r, h	d, g, n, r, h		
Increase advertisement of conservation incentives in conservation and drought plans		Yes	s,t	s,t	a, b, g, k, s, t, u	a, d, g,n, r, u	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, d, g, n, q, r	a, b, d, g, h, k, m, n, q, r	l,p	n/a	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r		
Water conservation savings tips	Already implemented through conservation program												l,p	n/a				
Landscaping tips during a drought (i.e., which plants to convert to drip, which to save, which to let die)		Yes	s,t	s,t	a, b, g, k, s, t, u	a, d, g,n, r, u	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r		a, b, d, g, h, k, m, n, q, r	l,p	n/a	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r		
Post-drought landscape revival information		Yes	s,t	s,t	a, b, g, k, s, t, u	a, d, g,n, r, u	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r		a, b, d, g, h, k, m, n, q, r	l,p	n/a	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r		
Use of gray water where legal and appropriate	No													n/a				
Promote existing xeriscape gardens	Already implemented through conservation program													n/a				
Ways to clean sidewalks, driveways, and other hard surfaces without using hoses	Already implemented through conservation program													n/a				
Ways to wash vehicles to minimize water waste	Already implemented through conservation program													n/a				
Water saving targets and actual consumption by individual customer, city, sector, etc.	No	No												n/a				
Instruction to customers on how to set up a water use plan for their homes or business	No	No												n/a				
Instructions on how to track water use within the home	No	No												n/a				
Publicize efforts of individuals and businesses as examples of how to reduce water use	Yes- Business Star Program already implemented through conservation plan. To be expanded in times of drought.		s,t	s,t	a, b, g, k, s, t, u	a, d, g,n, r, u	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r		a, b, d, g, h, k, m, n, q, r	l,p	n/a	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r		
Encourage intense public discussion and media involvement concerning ways to reduce water use while minimizing impacts (i.e., landscaping impacts)		Yes - Expanded beyond conservation program	s,t	s,t	a, b, g, k, s, t, u	a, d, g,n, r, u	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r		a, b, d, g, h, k, m, n, q, r	l,p	n/a	a, b, d, g, h, k, m, n, q, r	a, b, d, g, h, k, m, n, q, r		

Drought Public Information Campaign

Public Information Campaign Components	Screening [1]		Targeted Audience [2]															Coordinate with Other Entities [4]
	Long-term Mitigation Actions	Short-term Reponse Strategy	Decision makers/policy makers	Governmental bodies/city departments (i.e. parks, fire department)	Community recreational facilities	Media	Single-family residential	Multi-family residential	HOAs	Commercial business owners	Commercial business employees	School facility managers	School children	Industrial businesses	Specific targeted businesses (local nurseries, landscape architects, health facilities)	Large water users (golf courses)	*Insert other audience members [3]*	
Do-it-yourself water waste reduction/water savings brochure	Already implemented through conservation program													n/a				
Provide customers with a drought report card at the year showing monthly/annual water use pre-drought and during the drought	No	No												n/a				
Insert additional information to convey to the public [3]														n/a				

Drought Stages, Trigger Points, and Response Targets

WORKSHEET E - DROUGHT STAGES, TRIGGER POINTS, AND RESPONSE TARGETS

Instructions:
[1] List additional drought indicators that may be used to monitor drought not included in this list.
[2] Identifiy drought indicators currently used to monitor drought by entering a "X".
[3] Identifiy new drought indicators that will be monitored as a result of this planning effort by entering a "X".
[4] Identifiy the key drought indicators that will be used to develop trigger points by entering a "X". (This will not be applicable for providers choosing not to develop trigger points).
[5] List the time period in which the trigger point is effective (i.e. reservoir level trigger point - **late May**).
[6] List drought stages.
[7] List drought trigger points correponding to each stage.
[8] List response targets corresponding to each stage.

Identification of Drought Indicators and Development of Trigger Points

Drought Indicators [1]	Currently Monitored [2]	New Drought Indicator [3]	Key Drought Indicator Selected to Develop Trigger Points [4]	Timing [5]
Standard Precipitation Index (SPI)				
Surface Water Supply Index (SWSI)				
Modifed Palmer Drought Index				
Streamflows	X			
Reservoir levels	X		X	July 1st
Precipitation records	X			
Snowpack	X			
Groundwater levels		X (if wells are developed)		
River administration (call data)	X			
Soil moisture				
Evapotranspiration				
Seasonal local weather predictions		X		
Add additional drought indicators				

Drought Stages, Trigger Points, and Response Targets

Stage [6]	Drought Trigger Point(s) [7]		Response Targets [8]	
Watch	Less than 90% of full		10% savings	
Warning	Less than 80% of full		25% savings	
Critical	Less than 65% of full		40% savings	
Emergency	Less than 50% of full		50% savings	

Staged Drought Response Program

WORKSHEET F - STAGED DROUGHT RESPONSE PROGRAM

Instructions:
[1] List the supply-side response strategies selected for the Plan by appropriate category (Step 3). Categories in this worksheet may be modified to match the Plan.
[2] Replace Stage 1, Stage 2, etc. to match the drought stage names in the Plan (Step 4). This worksheet includes five stages as a default. Delete or add stages to match the Plan.
[3] Insert the appropriate drought measures corresponding to each response strategy.
[4] List the public education campaign activities selected for the Plan (Step 3).
[5] List the public education campaign activities by drought stage (Step 6). If appropriate specify the targeted audience, communication tools, and information to convey.

Note: This worksheet was used as an iterim product to develop the Staged Drought Response Program. Results in this table do no reflect the final program provided in Worksheets G and H.

Supply-Side Response Strategies					
Response Strategies [1]	**Drought Stages [2] and [3]**				
	Pre-drought Mitigation	Watch	Warning	Critical	Emergency
Water Supply Augmentation					
n/a	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Water Rights Management and Coordination with Other Entities					
Pay senior water user to not place a "call" on the river Pay upstream water user to allow diversion of more water Purchase water from other entities (i.e., neigboring cities, federal projects) Arrange for exchanges Lease irrigation rights from farmers Negotiate purchases or 'options' Develop water transfers with other entities Trade water supplies with other entities to increase yield	*n/a*	These options will be explored at the onset of a drought and could be implemented for any of the four drought stages pending on terms of the agreement(s).			
Increase Water Use Efficiency					
Change pattern of water storage and release operations to optimize efficiency -	*n/a*				
Modify reservoir releases to maintain streamflows during critical times of the day during the tourist season	*n/a*	Streamflow impacts minimal - no action	Highest releases to occur from 12:00 to 3:00 for tubing July - Aug	Highest releases to occur from 1:00 to 3:00 for tubing July - Aug	Water supplies too stressed to implement action
Minimize water quality impacts by adjusting reservoir releases to maintain Castle Reservoir storage at 50% of capacity	*n/a*	Water quality impacts minimal - no adjustments to operations necessary	Adjust reservoir releases accordingly	Adjust reservoir releases accordingly	Water supplies too stressed to implement action
Demand-Side Response Strategies					
Provider/Municipality					
Implement drought surcharges	*n/a*	No surcharge	No surcharge	Drought surcharge will be implemented to support water use restrictions and achieve response target.	Drought surcharge will be implemented to support water use restrictions and achieve response target.

Staged Drought Response Program

Response Strategies [1]	Drought Stages [2] and [3]				
	Pre-drought Mitigation	Watch	Warning	Critical	Emergency
Eliminate/reduce irrigation on provider/muncipal owned parks and landscaping	*n/a*	Follow standard practice which is involves water audits and efficient water use.	Follow standard practice which is involves water audits and efficient water use.	Eliminate turf irrigation on city parks and landscaping. Maintain irrigation on sports fields & irrigate trees & shrubs.	Eliminate all turf irrigation only maintaining trees.
Prohibit watering during fall, winter, and early spring	*n/a*	No restriction.	Eliminate turf irrigation during fall, winter, & early spring.	Eliminate all irrigation with exception to trees during fall, winter, & early spring.	Eliminate all irrigation during fall, winter, & early spring.
Limit/prevent washing of city fleet vehicles	*n/a*	No restriction.	Limit city field vehicles to washing biweekly and washing of other vehicles to once a month.	Prohibt washing of all city vehicles.	Prohibt washing of all city vehicles.
Limit hydrant washing and flushing	*n/a*	No restriction.	Reduce hydrant washing and flushing to once every 3 months.	Reduce hydrant washing and flushing to once every 3 months.	Reduce hydrant washing and flushing to once every 6 months.
Limit use of water for fire training	*n/a*	No restriction.	No restriction.	Water for fire training is prohibited.	Water for fire training is prohibited.
Eliminate all fire hydrant uses except those required for public safety	*n/a*	No restriction.	No restriction.	Fire hydrant use is restricted with exception to essential uses for public safety.	Fire hydrant use is restricted with exception to essential uses for public safety.
Turn off ornamental fountains in buildings and parks	*n/a*	No restriction.	Ornamental fountains and drinking fountains are turned off in parks.	Use of ornamental fountains and drinking fountains in parks and buldings is prohibited.	Use of ornamental fountains and drinking fountains in parks and buldings is prohibited.
Conduct indoor water audits	*n/a*	Conduct indoor water audits on all city-owned buildings	Conduct indoor water audits on all city-owned buildings	Conduct indoor water audits on all city-owned buildings	Mandate indoor water audits for all businsses exceeding employment of over 5 people and for all city owned buildings. Provide free indoor water audits for all other customers.
Residential					
Enforce landscape watering restrictions	*n/a*	Voluntary restrictions.	Mandatory restrictions. See Worksheet G.	Mandatory restrictions. See Worksheet G.	Landscape irrigation is prohibited.
Limit number of watering days per week	*n/a*	Voluntary restrictions.	Mandatory restrictions. See Worksheet G.	Mandatory restrictions. See Worksheet G.	Landscape irrigation is prohibited.
Prohibit lawn watering during fall, winter, and early spring	*n/a*	n/a	Voluntary	Mandatory	n/a - all outdoor irrigation is prohibited
Limit watering to hand-held hose or no-volume nonspray device	*n/a*	n/a	n/a	Mandatory restrictions. See Worksheet G.	Landscape irrigation is prohibited with exception to a small amount to ensure survival of trees.
Limit/prohibit installation of new sod, seeding, and/or other landscaping	*n/a*	No restrictions.	Voluntary restrictions.	Mandatory restrictions.	Mandatory restrictions.
Enforce restrictions on spraying of impervious surfaces	*n/a*	Voluntary restrictions.	Spraying of impervious surfaces is restricted.	Spraying of impervious surfaces is restricted.	Spraying of impervious surfaces is restricted.

Staged Drought Response Program

Response Strategies [1]	Drought Stages [2] and [3]				
	Pre-drought Mitigation	Watch	Warning	Critical	Emergency
Prohibit/limit vehicle washing	*n/a*	Restricted to shut-off nozzle and bucket. (Includes car dealers)	Restricted to shut-off nozzle and bucket. (Includes car dealers)	Prohibited. (Includes car dealers)	Prohibited. (Includes car dealers)
Prohibit/limit nonrecirculating fountains	*n/a*	No restriction.	Nonrecirculating fountains are prohibited.	All fountains are prohibited.	All fountains are prohibited.
Prohibit/limit filling and use of swimming pools & hot tubs	*n/a*	Encourage best management practices (use of pool covers, reuse of water at the end of the season for irrigation and repair of leaks).	Encourage best management practices (use of pool covers, reuse of water at the end of the season for irrigation and repair of leaks).	Filling of private pools is prohibited. Encourage best management practices for all commercial pools (use of pool covers, reuse of water at the end of the season for irrigation and repair of leaks).	Filling of private pools and commercial outdoor pools are prohibited.
Enforce indoor water restrictions	*n/a*	n/a	n/a	n/a	Water usage target of 40 gpcd. Fines could be implemented if water use exceeds this amount.
Promote/enforce reduction of water-cooled air conditioning including swamp coolers and humidifiers.	*n/a*	Promote voluntary reduction of water-cooled air conditioning and adjust temperature. Encourage reliance on room size humidifiers and swamp coolers as opposed to whole house units.	Promote voluntary reduction of water-cooled air conditioning and adjust temperature. Encourage reliance on room size humidifiers and swamp coolers as opposed to whole house units.	Promote voluntary reduction of water-cooled air conditioning and adjust temperature. Encourage reliance on room size humidifiers and swamp coolers as opposed to whole house units.	Promote voluntary reduction of water-cooled air conditioning and adjust temperature. Encourage reliance on room size humidifiers and swamp coolers as opposed to whole house units.
Commercial					
Prohibit/limit use of construction water	*n/a*	Encourage reduction of construction water use where feasible.	Encourage reduction of construction water use where feasible.	Encourage reduction of construction water use where feasible.	Prohibit use of construction water unless upon a negotiated basis.
Enforce policy guidelines/limitations for installation of new sod and/or other landscaping	*n/a*	No restrictions.	Voluntary restrictions.	Mandatory restrictions.	Mandatory restrictions.
Enforce outdoor landscape watering restrictions	*n/a*	Volunatary restrictions.	Mandatory restrictions. See Worksheet G.	Mandatory restrictions. See Worksheet G.	Mandatory restrictions. See Worksheet G.
Promote/require indoor and outdoor water audits where applicable	*n/a*	Provide voluntary free outdoor water audits.	Provide voluntary free outdoor water audits.	Require mandatory outdoor water use audits. Provide free service.	n/a - irrigation is prohibited.
Turn off indoor and outdoor ornamental fountains	*n/a*	No restriction.	Nonrecirculating fountains are prohibited.	All fountains are prohibited.	All fountains are prohibited.
Prohibit/limit filling and use of swimming pools & hot tubs	*n/a*	Encourage best management practices (use of pool covers, reuse of water at the end of the season for irrigation and repair of leaks).	Encourage best management practices (use of pool covers, reuse of water at the end of the season for irrigation and repair of leaks).	Filling of private pools is prohibited. Encourage best management practices for all commercial pools (use of pool covers, reuse of water at the end of the season for irrigation and repair of leaks).	Filling of private pools and commercial outdoor pools are prohibited.

Staged Drought Response Program

Response Strategies [1]	Drought Stages [2] and [3]				
	Pre-drought Mitigation	Watch	Warning	Critical	Emergency
Enforce water use restrictions on commercial car washes	*n/a*	Voluntary reductions in annual water use by 10%. Encourage best management practices.	Voluntary reductions in annual water use by 10%. Encourage best management practices.	Require implementation of best managmeent practices and that limit water use to 40 gal per vehicle.	Prohibit commerical car washing.
Promote/enforce service of water in restaurants only upon request	*n/a*	Voluntary reductions in water use. Do not serve water unless customers ask for it.	Promote use of less service dishes and not serving water unless customers ask for it.	Mandate use of less service dishes and not serving water unless customers ask for it.	Mandate use of less service dishes and not serving water unless customers ask for it.
Promote/enforce reduction in frequency of linen and towel washing in hotels	*n/a*	Encourage use of signs that promote conservation (short showers, washing of linens one a wk per stay, reduce use of towels).	Encourage use of signs that promote conservation (short showers, washing of linens one a wk per stay, reduce use of towels).	Require use of signs that promote conservation (short showers, washing of linens one a wk per stay, reduce use of towels).	Require use of signs that promote conservation (short showers, washing of linens one a wk per stay, reduce use of towels).
Industrial					
n/a	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Public Education Campaign Activities					
Public Education Campaign Activities [4]	**Drought Stages [2] and [5]**				
	Stage 1	**Stage 2**	**Stage 3**	**Stage 4**	**Stage 5**
not used	*n/a*	See Section 4.4.			

WORKSHEET G – DROUGHT MITIGATION AND STAGED DROUGHT RESPONSE PROGRAM

Stage: Watch

Drought Trigger Points: Storage less than 90% of full on July 1 and measured snowpack 90% of normal by the end of April.

Drought Stage and Trigger Summary: The Watch drought stage is triggered when the actual or forecasted storage on July 1st is less than 90% of full. The drought response is to primarily focus on voluntary measures with the objective of reaching a water use reduction target of 10% during the irrigation season.

Supply-Side Response Measures

The following two supply-side measures may be implemented regardless of the drought severity and stage. The specifics on how each measure would be implemented and timing would be identified at the onset of the drought.

- Seek technical and financial assistance opportunities – This may include assistance from the public sector at the federal, state, or county level or include assistance from private entities such as non-profit organizations promoting water conservation and drought awareness. Assistance may include grants, loans, technical assistance (i.e. water use efficiency improvement), education, etc. Shallow Creek plans to be aware of the technical and financial opportunities before a drought enabling the City to take advantage of the opportunities quickly and efficiently when a drought occurs.

- Water rights management and cooperative agreements – Shallow Creek's water supply yields may be increased by making some adjustments to how water rights are traditionally managed and through other synergies developed via cooperative agreements with other local water users. Where possible, these agreements will be established in advance of a drought as part of the mitigation effort and activated during drought periods. However the activation of these agreements and identification of new arrangements during drought periods will be a component of the drought response. Appropriate Substitute Water Supply Plans will be filed to ensure that the agreement/arrangement(s) are viable under Colorado Water Law. These agreement/arrangement(s) may include the following:

  - Acquire water from other entities – Shallow Creek's water supply system is situated in such a manner that it could divert and utilize water from other entities via exchange. Purchase, lease, trade, temporary fallowing, and water transfer arrangements with downstream agricultural users and nearby water providers will be explored as an option during drought periods.
  - Pay upstream water users to divert less water – This would include Snow Mountain Ski Resort who can significantly reduce stream flows in November and December during snow making periods.

Demand-Side Response Measures

Utilities Department

- Irrigation of City-owned property (parks and open spaces) – enforce standard practices which includes water audits at the beginning of the irrigation season and efficient water use.

- Washing of City-owned vehicles – Washing of City-owned field vehicles is limited to once every two weeks and washing of all other vehicles is limited to once per a month.

- Fountains – Ornamental fountains and drinking fountains in City-owned parks are turned off from 10:00 am to 4:00 pm.

Residential Voluntary Restrictions

- Outdoor water restrictions – residents are encouraged to follow the voluntary outdoor water restrictions according to the following schedule:

Type of Property	Watering Days (three days per week)
Single family residential with even number address	Saturday and Wednesday
Single family residential with odd number address	Sunday and Thursday
All other residential properties (multifamily, HOAs, etc)	Monday and Friday

- Impervious surfaces (driveways, sidewalks, patios, etc) – recommend minimizing power washing and spraying on impervious surfaces. A broom or mop may be used as a replacement.

- Personal vehicles – should only be washed using a bucket and hand-held hose with an automatic shut-off nozzle.

- Private swimming pools and hot tubs – all swimming pools and hot tubs should be covered when not being used to reduce evaporation. Regular maintenance should minimize leaks and reuse the water for irrigation when emptying the pool/hot tub.

- Water cooled air conditioning, swamp coolers, and humidifiers – adjust room temperatures to reduce use of water-cooled air conditioning. Use room size humidifiers and swamp coolers in most utilized rooms as opposed to whole house units.

Commercial and Institutional

- Construction water – appropriate best management practices should be employed to conserve and prevent wasting of construction water.

- Outdoor water restrictions – commercial businesses are encouraged to follow the voluntary outdoor water restrictions according to the following schedule:

Type of Property	Watering Days (two days per week)
Businesses with even number address	Saturday and Wednesday
Businesses with odd number address	Sunday and Thursday
Large irrigators (i.e. golf courses, schools/athletic fields)	Monday and Friday

- Outdoor water audits – Shallow Creek has partnered with a natural resources conservation non-profit organization that promotes efficient water use. This non-profit organization provides free water audits for an unlimited number of customers during drought periods. Commercial businesses are encouraged to sign-up for a free outdoor water audit through the Utilities website.

- Commercial swimming pools and hot tubs – all swimming pools and hot tubs should be covered when not being used to reduce evaporation. Regular maintenance should minimize leaks and reuse the water for irrigation when emptying the pool/hot tub.

- Commercial car washes – all commercial car washes are encouraged to implement best management practices to reduce water use by 10% where technically feasible.

- Car dealership vehicles – should only be washed using a bucket and hand-held hose with an automatic shut-off nozzle.

- Restaurants – all restaurants are encouraged to not serve water unless customers specifically ask for it.

- Lodging – all lodging establishments are encouraged to place water conservation cards in every room promoting water conservation (i.e. short showers) as well as not changing linens and towels unless a customer specifically requests the service.

Public Campaign

Outlined in Section 4.4. Details of the public drought campaign are to be developed at the onset of a drought.

Enforcement Procedures

Provided in Section 7.5.

WORKSHEET G – DROUGHT MITIGATION AND STAGED DROUGHT RESPONSE PROGRAM

Stage: Warning

Drought Trigger Points: Storage less than 80% of full on July 1 and measured snowpack 75% of normal by the end of April.

Drought Stage and Trigger Summary: The Warning drought stage is triggered when the actual or forecasted storage on July 1st is less than 80% of full capacity. The drought response is to primarily focus on mandatory measures with the objective of reaching a water use reduction target of 25% during the irrigation season.

Supply-Side Response Measures:

The following two supply-side measures may be implemented regardless of the drought severity and stage. The specifics on how each measure would be implemented and timing would be identified at the onset of the drought.

- Seek technical and financial assistance opportunities – This may include assistance from the public sector at the federal, state, or county level or include assistance from private entities such as non-profit organizations promoting water conservation and drought awareness. Assistance may include grants, loans, technical assistance (i.e. water use efficiency improvement), education, etc. Shallow Creek plans to be aware of the technical and financial opportunities before a drought enabling the City to take advantage of the opportunities quickly and efficiently when a drought occurs.

- Water rights management and cooperative agreements – Shallow Creek's water supply yields may be increased by making some adjustments to how water rights are traditionally managed and though other synergies developed via cooperative agreements with other local water users. Where possible, these agreements will be established in advance of a drought as part of the mitigation effort and activated during drought periods. However the activation of these agreements and identification of new arrangements during drought periods will be a component of the drought response. Appropriate Substitute Water Supply Plans will be filed to ensure that the agreement/arrangement(s) are viable under Colorado Water Law. These agreement/arrangement(s) may include the following:

  - Acquire water from other entities – Shallow Creek's water supply system is situated in such a manner that it could divert and utilize water from other entities via exchange. Purchase, lease, trade, temporary fallowing, and water transfer arrangements with downstream agricultural users and nearby water providers will be explored as an option during drought periods.
  - Pay upstream water users to divert less water – This would include Snow Mountain Ski Resort who can significantly reduce stream flows in November and December during snow making periods.

- Modify reservoir releases to enhance streamflows during critical recreational times of the day during the tourist season. Highest releases are to occur from 1:00 pm to 3:00 pm for tubing July through August.

- Adjust reservoir releases to maintain Castle Reservoir storage at 50% of capacity to avoid degradation of drinking water quality.

Demand-Side Response Measures:

Utilities Department

- Irrigation of City-owned property (parks and open spaces) – enforce standard practices which includes water audits at the beginning of the irrigation season and efficient water use.

- Fall, winter, and spring turf irrigation – all turf irrigation on City-owned property from September 30 to May 1 is prohibited.

- Washing of City-owned vehicles – washing of City-owned field vehicles (e.g. parks vehicles) is limited to once every two weeks and washing of all other City vehicles is limited to once per a month.

- Hydrants – Reduce frequency of hydrant washing and flushing.

- Ornamental fountains and drinking fountains – All ornamental and drinking fountains in City-owned parks are turned off.

Residential

- Outdoor water restrictions – residents must follow the mandatory outdoor water restrictions according to the following schedule:

Type of Property	Watering Days (two days per week)
Single family residential with even number address	Saturday and Wednesday
Single family residential with odd number address	Sunday and Thursday
All other residential properties (multifamily, HOAs, etc)	Monday and Friday

- Fall, winter, and spring turf irrigation – residents are encouraged to reduce turf irrigation from September 30 to May 1.

- Installation of new sod, seeding, and other landscaping – residents are encouraged to forego the installation of new sod, seeding, and landscaping until the drought has ceased.

- Impervious surfaces (driveways, sidewalks, patios, etc) – power washing and spraying on impervious surfaces are prohibited. A broom or mop may be used as a replacement.

- Personal vehicles – should only be washed using a bucket and hand-held hose with an automatic shut-off nozzle.

- Non-recirculating fountains – all non-recirculating outdoor fountains must be turned off.

- Private swimming pools and hot tubs – all swimming pools and hot tubs should be covered when not being used to reduce evaporation. Regular maintenance should minimize leaks and reuse the water for irrigation when emptying the pool/hot tub.

- Water cooled air conditioning, swamp coolers and humidifiers – adjust room temperatures to reduce use of water-cooled air conditioning. Use room size humidifiers and swamp coolers in most utilized rooms as opposed to whole house units.

Commercial and Institutional

- Construction water – appropriate best management practices should be employed to conserve and prevent wasting of construction water.

- Outdoor water restrictions – commercial businesses must follow the mandatory outdoor water restrictions according to the following schedule:

Type of Property	Watering Days (two days per week)
Businesses with even number address	Saturday and Wednesday
Businesses with odd number address	Sunday and Thursday
Large irrigators (i.e. golf courses, schools/athletic fields)	Monday and Friday

- Outdoor water audits – Shallow Creek has partnered with a natural resources conservation non-profit organization that promotes efficient water use. This non-profit organization provides free water audits for an unlimited number of customers during drought periods. Commercial businesses are encouraged to sign-up for a free outdoor water audit through Utilities' website.

- Installation of new sod, seeding, and other landscaping – businesses are encouraged to forego the installation of new sod, seeding, and landscaping until the drought has ceased.

- Non-recirculating fountains – all non-recirculating outdoor fountains must be turned off.

- Commercial swimming pools and hot tubs – all swimming pools and hot tubs should be covered when not being used to reduce evaporation. Regular maintenance should minimize leaks and reuse the water for irrigation when emptying the pool/hot tub.

- Commercial car washes – all commercial car washes are encouraged to implement best management practices to reduce water use by 10% where technically feasible.

- Car dealership vehicles – should only be washed using a bucket and hand-held hose with an automatic shut-off nozzle.

- Restaurants – all restaurants are encouraged to not serve water unless customers specifically ask for it in addition reducing the number of service dishes (conserving water used for washing).

- Lodging – all lodging establishments are encouraged to place water conservation cards in every room promoting water conservation (i.e. short showers) as well as not changing linens and towels unless a customer specifically requests the service.

Public Campaign

Outlined in Section 4.4. Details of the public drought campaign are to be developed at the onset of a drought.

Enforcement Procedures

Provided in Section 7.5.

WORKSHEET G – DROUGHT MITIGATION AND STAGED DROUGHT RESPONSE PROGRAM

Stage: Critical

Drought Trigger Points: Storage less than 65% of full on July 1 and measured snowpack 50% of normal by the end of April.

Drought Stage and Trigger Summary: The Critical drought stage is triggered when the actual or forecasted storage on July 1st is less than 65% of full capacity. The drought response is to primarily focus on mandatory measures with the objective of reaching a water use reduction target of 40% during the irrigation season.

Supply-Side Response Measures:

The following two supply-side measures may be implemented regardless of the drought severity and stage. The specifics on how each measure would be implemented and timing would be identified at the onset of the drought.

- Seek technical and financial assistance opportunities – This may include assistance from the public sector at the federal, state, or county level or include assistance from private entities such as non-profit organizations promoting water conservation and drought awareness. Assistance may include grants, loans, technical assistance (i.e. water use efficiency improvement), education, etc. Shallow Creek plans to be aware of the technical and financial opportunities before a drought enabling the City to take advantage of the opportunities quickly and efficiently when a drought occurs.

- Water rights management and cooperative agreements – Shallow Creek's water supply yields may be increased by making some adjustments to how water rights are traditionally managed and though other synergies developed via cooperative agreements with other local water users. Where possible, these agreements will be established in advance of a drought as part of the mitigation effort and activated during drought periods. However the activation of these agreements and identification of new arrangements during drought periods will be a component of the drought response. Appropriate Substitute Water Supply Plans will be filed to ensure that the agreement/arrangement(s) are viable under Colorado Water Law. These agreement/arrangement(s) may include the following:

  - Acquire water from other entities – Shallow Creek's water supply system is situated in such a manner that it could divert and utilize water from other entities via exchange. Purchase, lease, trade, temporary fallowing, and water transfer arrangements with downstream agricultural users and nearby water providers will be explored as an option during drought periods.
  - Pay upstream water users to divert less water – This would include Snow Mountain Ski Resort who can significantly reduce stream flows in November and December during snow making periods.

- Modify reservoir releases to enhance streamflows during critical recreational times of the day during the tourist season. The highest releases are to occur from 1:00 pm to 3:00 pm for tubing July through August.

- Adjust reservoir releases to maintain Castle Reservoir storage at 50% of capacity to avoid degradation of drinking water quality.

Demand-Side Response Measures:

Utilities Department

- Drought surcharge – assess and design a drought surcharge to support water use restrictions and the targeted water savings. Surcharges will be applied to all customers.

- Irrigation of City-owned property (parks and open spaces) – restrict turf irrigation on City parks and open spaces. Sports fields, trees, and shrubs may be irrigated on a pre-determined limited basis. Preferred "green spaces" specified through a public outreach survey may also be irrigated on a pre-determined limited basis. This public outreach survey will be conducted by the Public Affairs Department if there is sufficient time and budget for such a survey.

- Fall, winter, and spring turf irrigation – all turf irrigation on City-owned property from September 30 to May 1 is prohibited.

- Washing of City-owned vehicles – washing of City-owned vehicles is prohibited.

- Reduce frequency of hydrant washing and flushing

- Water for fire training and use of fire hydrant – use of all water for fire training and of water from the hydrant is prohibited unless essential for public safety.

- Ornamental fountains and drinking fountains – all ornamental fountains and drinking fountains on City-owned property and City-owned buildings are to be turned off.

Residential

- Outdoor water restrictions – irrigation is limited to the use of a hand-held hose or non-spray device (drip system) and must adhere to the following schedule:

Type of Property	Watering Days (one day per week)
Single family residential with even number address	Saturday
Single family residential with odd number address	Thursday
All other residential properties (multifamily, HOAs, etc)	Monday

- Fall, winter, and spring turf irrigation – residents are restricted from irrigating turf from September 30 to May 1.

- Installation of new sod, seeding, and other landscaping – residents are to forego the installation of new sod, seeding, and landscaping until the drought has ceased.

- Impervious surfaces (driveways, sidewalks, patios, etc) – power washing and spraying are prohibited. A broom or mop may be used as a replacement.

- Personal vehicles – all washing of personal vehicles is prohibited except at commercial car washes.

- Fountains – All outdoor and indoor fountains must be turned off.

- Private swimming pools and hot tubs – the filling of private swimming pools and hot tubs is prohibited.

- Water cooled air conditioning, swamp coolers, and humidifiers – adjust room temperatures to reduce use of water-cooled air conditioning. Use room size humidifiers and swamp coolers in most utilized rooms as opposed to whole house units.

<u>Commercial and Institutional</u>

- Construction water – appropriate best management practices should be employed to conserve and prevent wasting of construction water.

- Outdoor water restrictions – irrigation is limited to the use of a hand-held hose or non-spray device (drip system) and must adhere to the following schedule:

Type of Property	Watering Days (one day per week)
Businesses with even number address	Saturday
Businesses with odd number address	Thursday
Large irrigators (i.e. golf courses, schools/athletic fields)	Monday

- Outdoor water audits – Shallow Creek has partnered with a natural resources conservation non-profit organization that promotes efficient water use. This non-profit organization provide free water audits for an unlimited number of customers during drought periods. Commercial businesses are required to sign-up for a free outdoor water audit through the Utilities' website.

- Installation of new sod, seeding, and other landscaping – businesses are to forego the installation of new sod, seeding, and landscaping until the drought has ceased.

- Fountains – all indoor and outdoor fountains must be turned off.

- Commercial swimming pools and hot tubs – the filling of swimming pools and hot tubs is discouraged.
- Commercial car washes – all commercial car washes are required to implement best management practices and limit water use to 40 gallons per vehicle.
- Vehicles at car dealerships – all washing of vehicles on car dealership property is prohibited.
- Restaurants – all restaurants are to not serve water unless customers specifically ask for it, in addition to reducing the number of service dishes (conserving water used for washing).
- Lodging – all lodging establishments must place water conservation cards in every room promoting water conservation (i.e. short showers) as well as not changing linens and towels unless a customer specifically requests the service.

Public Campaign

Outlined in Section 4.4. Details of the public drought campaign are to be developed at the onset of a drought.

Enforcement Procedures

Provided in Section 7.5.

WORKSHEET G – DROUGHT MITIGATION AND STAGED DROUGHT RESPONSE PROGRAM

Stage: Emergency

Drought Trigger Points: Storage less than 50% of full on July 1 and measured snowpack 30% of normal by the end of April.

Drought Stage and Trigger Summary: The Emergency drought stage is triggered when the actual or forecasted storage on July 1st is less than 50% of full capacity. The drought response is to focus on mandatory measures with the objective of reaching a water use reduction target of 50% during the irrigation season with additional savings during the non-irrigation season.

Supply-Side Response Measures:

The following two supply-side measures may be implemented regardless of the drought severity and stage. The specifics on how each measure would be implemented and timing would be identified at the onset of the drought.

- Seek technical and financial assistance opportunities – This may include assistance from the public sector at the federal, state, or county level or include assistance from private entities such as non-profit organizations promoting water conservation and drought awareness. Assistance may include grants, loans, technical assistance (i.e. water use efficiency improvement), education, etc. Shallow Creek plans to be aware of the technical and financial opportunities before a drought enabling the City to take advantage of the opportunities quickly and efficiently when a drought occurs.

- Water rights management and cooperative agreements – Shallow Creek's water supply yields may be increased by making some adjustments to how water rights are traditionally managed and though other synergies developed via cooperative agreements with other local water users. Where possible, these agreements will be established in advance of a drought as part of the mitigation effort and activated during drought periods. However, the activation of these agreements and identification of new arrangements during drought periods will be a component of the drought response. Appropriate Substitute Water Supply Plans will be filed to ensure that the agreement/arrangement(s) are viable under Colorado Water Law. These agreement/arrangement(s) may include the following:

  - Acquire water from other entities – Shallow Creek's water supply system is situated in such a manner that it could divert and utilize water from other entities via exchange. Purchase, lease, trade, temporary fallowing, and water transfer arrangements with downstream agricultural users and nearby water providers will be explored as an option during drought periods.
  - Pay upstream water users to divert less water – This would include Snow Mountain Ski Resort who can significantly reduce stream flows in November and December during snow making periods.

Demand-Side Response Measures:

Utilities Department

- Drought surcharge – assess and design a drought surcharge to support water use restrictions and the targeted water savings. Surcharges will be applied to all customers.

- Irrigation of City-owned property (parks and open spaces) – eliminate all turf irrigation on City parks and open spaces until drought has ceased. Limited irrigation of trees with a hand-held hose or non-spray device is allowed to help ensure survival.

- Washing of City-owned vehicles – washing of City-owned vehicles is prohibited.

- Hydrant washing and flushing – hydrant washing and flushing is prohibited unless necessary for public safety reasons.

- Water for fire training and use of fire hydrant – use of all water for fire training and of water from the hydrant is prohibited unless essential for public safety.

- Ornamental fountains and drinking fountains – all ornamental fountains and drinking fountains on City-owned property and City-owned buildings are to be turned off.

Residential

- Outdoor water restrictions – all outdoor irrigation is prohibited with exception to watering of trees with a hand-held hose every first and third Wednesday of the month from June through December.

- Installation of new sod, seeding, and other landscaping – residents are to forego the installation of new sod, seeding, and landscaping until the drought has ceased.

- Impervious surfaces (driveways, sidewalks, patios, etc) – power washing and spraying are prohibited. A broom or mop may be used as a replacement.

- Personal vehicles – all washing of personal vehicles is prohibited except at commercial car washes.

- Fountains – All outdoor and indoor fountains must be turned off.

- Private swimming pools and hot tubs – the filling of private swimming pools and hot tubs is prohibited.

- Water cooled air conditioning, swamp coolers and humidifiers – adjust room temperatures to reduce use of water-cooled air conditioning. Use room size humidifiers and swamp coolers in most utilized rooms as opposed to whole house units.

- Indoor water restrictions – residents are limited to 30 gallons per person per day.

- Indoor water audits – residents are encouraged to sign-up for a free indoor water audit provided free-of-charge by Utilities.

Commercial and Institutional

- Construction water – use of all construction water is prohibited unless necessary for air quality and construction reasons. This must be negotiated beforehand with Utilities.
- Outdoor water restrictions – all outdoor irrigation is prohibited with exception to the watering of trees with a hand-held hose every first and third Wednesday of the month from June through September.
- Installation of new sod, seeding, and other landscaping – businesses are to forego the installation of new sod, seeding, and landscaping until the drought has ceased.
- Fountains – all indoor and outdoor fountains must be turned off.
- Commercial swimming pools and hot tubs – the filling of commercial swimming pools and hot tubs is prohibited.
- Commercial car washes – all commercial car washes are prohibited from using water for vehicle washing.
- Commercial car washes – all commercial car washes are required to implement best management practices and limit water use to 20 gallons per vehicle.
- Restaurants – all restaurants are to not serve water unless customers specifically ask for it and are required to reduce the number of service dishes (conserving water used for washing).
- Lodging – all lodging establishments must place water conservation cards in every room promoting water conservation (i.e. short showers) as well as not changing linens and towels unless a customer specifically requests the service.
- Indoor water audits – all businesses are encouraged to sign up for a free indoor water audit provided free-of-charge by Utilities. Businesses with over 5 active employees working at the same time are required to sign up for the audit.

Public Campaign

Outlined in Section 4.4. Details of the public drought campaign are to be developed at the onset of a drought.

Enforcement Procedures

Provided in Section 7.5.

Staged Drought Response Program

WORKSHEET H - STAGED DROUGHT RESPONSE PROGRAM

Instructions:
[1] List the response strategies selected for the Plan by appropriate category (Step 3). Categories in this worksheet may be modified to match the Plan.
[2] Replace Stage 1, Stage 2, etc. to match the drought stage names in the Plan (Step 4). This worksheet includes five stages as a default. Delete or add stages to match the Plan. Add appropriate drought triggers & response targets.
[3] Insert the appropriate drought measures corresponding to each response strategy.
[4] List the public education campaign activities selected for the Plan (Step 3).
[5] List the public education campaign activities by drought stage (Step 6). If appropriate specify the targeted audience, communication tools, and information to convey.
[6] List the enforcement activities by drought stage (Step 7).

Supply-Side Response Strategies [1]						
	Drought Stages [2] and [3]					
Drought Stage	Pre-drought Mitigation	Watch	Warning	Critical	Emergency	n/a
Trigger	*n/a*	Reservoirs less than 90% full	Reservoirs less than 80% full	Reservoirs less than 65% full	Reservoirs less than 50% full	n/a
Response Target	*n/a*	10% savings	25% savings	40% savings	50% savings	n/a
Water Supply Augmentation						
n/a	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Water Rights Management and Coordination with Other Entities						
Pay senior water user to not place a "call" on the river Pay upstream water user to allow diversion of more water Purchase water from other entities (i.e., neigboring cities, federal projects) Arrange for exchanges Lease irrigation rights from farmers Negotiate purchases or 'options' Develop water transfers with other entities Trade water supplies with other entities to increase yield	*n/a*	These options will be explored at the onset of a drought and could be implemented for any of the four drought stages pending on terms of the agreement(s).				*n/a*
Increase Water Use Efficiency						
Change pattern of water storage and release operations to optimize efficiency -	*n/a*					
Modify reservoir releases to maintain streamflows during critical times of the day during the tourist season	*n/a*	Streamflow impacts minimal - no action	Highest releases to occur from 12:00 to 3:00 for tubing July - Aug	Highest releases to occur from 1:00 to 3:00 for tubing July - Aug	Water supplies too stressed to implement action	n/a
Minimize water quality impacts by adjusting reservoir releases to maintain Castle Reservoir storage at 50% of capacity	*n/a*	Water quality impacts minimal - no adjustments to operations necessary	Adjust reservoir releases accordingly	Adjust reservoir releases accordingly	Water supplies too stressed to implement action	n/a
Demand-Side Response Strategies [1]						
Provider/Municipality						
Implement drought surcharges	*n/a*	No surcharge	No surcharge	Drought surcharge will be implemented to support water use restrictions and achieve response target.	Drought surcharge will be implemented to support water use restrictions and achieve response target.	n/a
Eliminate/reduce irrigation on provider/muncipal owned parks and landscaping	*n/a*	Follow standard practice which is involves water audits and efficient water use.	Follow standard practice which is involves water audits and efficient water use.	Eliminate turf irrigation on city parks and landscaping. Maintain irrigation on sports fields & irrigate trees & shrubs.	Eliminate all turf irrigation only maintaining trees.	n/a
Prohibit watering during fall, winter, and early spring	*n/a*	No restriction.	Eliminate turf irrigation during fall, winter, & early spring.	Eliminate all irrigation with exception to trees during fall, winter, & early spring.	Eliminate all irrigation during fall, winter, & early spring.	n/a
Limit/prevent washing of city fleet vehicles	*n/a*	No restriction.	Limit city field vehicles to washing biweekly and washing of other vehicles to once a month.	Prohibt washing of all city vehicles.	Prohibt washing of all city vehicles.	n/a

Staged Drought Response Program

	Drought Stages [2] and [3]					
Drought Stage	Pre-drought Mitigation	Watch	Warning	Critical	Emergency	n/a
Trigger	*n/a*	Reservoirs less than 90% full	Reservoirs less than 80% full	Reservoirs less than 65% full	Reservoirs less than 50% full	n/a
Response Target	*n/a*	10% savings	25% savings	40% savings	50% savings	n/a
Limit hydrant washing and flushing	*n/a*	No restriction.	Reduce hydrant washing and flushing to once every 3 months.	Reduce hydrant washing and flushing to once every 3 months.	Reduce hydrant washing and flushing to once every 6 months.	n/a
Limit use of water for fire training	*n/a*	No restriction.	No restriction.	Water for fire training is prohibited.	Water for fire training is prohibited.	n/a
Eliminate all fire hydrant uses except those required for public safety	*n/a*	No restriction.	No restriction.	Fire hydrant use is restricted with exception to essential uses for public safety.	Fire hydrant use is restricted with exception to essential uses for public safety.	**n/a**
Turn off ornamental fountains in buildings and parks	*n/a*	No restriction.	Ornamental fountains and drinking fountains are turned off in parks.	Use of ornamental fountains and drinking fountains in parks and buldings is prohibited.	Use of ornamental fountains and drinking fountains in parks and buldings is prohibited.	n/a
Conduct indoor water audits	*n/a*	Conduct indoor water audits on all city-owned buildings	Conduct indoor water audits on all city-owned buildings	Conduct indoor water audits on all city-owned buildings	Mandate indoor water audits for all businsses exceeding employment of over 5 people and for all city owned buildings. Provide free indoor water audits for all other customers.	n/a
Residential						
Enforce landscape watering restrictions	*n/a*	Voluntary restrictions.	Mandatory restrictions. See Worksheet G.	Mandatory restrictions. See Worksheet G.	Landscape irrigation is prohibited.	n/a
Limit number of watering days per week	*n/a*	Voluntary restrictions.	Mandatory restrictions. See Worksheet G.	Mandatory restrictions. See Worksheet G.	Landscape irrigation is prohibited.	n/a
Prohibit lawn watering during fall, winter, and early spring	*n/a*	n/a	Voluntary	Mandatory	n/a - all outdoor irrigation is prohibited	n/a
Limit watering to hand-held hose or no-volume nonspray device	*n/a*	n/a	n/a	Mandatory restrictions. See Worksheet G.	Landscape irrigation is prohibited with exception to a small amount to ensure survival of trees.	n/a
Limit/prohibit installation of new sod, seeding, and/or other landscaping	*n/a*	No restrictions.	Voluntary restrictions.	Mandatory restrictions.	Mandatory restrictions.	n/a
Enforce restrictions on spraying of impervious surfaces	*n/a*	Voluntary restrictions.	Spraying of impervious surfaces is restricted.	Spraying of impervious surfaces is restricted.	Spraying of impervious surfaces is restricted.	n/a
Prohibit/limit vehicle washing	*n/a*	Restricted to shut-off nozzle and bucket. (Includes car dealers)	Restricted to shut-off nozzle and bucket. (Includes car dealers)	Prohibited. (Includes car dealers)	Prohibited. (Includes car dealers)	n/a
Prohibit/limit nonrecirculating fountains	*n/a*	No restriction.	Nonrecirculating fountains are prohibited.	All fountains are prohibited.	All fountains are prohibited.	n/a
Prohibit/limit filling and use of swimming pools & hot tubs	*n/a*	Encourage best management practices (use of pool covers, reuse of water at the end of the season for irrigation and repair of leaks).	Encourage best management practices (use of pool covers, reuse of water at the end of the season for irrigation and repair of leaks).	Filling of private pools is prohibited. Encourage best management practices for all commercial pools (use of pool covers, reuse of water at the end of the season for irrigation and repair of leaks).	Filling of private pools and commercial outdoor pools are prohibited.	n/a

Staged Drought Response Program

	Drought Stages [2] and [3]					
Drought Stage	Pre-drought Mitigation	Watch	Warning	Critical	Emergency	n/a
Trigger	*n/a*	Reservoirs less than 90% full	Reservoirs less than 80% full	Reservoirs less than 65% full	Reservoirs less than 50% full	n/a
Response Target	*n/a*	10% savings	25% savings	40% savings	50% savings	n/a
Enforce indoor water restrictions	*n/a*	n/a	n/a	n/a	Water usage target of 40 gpcd. Fines could be implemented if water use exceeds this amount.	n/a
Promote/enforce reduction of water-cooled air conditioning including swamp coolers and humidifiers.	*n/a*	Promote voluntary reduction of water-cooled air conditioning and adjust temperature. Encourage reliance on room size humidifiers and swamp coolers as opposed to whole house units.	Promote voluntary reduction of water-cooled air conditioning and adjust temperature. Encourage reliance on room size humidifiers and swamp coolers as opposed to whole house units.	Promote voluntary reduction of water-cooled air conditioning and adjust temperature. Encourage reliance on room size humidifiers and swamp coolers as opposed to whole house units.	Promote voluntary reduction of water-cooled air conditioning and adjust temperature. Encourage reliance on room size humidifiers and swamp coolers as opposed to whole house units.	n/a
Commercial						
Prohibit/limit use of construction water	*n/a*	Encourage reduction of construction water use where feasible.	Encourage reduction of construction water use where feasible.	Encourage reduction of construction water use where feasible.	Prohibit use of construction water unless upon a negotiated basis.	n/a
Enforce policy guidelines/limitations for installation of new sod and/or other landscaping	*n/a*	No restrictions.	Voluntary restrictions.	Mandatory restrictions.	Mandatory restrictions.	n/a
Enforce outdoor landscape watering restrictions	*n/a*	Volunatary restrictions.	Mandatory restrictions. See Worksheet G.	Mandatory restrictions. See Worksheet G.	Mandatory restrictions. See Worksheet G.	n/a
Promote/require indoor and outdoor water audits where applicable	*n/a*	Provide voluntary free outdoor water audits.	Provide voluntary free outdoor water audits.	Require mandatory outdoor water use audits. Provide free service.	n/a - irrigation is prohibited.	n/a
Turn off indoor and outdoor ornamental fountains	*n/a*	No restriction.	Nonrecirculating fountains are prohibited.	All fountains are prohibited.	All fountains are prohibited.	n/a
Prohibit/limit filling and use of swimming pools & hot tubs	*n/a*	Encourage best management practices (use of pool covers, reuse of water at the end of the season for irrigation and repair of leaks).	Encourage best management practices (use of pool covers, reuse of water at the end of the season for irrigation and repair of leaks).	Filling of private pools is prohibited. Encourage best management practices for all commercial pools (use of pool covers, reuse of water at the end of the season for irrigation and repair of leaks).	Filling of private pools and commercial outdoor pools are prohibited.	n/a
Enforce water use restrictions on commercial car washes	*n/a*	Voluntary reductions in annual water use by 10%. Encourage best management practices.	Voluntary reductions in annual water use by 10%. Encourage best management practices.	Require implementation of best managmeent practices and that limit water use to 40 gal per vehicle.	Prohibit commerical car washing.	n/a
Promote/enforce service of water in restaurants only upon request	*n/a*	Voluntary reductions in water use. Do not serve water unless customers ask for it.	Promote use of less service dishes and not serving water unless customers ask for it.	Mandate use of less service dishes and not serving water unless customers ask for it.	Mandate use of less service dishes and not serving water unless customers ask for it.	n/a
Promote/enforce reduction in frequency of linen and towel washing in hotels	*n/a*	Encourage use of signs that promote conservation (short showers, washing of linens one a wk per stay, reduce use of towels).	Encourage use of signs that promote conservation (short showers, washing of linens one a wk per stay, reduce use of towels).	Require use of signs that promote conservation (short showers, washing of linens one a wk per stay, reduce use of towels).	Require use of signs that promote conservation (short showers, washing of linens one a wk per stay, reduce use of towels).	n/a
Industrial						
n/a	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*

Staged Drought Response Program

	Drought Stages [2] and [3]					
Drought Stage	Pre-drought Mitigation	Watch	Warning	Critical	Emergency	n/a
Trigger	*n/a*	Reservoirs less than 90% full	Reservoirs less than 80% full	Reservoirs less than 65% full	Reservoirs less than 50% full	n/a
Response Target	*n/a*	10% savings	25% savings	40% savings	50% savings	n/a
Public Education Campaign Activities [4], [5]						
not used	*n/a*	See Section 4.4.				*n/a*
Enforcement Actvities [6]						
not used	*n/a*	Not used for this plan.				*n/a*

Mitigation Action Plan

WORKSHEET I - MITIGATION ACTION PLAN

Instructions:
[1] List identified mitigation measures.
[2] List activity(ies) necessary to implement the mitigation measure.
[3] List important milestone deadlines for each mitigation measure.
[4] List staff/entities responsible for administration of the mitigation measure.
[5] List funding sources.

Mitigation [1]	Implementation Activities [2]	Milestone Deadlines [3]	Administration [4]	Funding [5]
Drought Mitigation Plan	Complete stakeholder process	June 2011	Utilities Department	n/a for this plan
	Complete Plan	June 2011		n/a for this plan
	Pass drought-related ordinances	August 2011		n/a for this plan
Development of new water supplies	Raw Water Master Plan	December 2011	Utilities Department	n/a for this plan
	Feasibility studies for new supplies	June 2012		n/a for this plan
	Design of necessary facilities	March 2012		n/a for this plan
	Construction of necessary facilities	March to September 2013		n/a for this plan
Existing maintenance and operational activities that improve water distribution efficiency				
Audits of water distribution system	Conducted annually (1/4 of system audited per year)	Conducted in the spring	Utilities Department	n/a for this plan
Repairs of leaks	Conducted on as-needed basis	n/a	Utilities Department	n/a for this plan
Monitoring and replacement of inaccurate meters	Conducted annually (1/4 of meters checked per year)	n/a	Utilities Department	n/a for this plan
Operations to avoid reservoir spills	Ongoing management of water supply system	n/a	Utilities Department	n/a for this plan
New maintenance and operational activities that improve water distribution efficiency				
Operational changes that incorporate new water supplies	Complete operational study via the Raw Water Master Plan	December 2011	Utilities Department	n/a for this plan
	Make adjustments to operations once new supplies are online	September 2013		n/a for this plan
Modification of water treatment plant to recycle wash water	Complete Raw Water Master Plan	December 2011	Utilities Department	n/a for this plan
	Allocate funds and hire design contractor	December 2011	Utilities Department	n/a for this plan
	Complete construction	December 2011	Utilities Department	n/a for this plan
Conservation measures specified in the Conservation Plan				
Conservation programs specified in Table 1	Implemented via conservation plan	Specified in conservation plan	Conservation staff in Utilities Department	n/a for this plan

Mitigation Action Plan

Mitigation [1]	Implementation Activities [2]	Milestone Deadlines [3]	Administration [4]	Funding [5]
Standard practices of the Utilities Department and Shallow Creek City Staff				
Annual irrigation audits on city-owned parks and open spaces	Hire contractor to perform audits every April	Audits are initiated every May and completed within several weeks	Parks Department	n/a for this plan
Staff education on water conservation	Lunchoen meetings held twice a year	n/a	Conservation staff in Utilities Department	n/a for this plan
Use of low volume irrigation instead of sprinklers and misters	n/a	n/a	Parks Department	n/a for this plan
Installation of water saving fixtures in all city-owned buildings	Replacement of toilets, dishwashers, showerheads and urinals with more water efficient applicances/fixtures	Toilets projected to be 100% replaced by 2012 Remaining fixtures/applicances to be completed by 2014	City maintenance staff	n/a for this plan

Demand Projection and Priority Allocation

WORKSHEET J - DEMAND PROJECTION AND PRIORITY ALLOCATION

Instructions:
[1] Enter total monthly projected demands assuming drought conditions.
[2] Enter demand priority names based on the water priorities developed in Step 1.
[3] Allocate the total monthly demands by priority for each respective month. For example, if the total monthly demand for January is 800 AF, 600 AF may be of high priority, 100 AF of medium priority, and the remaining 100 AF of low priority.

This allocation is based on a Critical Stage Response for demonstration purposes. The allocation will vary based on drought stage.

Projected Drought Demands and Allocation of Demands

	Total Demands [1]	Demand Priorities [2], [3]					Monthly Demand Allocation
		Health and Safety	Business	Public Outdoor Irrigation	Construction Water	Outdoor Irrigation	
January	80	52	26	0	2	0	2%
February	80	52	26	0	2	0	2%
March	120	78	40	0	2	0	3%
April	200	130	66	0	4	0	5%
May	400	244	116	12	8	20	10%
June	760	464	220	23	15	38	19%
July	880	537	255	26	18	44	22%
August	840	512	244	25	17	42	21%
September	360	220	104	11	7	18	9%
October	120	78	40	0	2	0	3%
November	80	52	26	0	2	0	2%
December	80	52	26	0	2	0	2%
Annual Total	*4000*	*2470*	*1190*	*97*	*80*	*162*	100%

Demand Prioritiy Allocation Percentages

						Total
Summer (May - Sept)	*61%*	*29%*	*3%*	*2%*	*5%*	*100%*
Winter (Oct - April)	*65%*	*33%*	*0%*	*2%*	*0%*	*100%*

Notes:
Total Demands in Column [1] are estimated by multiplying the Total Annual Demand of 4000 AF by the respective percentages in the Monthly Demand Allocation column.
The Total Monthly Demands in column [1] are allocated among the demand priorities according to the respective Demand Priority Allocation Percentages at the bottom of the table.

Drought Monitoring

WORKSHEET K - DROUGHT MONITORING

Instructions: This worksheet can be used as a means to monitor and record drought conditions on a monthly basis.
[1] Enter appropriate year.
[2] Enter appropriate month.
[3] List the drought indices being monitored and corresponding monthly data.
[4] List monthly supplies (i.e., water treatment plant production).
[5] List monthly demands (this may be actual demands or average historical monthly demands).
[6] Determine shortage by taking difference of supplies and demands.
[7] Record monthly storage if applicable.
[8] Record groundwater levels if applicable.

Please note: These data was developed for demonstration purposes and does not represent real hydrology.

Year [1]	Month [2]	Drought Indices [3]			Supplies [4]	Demands [5]	Shortage [6]	Storage [7]	Groundwater Levels [8]
		*Reservoir Storage (% of Full) **	*Snowpack (% of nomal) ***						
2008	Jan	not recorded	80%		122	114	no shortage	Recorded as drought index.	n/a
2008	Feb	not recorded	90%		122	114	no shortage	Recorded as drought index.	n/a
2008	Mar	not recorded	100%		182	170	no shortage	Recorded as drought index.	n/a
2008	Apr	33%	110%		304	284	no shortage	Recorded as drought index.	n/a
2008	May	38%	100%		608	568	no shortage	Recorded as drought index.	n/a
2008	Jun	74%	90%		1,154	1,079	no shortage	Recorded as drought index.	n/a
2008	Jul	94%			1,337	1,249	no shortage	Recorded as drought index.	n/a
2008	Aug	89%			1,276	1,193	no shortage	Recorded as drought index.	n/a
2008	Sep	80%			547	511	no shortage	Recorded as drought index.	n/a
2008	Oct	71%			182	170	no shortage	Recorded as drought index.	n/a
2008	Nov	66%	80%		122	114	no shortage	Recorded as drought index.	n/a
2008	Dec	66%	90%		122	114	no shortage	Recorded as drought index.	n/a
2009	Jan	not recorded	110%		111	104	no shortage	Recorded as drought index.	n/a
2009	Feb	not recorded	105%		111	104	no shortage	Recorded as drought index.	n/a
2009	Mar	not recorded	110%		166	156	no shortage	Recorded as drought index.	n/a
2009	Apr	35%	100%		277	259	no shortage	Recorded as drought index.	n/a
2009	May	40%	95%		555	518	no shortage	Recorded as drought index.	n/a
2009	Jun	78%	95%		1,054	985	no shortage	Recorded as drought index.	n/a
2009	Jul	99%			1,220	1,140	no shortage	Recorded as drought index.	n/a
2009	Aug	94%			1,165	1,089	no shortage	Recorded as drought index.	n/a
2009	Sep	84%			499	467	no shortage	Recorded as drought index.	n/a
2009	Oct	74%			166	156	no shortage	Recorded as drought index.	n/a
2009	Nov	70%			111	104	no shortage	Recorded as drought index.	n/a
2009	Dec	69%			111	104	no shortage	Recorded as drought index.	n/a

Notes:
* Represents total reservoir storage at beginning of month
** % of Snowpack at beginning of month
Please not detailed daily accounting data for reservoir levels is recorded in alternative spreadsheet as well as additional snowpack readings.
This spreadsheet provides a monthly snapshot and does not capture daily variability which is important to also record during a drought. This spreadsheet could be modified to include daily data.